ABBREVIATIONS

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION

COMMONLY USED ABBREVIATION

"A" ABBREVIATION TABLE

"A" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
A	Amperes
A/C	Air Conditioning
A/T	Automatic Transmission/Transaxle
AAP	Auxiliary Accelerator Pump
AB	Air Bleed
ABCV	Air Bleed Control Valve
ABDC	After Bottom Dead Center
ABRS	Air Bag Restraint System
ABS	Anti-Lock Brake System
AC	Alternating Current
ACC	A/C Clutch Compressor
ACCS	A/C Cycling Switch
ACCUM	Accumulator
ACCY	Accessory
ACT	Air Charge Temperature Sensor
ACV	Thermactor Air Control Valve
ADJ	Adjust or Adjustable
ADV	Advance
AFS	Airflow Sensor
AI	Air Injection
AIR or A.I.R.	Air Injection Reactor
AIS	Air Injection System
ALCL	Assembly Line Communications Link
ALDL	Assembly Line Diagnostic Link
ARC	Automatic Ride Control
ASCD	Automatic Speed Control Device
ASCS	Air Suction Control Solenoid
ASD	Auto Shutdown
ASDM	Air Bag System Diagnostic Module
ASV	Air Suction Valve
ATC	Automatic Temperature Control
ATDC	After Top Dead Center
ATF	Automatic Transmission Fluid
ATS	Air Temperature Sensor
AXOD	Automatic Transaxle Overdrive
Abs.	Absolute
Accy.	Accessory
Alt.	Alternator or Altitude
Amp.	Ampere
Assy.	Assembly
Auto.	Automatic
Aux.	Auxiliary
Avg.	Average

"B" ABBREVIATION TABLE

"B" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
B/P	Backpressure
BAC	By-Pass Air Control
BAP	Barometric Absolute Pressure Sensor
BARO	Barometric
BBDC	Before Bottom Dead Center
BCM	Body Control Module
BDC	Bottom Dead Center
BHP	Brake Horsepower
BLK	Black
BLU	Blue
BMAP	Barometric & Manifold Absolute Pressure Sensor
BOO	Brake On-Off Switch
BP	Barometric Pressure sensor
BPS	Barometric Pressure Sensor
BPT	Backpressure Transducer
BRN	Brown
BTDC	Before Top Dead Center
BTU	British Thermal Unit
BVSV	Bimetallic Vacuum Switching Valve
Baro.	Barometric
Batt.	Battery
Bbl.	Barrel (Example: 4-Bbl.)
Blst.	Ballast
Blwr.	Blower
Brkr.	Breaker

"C" ABBREVIATION TABLE

"C" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
° C	Celsius (Degrees)
C(3) I	Computer Controlled Coil Ignition
C(4)	Computer Controlled Catalytic Converter
CANP	Canister Purge solenoid
CARB	California Air Resources Board
CAT	Catalytic Converter
CB	Circuit Breaker
CBD	Closed Bowl Distributor
CBVV	Carburetor Bowl Vent Valve
cc	Cubic Centimeter
CCC	Computer Command Control
CCD	Computer Controlled Dwell
CCM	Central Control Module
CCO	Converter Clutch Override
CCOT	Cycling Clutch Orifice Tube
CCW	Counterclockwise
CDI	Capacitor Discharge Ignition
CEC	Computerized Engine Control
CFI	Central Fuel Injection
CID	Cubic Inch Displacement
CID	Cylinder Identification sensor
CIS	Continuous Injection System
CIS-E	Continuous Injection System-Electronic
CKT	Circuit
CLR	Clear
CNG	Compressed Natural Gas

CO	Carbon Monoxide
CO2	Carbon Dioxide
CONV	Convertible
CP	Canister Purge
CPA	Connector Position Assurance
CPS	Crank Position Sensor
CTS	Coolant Temperature Sensor
CV	Check Valve or Constant Velocity
CVC	Constant Vacuum Control
CW	Clockwise
CYL or Cyl.	Cylinder
Calif.	California
Carb.	Carburetor
Chrg.	Charging
Circ.	Circuit
Cntrl.	Control
Comp.	Compressor or Compartment
Conn.	Connector
Cont.	Continued
Conv.	Convertible or Converter
Cu. In.	Cubic Inch
Cyl.	Cylinder

"D" ABBREVIATION TABLE

"D" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
"D"	Drive
DBC	Dual Bed Catalyst
DC	Direct Current or Discharge
DDD	Dual Diaphragm Distributor
DERM	Diagnostic Energy Reserve Module
DFI	Digital Fuel Injection
DIC	Driver Information Center
DIS	Direct Ignition System
DIS	Distributorless Ignition System
DIST	Distribution
DISTR	Distributor
DK BLU	Dark Blue
DK GRN	Dark Green
DME	Digital Motor Electronics (Motronic System)
DOHC	Double Overhead Cam
DOT	Department of Transportation
DP	Dashpot
DRB-II	Diagnostic Readout Box
DVOM	Digital Volt/Ohm Meter (see VOM)
Def.	Defogger or Defroster
Def.	Defrost
Defog.	Defogger
Diag.	Diagnostic
Dist.	Distributor or Distribution
Dr.	Door

"E" ABBREVIATION TABLE

"E" ABBREVIATION TABLE

ABBREVIATION	DEFINITION

EAC	Electric Assist Choke
EACV	Electric Air Control Valve
EBCM	Electronic Brake Control Module
ECA	Electronic Control Assembly
ECAT	Electronically Controlled Automatic Transaxle
ECM	Electronic Control Module
ECT	Engine Coolant Temperature Sensor
ECU	Electronic Control Unit or Engine Control Unit
EDF	Electric Drive Fan relay assembly
EDIS	Electronic Distributorless Ignition System
EEC	Electronic Engine Control
EECS	Evaporative Emission Control System
EEPROM	Electronically Erasable PROM
EFE	Early Fuel Evaporation
EFI	Electronic Fuel Injection
EGO	Exhaust Gas Oxygen sensor (see HEGO)
EGR	Exhaust Gas Recirculation system
EGRC	EGR Control solenoid or system
EGRV	EGR Vent solenoid or system
EMR	Emission Maintenance Reminder Module
ESA	Electronic Spark Advance
ESC	Electronic Spark Control
EST	Electronic Spark Timing
ETR	Emergency Tensioning Retractor
EVAP	Fuel Evaporative System
EVIC	Electronic Vehicle Information Center
EVO	Electronic Variable Orifice
EVP	EGR Valve Position Sensor
EVR	EGR Valve Regulator
EVRV	Electronic Vacuum Regulator Valve
Elect.	Electronic
Eng.	Engine
Evap.	Evaporative
Exc.	Except

"F" ABBREVIATION TABLE

"F" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
° F	Fahrenheit (Degrees)
F/B	Fuse Block
FBC	Feedback Carburetor
FI	Fuel Injector or Fuel Injection
FICD	Fast Idle Control Device
FIPL	Fuel Injector Pump Lever
FP	Fuel Pump
FPM	Fuel Pump Monitor
FPR-VSV	Fuel Pressure Regulator Vacuum Switching Valve
FWD	Front Wheel Drive
Fed.	Federal
Ft. Lbs.	Foot Pounds

"G" ABBREVIATION TABLE

"G" ABBREVIATION TABLE

ABBREVIATION	DEFINITION

g	grams
GND or GRND	Ground
GRN	Green
GRY	Gray
Ga.	Gauge
Gals.	gallons
Gov.	Governor

"H" ABBREVIATION TABLE

"H" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
H/D	Heavy Duty
HAC	High Altitude Compensation
HC	Hydrocarbons
HEDF	High Speed Electro Drive Fan relay or circuit
HEGO	Heated Exhaust Gas Oxygen Sensor
HEGOG	HEGO Ground circuit
HEI	High Energy Ignition
HLDT	Headlight
HO	High Output
HP	High Performance
HSC	High Swirl Combustion
HSO	High Specific Output
HTR	Heater
HVAC	Heating
Headlt.	Headlight
Hg	Mercury
Hgt.	Height
Htr.	Heater
Hz	Hertz (Cycles Per Second)

"I" ABBREVIATION TABLE

"I" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
I.D.	Inside Diameter
IAC	Idle Air Control
IACV	Idle Air Control Valve
IC	Integrated Circuit
ID	Identification
IDM	Ignition Diagnostic Monitor
IGN	Ignition system or circuit
ILC	Idle Load Compensator
In. Hg	Inches of Mercury
INCH Lbs.	Inch Pounds
INFL REST	Inflatable Restraint
INJ	Injector or Injection
IP	Instrument Panel
IPC	Instrument Panel Cluster
ISA	Idle Speed Actuator
ISC	Idle Speed Control
ISS	Idle Stop Solenoid
ITS	Idle Tracking Switch
IVSV	Idle Vacuum Switching Valve

Ign.	Ignition
In.	Inches
Inj.	Injector

"J" ABBREVIATION TABLE

"J" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
J/B	Junction Block

"K" ABBREVIATION TABLE

"K" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
k/ohms	1000 ohms (kilo as in k/ohms)
kg	Kilograms (weight)
kg/cm²	Kilograms Per Square Centimeter
KAM	Keep Alive Memory
KAPWR	Keep Alive Power
KM/H	Kilometers Per Hour
KOEO	Key On Engine Off
KOER	Key On Engine Running
KS	Knock Sensor

"L" ABBREVIATION TABLE

"L" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
L	Liter(s)
L/D	Light Duty
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LH	Left Hand
LOS	Limited Operation Strategy
LT BLU	Light Blue
LT GRN	Light Green
LUS	Lock-Up Solenoid
Lbs.	Pounds
Lt(s).	Light(s)
Lugg.	Luggage

"M" ABBREVIATION TABLE

"M" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
mA	Milliamps
mV	Millivolts
mfd.	Microfarads

mm	Millimeters
M/T	Manual Transaxle or Transmission
MA PFI	Mass Air Sequential Port Fuel Injection system
MA or MAF	Mass Airflow
MAF	Mass Air Flow sensor
MAFS	Mass Airflow Sensor
MAP	Manifold Absolute Pressure sensor
MAT	Manifold Air Temperature
MCU	Microprocessor Control Unit
MCV	Mixture Control Valve
MEM-CAL	Memory Calibration Chip
MFI	Multiport Fuel Injection
MIL	Malfunction Indicator Light
MLP	Manual Lever Position
MPFI	Multi Point Fuel Injection
MPH	Miles Per Hour
MPI	Multi-Point (Fuel) Injection
Man.	Manual
Mech.	Mechanical
Mem.	Memory
Mtr.	Motor

"N" ABBREVIATION TABLE

"N" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
N.m	Newton-Meter
NA	Not Available
NDS	Neutral Drive Switch
NGS	Neutral Gear Switch
NOx	Oxides of Nitrogen
NPS	Neutral Pressure Switch
No.	Number
Nos.	Numbers

"O" ABBREVIATION TABLE

"O" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
O	Oxygen
O.D.	Outside Diameter
O/S	Oversize
O2	Oxygen
OC	Oxidation Catalyst
OCC	Output Circuit Check
OD	Overdrive
ODO	Odometer
OHC	Overhead Camshaft
ORG	Orange
OSC	Output State Check
Opt.	Option or Optional
oz.	Ounce
ozs.	Ounces

"P" ABBREVIATION TABLE

"P" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
"P"	Park
P/C	Printed Circuit
P/N	Park/Neutral
P/S	Power Steering
PAV	Pulse Air Valve
PC-SOL	Purge Control Solenoid
PCM	Powertrain Control Module
PCS	Purge Control Solenoid
PCSDM	Passenger Compartment Sensor/Diagnostic Module
PCV	Positive Crankcase Ventilation
PFE	Pressure Feedback EGR sensor or circuit
PFI	Port Fuel Injection (see MA SEFI)
PGM-CARB	Programmed Carburetor
PGM-FI	Programmed Fuel Injection
PIP	Profile Ignition Pickup
PNK	Pink
PPL	Purple
PRNDL	Park Reverse Neutral Drive Low
PROM	Programmable Read-Only Memory
psi	Pounds Per Square Inch
PSPS	Power Steering Pressure Switch
PTC	Positive Temperature Coefficient
PTO	Power Take-Off
PWR GND	Power Ground circuit
Pkg.	Package
Press.	Pressure
Prog.	Programmed or Programmable
Pts.	Pints
Pwr.	Power

"Q" ABBREVIATION TABLE

"Q" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
Qts.	Quarts

"R" ABBREVIATION TABLE

"R" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
RABS	Rear Anti-Lock Brake System
RAC	Remote Accessory Control
RAM	Random Access Memory
RAP	Retained Accessory Power
RECIRC	Recirculation
RED	Red
RH	Right Hand
ROM	Read Only Memory
RPM	Revolutions Per Minute

RVB	Rear Vacuum Break
RWAL	Rear Wheel Anti-Lock Brake
RWD	Rear Wheel Drive
Recirc.	Recirculate or Recirculation
Reg.	Regulator
Rly.	Relay

"S" ABBREVIATION TABLE

"S" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
SAW	Spark Angle Word
SBC	Single Bed Converter
SBEC	Single Board Engine Controller
SC	Super Charged
SCC	Spark Control Computer
SCS	Air Suction Control Solenoid
SDM	Supplemental Restraint System Diagnostic Module
SDU	SRS Diagnostic Unit
SEN	Sensor
SES	Service Engine Soon
SFI	Sequential (Port) Fuel Injection
SIG RTN	Signal Return circuit
SIL	Shift Indicator Light
SIR	Supplemental Inflatable Restraint
SMEC	Single Module Engine Controller
SOHC	Single Overhead Cam
SOL or Sol.	Solenoid
SPFI	Sequential Port Fuel Injection
SPK	Spark Control
SPOUT	Spark Output Signal
SRS	Supplemental Restraint System (Air Bag)
SS 3/4-4/3	Shift Solenoid circuit
SSI	Solid State Ignition
STAR	Self-Test Automatic Readout
STI	Self Test Input circuit
STO	Self-Test Output
SUB-O2	Sub Oxygen Sensor
Sen. or Sens.	Sensor
Sol.	Solenoid
Sprchg.	Supercharger
Strg.	Steering
Susp.	Suspension
Sw.	Switch
Sys.	System

"T" ABBREVIATION TABLE

"T" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
T.V.	Throttle Valve
TAB	Thermactor Air By-Pass
TAC	Thermostatic Air Cleaner
TAD	Thermactor Air Diverter
TAN	Tan
TBI	Throttle Body Injection

TCC	Torque Converter Clutch
TCCS	Toyota Computer Control System
TDC	Top Dead Center
TDCL	Total Diagnostic Communication Link
TFI	Thick Film Ignition system
TGS	Top Gear Switch (cancels SIL in top gear)
THERMAC	Thermostatic Air Cleaner
THS	Transmission Hydraulic Switch
TP/TPS	Throttle Position Sensor
TPI	Tuned Port Injection
TPS	Throttle Position Sensor/Switch
TS	Temperature Sensor
TSB	Technical Service Bulletin
TTS	Transmission Temperature Switch
TV	Thermovalve
TWC	Three-Way Catalyst
Temp.	Temperature
Trans.	Transaxle/Transmission

"V" ABBREVIATION TABLE

"V" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
V	Valve
VAF	Vane Air Flow sensor or circuit
VAPS	Variable Assist Power Steering
VAT	Vane Air Temperature
VATS	Vehicle Anti-Theft System
VBATT	Vehicle Battery Voltage
VCC	Viscous Converter Clutch
VIN	Vehicle Identification Number
VIO	Violet
VLR	Volt Loop Reserve
VM	Vacuum Modulator
VM	Vane Meter
VOM	Volt-Ohmmeter (Analog)
VPWR	Vehicle Power supply voltage (10-14 volts)
VREF	Voltage Reference (ECA supplied reference voltage
VRV	Vacuum Regulator Valve
VSC	Vehicle Speed Control sensor or signal
VSS	Vehicle Speed Sensor or signal
VSV	Vacuum Switching Valve
Vac.	Vacuum
Volt.	Voltage

"W" ABBREVIATION TABLE

"W" ABBREVIATION TABLE

ABBREVIATION	DEFINITION
W/	With
W/O	Without
WAC	WOT A/C Cut-off switch or circuit
WAC	Wide Open Throttle A/C Switch
WHT	White
WOT	Wide Open Throttle
YEL	Yellow

A/C COMPRESSOR REFRIGERANT OIL CHECKING

1997-99 Mitsubishi Montero Sport

1997-99 A/C SYSTEM GENERAL SERVICING
Mitsubishi - Compressor Refrigerant Oil Checking

All Models

* PLEASE READ THIS FIRST *

NOTE: Always refer to underhood A/C specification label in engine compartment or A/C compressor label while servicing A/C system. If engine compartment/compressor label specifications differ from specifications in this article, use underhood/compressor label specifications.

A/C COMPRESSOR APPLICATIONS

A/C COMPRESSOR APPLICATION TABLE

Application	Compressor
Diamante	Sanden MSC105CVS Scroll
Galant	Sanden MSC90C12 Scroll
Eclipse & Eclipse Spyder	
2.0L Non-Turbo	Nippondenso 10PA17C 10-Cyl.
2.0L Turbo & 2.4L	Sanden MSC105CVS Scroll
Mirage	Sanden MSC90 Scroll
Montero	Nippondenso 10PA15 10-Cyl.
Montero Sport	Sanden MSC105C Scroll
3000GT	Sanden MSC105 Scroll

REFRIGERANT OIL & REFRIGERANT CAPACITY SPECIFICATIONS

NOTE: DO NOT exceed A/C system refrigerant oil capacity when servicing system.

REFRIGERANT OIL & R-134a REFRIGERANT CAPACITY TABLE

Application	(1) Oil Ounces	Refrigerant Ounces
Diamante	(3) 5.7-6.4	23.0-24.3
Eclipse & Eclipse Spyder		
2.0L Non-Turbo	(3) (4) 2.7-4.1	24.7-26.1
2.0L Turbo & 2.4L	(2) (3) 5.7-6.4	24.7-26.1
Galant	(2) (3) 4.1	23.0-24.3
Mirage	(2) (3) 4.1-5.1	19.6-21.0
Montero	(2) (4) 2.7	21.0-23.0
Montero Sport	(2) (3) 5.1	23.0-24.0
3000GT	(3) 8.6-11.0	26.0-28.0

(1) - Total system capacity, unless otherwise noted.
(2) - Compressor refrigerant oil capacity.
(3) - Use SUN PAG 56 refrigerant oil.
(4) - Use ND-Oil 8 refrigerant oil.

REFRIGERANT OIL

Only NEW, moisture-free refrigerant oil should be used in the air conditioning system. This oil is highly refined and dehydrated so moisture content is less than 10 parts per million. The oil container must be tightly closed at all times when not in use, or moisture from the air will be absorbed into the refrigerant oil.

SERVICING PRECAUTIONS

DISCHARGING SYSTEM

Discharge A/C system, using approved refrigerant recovery/recycling equipment. Always follow recovery/recycling equipment manufacturer's instructions. After refrigerant recovery process is completed, the amount of compressor oil removed must be measured and the same amount added to A/C system.

DISCONNECTING LINES & FITTINGS

After system is discharged, carefully clean area around all fittings to be opened. Always use 2 wrenches when tightening or loosening fittings. Some refrigerant lines are connected with a coupling. Special tools may be required to disconnect lines. Cap or plug all openings as soon as lines are removed. Remove caps until connections of lines and fittings are to be completed.

CONNECTING LINES & FITTINGS

NOTE: All R-134a based systems use 1/2"-16 ACME threaded fittings. Ensure all replacement parts match the connections of the system being worked on.

Always use a new gasket or "O" ring when connecting lines or fittings. Coat "O" ring with refrigerant oil and ensure it is not twisted during installation. Always use two wrenches to prevent damage to lines and fittings.

PLACING SYSTEM IN OPERATION

After component service or replacement has been completed and all connections have been made, thoroughly evacuate system with a vacuum pump. Charge system with proper amount of refrigerant and perform leak test. See the REFRIGERANT OIL & R-134a REFRIGERANT CAPACITY table for system capacities. Check all fittings that have been opened. After system has been leak tested, check system performance.

NOTE: Most compressors are pre-charged with a fixed amount of refrigerant (shipping) oil. Drain compressor oil from new compressor and add refrigerant oil to new compressor according to amount removed from old compressor. Always refer to underhood A/C specification label or A/C compressor label while servicing A/C system.

NIPPONDENSO

Eclipse 2.0L Non-Turbo & Montero

A new compressor is shipped with refrigerant oil. Drain and measure oil from old compressor. Remove refrigerant oil from new compressor equal to difference between amount drained from old compressor and amount shipped in new compressor. If any other major

components are replaced, add refrigerant oil as specified. See COMPONENT REFRIGERANT OIL CAPACITIES (MITSUBISHI) table.

COMPONENT REFRIGERANT OIL CAPACITIES TABLE (MITSUBISHI)

Component	Ounces
Compressor (1)	
Eclipse 2.0L Non-Turbo	3.4
Montero	2.7
Condenser	
Eclipse 2.0L Non-Turbo	1.4
Montero	1.4
Evaporator	
Eclipse 2.0L Non-Turbo	1.4
Montero	1.4
Receiver-Drier	
Eclipse 2.0L Non-Turbo	0.3
Montero	0.3
Refrigerant Lines	
Montero	0.3

(1) - If new compressor is shipped without refrigerant oil, add same amount of new refrigerant oil to new compressor that was drained from old compressor.

SANDEN

A new compressor is shipped with refrigerant oil. Drain and measure refrigerant oil from old compressor. Remove refrigerant oil from new compressor equal to difference between amount drained from old compressor and amount shipped in new compressor. If any other major components are replaced, add refrigerant oil as specified. See COMPONENT REFRIGERANT OIL CAPACITIES TABLE (SANDEN SCROLL).

COMPONENT REFRIGERANT OIL CAPACITIES TABLE (SANDEN SCROLL)

Component	Ounces
Compressor (1)	
Mirage	4.4
Diamante, Eclipse 2.0L Turbo & 2.4L & Galant	5.1-5.7
3000GT	5.4
Condenser	0.5
Evaporator	2.0
Receiver-Drier	0.3
Refrigerant Lines	0.3

(1) - If new compressor is shipped without refrigerant oil, add same amount of new refrigerant oil to new compressor that was drained from old compressor.

A/C COMPRESSOR SERVICING

1997-99 Mitsubishi Montero Sport

1997-99 A/C SYSTEM GENERAL SERVICING
Mitsubishi - A/C Compressor Servicing

All Models

* PLEASE READ THIS FIRST *

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

A/C COMPRESSOR APPLICATIONS

A/C COMPRESSOR APPLICATION TABLE

Application	Compressor
Diamante	Sanden MSC105CVS Scroll
Galant	Sanden MSC90C12 Scroll
Eclipse & Eclipse Spyder	
2.0L Non-Turbo	Nippondenso 10PA17C 10-Cyl.
2.0L Turbo & 2.4L	Sanden MSC105CVS Scroll
Mirage	Sanden MSC90 Scroll
Montero	Nippondenso 10PA15 10-Cyl.
Montero Sport	Sanden MSC105C Scroll
3000GT	Sanden MSC105 Scroll

NIPPONDENSO 10-CYLINDER

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

CLUTCH COIL

Removal

1) Use a M8 X 40 mm bolt with 7/32" of the threaded end machined to a cone shape to remove clutch plate.

2) Remove snap ring and shim(s) from shaft. Tap pulley off shaft with plastic hammer. If pulley cannot be removed by hand, use a puller. Remove snap ring, bearing, and seal (if equipped) from pulley. See Figs. 1 and 2. Remove screw for clutch coil lead. Remove snap ring and clutch coil.

Installation

To install, reverse removal procedure. Ensure snap rings are installed with beveled side facing out. Tighten shaft bolt (or nut) to 11-15 ft. lbs. (15-20 N.m). Ensure air gap between clutch plate and pulley is .016-.028" (.41-.71 mm). If air gap is incorrect, add or remove shim(s) as necessary.

NOTE: On some compressors, it is necessary to use a dial indicator on clutch plate to check air gap. Energize clutch coil and zero dial indicator. De-energize clutch coil and measure air gap. Ensure air gap is as specified.

SHAFT SEAL

NOTE: Remove compressor through-bolts and front housing to remove shaft seal. Alternately tighten through-bolts to 18-21 ft. lbs. (24-28 N.m).

Removal

1) Remove clutch plate and pulley. Remove shim(s) from shaft. Remove clutch coil if necessary. Remove felt and felt retainer (if equipped). See Figs. 1 and 2. Place shaft key remover on shaft and turn to remove key.

2) Remove seal plate snap ring. Engage plate remover on seal plate, and pull up to remove seal plate. Engage shaft seal remover/installer to shaft seal, and pull up to remove shaft seal from front housing.

Installation

1) Apply clean refrigerant oil to compressor housing bore. Lubricate shaft seal with refrigerant oil and install in front housing. Lubricate seal plate and install in front housing.

2) Install shaft key, snap ring, felt retainer and felt. With clutch plate installed, ensure air gap between clutch plate and pulley is .016-.028" (.41-.71 mm). If air gap is incorrect, add or remove shim(s) as necessary.

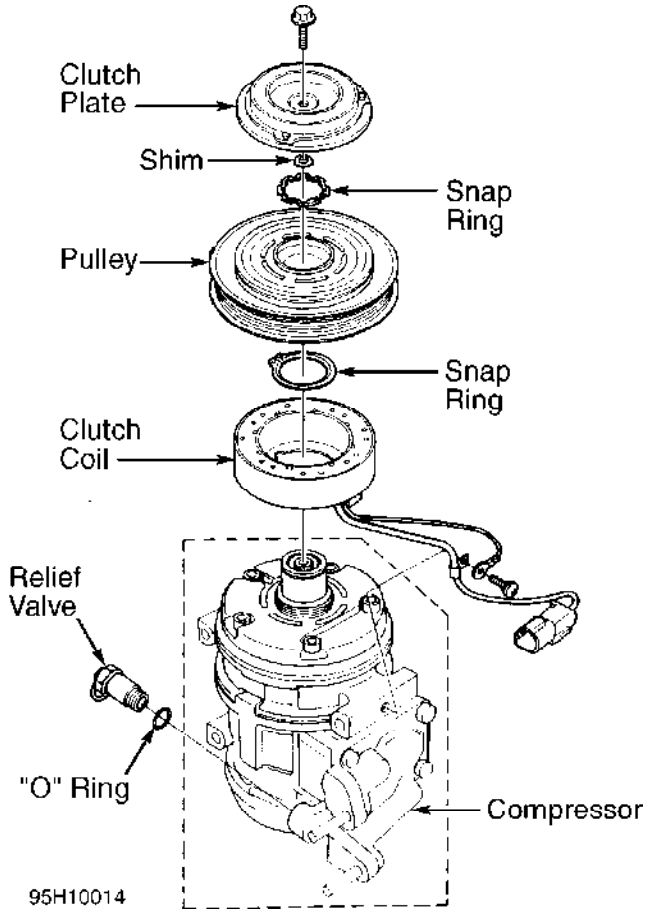

Fig. 1: Exploded View Of Compressor Clutch (Typical 10-Cyl.)
Courtesy of American Honda Motor Co., Inc.

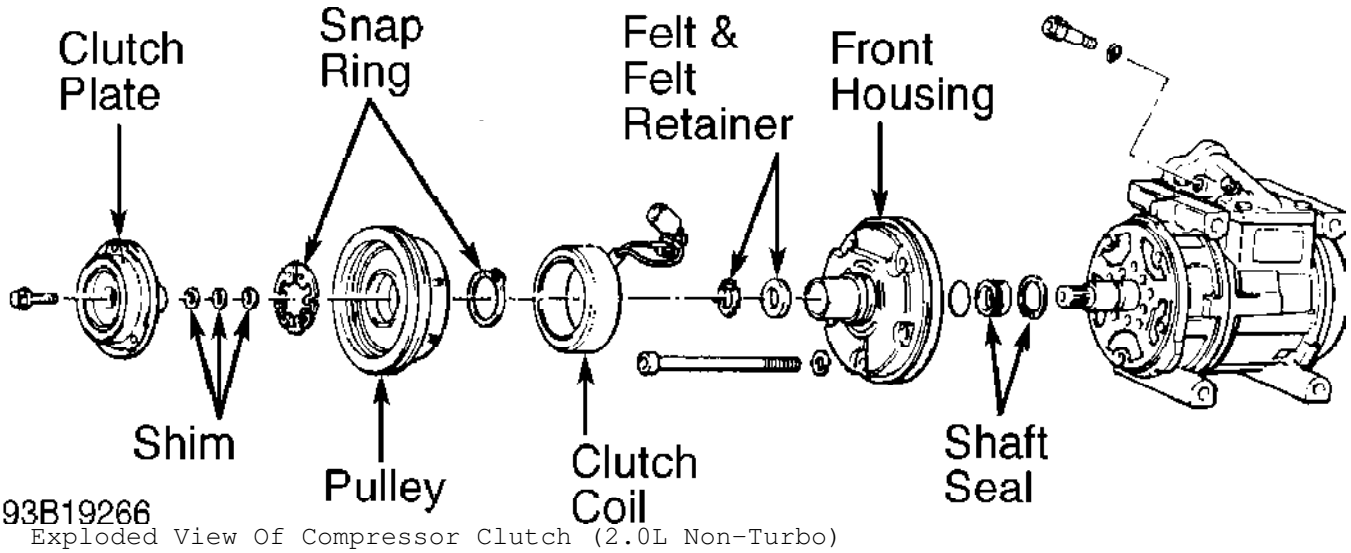

Fig. 2: Exploded View Of Compressor Clutch (2.0L Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America.

SANDEN SCROLL

CLUTCH COIL & SHAFT SEAL

NOTE: Due to variety of clutch and shaft seal configurations, obtain appropriate A/C compressor service tools for compressor being serviced.

Removal

1) Remove drive belt pulley (if equipped). Hold clutch plate using Pliers (MB991367) and Bolts (MB991386). Use a ratchet and socket to remove clutch hub nut.

2) Remove clutch plate. See Fig. 3. Remove snap ring with internal snap ring pliers. Remove clutch hub (rotor). Remove snap ring and clutch coil.

3) Using an awl, remove bearing cover and retainer. Using Bearing Remover (MB991456), engage bearing grooves. Place base of bearing remover over remover arms and tighten nut.

4) Tighten bearing remover bolt to withdraw bearing from compressor. Engage grooves of Shaft Seal Remover/Installer (MB991458) and pull straight up on shaft seal.

Installation

1) To install shaft seal, ensure front housing is free of foreign objects. Lubricate Shaft Seal Protector (MB991459) and place over compressor shaft. Lubricate shaft seal and install using shaft seal remover/installer. Remove shaft seal protector.

2) Using a 21-mm socket or Drift (MB991301), carefully press bearing onto compressor shaft. Install clutch coil so that alignment pin is engaged. Install clutch coil snap ring with tapered side facing out.

3) Align armature plate with crankshaft spline. Tighten shaft nut to 12 ft. lbs. (16 N.m). Using feeler gauge, ensure clearance between pressure plate and pulley is .02-.03" (0.5-0.8 mm) on Diamante and .016-.024" (0.4-0.6 mm) on all other models. If clearance is incorrect, add or remove shim(s) as necessary.

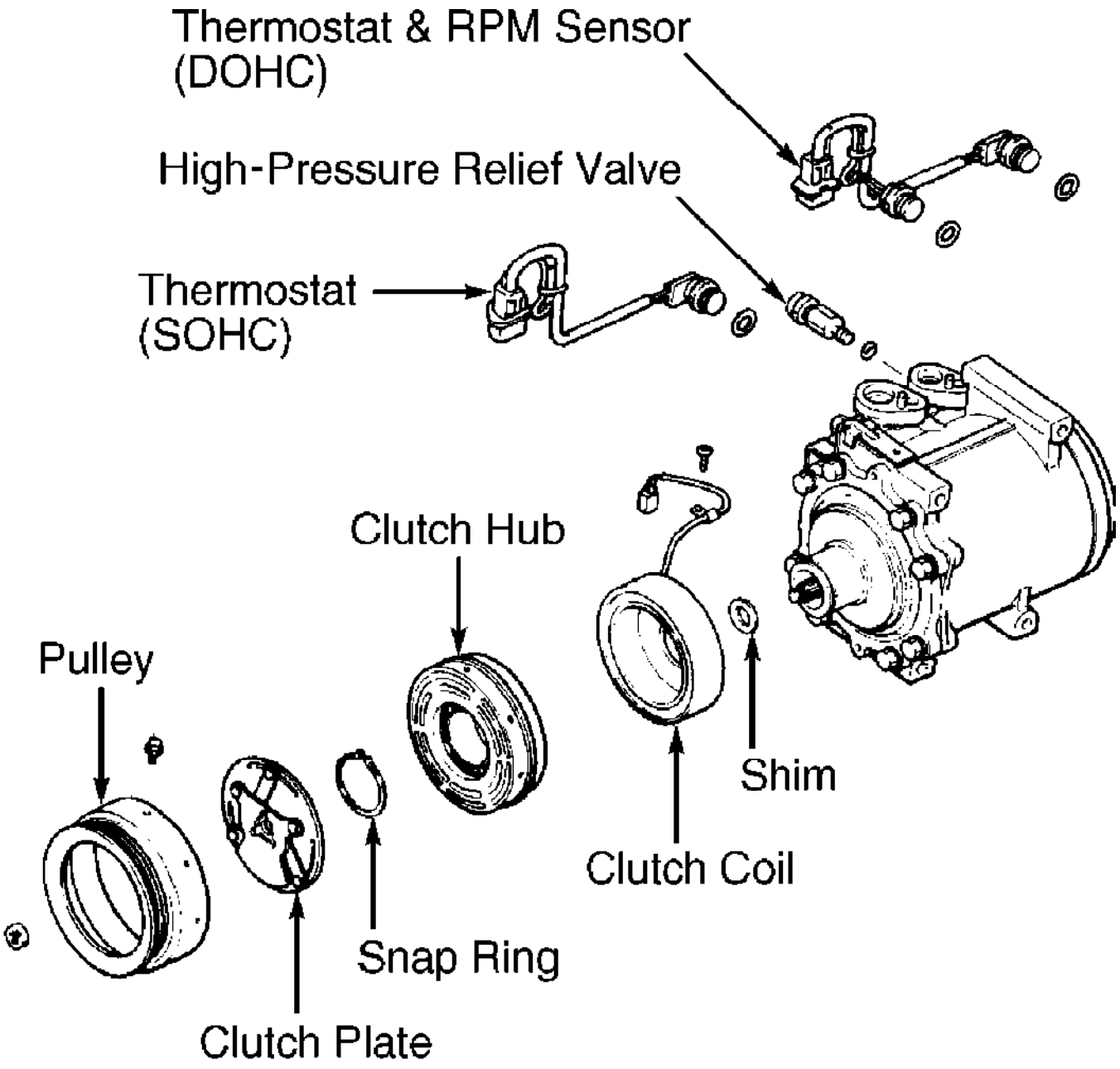

Fig. 3: Exploded View Of Compressor Clutch (Sanden Scroll MSC105; MSC90C Is Similar)
Courtesy of Mitsubishi Motor Sales Of America.

* A/C-HEATER SYSTEM UNIFORM INSPECTION GUIDELINES *

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
A/C-Heater System Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

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MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards

are continually republished. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience,

or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A - Part no longer performs intended purpose
B - Part does not meet a design specification (regardless of performance)
C - Part is missing

NOTE: When a repair is required, the shop must refuse partial

service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

HEATING, VENTILATION, AND AIR CONDITIONING

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

CAUTION: Before working on any air conditioning system, be sure to review current local, state, federal, and EPA regulations regarding charging, recycling, and disposal of refrigerant.

ACCUMULATORS

ACCUMULATOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Beyond vehicle manufacturer's service interval	3	Suggest replacement.
Dessicant at the end of its useful life (saturated with moisture)	1	Suggest repair or replacement.
Dessicant bag deteriorated	A	(1) Require replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Tubing connection leaking	A	Require repair or replacement.

(1) - Inspect system to determine effects of dessicant bag deterioration.

ACTUATORS (ELECTRICAL)

ACTUATOR (ELECTRICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	1	(1) Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	1	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

ACTUATORS (VACUUM)

ACTUATOR (VACUUM) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of

			hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted, affecting performance	A	.....	(1) Require repair or replacement.
Connector melted, not affecting performance	2	.....	(1) Suggest repair or replacement.
Connector missing	C	.....	Require replacement.
Inoperative	A	.....	(2) Require replacement.
Leaking (vacuum)	A	..	Require repair or replacement.
Linkage bent, affecting performance	A	...	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	...	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	...	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	...	Suggest repair or replacement of linkage.
Linkage broken	A	...	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	...	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	...	Suggest repair or replacement of linkage.
Linkage missing	C	.....	Require replacement.
Linkage noisy	2	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Noisy	2	..	Suggest repair or replacement.
Out of adjustment	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AIR CONDITIONING FITTINGS

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES.

AIR CONDITIONING HOSES

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES.

AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES

AIR CONDITIONING METAL LINE, HOSE AND FITTING ASSEMBLY INSPECTION

Condition	Code	Procedure

Abrasion damage, affecting structural integrity	A	..	Require repair or replacement.
Abrasion damage, not affecting structural integrity	..	.....	No service suggested or required.
Application incorrect	B	.....	Require replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Clamp corroded, not reusable	1	.....	Suggest replacement.
Connected incorrectly	A	.....	Require repair.
Corroded, affecting structural integrity	A	.....	Require replacement.
Corroded, not affecting structural integrity	..	.....	No service suggested or required.
Cracked	A	..	Require repair or replacement.
Fitting type incorrect (such as compression fitting)	B	.....	Require replacement.
Flange leaking	A	..	Require repair or replacement.
Insufficient clamping force, allowing hose to leak	A	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Melted	1	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	.....	Require replacement.
Protective sleeves damaged	2	.	Suggest replacement of sleeves.
Protective sleeves missing	C	.	Require replacement of sleeves.
Restricted, affecting performance	A	..	Require repair or replacement.
Routed incorrectly	2	.....	Require repair.
Swollen	1	.....	Suggest replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Type incorrect	1	..	Suggest repair or replacement.

AIR CONTROL DOORS

See PLENUMS.

AIR DAMS (EXTERNAL)

AIR DAM (EXTERNAL) INSPECTION

Condition	Code	Procedure

Application incorrect, affecting air conditioning system performance	A	..	Require repair or replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Bent, affecting air conditioning system performance	A	..	Require repair or replacement.
Blocked, affecting air conditioning system performance	A	..	Require repair or replacement.
Broken, affecting air conditioning system performance	A	..	Require repair or replacement.
Cracked, affecting air conditioning system performance	A	..	Require repair or replacement.
Loose, affecting air conditioning system performance	A	.....	Require repair.
Loose, not affecting air conditioning system performance	2	.....	Suggest repair.
Missing, affecting air conditioning system performance	C	.....	Require replacement.

AIR DISTRIBUTION SYSTEM

See PLENUMS.

BELTS

BELT INSPECTION

Condition	Code		Procedure
Alignment incorrect	B	.....	(1) Further inspection required.
Cracked	1	.....	Suggest replacement.
Frayed	1	.....	Suggest replacement.
Missing	C	.....	Require replacement.
Noisy	2	.....	(2) Further inspection required.
Plies separated	A	.....	Require replacement.
Serpentine belt routed incorrectly	B	.....	Require repair.
Tension out of specification	B	.....	Require adjustment or replacement.
Worn beyond adjustment range	B	.....	Require replacement.

Worn so it contacts bottom of pulley	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.

BLEND DOORS

See PLENUMS.

BLOWER FANS (BLOWER WHEEL OR SQUIRREL CAGE)

BLOWER FAN (BLOWER WHEEL OR SQUIRREL CAGE) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Application incorrect ...	B ..	Require repair or replacement.
Broken	A	Require replacement.
Cracked	A	Require replacement
Distorted	A	Require replacement.
Fins missing	C	Require replacement.
Hub separated	A	Require replacement.
Inoperative	A	(1) Require replacement.
Mounting loose	A ..	Require repair or replacement.
Noisy	2	Suggest replacement.
Out of balance	A ..	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

BLOWER MOTORS

BLOWER MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Connector broken	A ..	Require repair or replacement.
Connector (Weatherpack type) leaking	A ..	Require repair or replacement.
Connector melted, affecting performance ..	A	(1) Require repair or replacement.
Connector melted, not		

affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Current draw out of specification	B	Require repair or replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Motor speed insufficient	2	Suggest repair or replacement.
Noisy	2	Suggest replacement.
Rotation incorrect for application	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

BLOWER RESISTORS

BLOWER RESISTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Conductor exposed	A	Require replacement.
Connector broken	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	1	(1) Suggest repair or replacement.

Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Insulation overheated ...	A	Require replacement.
Terminal broken	A ..	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A ..	Require repair or replacement.
Terminal corroded, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal loose, affecting performance	B ..	Require repair or replacement.
Terminal loose, not affecting performance ..	1 ..	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

BLOWER SWITCHES

See SWITCHES.

CABIN AIR FILTERS

CABIN AIR FILTER INSPECTION

Condition	Code	Procedure
Air flow obstruction	A	Require cleaning or replacement.
Maintenance intervals ...	3	Suggest replacement.
Missing	C	Require replacement.

CIRCUIT BREAKERS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

COMPRESSOR CLUTCH ASSEMBLIES

COMPRESSOR CLUTCH ASSEMBLY INSPECTION

Condition	Code	Procedure
Air gap incorrect	B ..	Require repair or replacement.
Bearing seized	A ..	Require replacement of bearing or assembly.
Bearing worn, affecting performance	A ..	Require replacement of bearing or assembly.
Coil shows signs of overheating	1	Suggest replacement of coil.
Connector broken	A ..	Require repair or replacement.
Connector (Weatherpack type) leaking	A ..	Require repair or replacement.
Connector melted,		

affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Hub broken	A	Require replacement.
Hub cracked	B	Require replacement.
Hub loose on shaft	A	Require replacement.
Hub scored, affecting performance	A	Require replacement.
Hub warped, affecting performance	A	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Slips	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Will not disengage	A	Require repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

COMPRESSORS

COMPRESSOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance		No service suggested or required.

Bracket broken, affecting performance	A		Require replacement.
Bracket broken, not affecting performance			No service suggested or required.
Bracket corroded, affecting performance	A		Require repair or replacement.
Bracket corroded, not affecting performance	2		Suggest repair or replacement.
Bracket cracked, affecting performance	A		Require repair or replacement.
Bracket cracked, not affecting performance	1		Suggest repair or replacement.
Bracket holes elongated, affecting performance	A		Require repair or replacement.
Bracket holes elongated, not affecting performance			No service suggested or required.
Bracket loose, affecting performance	A		Require repair or replacement.
Bracket loose, not affecting performance	1		Suggest repair or replacement.
Bracket missing	C		Require replacement.
Housing broken, affecting performance	A		Require repair or replacement.
Housing broken, not affecting performance			No service suggested or required.
Housing cracked, affecting performance	A		Require repair or replacement.
Housing cracked, not affecting performance	1		Suggest repair or replacement.
Inoperative	A		(1) Require repair or replacement.
Leaking	A		Require repair or replacement.
Noisy	2		(2) Suggest repair or replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A		Require replacement.
Tubing connection leaking	A		Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Compressor noise can also be caused by low oil level, state of charge, air contamination, or type of refrigerant.

CONDENSER AIR SEALS

CONDENSER AIR SEAL INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

CONDENSER FAN MOTORS

See COOLING FAN MOTORS.

CONDENSERS

CONDENSER INSPECTION

Condition	Code	Procedure
Abrasion damage, affecting structural integrity	A	Require repair or replacement.
Abrasion damage, not affecting structural integrity		No service suggested or required.
Air flow obstruction, affecting performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent, affecting performance	A	Require repair or replacement.
Bent, not affecting performance		No service suggested or required.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance		No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance		No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance		No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Corroded, not affecting structural integrity		No service suggested or

			required.
Fitting type incorrect (such as compression fitting)	B	.....	Require replacement.
Flange leaking	A	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Restricted internally	A	..	Require repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

CONTROL CABLES

CONTROL CABLE INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Binding	A	..	Require repair or replacement.
Bracket bent, affecting performance	A	..	Require repair or replacement.
Bracket bent, not affecting performance	..	.....	No service suggested or required.
Bracket broken, affecting performance	A	.....	Require replacement.
Bracket broken, not affecting performance	..	.....	No service suggested or required.
Bracket corroded, affecting performance	A	..	Require repair or replacement.
Bracket corroded, not affecting performance	2	..	Suggest repair or replacement.
Bracket cracked, affecting performance	A	..	Require repair or replacement.
Bracket cracked, not affecting performance	1	..	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	..	Require repair or replacement.
Bracket holes elongated, not affecting performance	..	.....	No service suggested or required.
Bracket loose, affecting performance	A	..	Require repair or replacement.
Bracket loose, not affecting performance	1	..	Suggest repair or replacement.
Bracket missing	C	.....	Require replacement.
Broken	A	..	Require repair or replacement.
Cracked	2	..	Suggest repair or replacement.

Disconnected	A	..	Require repair or replacement.
Kinked	2	..	Suggest repair or replacement.
Melted	A	.....	(1) Require repair or replacement.
Missing	C	.....	Require replacement.
Out of adjustment	B	.....	(2) Require repair or replacement.
Routed incorrectly	2	.....	Suggest repair.
Seized	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

CONTROL HEADS (FUNCTION SELECTORS)

CONTROL HEAD (FUNCTION SELECTOR) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted, affecting performance ..	A	..... (1) Require repair or replacement.
Connector melted, not affecting performance ..	2	..... (1) Suggest repair or replacement.
Connector missing	C	..... Require replacement.
Contaminated	2	.... Suggest require replacement.
Leaking	A	.. Require repair or replacement.
Malfunctioning	A	..... (2) Require repair or replacement.
Melted, affecting performance	A	..... (1) Require repair or replacement.
Melted, not affecting performance	..	..... No service suggested or required.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	..... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.

Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead burned	A	..	Require repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

CONTROL LINKAGES

CONTROL LINKAGE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	.. Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	. Require repair or replacement of hardware.
Bent	A	. Require repair or replacement.
Binding	A	. Require repair or replacement.
Bracket bent, affecting performance	A	. Require repair or replacement.
Bracket bent, not affecting performance	..	..... No service suggested or required.
Bracket broken, affecting performance	A	..... Require replacement.
Bracket broken, not affecting performance	..	..... No service suggested or required.
Bracket corroded, affecting performance	A	. Require repair or replacement.
Bracket corroded, not affecting performance	2	. Suggest repair or replacement.
Bracket cracked, affecting performance	A	. Require repair or replacement.
Bracket cracked, not affecting performance	1	. Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	. Require repair or replacement.
Bracket holes elongated, not affecting performance	..	..... No service suggested or required.
Bracket loose, affecting performance	A	. Require repair or replacement.
Bracket loose, not affecting performance	1	. Suggest repair or replacement.
Bracket missing	C	..... Require replacement.
Broken	A	..... Require replacement.
Cracked	A	. Require repair or replacement.
Disconnected	A	. Require repair or replacement.

Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(1) Require repair or replacement.
Seized	A	Require repair or replacement.

(1) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

CONTROL MODULES

NOTE: Includes, but not limited to: IRCM, Coolant Fan Control Module (CFCM), AC Controller, Amplifier, Programmers, Control Heads, Power Modules, etc.

CONTROL MODULE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector melted, affecting performance	A	(2) Require repair or replacement.
Connector melted, not affecting performance	2	(2) Suggest repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Inoperative	B	(4) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement. Check for accepted cleaning procedure.
(4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable.

COOLANT

COOLANT INSPECTION

Condition	Code	Procedure
Acidity (pH) incorrect	1	Suggest correction or replacement.
Contaminated	B	(1) Require replacement or recycling. Further inspection required.
Level incorrect	B	(2) Require filling to proper level.
Maintenance intervals	3	(3) Suggest replacement.
Mixture incorrect	B	Require correction or replacement.
Type incorrect	B	Require replacement.

(1) - Determine source of contamination and require correction prior to coolant replacement.
(2) - Determine source of incorrect level and suggest repair.
(3) - The system should be drained and/or flushed and refilled with correct coolant according to OEM recommended service interval and procedures.

COOLING FAN BLADES

COOLING FAN BLADE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.

Bent	A	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.

COOLING FAN CLUTCHES

NOTE: Some lateral movement, measured at the fan blade tip, may be normal.

COOLING FAN CLUTCH INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing noisy	A	Require replacement.
Bearing worn	A	Require replacement.
Fastener loose	A	Require repair or replacement of fastener.
Inoperative	A	(1) Require replacement.
Leaking	1	Suggest replacement.
Seized	A	Require replacement.
Slips (insufficient fan speed)	A	Require replacement.
Thermal control incorrect	B	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

COOLING FAN MOTORS

COOLING FAN MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.

Connector melted, not affecting performance	2	.....	(1) Suggest repair or replacement.
Connector missing	C	.....	Require replacement.
Hydraulic fan motor leaking	A	..	Require repair or replacement.
Inoperative	A	.....	(2) Require replacement.
Missing	C	.....	Require replacement.
Noisy	2	.....	Suggest replacement.
Rotation incorrect for application	B	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Vibration	1	.....	Suggest replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

EVAPORATOR DRAIN TUBES

EVAPORATOR DRAIN TUBE INSPECTION

Condition	Code		Procedure
Disconnected	A	.....	Require repair.
Leaking	A	.....	Require replacement.
Missing	C	.....	Require replacement.
Restricted	A	..	Require repair or replacement.
Routed incorrectly	B	.....	Require repair.

EVAPORATOR PRESSURE REGULATORS (EPRS)

EVAPORATOR PRESSURE REGULATOR (EPR) INSPECTION

Condition	Code		Procedure
Inoperative	A	.....	(1) Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

EVAPORATORS

EVAPORATOR INSPECTION

Condition	Code	Procedure
Abrasion damage, affecting structural integrity	A	Require repair or replacement.
Abrasion damage, not affecting structural integrity		No service suggested or required.
Air flow obstruction, affecting performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance		No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance		No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance		No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Corroded, not affecting structural integrity		No service suggested or required.
Evaporator foam seal leaking	A	Require replacement.
Evaporator foam seal missing	C	Require replacement.
Fitting type incorrect		

(such as compression fitting)	B	Require replacement.
Flange leaking	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted internally	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

EXPANSION VALVES

EXPANSION VALVE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Corroded internally	1	Suggest replacement.
Filter screen torn	A	Require replacement of screen.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Restricted	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Expansion valve operation may be affected by capillary tube location, corrosion, and insulation tape. Inoperative includes intermittent operation.

FUNCTION SELECTORS

See CONTROL HEADS (FUNCTION SELECTORS).

FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS

FUSE, FUSIBLE LINK AND CIRCUIT BREAKER INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Blown	A	(1) Require replacement.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(2) Require replacement.
Insulation damaged,		

conductors exposed	A	..	Require repair or replacement.
Insulation damaged, conductors not exposed .	1	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Routed incorrectly	B	.....	Require repair.
Secured incorrectly	B	.....	Require repair.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	..	Require repair or replacement.
Terminal corroded, not affecting performance ..	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance ..	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Inoperative includes intermittent operation.

FUSIBLE LINKS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

GASKETS

GASKET INSPECTION

Condition	Code		Procedure
Leaking	A	.....	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

HEATER CASES

See PLENUMS.

HEATER CONTROL VALVES

HEATER CONTROL VALVE INSPECTION

Condition	Code		Procedure
Application incorrect ...	B	.....	Require replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement

			of hardware.
Binding	2	..	Suggest repair or replacement.
Coolant leak	A	..	Require repair or replacement.
Disconnected	A	..	Require repair or replacement.
Malfunctioning	A	.....	(1) Require repair or replacement.
Missing	C	.....	Require replacement.
Restricted	A	..	Require repair or replacement.
Seized	A	..	Require repair or replacement.
Vacuum leak	A	..	Require repair or replacement.

(1) - Includes inoperative, intermittent operation, or failure to perform all functions.

HEATER CORES

HEATER CORE INSPECTION

Condition	Code		Procedure
Air flow obstruction	A	..	Require repair or replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	..	Require repair or replacement of hardware.
Connection leaking	A	..	Require repair or replacement.
Corroded	1	..	Suggest repair or replacement.
Disconnected	A	..	Require repair or replacement.
Fins damaged, affecting performance	A	..	Require repair or replacement.
Fins damaged, not affecting performance	..	.....	No service suggested or required.
Internal restrictions, affecting performance	A	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.

HEATER HOSES

HEATER HOSE INSPECTION

Condition	Code		Procedure
Application incorrect	B	.....	Require replacement.
Connected incorrectly	A	.....	Require repair.
Corroded, not reusable	1	.....	Suggest replacement.
Cracked	A	..	Require repair or replacement.
Hard (brittle)	1	..	Suggest repair or replacement.
Inner fabric (webbing) damaged	A	.....	Require replacement.
Insufficient clamping force, allowing hose to leak	A	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Maintenance intervals	3	.....	Suggest replacement.

Melted	1	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Outer covering damaged	1	.....	Suggest replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	.....	Require replacement.
Protective sleeves damaged	2	.	Suggest replacement of sleeves.
Protective sleeves missing	2	.	Suggest replacement of sleeves.
Restricted, affecting performance	A	..	Require repair or replacement.
Restricted, not affecting performance	2	..	Suggest repair or replacement.
Routed incorrectly	2	.....	Suggest repair.
Safety clip missing	C	.....	Require replacement.
Spongy	1	..	Suggest repair or replacement.
Stripped	A	.....	Require replacement.
Surface cracks (dry-rotted)	1	..	Suggest repair or replacement.
Swollen	B	.....	Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Type incorrect	1	..	Suggest repair or replacement.

HIGH PRESSURE RELIEF VALVES (HPRV)

HIGH PRESSURE RELIEF VALVE (HPRV) INSPECTION

Condition	Code	Procedure
Inoperative	A	..... (1) Require repair or replacement.
Leaking	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

IDLERS

See TENSIONERS.

IN-LINE FILTERS

IN-LINE FILTER INSPECTION

Condition	Code	Procedure
Connection leaking	B	.. Require repair or replacement.
Leaking	A	.. Require repair or replacement.
Restricted	A	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

METAL FITTINGS

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES.

METAL LINES

See AIR CONDITIONING METAL LINES, HOSES AND FITTING ASSEMBLIES.

MIX AND AIR CONTROL DOORS (BLEND DOORS)

See PLENUMS.

O-RINGS

O-RING INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

ORIFICE TUBES

ORIFICE TUBE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Bypassing internally	A	Require repair or replacement.
Filter screen torn	A	Require replacement.
Installation incorrect	B	Require repair.
Restricted	A	Require repair or replacement.

PILOT-OPERATED ABSOLUTES (POAS)

PILOT-OPERATED ABSOLUTE (POA) INSPECTION

Condition	Code	Procedure
Connection damaged	B	Require repair or replacement.
Fitting damaged	B	Require repair or replacement.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

PLENUMS

PLENUM INSPECTION

Condition	Code	Procedure
Air control door binding	A	Require repair or replacement
Air control door broken	A	Require repair or replacement.
Air control door leaking	A	Require repair or replacement.
Air control door seized	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked	2	Suggest repair or replacement.
Drain hole restricted	A	Require repair.
Drain plugged	A	Require repair.
Duct disconnected	A	Require repair or replacement.
Duct leaking	A	Require repair or replacement.
Duct missing	C	Require replacement.
Duct restricted	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Noisy	2	Suggest cleaning or repair.
Odor	2	Suggest cleaning or repair.
Restricted	A	Require cleaning, repair, or replacement.

PRESSURE CONTROL VALVES

See:

* EVAPORATOR PRESSURE REGULATORS (EPRS)
* HIGH PRESSURE RELIEF VALVES (HPRV)
* PILOT-OPERATED ABSOLUTES (POAS)
* SUCTION THROTTLING VALVES (STVS)
* VALVES IN RECEIVER (VIRS)

PRESSURE SENSORS

See THERMISTORS AND PRESSURE SENSORS.

PULLEYS

PULLEY INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not		

functioning	A	...	Require repair or replacement of hardware.
Bearing noisy	2	.....	Suggest replacement.
Bearing seized	A	..	Require repair or replacement.
Bearing worn	1	.....	Suggest replacement.
Cracked	A	.....	Require replacement.
Loose	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Pulley damaged, affecting belt life	A	.....	Require replacement.

RADIATORS

RADIATOR INSPECTION

Condition	Code		Procedure
Air flow obstruction	A	.....	Require repair.
Application incorrect	B	.....	Require replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	..	Require repair or replacement of hardware.
Connection leaking	A	..	Require repair or replacement.
Corroded	1	..	Suggest repair or replacement.
Drain inoperative	A	..	Require repair or replacement.
Fins damaged, affecting performance	A	..	Require repair or replacement.
Fins damaged, not affecting performance	..	.....	No service suggested or required.
Internal oil cooler leaking	A	..	Require repair or replacement.
Internal restrictions	B	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	..	Require repair or replacement.
Tubes damaged, affecting performance	A	..	Require repair or replacement.
Tubes damaged, not affecting performance	..	.....	No service suggested or required.

RECEIVER-DRIERS

NOTE: For VIRs, see VALVES IN RECEIVER (VIRS).

RECEIVER-DRIER INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware			

missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Contaminated, affecting performance	A	Require replacement.
Dessicant bag deteriorated	A	(1) Require replacement. Further inspection required.
Dessicant at the end of its useful life (saturated with moisture)	1	Suggest repair or replacement.
Fusible plug leaking	A	Require replacement of plug.
Leaking	A	Require replacement.
Pressure relief device leaking	A	Require replacement of pressure relief device.
Restricted	A	Require repair or replacement.
Sight glass no longer transparent	2	Suggest replacement of drier.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Tubing connection leaking	A	Require repair or replacement.

(1) - Inspect system to determine effects of dessicant bag deterioration.

REFRIGERANT

NOTE: Refrigerants include any SNAP (Significant New Alternative Policy)-approved blends.

REFRIGERANT INSPECTION

Condition	Code	Procedure
Contaminated (other than refrigerant blends)	B	Require service to remove contamination.
Different types of refrigerants in the same system (other than refrigerant blends)	B	Require repair.
Overcharged	B	Require repair.
Refrigerant type does not match fittings and label	B	Require repair.
Undercharged	B	Require repair.

REFRIGERANT OIL

REFRIGERANT OIL INSPECTION

Condition	Code	Procedure
Contaminated	1	Require repair or replacement.
Overfilled	B	Require repair.

Underfilled	B	Require repair.

RELAYS

RELAY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Housing broken	A	Require replacement.
Housing cracked	2	Suggest replacement.
Inoperative	A	(1) Require replacement.
Melted, affecting performance	A	(2) Require repair or replacement.
Melted, not affecting performance	2	(2) Suggest repair or replacement.
Missing	C	Require replacement.
Terminal broken	A ..	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A ..	Require repair or replacement.
Terminal corroded, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal loose, affecting performance	B ..	Require repair or replacement.
Terminal loose, not affecting performance ..	1 ..	Suggest repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

SEALS

SEAL INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SERVICE PORTS

SERVICE PORT INSPECTION

Condition	Code	Procedure
Application does not match refrigerant type	B	Require replacement.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Valve cap leaking	A	Require repair or replacement of cap.
Valve cap missing	C	Require replacement of valve cap.
Valve core sticking	B	Require repair or replacement.

SPRING LOCK COUPLINGS

SPRING LOCK COUPLING INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SUCTION THROTTLING VALVES (STVS)

SUCTION THROTTLING VALVE (STV) INSPECTION

Condition	Code	Procedure
Connection damaged	B	Require repair or replacement.
Fitting damaged	B	Require repair or replacement.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

SWITCHES (ELECTRICAL)

SWITCH (ELECTRICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.

Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	(3) Require replacement.
Out of adjustment	B	Require repair or replacement.
Pressure switch leaking	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Won’t return	A	Require repair or replacement.
Worn	1	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.
(3) - Missing includes high pressure cut-off switches not installed during a retrofit from R12 to R134a.

TENSIONERS

TENSIONER INSPECTION

Condition	Code	Procedure

Alignment incorrect	B ..	Require repair or replacement.
Application incorrect ...	B	Require replacement.
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Bearing worn	1	Suggest replacement.
Belt tension incorrect ..	B ...	Require adjustment or repair.
Bracket cracked	A ..	Require repair or replacement.
Housing cracked	A ..	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Pulley damaged, affecting belt life	A	Require replacement.
Seized	A ..	Require repair or replacement.

THERMISTORS AND PRESSURE SENSORS

NOTE: Includes, but not limited to, In-Car Temperature, Ambient Air Temperature, Sun Load Sensor, etc.

THERMISTOR AND PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Calibration incorrect ...	B ..	Require repair or replacement.
Connector broken	A ..	Require repair or replacement.
Connector (Weatherpack type) leaking	A ..	Require repair or replacement.
Connector melted, affecting performance ..	A	(1) Require repair or replacement.
Connector melted, not affecting performance ..	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance ...	2 ..	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A ..	Require repair or replacement.
Terminal corroded, not affecting performance ..	2 ..	Suggest repair or replacement.

Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead burned	A	..	Require repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

THERMOSTATS AND HOUSINGS

THERMOSTAT AND HOUSING INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked	A	Require replacement.
Housing corroded	1	Suggest replacement of housing.
Inoperative	A	(1) Require replacement.
Installation incorrect	B	Require repair or replacement.
Leaking	A	Require repair or replacement.
Thermostat missing	C	Require replacement of thermostat.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

VACUUM HOSES AND TUBES

VACUUM HOSE AND TUBE INSPECTION

Condition	Code	Procedure
Disconnected	A	Require repair.
Leaking	A	Require repair or replacement.
Melted	A	Require repair replacement.
Missing	C	Require replacement.
Oil-soaked (spongy)	1	Suggest replacement.
Restricted	A	Require repair or replacement.

Routing incorrect	B	Require repair.
Surface cracks (dry-rotted)	1	Suggest replacement.

VACUUM RESERVOIRS

VACUUM RESERVOIR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Check valve leaking internally	A	Require replacement.
Leaking	A ..	Require repair or replacement.
Missing	C	Require replacement.
Restricted	A ..	Require repair or replacement.

VACUUM TUBES

See VACUUM HOSES AND TUBES.

VALVES IN RECEIVER (VIRS)

VALVE IN RECEIVER (VIR) INSPECTION

Condition	Code	Procedure
Application incorrect ...	B	Require replacement.
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Bracket bent, affecting performance	A ..	Require repair or replacement.
Bracket bent, not affecting performance ..	.. ..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance ..	.. ..	No service suggested or required.
Bracket corroded, affecting performance ..	A ..	Require repair or replacement.
Bracket corroded, not affecting performance ..	2 ..	Suggest repair or replacement.
Bracket cracked, affecting performance	A ..	Require repair or replacement.

Condition	Code	Procedure
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance		No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Connection damaged	B	Require repair or replacement.
Contaminated, affecting performance	A	Require replacement.
Corroded internally	1	Suggest replacement.
Dessicant bag deteriorated	A	(1) Require replacement. Further inspection required.
Dessicant at the end of its useful life (saturated with moisture)	1	Suggest repair or replacement.
Filter screen torn	A	Require replacement of screen.
Fitting damaged	B	Require repair or replacement.
Fusible plug leaking	A	Require replacement of plug.
Inoperative	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Pressure relief device leaking	A	Require replacement of pressure relief device.
Restricted	A	Require repair or replacement.
Sight glass no longer transparent	2	Suggest replacement of drier.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Tubing connection leaking	A	Require repair or replacement.

(1) - Inspect system to determine effects of dessicant bag deterioration.
(2) - Inoperative includes intermittent operation or out of OEM specification.

WATER PUMPS (ELECTRIC AUXILIARY)

WATER PUMP (ELECTRIC AUXILIARY) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Circuit open	A	Require repair or replacement.
Circuit resistance (voltage drop) out of		

specification	A	..	Require repair or replacement.
Circuit shorted	A	..	Require repair or replacement.
Connector melted, affecting performance	A	.....	(1) Require repair or replacement.
Connector melted, not affecting performance	2	.....	(1) Suggest repair or replacement.
Connector missing	C	.....	Require replacement.
Diode open	A	..	Require repair or replacement.
Diode shorted	A	..	Require repair or replacement.
Insulation damaged, conductors exposed	A	..	Require repair or replacement.
Insulation damaged, conductors not exposed	1	.....	Suggest replacement.
Protective shield (conduit) melted	B	.....	(1) Require replacement.
Protective shield (conduit) missing	C	.....	Require replacement.
Routed incorrectly	B	.....	Require repair.
Secured incorrectly	B	.....	Require repair.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Voltage drop out of specification	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

A/C-HEATER SYSTEM

1997-99 Mitsubishi Montero Sport

1997-99 A/C-HEATER SYSTEMS
Mitsubishi - Manual A/C-Heater Systems

Montero Sport

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

A/C SYSTEM SPECIFICATIONS

A/C SYSTEM SPECIFICATIONS TABLE

Application	Specification
Compressor Type	Sanden MSC105C Scroll
Compressor Belt Deflection (1)	
New	13/64-15/64" (5.1-6.0 mm)
Used	17/64-19/64" (6.6-7.5 mm)
Compressor Oil Capacity	(2) 5.1 ozs.
Refrigerant (R-134a) Capacity	23-24 ozs.
System Operating Pressures (3)	
High Side	130-220 psi (9.1-15.5 kg/cm²)
Low Side	20-23 psi (1.4-1.6 kg/cm²)

(1) - With 22 lbs. (100 N.m) force applied midway on longest span of belt.
(2) - Use SUN PAG 56 refrigerant oil.
(3) - With ambient temperature at about 80°F (27°C).

DESCRIPTION

Slight variations exist among manual A/C-heater systems used. Either Sanden Scroll or Nippondenso 10-cylinder compressor is used. Cycling of compressor clutch is controlled by an automatic A/C Control Unit (ACCU).

Compressors will only operate within normal operating temperatures and pressures set for each model. An electric condenser fan operates whenever A/C system is operating. System components used vary depending upon model. Systems may include an ACCU, fan switch, evaporator, temperature sensor, dual-pressure switch, engine coolant temperature switch, compressor, condenser, receiver-drier and various pipes and hoses.

OPERATION

A/C CONTROL UNIT (ACCU)

ACCU controls cycling of compressor clutch based on information received from air thermosensor and air inlet sensor, dual-pressure switch, A/C switch and A/C engine coolant temperature switch. ACCU is attached to top of evaporator housing.

A/C SWITCH

When switch is turned on, air conditioning will operate if blower motor control lever is in a position other than OFF.

When activated, A/C switch allows A/C compressor clutch to engage and operate the compressor.

A/C ENGINE COOLANT TEMPERATURE SWITCH

The engine coolant temperature switch, located on thermostat housing, is wired in series with compressor clutch. When coolant temperature is greater than switch control temperature, power to compressor is cut and compressor is turned off until temperature returns to operating range. Switch will turn on at 226°F (108°C) and off at 235-243°F (112-118°C).

AIR SELECTOR LEVER

The lever moves horizontally to select source of air used inside passenger compartment. Lever moves from position on left (outside air mode) to position on right (recirculated air mode). Lever should be set in recirculated air mode for maximum A/C cooling.

BLOWER MOTOR CONTROL SWITCH

Blower motor control switch rotates to select blower motor speeds. As switch is rotated from left or OFF position, increasing speeds of blower operation are selected. In order for A/C system to operate, blower motor control switch must be in a position other than OFF.

MODE SELECTOR KNOB

Mode selector knob has six modes available to achieve desired distribution of air from various outlets.

When knob is rotated fully to left (counterclockwise), airflow is directed to upper passenger area. In second position (clockwise), airflow is directed to upper passenger area and slightly to leg area. Position 3, directs air mostly to leg area and slightly to upper passenger area. Position 4, directs air exclusively to leg area. Position 5, directs air to leg area and to windshield and door windows. Position 6, directs air exclusively to windshield and door windows.

TEMPERATURE CONTROL KNOB

Temperature control knob operates blend-air door in heater/air conditioning unit, mixing cooled and heated air so that selected air temperature can be obtained. The system will provide cooled air when A/C switch is in ON position and blower motor is in any position other than OFF. Temperature control knob should be on far left (maximum cooling) side of temperature selection scale when maximum A/C cooling is desired.

DUAL-PRESSURE SWITCH

The dual-pressure switch, mounted on receiver-drier, is wired in series with compressor clutch. Whenever system pressures drop below or increase above control points of switch, power supplied to compressor will be cut and compressor function will cease until pressures are back to normal operating ranges.

REFRIGERANT TEMPERATURE SENSOR

Refrigerant temperature sensor, located on compressor, de-energizes magnetic clutch if temperature exceeds 325°F (155°C) due to a problem in system.

ADJUSTMENTS

NOTE: For adjustment procedures, see the HEATER SYSTEM article.

TROUBLE SHOOTING

NO COOLING

1) Ensure compressor clutch is operating. If compressor clutch is operating, go to next step. If compressor clutch is not operating, check fuses and A/C switch. Check dual-pressure switch. Check air thermosensor. Check A/C engine coolant temperature switch. Check blower switch and relay. Check A/C compressor clutch coil.

2) Ensure system is properly charged with correct amount of refrigerant. Add refrigerant, or evacuate and recharge system as necessary. Ensure receiver-drier is not clogged. Check compressor belt for proper tension. Check for clogged expansion valve. Check compressor operation. Repair or replace components as necessary.

INSUFFICIENT AIRFLOW

Check for air leakage at air duct joint. Check for frost on evaporator. Ensure blower motor is operating properly. Check for obstructed air intake.

INSUFFICIENT COOLING

Ensure system is properly charged with correct amount of refrigerant and free of air and moisture. Add refrigerant, or evacuate and recharge system as necessary. Ensure receiver-drier is not clogged. Ensure sufficient airflow through condenser exists. Check compressor belt for proper tension. Check compressor operation. Repair or replace compressor as necessary. Check air thermosensor. Check for clogged expansion valve. Replace expansion valve as necessary. Check A/C compressor clutch coil.

INTERMITTENT COOL AIR

Check for air or moisture in system. Evacuate and recharge system as necessary. Check for expansion valve malfunction. Replace expansion valve if necessary. Check compressor belt for proper tension.

TESTING

WARNING: To avoid injury from accidental air bag deployment, read and follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

NOTE: For testing procedures not covered in this article, see the HEATER SYSTEM article.

A/C SYSTEM PERFORMANCE

1) Park vehicle out of direct sunlight. Install A/C gauge set. Start engine and allow it to idle at 1000 RPM. Turn A/C on. Set A/C controls to recirculated air, panel (vent) mode and full cold settings.

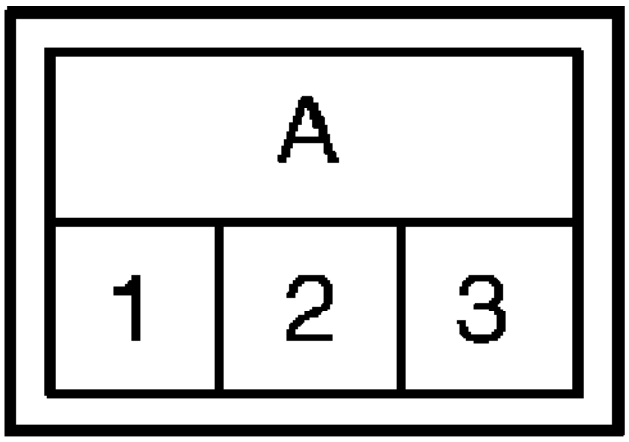
2) Set blower/fan on high speed. Close doors and windows. Insert thermometer in center vent. Operate system for 20 minutes to allow system to stabilize. Measure temperature. Discharge air temperature must be 44-51°F (7-11°C) at center vent, with high side and low side pressures within specification. See A/C SYSTEM SPECIFICATIONS table.

A/C CONTROL UNIT (ACCU)

Locate A/C Control Unit (ACCU), and disconnect 3-pin connector. Inspect connector and wiring for damage. Reconnect 3-pin connector and turn ignition and A/C on. Backprobe connector and ensure specified voltage exists at terminals specified. See A/C CONTROL UNIT (ACCU) SPECIFICATIONS table. See Fig. 1.

A/C CONTROL UNIT (ACCU) SPECIFICATIONS TABLE

Terminal No.	Condition	Voltage
1	A/C Relay Off	12
	A/C Relay On	0
2	A/C Switch Off	0
	A/C Switch On	12
3	Always	0



HARNESS SIDE VIEW

96J30097

Fig. 1: Testing ACCU
Courtesy of Mitsubishi Motor Sales of America.

A/C SWITCH

With A/C switch in indicated position, ensure continuity exists between listed terminals. See A/C SWITCH CONTINUITY TEST table. See Fig. 2.

A/C SWITCH CONTINUITY TEST TABLE

Switch Position	Terminal Position
OFF	3 & 6; 4 & 5
ON	1, 4 & 5; 3 & 6

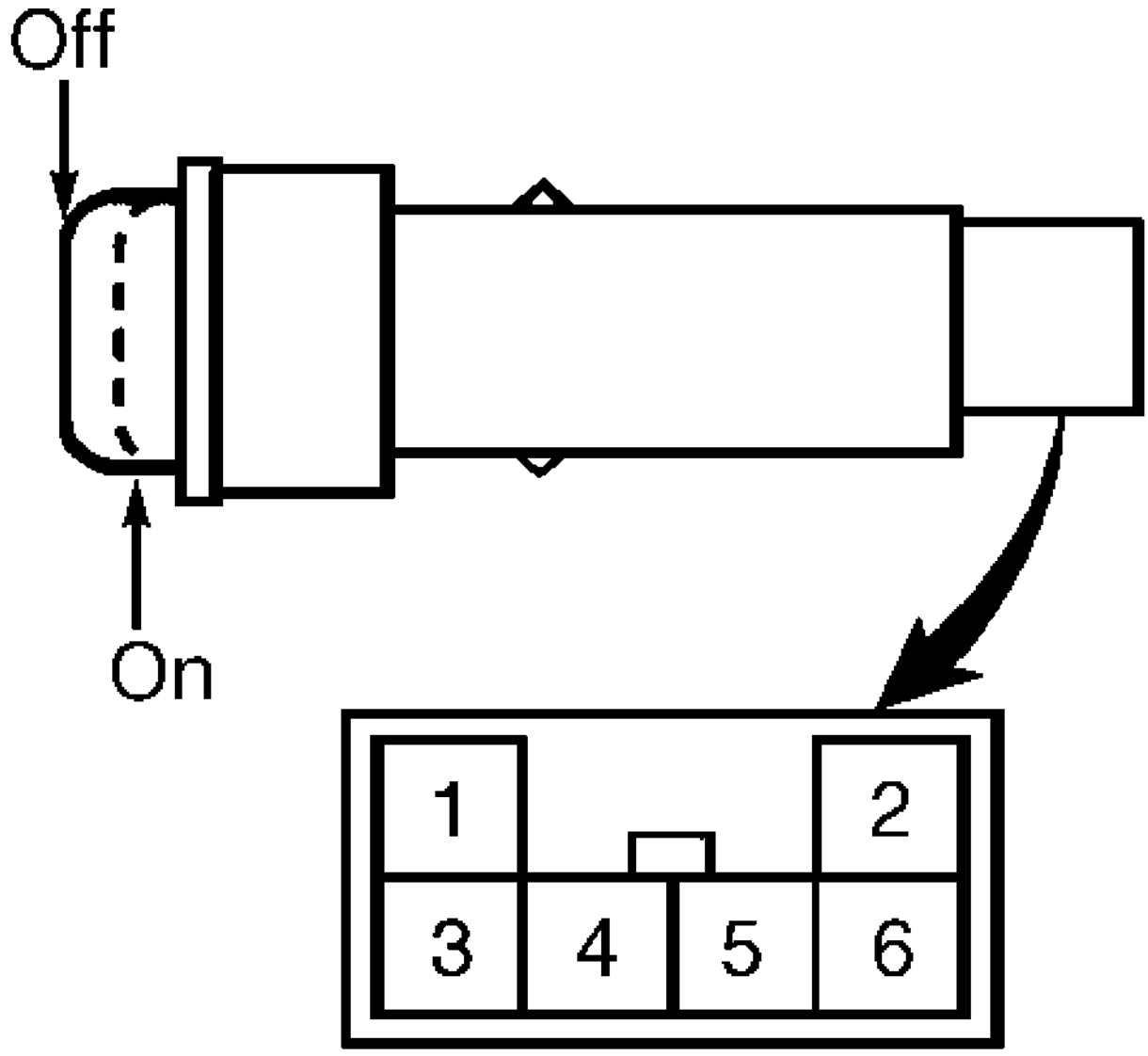


Fig. 2: Identifying A/C Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

A/C ENGINE COOLANT TEMPERATURE SWITCH

1) Disconnect A/C engine coolant temperature switch connector. Remove A/C engine coolant temperature switch. Carefully heat a pan of oil and hold coolant temperature switch up to threads in oil. Coolant switch is normally closed (continuity exists).

2) When oil reaches 235-243°F (112-118°C), coolant switch should open (no continuity). Replace A/C engine coolant temperature switch if it does not test as specified. See Fig. 3.

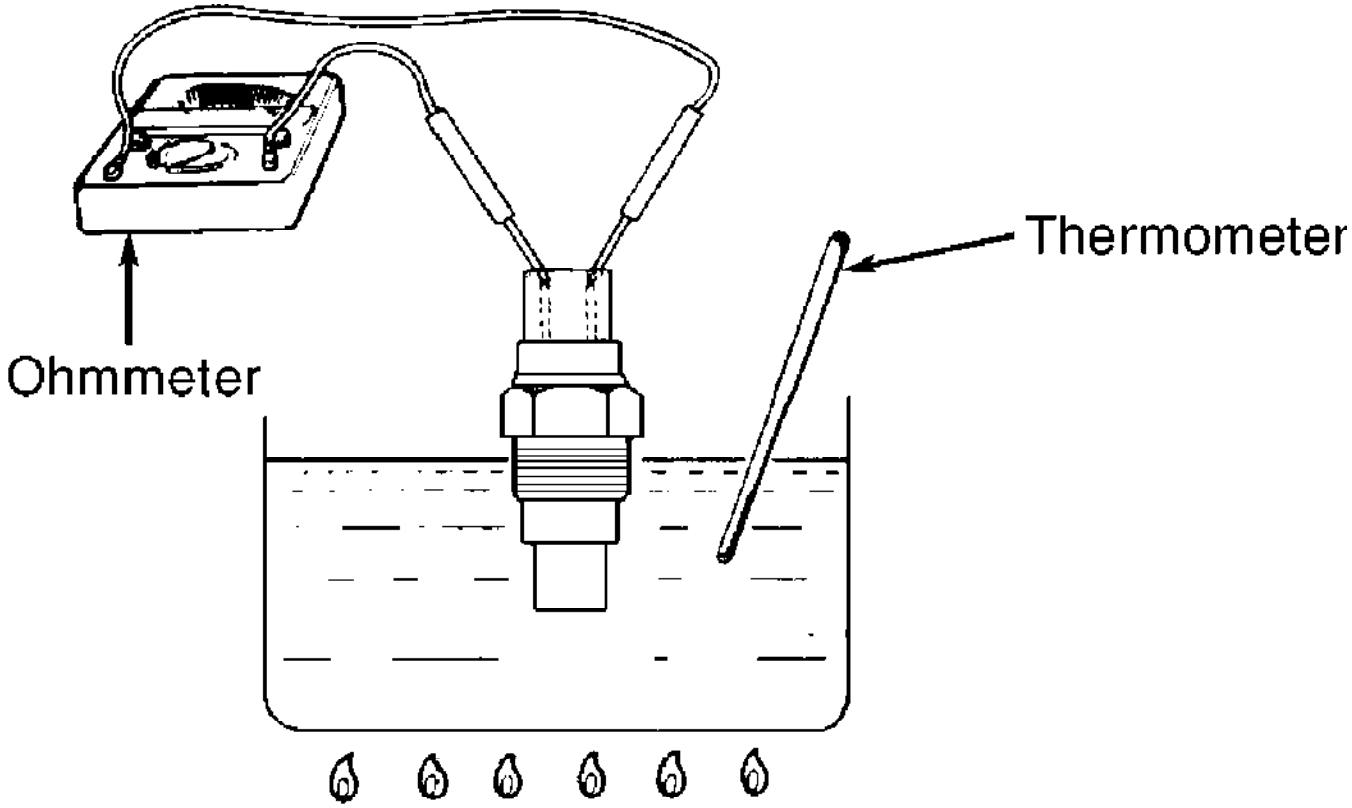


Fig. 3: Testing A/C Engine Coolant Temperature Switch
Courtesy of Mitsubishi Motor Sales of America.

AIR THERMOSENSOR & AIR INLET SENSOR

Disconnect sensor connector at evaporator case. See Fig. 15. Check terminal No. 3 with a test light. See Fig. 4. When temperature is above 38°F (3°C), terminal should have power. Replace thermosensor if light stays off.

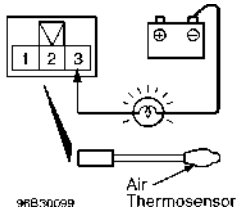


Fig. 4: Testing Air Thermosensor
Courtesy of Mitsubishi Motor Sales of America.

BLOWER RESISTOR

Disconnect blower resistor connector. Using an ohmmeter, measure resistance between indicated terminals. See BLOWER RESISTOR RESISTANCE table. See Fig. 5.

BLOWER RESISTOR RESISTANCE TABLE

Terminal No.	Approximate Ohms
1 & 3	0.68
2 & 3	2.00
3 & 4	1.11

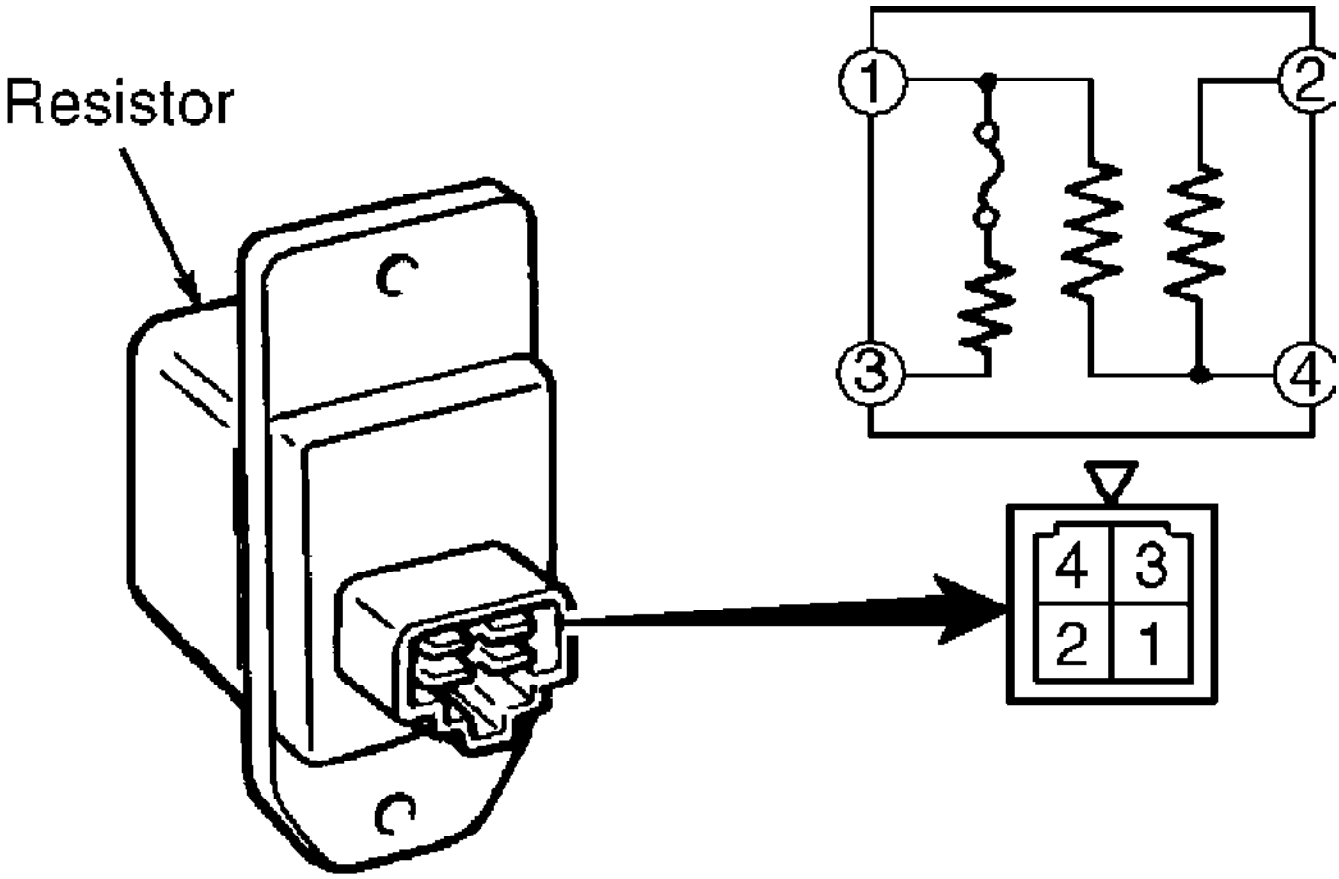


Fig. 5: Testing Blower Resistor
Courtesy of Mitsubishi Motor Sales of America.

BLOWER SWITCH

With blower switch in position indicated in BLOWER SWITCH CONTINUITY TEST table, ensure continuity exists between terminals listed. See Fig. 6.

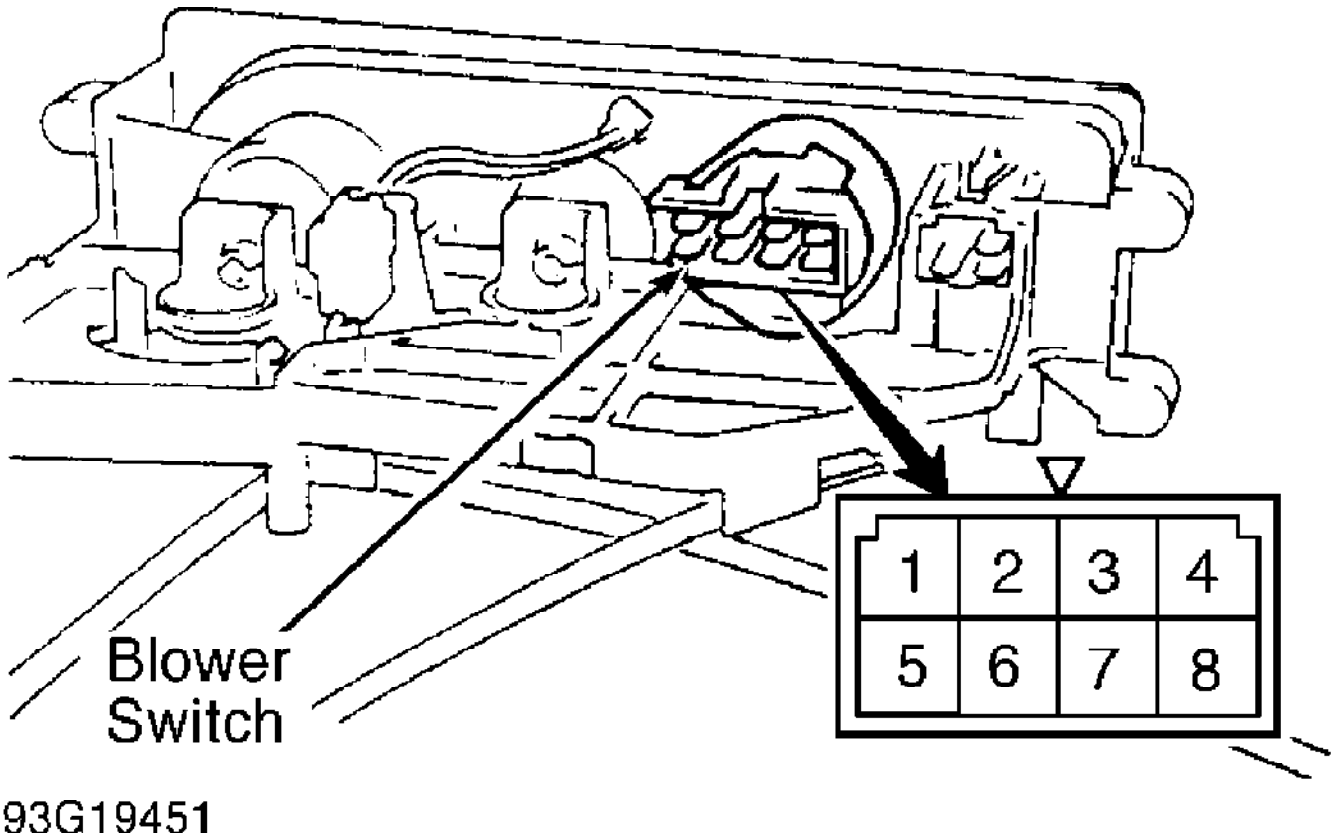


Fig. 6: Identifying Blower Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

BLOWER SWITCH CONTINUITY TEST TABLE

Switch Position	Terminal No.
OFF	(1)
Low	1 & 8; 3 & 5
Medium 1	1 & 8; 5 & 6
Medium 2	1 & 8; 2 & 5
High	1 & 8; 5 & 7

(1) - Continuity should not exist between any terminals.

MICRO SWITCH

Remove A/C-heater control panel. Disconnect connector. Ensure continuity exists at terminals No. 1 and 3 with mode selector knob in defrost and defrost/feet. See Fig. 7. Continuity should not exist in all other positions.

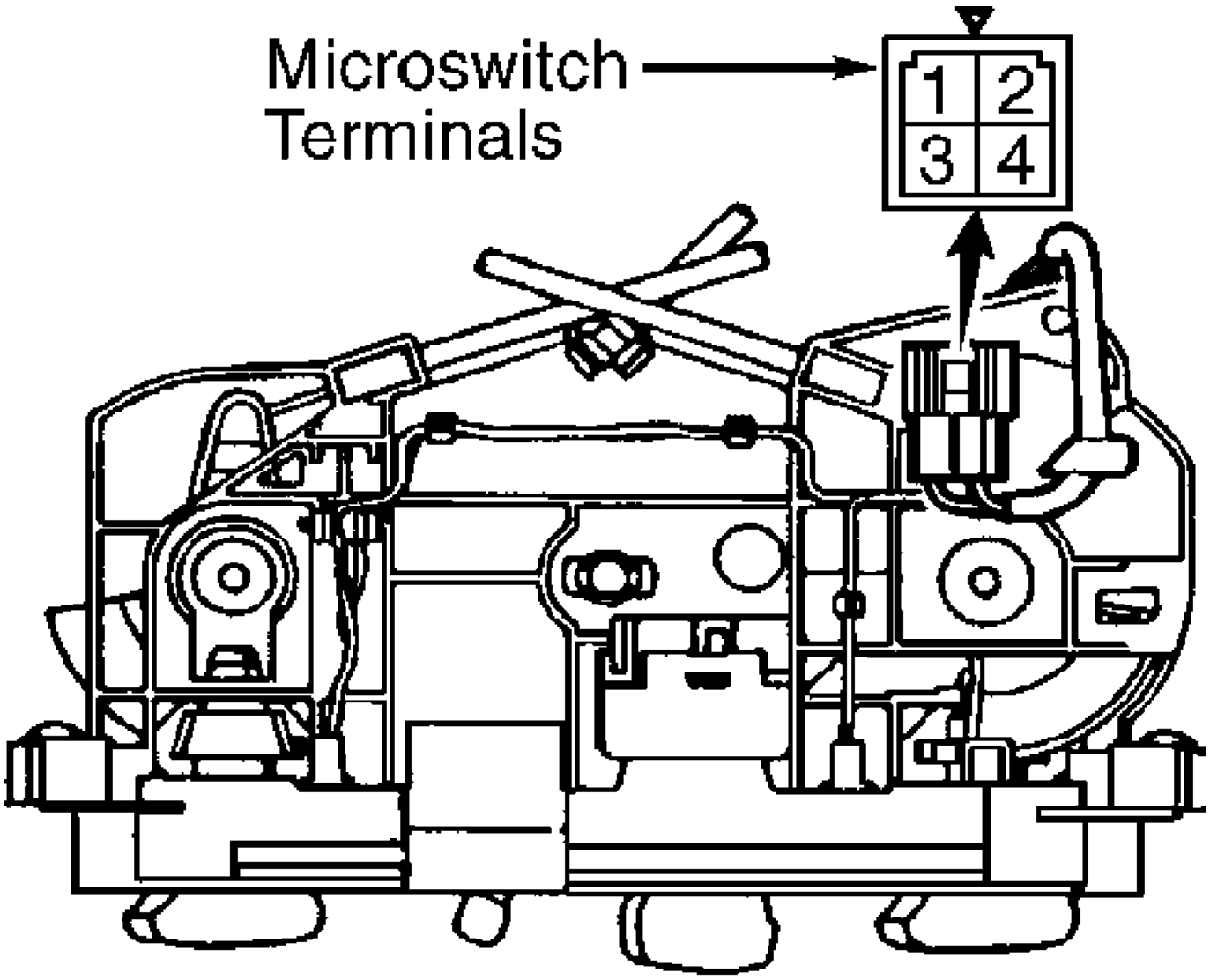


Fig. 7: Micro Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

DUAL-PRESSURE SWITCH

Disconnect dual-pressure connector, and connect a jumper wire across harness connector terminals. Connect manifold gauge set to system, and check operating pressures. Dual-pressure switch will allow compressor operation when system pressure is within specification. When high or low pressure side of dual-pressure switch is at operation pressure (ON), condition is normal if there is continuity between the respective terminals. If continuity is not present when switch is ON, replace dual-pressure switch. See PRESSURE SWITCH SPECIFICATIONS table.

PRESSURE SWITCH SPECIFICATIONS TABLE (1)

Application	ON Pressure psi (kg/cm²)	OFF Pressure psi (kg/cm²)

High Pressure	.....	341 (24)	.....	426 (30)
Low Pressure	.....	32 (2.2)	.....	28 (2.0)

(1) - With ambient temperature at 80°F (27°C)

COMPRESSOR CLUTCH

Disconnect wiring to compressor clutch. Connect battery voltage directly to A/C compressor clutch wiring harness terminals. If click is heard, clutch engagement is okay. If click is not heard, pulley and armature are not making contact. Repair or replace as necessary.

REFRIGERANT TEMPERATURE SENSOR

Ensure continuity exists between terminals with A/C off. Replace temperature sensor if continuity does not exist.

RELAYS

4-Terminal Relay

1) Remove relay from relay box located in engine compartment. Using an ohmmeter, check continuity between relay terminals. Continuity should exist between terminals No. 2 and 4, but not between terminals No. 1 and 3. See Fig. 8.

2) Connect battery voltage to terminal No. 2, and ground terminal No. 4. Ensure continuity now exists between terminals No. 1 and 3. If continuity is not as specified, replace relay.

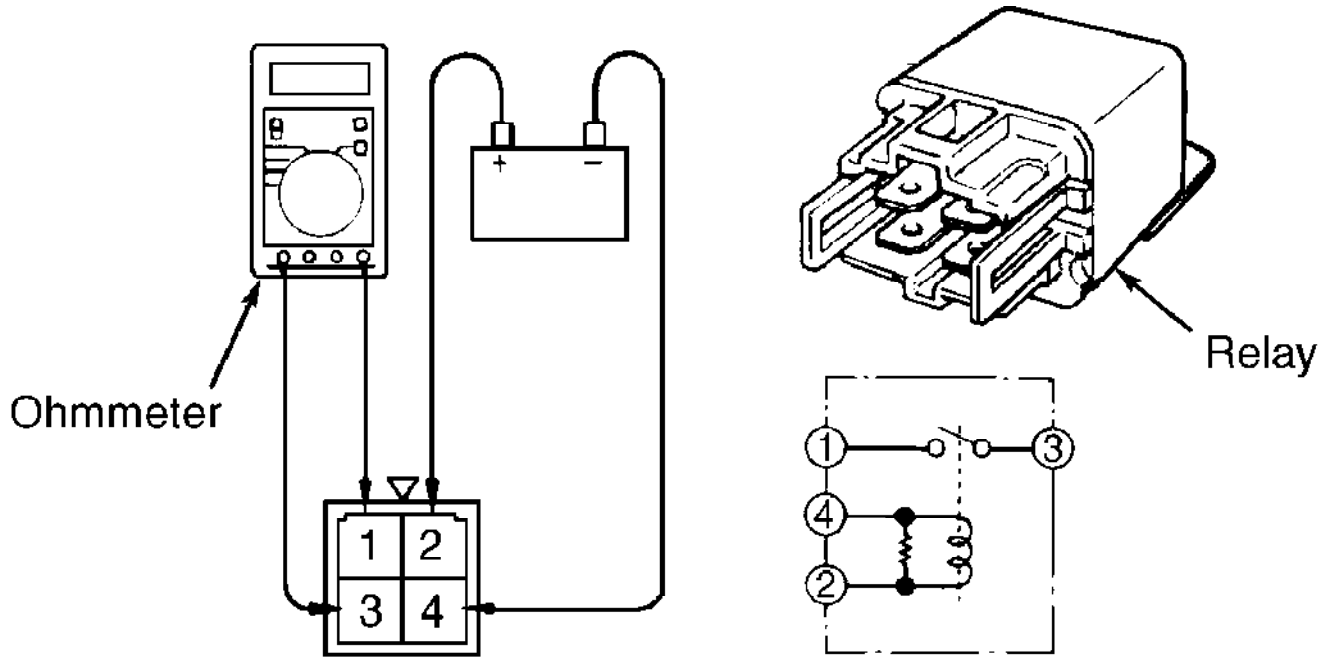


Fig. 8: Testing 4-Terminal Relay
Courtesy of Mitsubishi Motor Sales of America.

5-Terminal Relay

1) Remove relay from relay box located in engine compartment.

Using an ohmmeter, check continuity between relay terminals. Continuity should exist between terminals No. 1 and 3, but not between terminals No. 4 and 5. See Fig. 9.

2) Connect battery voltage to terminal No. 1, and ground terminal No. 3. Ensure continuity now exists between terminals No. 4 and 5. If continuity is not as specified, replace relay.

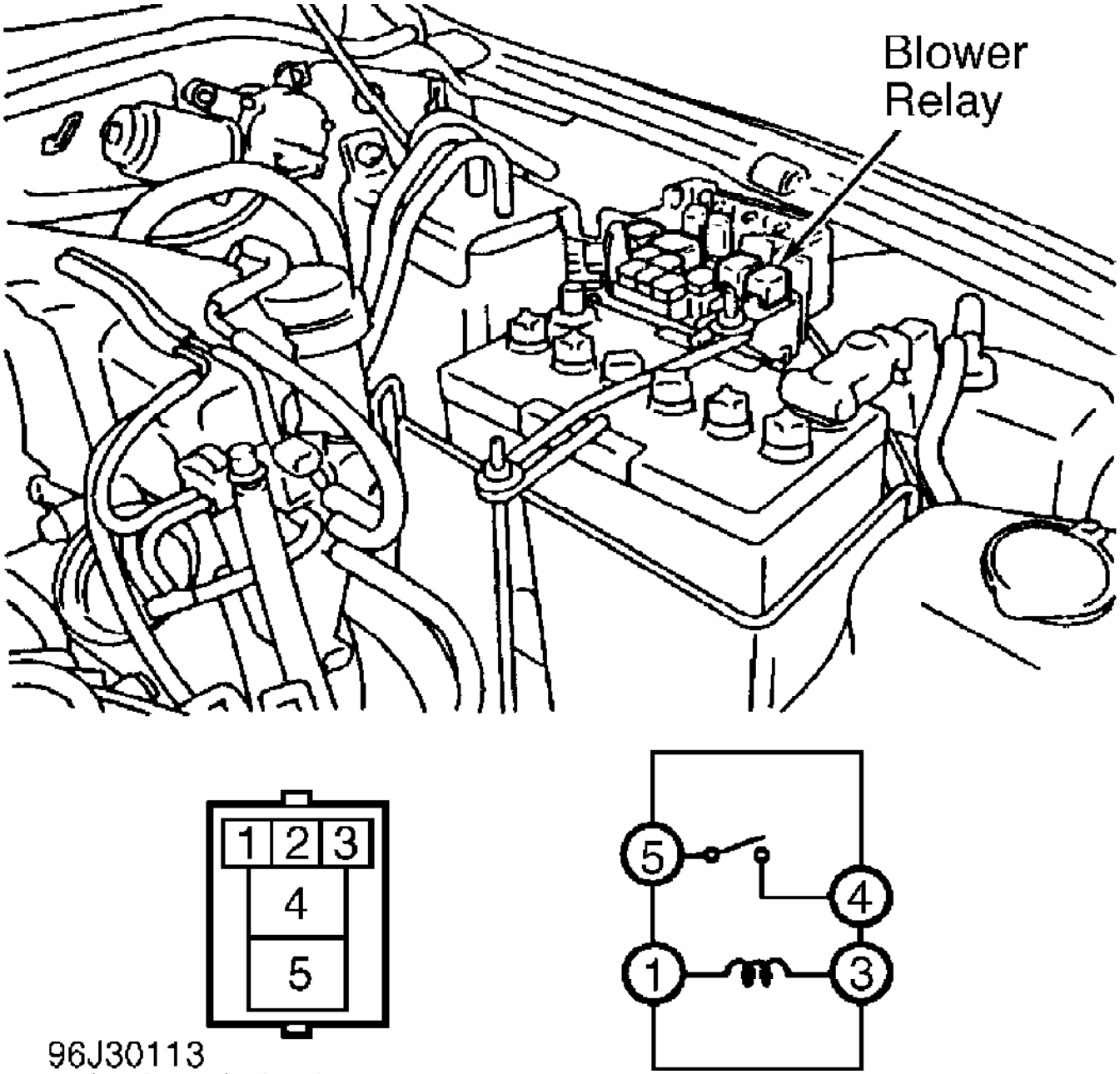


Fig. 9: Testing 5-Terminal Relay
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

WARNING: To avoid injury from accidental air bag deployment, read and follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR

BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

NOTE: For removal and installation procedures not covered in this article, see the HEATER SYSTEM article.

A/C CONTROL UNIT (ACCU)

Removal & Installation

Lower glove box. Remove 2 clips on top of evaporator, and remove ACCU. Disconnect wiring harness from ACCU. To install, reverse removal procedure. See Fig. 10 .

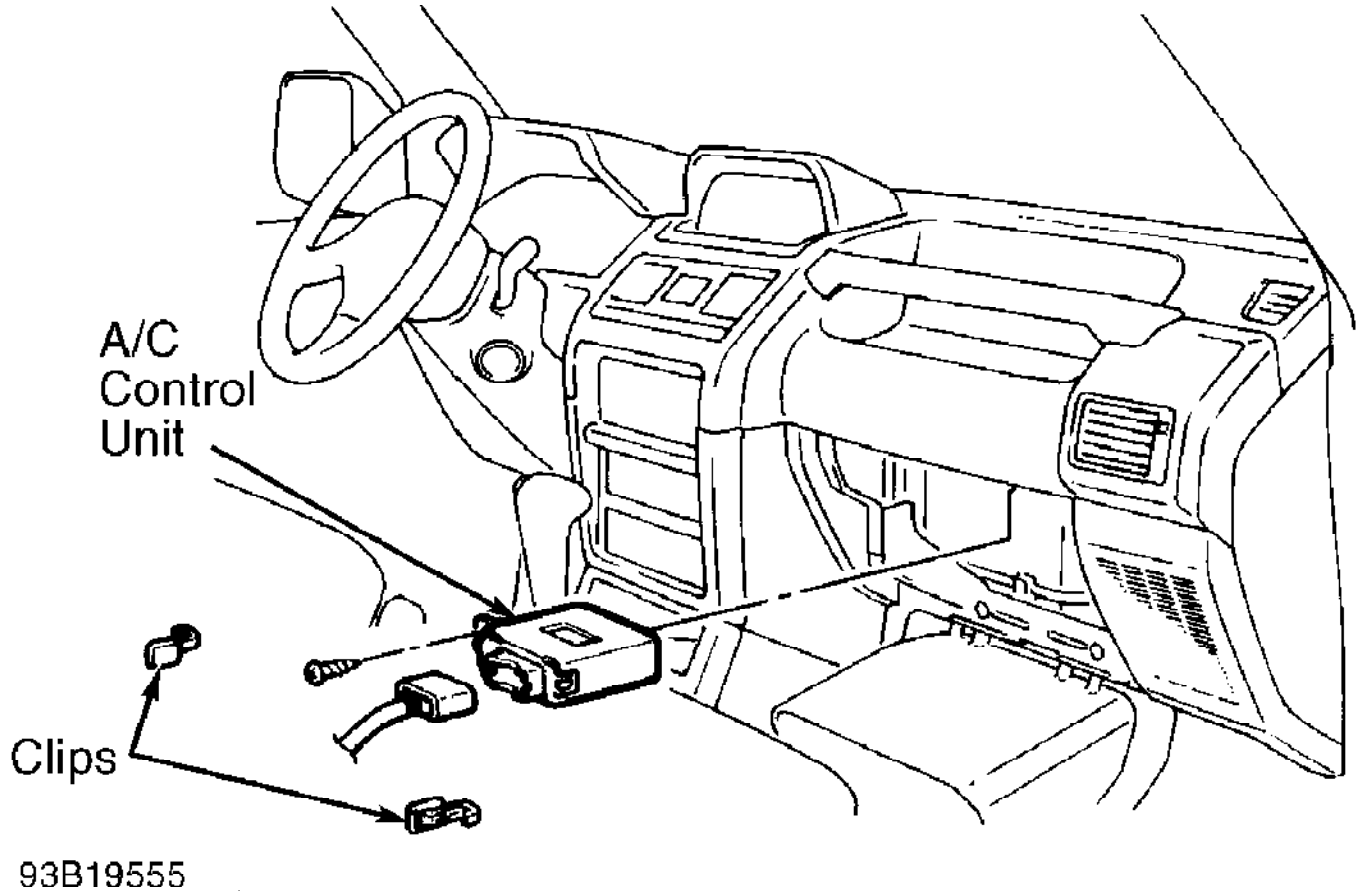


Fig. 10: Locating A/C Control Unit (ACCU) (Typical)
Courtesy of Mitsubishi Motor Sales of America.

A/C SWITCH

Removal & Installation

Remove heater control knobs. Remove glove box. Remove center panel mounting screws. Remove floor console and knee protector cover. Using a trim stick, remove upper side of panel. Remove A/C switch mounting screws. Pull switch away from panel. Remove switch. To install, reverse removal procedure.

A/C ENGINE COOLANT TEMPERATURE SWITCH

Removal & Installation

Drain coolant below level of thermostat housing. See Fig. 11.

Remove A/C engine coolant temperature switch wiring harness connector, and unscrew A/C engine coolant temperature switch from thermostat housing. To install, reverse removal procedure. Tighten A/C engine coolant temperature switch to specification. See TORQUE SPECIFICATIONS . Refill coolant and check for leaks.

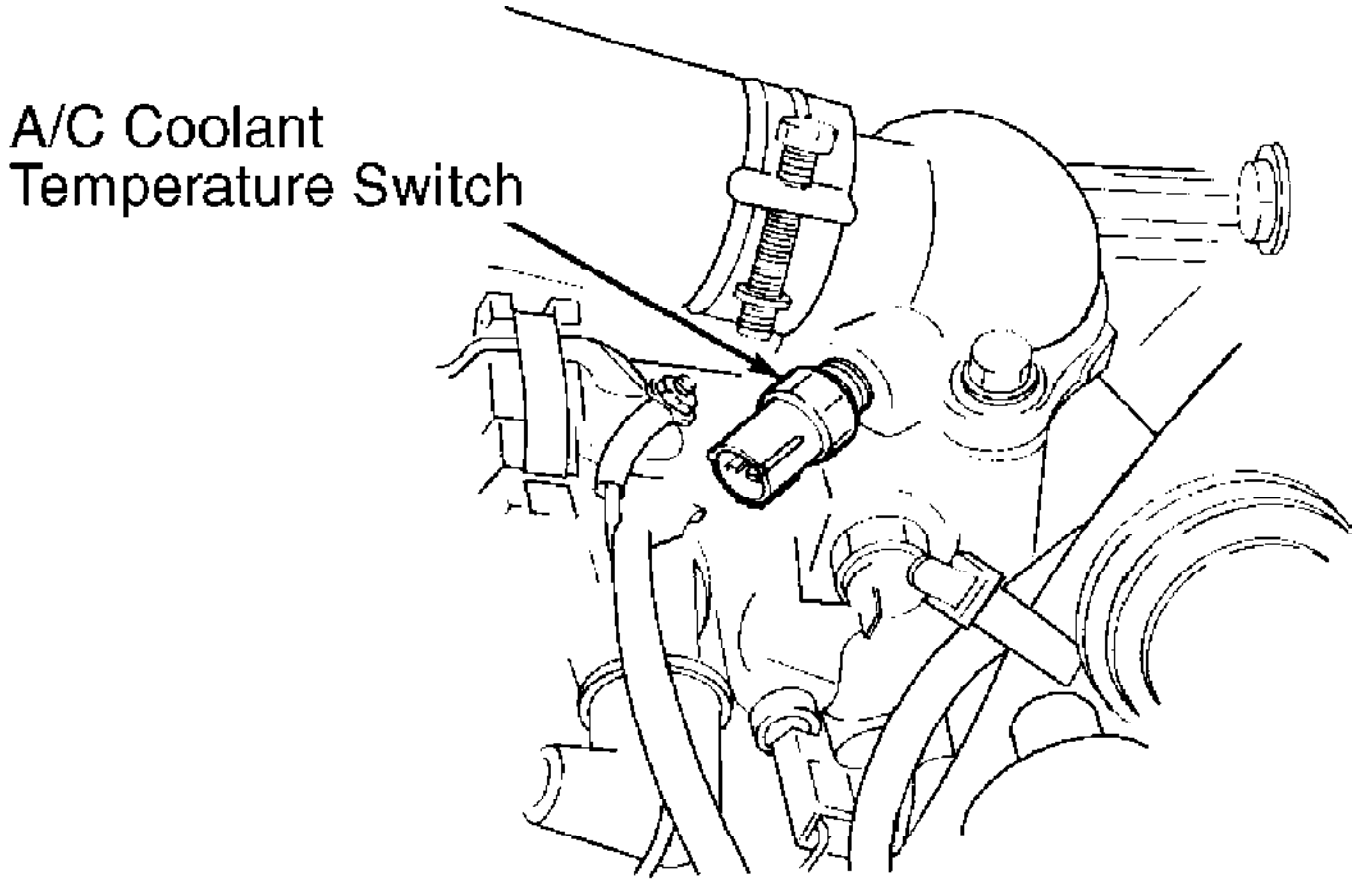


Fig. 11: Locating A/C Engine Coolant Temperature Switch
Courtesy of Mitsubishi Motor Sales of America.

BLOWER MOTOR & RESISTOR

Removal & Installation

Remove glove box and glove box frame. See Fig. 12. Remove speaker cover. Remove resistor on side of blower housing. Disconnect electrical connector at blower motor. Remove 3 screws, and remove blower motor assembly. To install, reverse removal procedure.

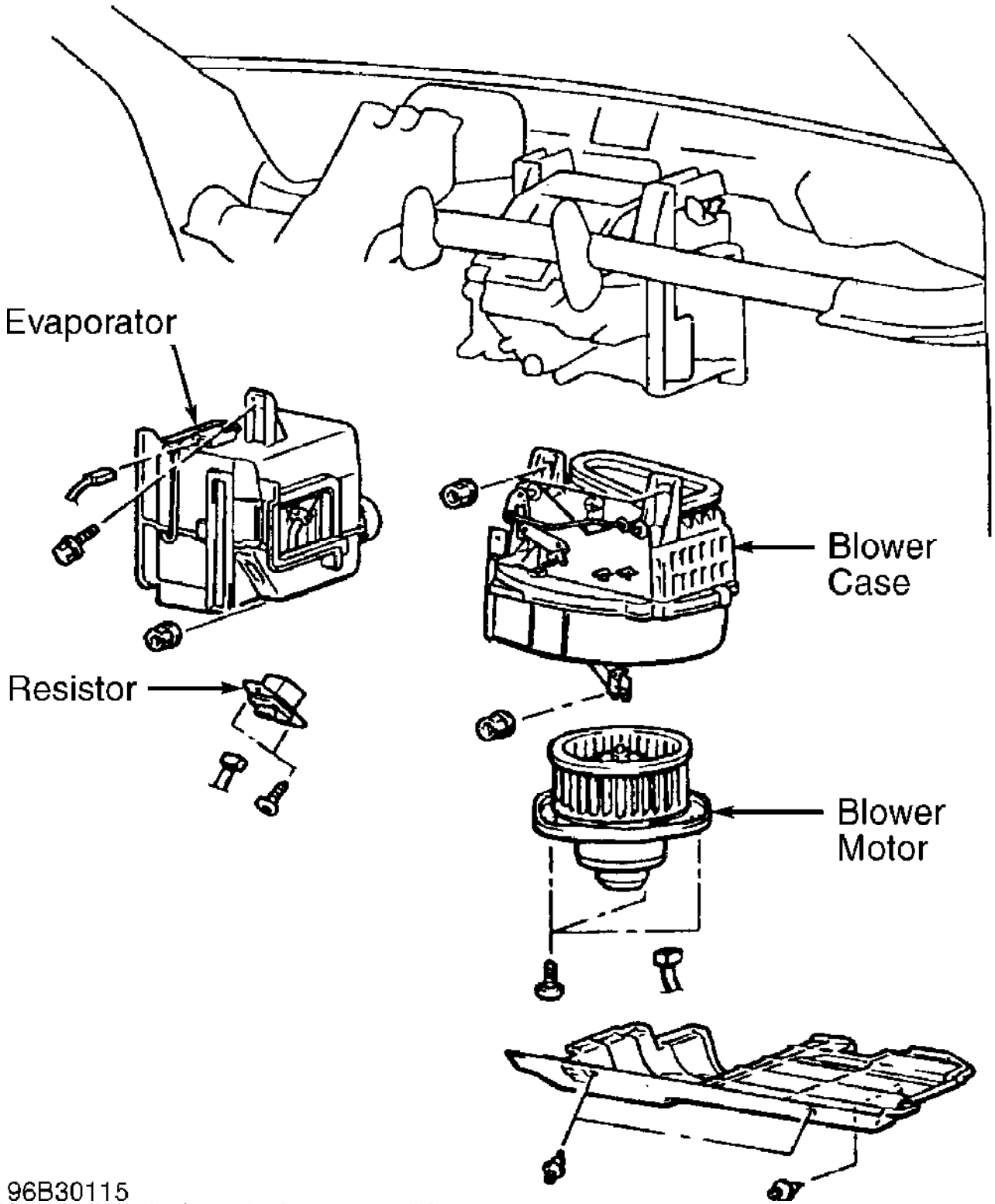
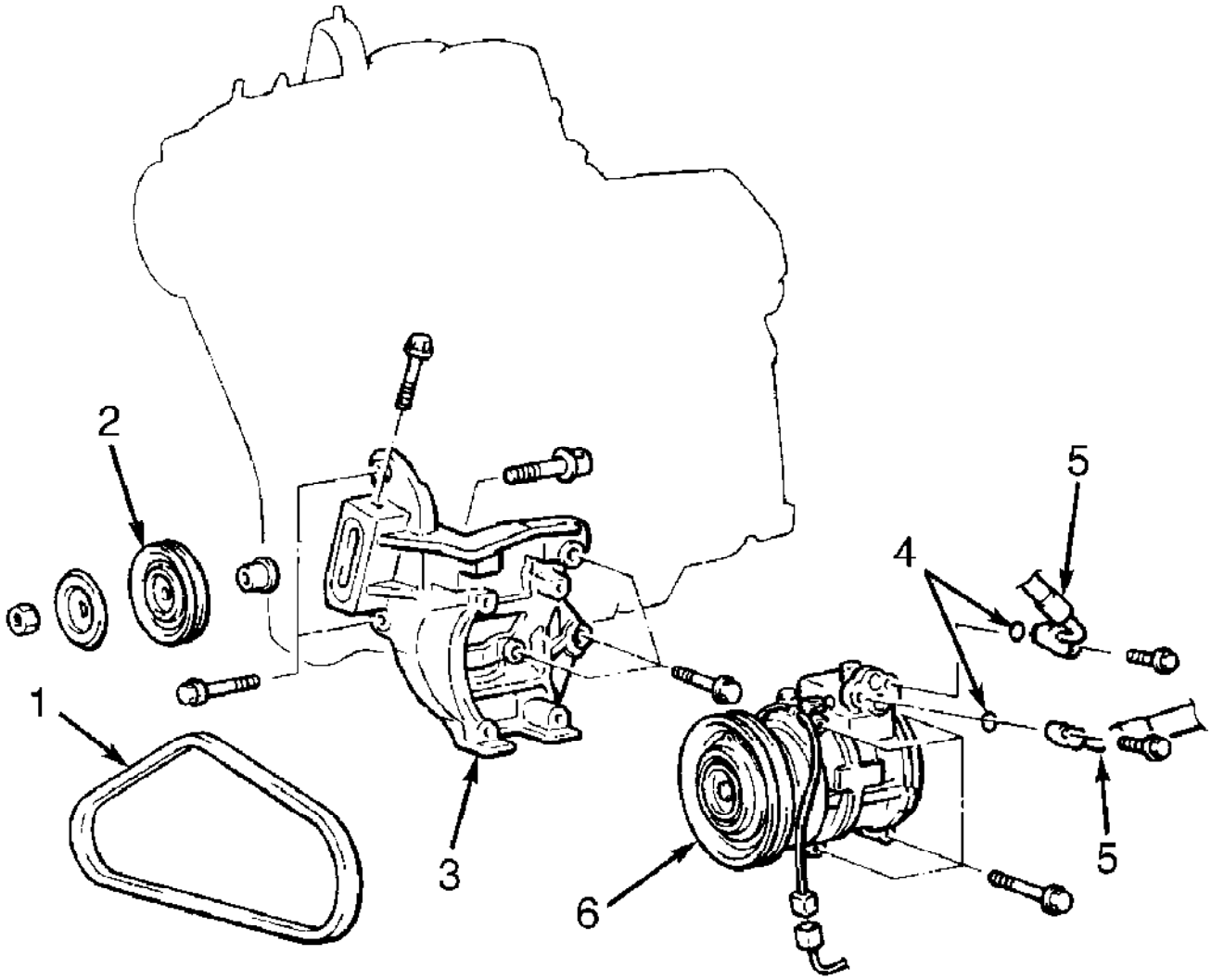


Fig. 12: Exploded View Of Blower Assembly
Courtesy of Mitsubishi Motor Sales of America.

COMPRESSOR

Removal & Installation

Discharge A/C system using approved refrigerant recovery/recycling equipment. Loosen idler pulley, and remove belt. Disconnect compressor electrical connector. Remove high and low pressure lines and "O" rings from compressor. Remove compressor mounting bolts. Remove compressor. To install, reverse removal procedure. See Fig. 13.



1. Drive Belt
2. Tension Pulley
3. Compressor Bracket
4. "O" Ring
5. Hose Connections
6. Compressor

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Fig. 13: Exploded View Of Compressor Mounting (Typical)
Courtesy of Mitsubishi Motor Sales of America.

CONDENSER

Removal & Installation

Discharge A/C system using approved refrigerant recovery/recycling equipment. Remove front grille and grille brackets. Remove hood latch and front bumper. Remove hood latch support bracket. Remove condenser fan and shroud. Disconnect high and low pressure lines from condenser. Remove 4 condenser mounting bolts. Lift condenser from vehicle. To install, reverse removal procedure. See Fig. 14. If replacing condenser, add .5 ounce of refrigerant oil to new condenser.

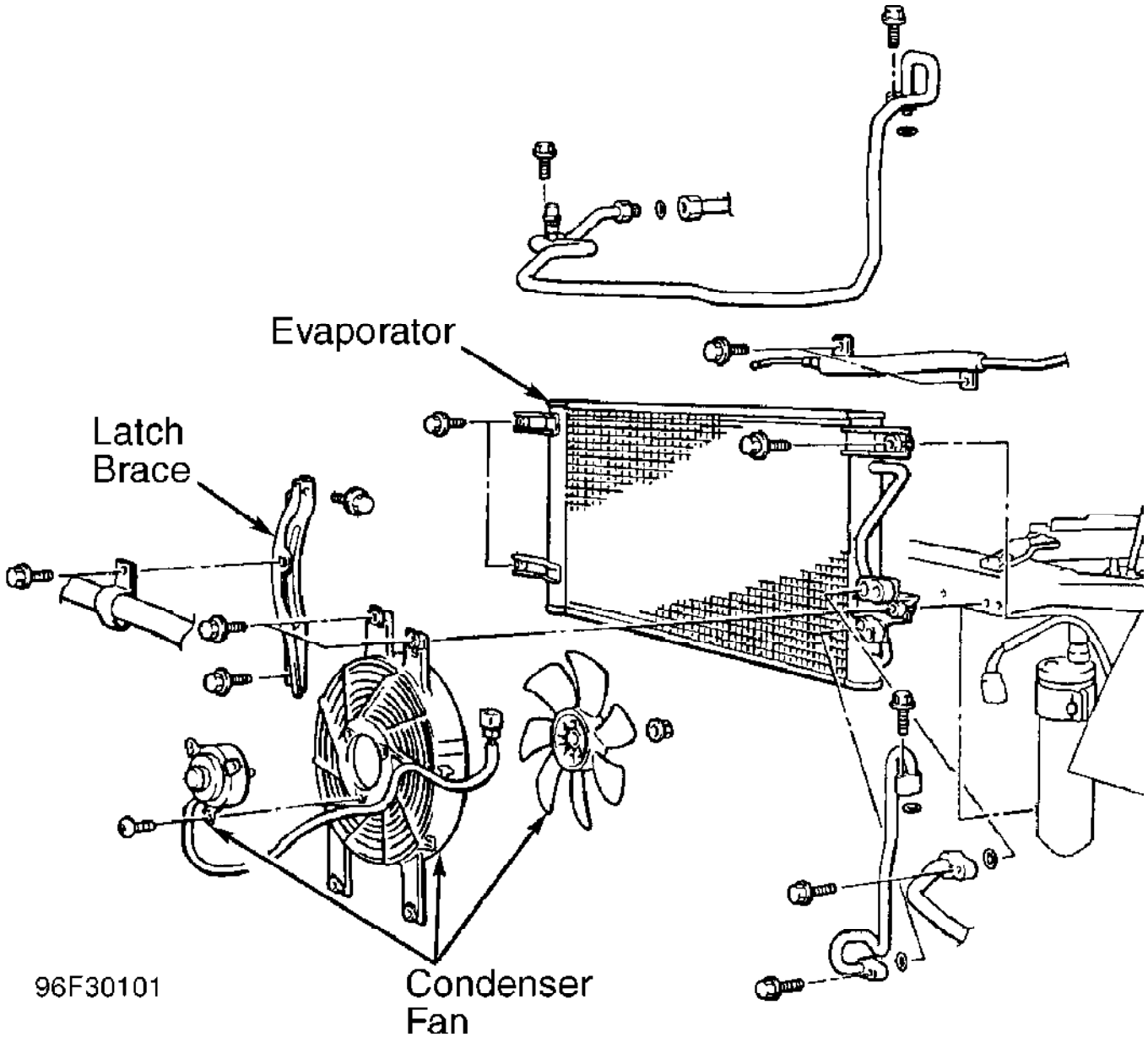

Fig. 14: Exploded View Of Condenser & Condenser Fan Motor
Courtesy of Mitsubishi Motor Sales of America.

EVAPORATOR ASSEMBLY

Removal & Installation

1) Discharge A/C system using approved refrigerant

recovery/recycling equipment. Disconnect refrigerant line connections. Remove lower glove box assembly. Remove air and defroster ducts. Remove drain hose. Disconnect harness connectors. Remove nut from firewall mounting bracket. Remove evaporator top bolts in passenger compartment. Remove evaporator assembly. To install, reverse removal procedure. See Figs. 15 and 16. If replacing evaporator, add 1.4 ounces of refrigerant oil to new evaporator.

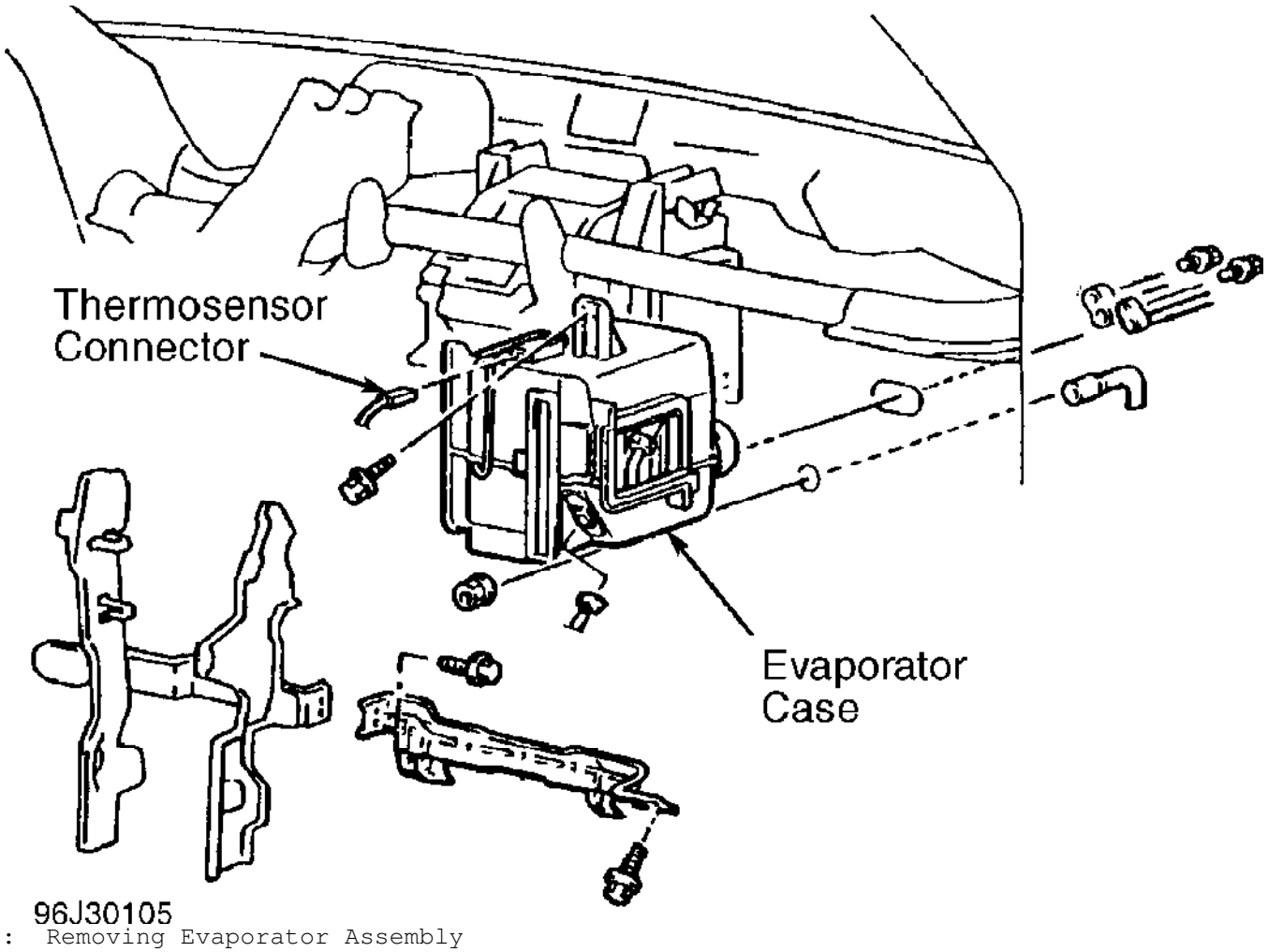

Fig. 15: Removing Evaporator Assembly
Courtesy of Mitsubishi Motor Sales of America.

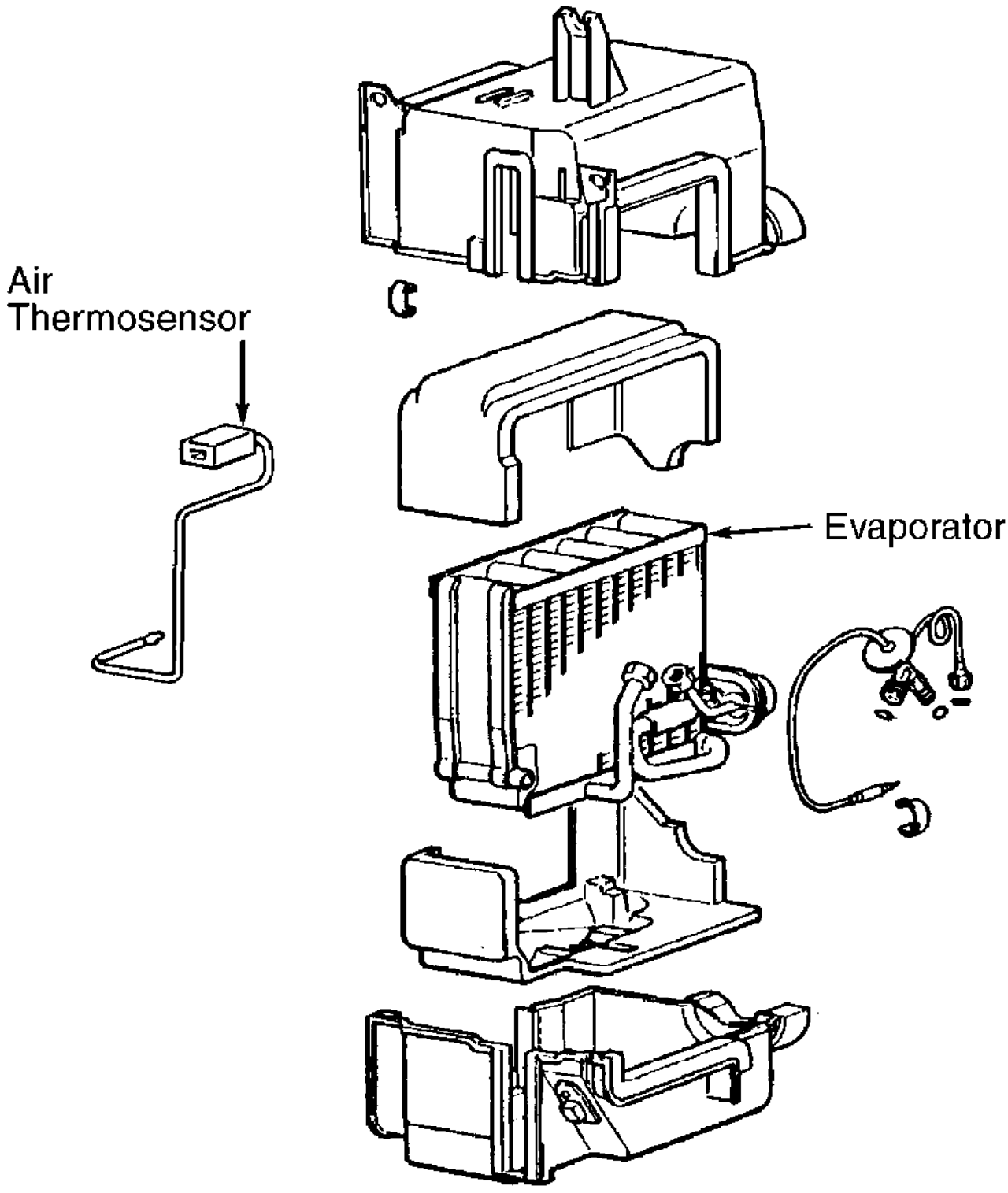

Fig. 16: Exploded View Of Evaporator Assembly
Courtesy of Mitsubishi Motor Sales of America.

REFRIGERANT TEMPERATURE SENSOR

Removal & Installation

Discharge A/C system using approved refrigerant recovery/recycling equipment. Disconnect refrigerant temperature sensor wiring connector. Remove temperature sensor from compressor. To install, reverse removal procedure. Use new "O" ring on temperature sensor.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt/Nut	17-20 (23-27)
A/C Compressor Bracket Bolt/Nut	37 (50)
A/C Compressor Clutch Coil Nut	12 (16)
A/C Engine Coolant Temperature Switch	26 (35)
	INCH Lbs. (N.m)
Blower Motor Bolts/Nuts	44 (5)
Condenser Bolts/Nuts	106 (12)
Dual-Pressure Switch	89 (10)
Evaporator Assembly Bolts/Nuts	44 (5)
Heater Assembly Bolts/Nuts	44 (5)

WIRING DIAGRAM

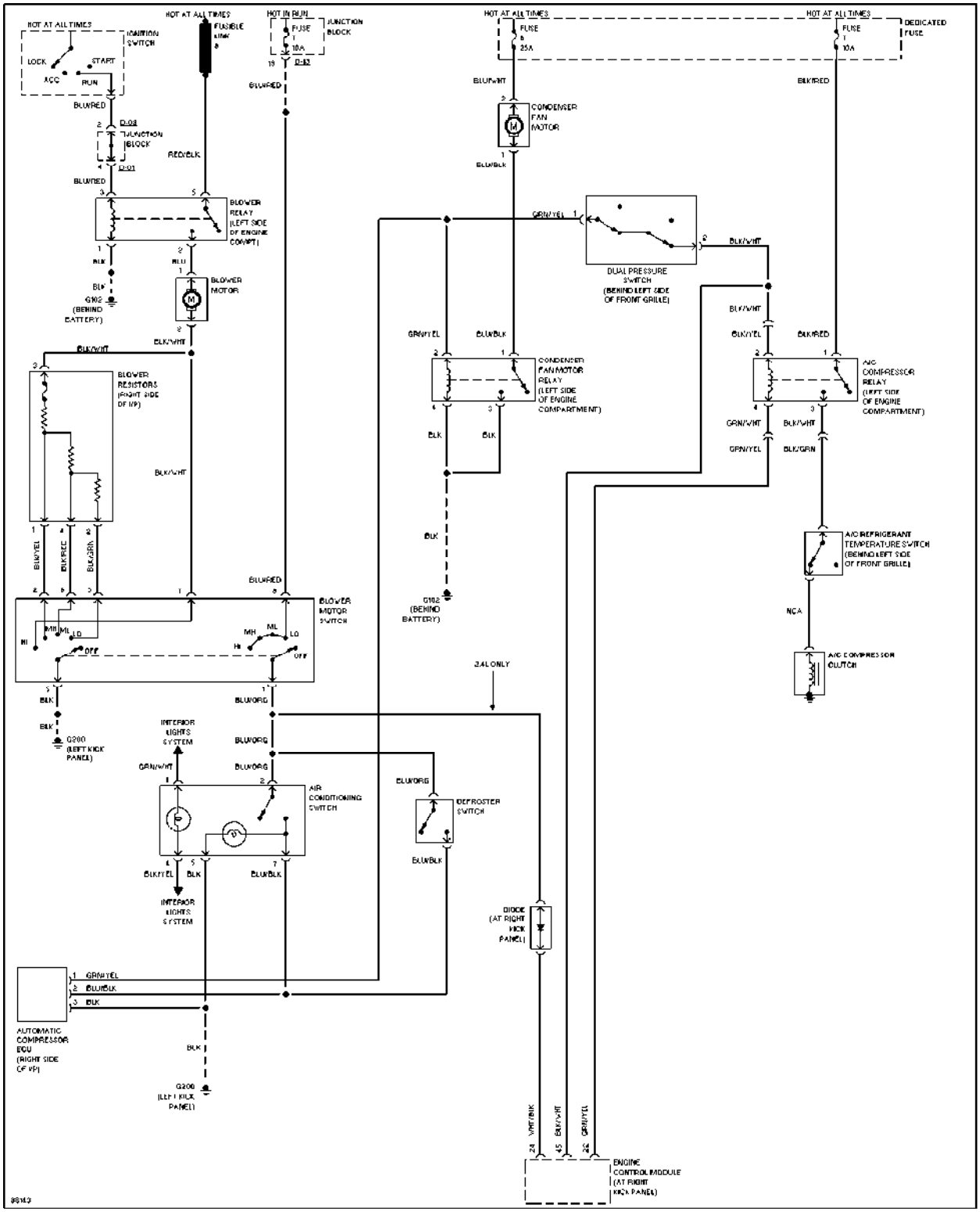

Fig. 17: Manual A/C-Heater System Wiring Diagram
Courtesy of Mitsubishi Motor Sales of America.

A/C SYSTEM GENERAL SERVICING

1997-99 Mitsubishi Montero Sport

1997-99 A/C SYSTEM GENERAL SERVICING
Mitsubishi - General Servicing Procedures

All Models

* PLEASE READ THIS FIRST *

NOTE: Always refer to underhood A/C specification label in engine compartment or A/C compressor label while servicing A/C system. If engine compartment/compressor label specifications differ from specifications in this article, use underhood/compressor label specifications.

USING R-12 & R-134a REFRIGERANT

HANDLING/SAFETY PRECAUTIONS

1) Always work in a well-ventilated, clean area. Refrigerant is colorless and is invisible as a gas. Refrigerant is heavier than oxygen and will displace oxygen in a confined area. Avoid breathing refrigerant vapors. Exposure may irritate eyes, nose and throat.

2) The system's high pressure can cause severe injury to eyes and skin if a hose were to burst. Always wear eye protection when working around A/C system and refrigerant. If necessary, wear rubber gloves or other protective clothing.

3) Refrigerant evaporates quickly when exposed to atmosphere, freezing anything it contacts. If liquid refrigerant contacts eyes or skin, DO NOT rub eyes or skin. Immediately flush affected area with cool water for 15 minutes and consult a doctor or hospital.

4) Never use R-134a in combination with compressed air for leak testing. Pressurized R-134a in the presence of oxygen (air concentrations greater than 60% by volume) may form a combustible mixture. DO NOT introduce compressed air into R-134a containers (full or empty), A/C system components or service equipment.

5) DO NOT expose A/C system components to high temperatures, steam cleaning for example, as excessive heat will cause refrigerant/system pressure to increase. Never expose refrigerant directly to open flame. If refrigerant needs to be warmed, place bottom of refrigerant tank in warm water. Water temperature MUST NOT exceed 125°F (52°C).

6) Use care when handling refrigerant containers. DO NOT drop, strike, puncture or incinerate containers. Use Department Of Transportation (DOT) approved, DOT 4BW or DOT 4BA refrigerant containers.

7) Never overfill refrigerant containers. The safe filling level of a refrigerant container MUST NOT exceed 60% of the container's gross weight rating. Store refrigerant containers at temperature less than 125°F (52°C).

8) R-12 refrigerant (Freon) will be sold and stored in White containers, while R-134a refrigerant will be sold and stored in 30 or 50-pound Light Blue containers.

9) R-12 and R-134a refrigerants must never be mixed, as their desiccants and lubricants are not compatible. If the refrigerants are mixed, system cross-contamination or A/C system component failure may occur. Always use separate servicing and refrigerant recovery/recycling equipment.

10) Follow equipment manufacturer instructions of all service equipment to be used. The Material Safety Data Sheet (MSDS), provided by refrigerant manufacturer/suppliers, contains valuable information

regarding the safe handling of refrigerants.

IDENTIFYING R-134a SYSTEMS & COMPONENTS

To prevent refrigerant cross-contamination, use following methods to identify R-134a based systems and components.

Fittings & "O" Rings

All R-134a based A/C systems use 1/2" - 16 ACME threaded fittings (identifiable by square threads) and quick-connect service couplings. See Fig. 1. Besides the use of these fittings, most manufacturers will use Green colored "O" rings in R-134a systems.

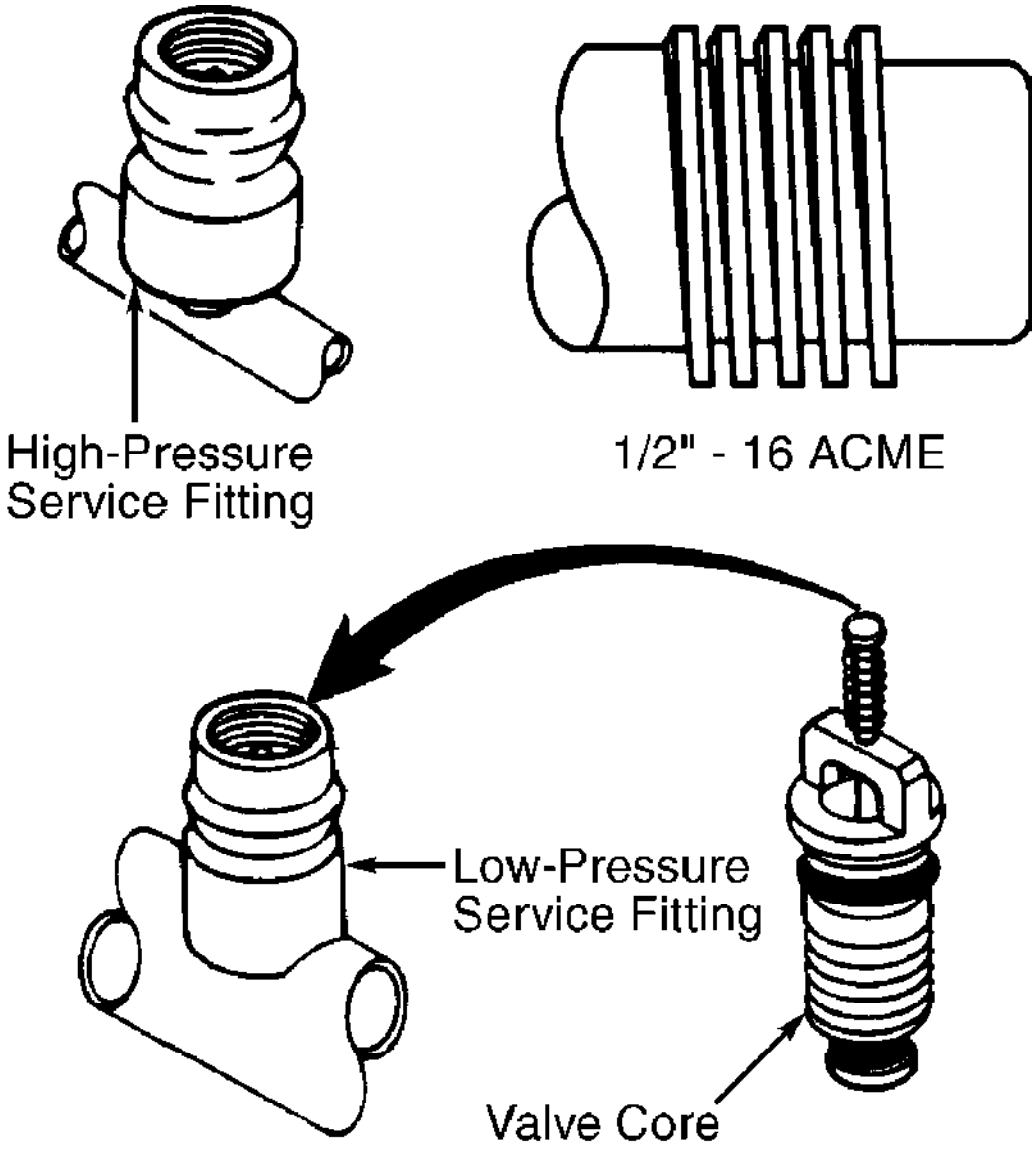

Fig. 1: Identifying R-134a Fittings & Quick-Connect Service Couplings
Courtesy of Audi of America, Inc.

Underhood A/C Specification Labels

Most R-134a based systems will be identified through the use

of Green or Light Blue underhood labels, or with R-134a refrigerant clearly printed on labels. See Fig. 2. The underhood label used on Ford Motor Co. vehicles is Yellow. Some manufacturers will identify R-12 based systems with White, Red, Silver or Gold underhood labels. Before servicing an A/C system, always determine which refrigerant is being used.

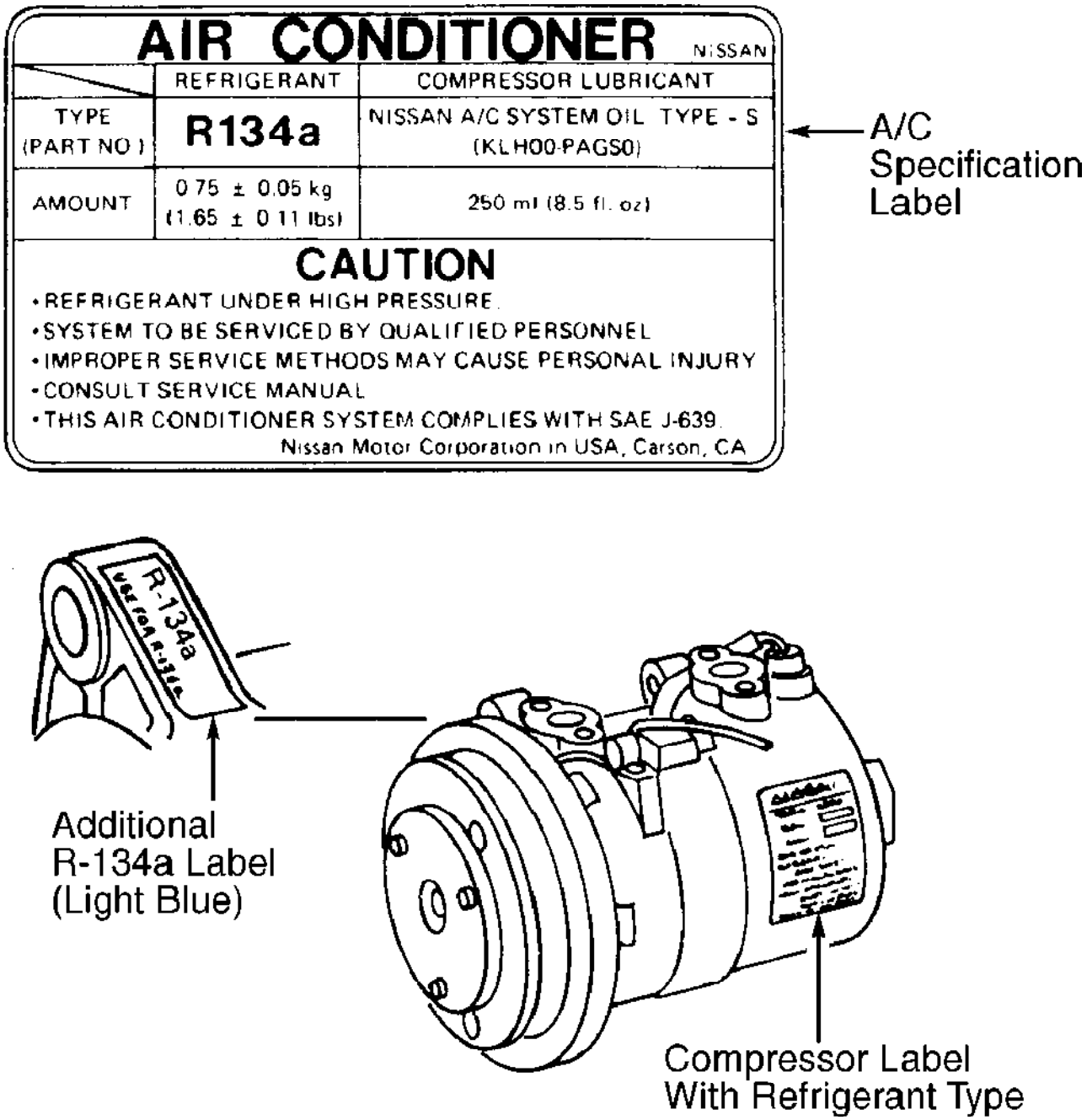

Fig. 2: Underhood A/C Specification Labels (Typical)
Courtesy of Nissan Motor Co., U.S.A.

Other Means Of Identification

Refrigerant R-134a, when viewed through a sight glass, may

have a "milky" appearance due to the mixture of refrigerant and lubricating oil. As the refrigerant and oil DO NOT exhibit a "clear" sight glass on a properly charged A/C system, most R-134a systems have no sight glass.

REFRIGERANT OILS

NOTE: Use ONLY the specified oil for the appropriate system or A/C compressor. Always check the underhood A/C specification label or A/C compressor label before adding refrigerant oil to A/C compressor/system. See Fig. 2. If engine compartment/ compressor label specifications differ from specifications in this article, use underhood/compressor label specifications.

Refrigerant R-12 based systems use mineral oil, while R-134a systems use synthetic/Polyalkylene Glycol (PAG) oils. Using a mineral oil based lubricant with R-134a will result in A/C compressor failure due to lack of proper lubrication. The following R-134a refrigerant oils are currently available:

Use DENSO/ND-Oil 8 refrigerant oil on Nippondenso compressors. Use SUN PAG 56 refrigerant oil on Sanden compressors.

NOTE: Synthetic/PAG oils absorb moisture very rapidly, 2.3-5.6 percent by weight, as compared to a mineral oil absorption rate of .005 percent by weight.

SERVICE EQUIPMENT

Because R-134a is not interchangeable with R-12, separate sets of hoses, manifold gauge set and recovery/recycling equipment are required to service vehicles. This is necessary to avoid cross-contaminating and damaging system.

All equipment used to service systems using R-134a must meet SAE standard J1991. The service hoses on the manifold gauge set must have manual (turn wheel) or automatic back-flow valves at the service port connector ends. This will prevent refrigerant from being released into the atmosphere.

For identification purposes, R-134a service hoses must have a Black stripe along its length and be clearly labeled SAE J2196/R-134a. The low pressure test hose is Blue with a Black stripe. The high pressure test hose is Red with a Black stripe, and the center test hose is Yellow with a Black stripe.

R-134a manifold gauge sets can be identified by one or all of the following: Labeled FOR USE WITH R-134a on set, labeled HFC-134 or R-134a on gauge face, or by a Light Blue color on gauge face. In addition, pressure/temperature scales on R-134a gauge sets are different from R-12 manifold gauge sets.

SYSTEM SERVICE VALVES

SCHRADER-TYPE VALVES

NOTE: Although similar in construction and operation to a tire valve, NEVER replace a Schrader-type valve with a tire valve.

Schrader valve is similar in construction and operation to a tire valve. When a test gauge hose with built-in valve core depressor is attached, Schrader stem is pushed inward to the open position and allows system pressure to reach gauge.

If test hose does not have a built-in core depressor, an adapter must be used. Never attach hose or adapter to Schrader valve unless it is first connected to manifold gauge set.

Refrigerant R-12 Schrader-type valve cores have TV5 thread size. Refrigerant R-134a Schrader-type valve cores use M6 (Metric) threads. R-134a valve cores can be easily identified by use of "O" rings and external spring. See Fig. 1.

SERVICE VALVE LOCATIONS

SERVICE VALVE LOCATIONS TABLE

Vehicle	High	Low
Diamante	(3)	(3)
Montero	(4)	(4)
All Others	(1)	(2)

(1) - On high pressure (discharge) hose/line.
(2) - On low pressure (suction) hose/line.
(3) - On compressor discharge and suction ports.
(4) - On receiver-drier (high side) and on compressor (low side).

REFRIGERANT RECOVERY/RECYCLING

CAUTION: Separate sets of hoses, gauges and refrigerant recovery/recycling equipment MUST be used for R-12 and R-134a based systems. DO NOT mix R-12 and R-134a refrigerants, as their refrigerant oils and desiccants are not compatible. On systems with R-134a refrigerant, use Polyalkylene Glycol (PAG) wax-free refrigerant oil.

Refrigerant recovery/recycling equipment is used to remove refrigerant from vehicle's A/C system without polluting atmosphere. To remove and recycle refrigerant, connect the recovery/recycling system and follow instructions provided with the equipment.

The removed refrigerant is filtered, dried and stored in a tank within the recovery/recycling system until it is ready to be pumped back into the vehicle's A/C system. With refrigerant stored in the recovery/recycling system, A/C system can be opened without polluting atmosphere.

A/C SYSTEM SPECIFICATIONS

1997-99 Mitsubishi Montero Sport

1997-99 A/C-HEATER SYSTEMS
Mitsubishi - A/C System Specifications

Montero Sport

A/C SYSTEM SPECIFICATIONS

A/C SYSTEM SPECIFICATIONS TABLE

Application	Specification
Compressor Type	Sanden MSC105C Scroll
Compressor Belt Deflection (1)	
New	13/64-15/64" (5.1-6.0 mm)
Used	17/64-19/64" (6.6-7.5 mm)
Compressor Oil Capacity	(2) 5.1 ozs.
Refrigerant (R-134a) Capacity	23-24 ozs.
System Operating Pressures (3)	
High Side	130-220 psi (9.1-15.5 kg/cm²)
Low Side	20-23 psi (1.4-1.6 kg/cm²)

(1) - With 22 lbs. (100 N.m) force applied midway on longest span of belt.
(2) - Use SUN PAG 56 refrigerant oil.
(3) - With ambient temperature at about 80°F (27°C).

D - ADJUSTMENTS - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - On-Vehicle Adjustments

Montero Sport - 2.4L

ENGINE MECHANICAL

Before performing any on-vehicle adjustments to fuel or ignition system, ensure engine mechanical condition is okay (i.e., engine compression).

VALVE CLEARANCE

NOTE: All models use hydraulic lash adjusters.

CHECKING HYDRAULIC VALVE LIFTERS

1) Warm engine to normal operating temperature. Remove valve cover. Position cylinder No. 1 at TDC on compression stroke. On 4-cylinder engines, check intake rockers on cylinders No. 1 and 2. Check exhaust rockers on cylinders No. 1 and 3. OnV6 engines, check intake rockers on cylinders No. 1, 5 and 6. Check exhaust rockers on cylinders No. 1, 2 and 3.

2) Push downward on end of rocker arm above lash adjuster. Rotate crankshaft 360 degrees. On 4-cylinder engines, check intake rockers on cylinders No. 3 and 4. Check exhaust rockers on cylinders No. 2 and 4. Check exhaust rockers on cylinders No. 4, 5 and 6. If lash adjuster is normal, it will feel solid.

3) If lash adjuster moves downward easily when pushed, replace adjuster. If lash adjuster feels soft or spongy, air has probably entered lash adjuster. If this occurs, check engine oil level. If engine oil level is okay, check oil screen and oil screen gasket for damage.

4) After repairing cause of air ingestion, warm engine to operating temperature. Drive vehicle at low speed for approximately 5 minutes. Turn engine off for a few minutes.

5) Restart engine and drive at low speed for approximately 5 minutes. Repeat this step several times for about one hour. This helps remove air from engine oil.

IGNITION TIMING

NOTE: Perform all checks with engine at normal operating temperature, cooling fan and accessories off, transmission in Park or Neutral, and front wheels in straight-ahead position.

1) Ignition timing is controlled by Powertrain Control Module (PCM) and is not adjustable. Manufacturer provides procedure for checking timing. On models with distributor, DO NOT attempt to adjust ignition timing by rotating distributor.

2) Connect scan tool to Data Link Connector (DLC). DLC is located below dash, near steering column. Install a timing light. Start engine and allow it to idle.

3) Using scan tool, read curb idle speed (RPM). Ensure curb idle speed is about 750 RPM. Turn engine off. Curb i speed is automatically controlled by Idle Air Control (IAC) system. If curb idle speed is not as specified, see DTC P0505 in

H - TESTS W/O CODES - 2.4L article.

CAUTION: MFI system actuator test must be cancelled or test will continue to run for 27 minutes. Driving vehicle under this condition may damage engine.

4) Using scan tool, select MFI SYSTEM ACTUATOR TEST, then select item 17. Read basic ignition timing value. See IGNITION TIMING SPECIFICATIONS table. If basic ignition timing is within specification, go to next step. If basic ignition timing is not within specification, cancel MFI system actuator test. See DTCS P0100, P0105, P0115 and P0335 in H - TESTS W/O CODES - 2.4L article.

5) Read actual ignition timing value. If actual ignition timing is not within specification, cancel MFI system actuator test. See DTCS P0100, P0105, P0115 and P0335 in H - TESTS W/O CODES - 2.4L article.

IGNITION TIMING TABLE (Degrees BTDC @ RPM)

Application	(1) Basic	(2) (3) Actual
2.4L	2-8 @ 650-850	10 @ 650-850

(1) - With ignition timing adjustment connector grounded or vacuum hose (farthest from distributor) disconnected.
(2) - With ignition timing adjustment connector ungrounded or vacuum hose (farthest from distributor) connected. Actual ignition timing is approximate and may fluctuate.
(3) - If vehicle altitude is more than 2300 feet above sea level, actualtiming may be advanced (5 degrees).

IDLE SPEED & MIXTURE

* PLEASE READ THIS FIRST *

NOTE: Perform adjustments with engine at normal operating temperature, cooling fan and accessories off, transmission in Park or Neutral, and front wheels in straight-ahead position.

BASIC IDLE SPEED

NOTE: Ensure vehicle is at normal operating temperature with all lights, cooling fan and accessories off. Shift transmission into Neutral or Park position.

NOTE: Basic idle speed should only be adjusted after verifying that spark plugs, fuel injectors, idle air control motor and engine compression are okay.

1) Basic idle speed can only be adjusted using a scan tool to ground Data Link Connector (DLC). Connect scan tool to DLC. DLC is located below dash, near steering column.

2) Start engine and allow it to idle. Using scan tool, select MFI SYSTEM ACTUATOR TEST, then select item 30. Check basic idle speed. See IDLE SPEED SPECIFICATIONS table.

CAUTION: MFI system actuator test must be cancelled or test will continue to run for 27 minutes. Driving vehicle under this condition may damage engine.

3) Cancel MFI system actuator test. If idle speed is not within specification, turn engine speed adjusting screw until correct engine speed is obtained. See Fig. 1. Access to speed adjusting screw is obtained by removing rubber plug on throttle body.

4) If idle speed cannot be lowered by turning engine speed adjusting screw, determine if fixed Speed Adjusting Screw (SAS). Fixed SAS is stop screw contacting throttle lever. See FIXED SPEED ADJUSTING SCREW for procedure.

5) After all adjustments are verified to be correct, possible cause of incorrect idle speed is deterioration of Idle Air Control (IAC) circuit. See DTC P0505 in H - TESTS W/O CODES - 2.4L article.

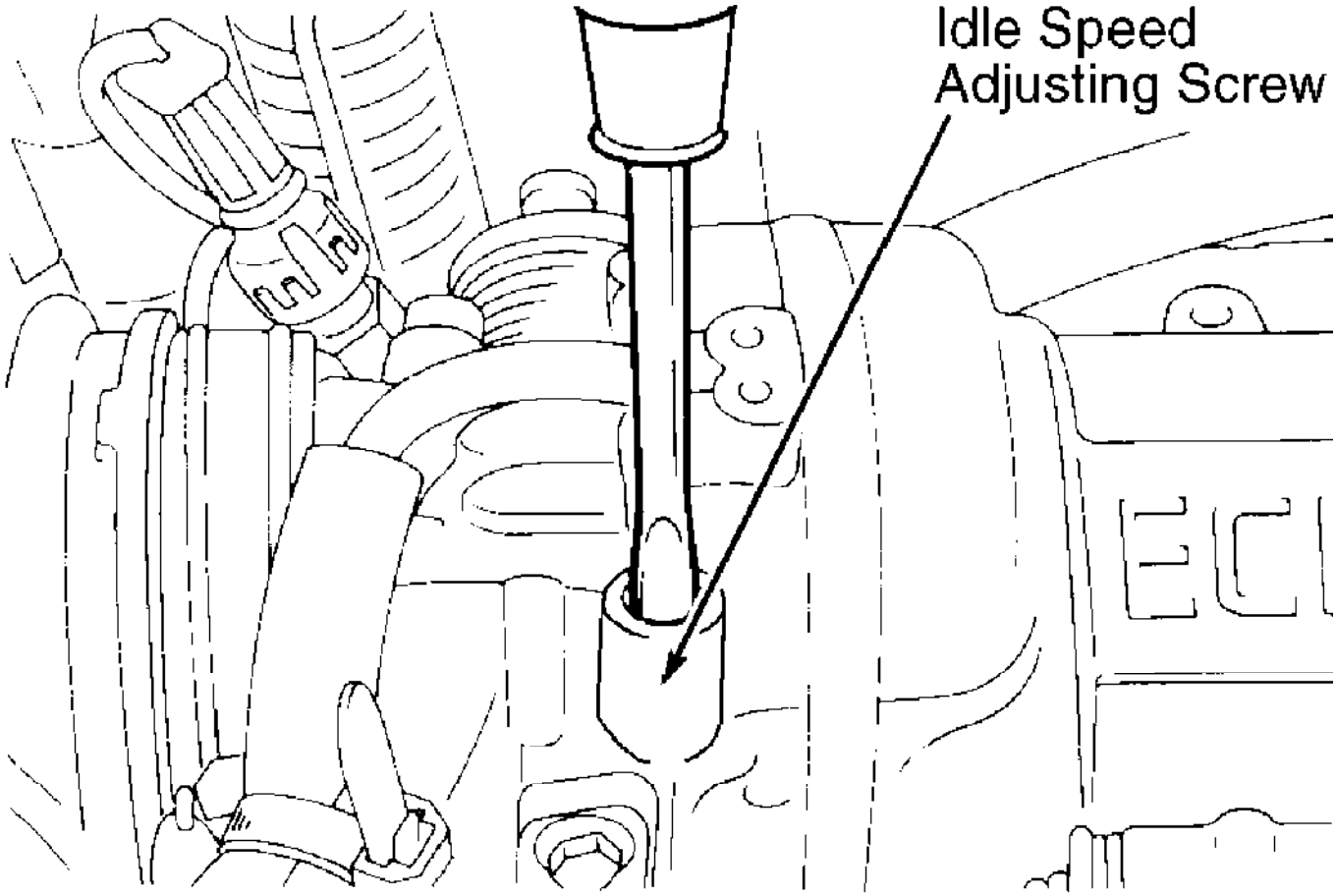

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Fig. 1: Adjusting Idle Speed (Typical)
Courtesy of Mitsubishi Motor Sales of America.

IDLE SPEED SPECIFICATIONS TABLE

Application	Curb Idle	Basic Idle
2.4L	650-850	700-800

(1) - Information is not available from manufacturer.

CURB (SLOW) IDLE SPEED

NOTE: Curb idle speed is controlled by Idle Air Control (IAC) motor. Adjustment is usually not necessary. For curb idle speed specifications, see IDLE SPEED SPECIFICATIONS table under BASIC IDLE SPEED.

1) Check ignition timing and adjust if necessary. See IGNITION TIMING. Run engine at 2000-3000 RPM for more than 5 seconds. Allow engine to idle for 2 minutes. Check curb idle speed.

2) If curb idle speed is not within specification, check IAC system. See DTC P0505 in H - TESTS W/O CODES - 2.4L article. If IAC system is okay, adjust basic idle speed. See BASIC IDLE SPEED.

FIXED SPEED ADJUSTING SCREW

NOTE: Fixed Speed Adjusting Screw (SAS) is preset by manufacturer and usually does not require adjustment. Only adjust fixed SAS if other adjustment procedures require it, or if manufacturer's original setting has been changed.

1) Loosen throttle cable. Loosen fixed SAS lock nut. See Fig. 2. Turn fixed SAS counterclockwise until throttle valve is fully closed. Turn fixed SAS clockwise until throttle valve begins to open. Turn fixed SAS clockwise 1 1/4 turns after throttle valve begins to open.

2) Tighten lock nut while holding fixed SAS in position. Adjust throttle cable. Adjust basic idle speed. See BASIC IDLE SPEED. Adjust Throttle Position (TP) sensor. See TP SENSOR ADJUSTMENT under THROTTLE POSITION (TP) SENSOR.

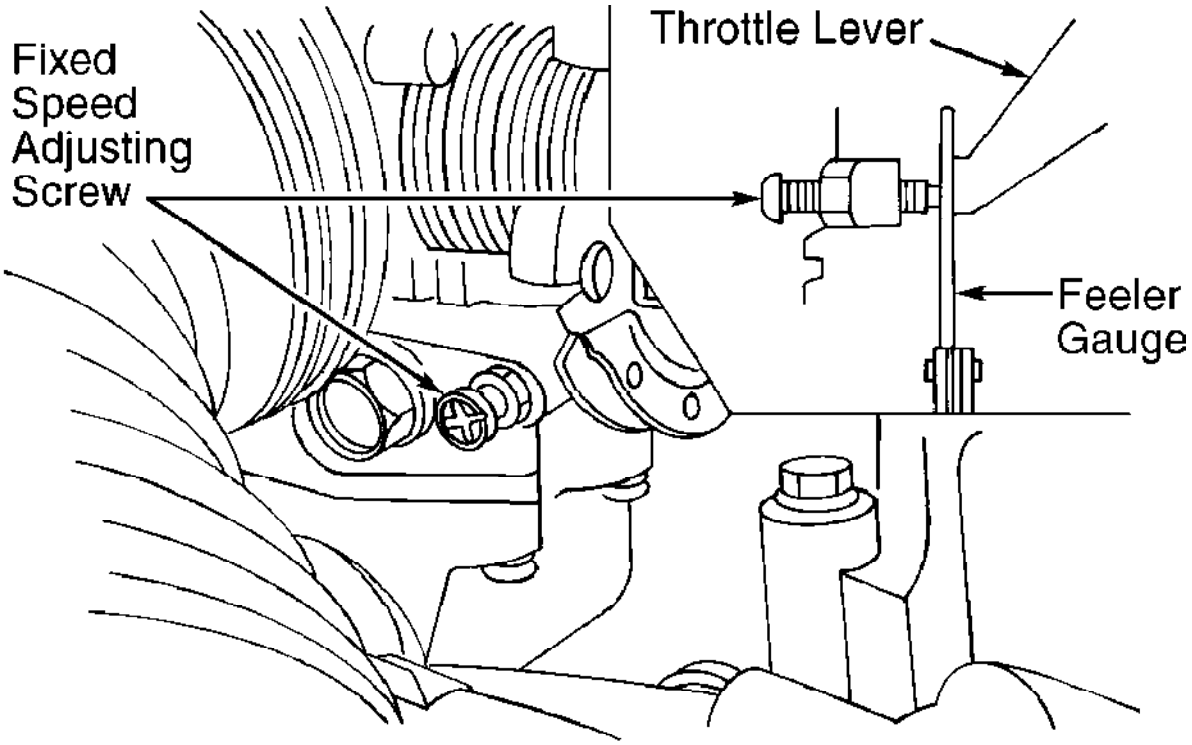

Fig. 2: Adjusting Fixed Speed Adjusting Screw (Typical)
Courtesy of Mitsubishi Motor Sales of America.

IDLE MIXTURE

NOTE: Idle mixture is computer controlled on fuel injected engines and is nonadjustable. CO level should not exceed .5%. HC level should not exceed 100 ppm. If mixture levels exceed limits, see H - TESTS W/O CODES - 2.4L article.

THROTTLE POSITION (TP) SENSOR

TP SENSOR ADJUSTMENT

NOTE: Ensure basic idle speed is set to specification before adjusting TP sensor. See BASIC IDLE SPEED under IDLE SPEED & MIXTURE. Perform all adjustments with engine at normal operating temperature, front wheels in straight-ahead position, cooling fan and all accessories off, and transmission in Park or Neutral.

1) Disconnect TP sensor connector. Using jumper wires, connect an external ohmmeter between TP sensor terminals No. 3 and 4. Insert .018" (.45 mm) feeler gauge between fixed speed adjusting screw and throttle lever.

2) Loosen TP sensor mounting screws and rotate TP sensor fully counterclockwise. Ensure there is continuity between terminals No. 3 and 4. Rotate TP sensor clockwise until there is no continuity and tighten screws. Install Test Harness (MB991348) between TP sensor and harness connector.

3) Turn ignition on. Using external voltmeter, measure TP sensor output voltage between terminals No. 2 and 4. If voltage is not .4-1.0 volt, check harness and sensor. See DTC P0120 in H - TESTS W/O CODES - 2.4L article.

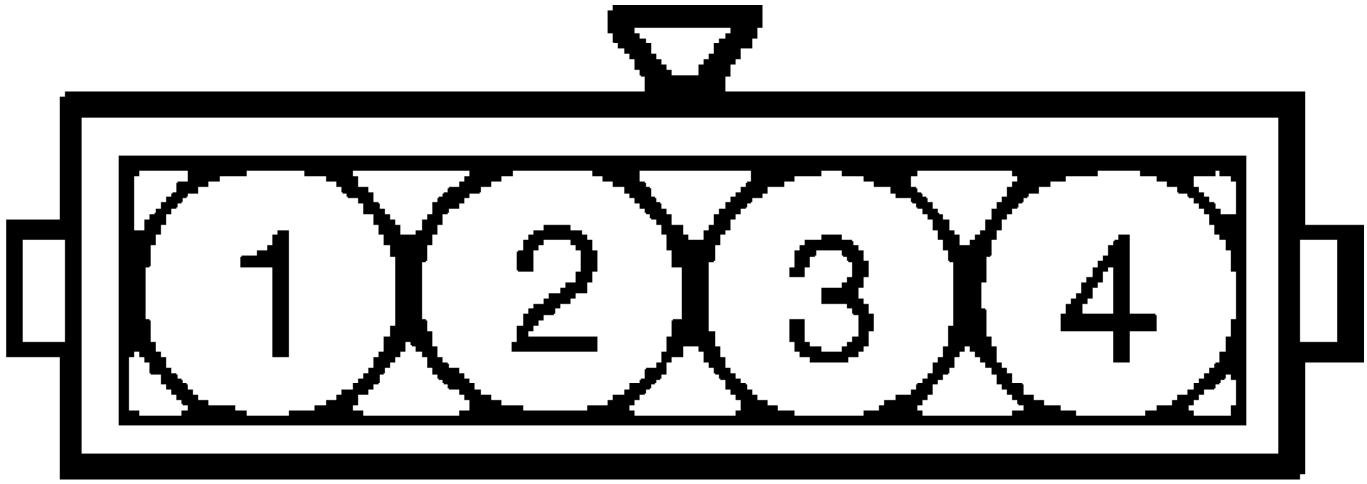

Fig. 3: Identifying TP Sensor Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

D - ADJUSTMENTS - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - On-Vehicle Adjustments

Montero Sport - 3.0L

ENGINE MECHANICAL

Before performing any on-vehicle adjustments to fuel or ignition system, ensure engine mechanical condition is okay (i.e., engine compression).

VALVE CLEARANCE

NOTE: All models use hydraulic lash adjusters.

CHECKING HYDRAULIC VALVE LIFTERS

1) Warm engine to normal operating temperature. Remove valve cover. Position cylinder No. 1 at TDC on compression stroke. On 4-cylinder engines, check intake rockers on cylinders No. 1 and 2. Check exhaust rockers on cylinders No. 1 and 3. OnV6 engines, check intake rockers on cylinders No. 1, 5 and 6. Check exhaust rockers on cylinders No. 1, 2 and 3.

2) Push downward on end of rocker arm above lash adjuster. Rotate crankshaft 360 degrees. On 4-cylinder engines, check intake rockers on cylinders No. 3 and 4. Check exhaust rockers on cylinders No. 2 and 4. On V6 engines, check intake rockers on cylinders No. 2, 3 and 4. Check exhaust rockers on cylinders No. 4, 5 and 6. If lash adjuster is normal, it will feel solid.

3) If lash adjuster moves downward easily when pushed, replace adjuster. If lash adjuster feels soft or spongy, air has probably entered lash adjuster. If this occurs, check engine oil level. If engine oil level is okay, check oil screen and oil screen gasket for damage.

4) After repairing cause of air ingestion, warm engine to operating temperature. Drive vehicle at low speed for approximately 5 minutes. Turn engine off for a few minutes.

5) Restart engine and drive at low speed for approximately 5 minutes. Repeat this step several times for about one hour. This helps remove air from engine oil.

IGNITION TIMING

NOTE: Perform all checks with engine at normal operating temperature, cooling fan and accessories off, transmission in Park or Neutral, and front wheels in straight-ahead position.

1) Ignition timing is controlled by Powertrain Control Module (PCM) and is not adjustable. Manufacturer provides procedure for checking timing. On models with distributor, DO NOT attempt to adjust ignition timing by rotating distributor.

2) Connect scan tool to Data Link Connector (DLC). DLC is located below dash, near steering column. Install a timing light. Start engine and allow it to idle.

3) Using scan tool, read curb idle speed (RPM). Ensure curb idle speed is about 750 RPM. Turn engine off. Curb i speed is automatically controlled by Idle Air Control (IAC) system. If curb

idle speed is not as specified, see DTC P0505 in appropriate G - TESTS W/CODES - 3.0L article.

CAUTION: MFI system actuator test must be cancelled or test will continue to run for 27 minutes. Driving vehicle under this condition may damage engine.

4) Using scan tool, select MFI SYSTEM ACTUATOR TEST, then select item 17. Read basic ignition timing value. See IGNITION TIMING SPECIFICATIONS table. If basic ignition timing is within specification, go to next step. If basic ignition timing is not within specification, cancel MFI system actuator test. See DTCS P0100, P0105, P0115 and P0335 in appropriate G - TESTS W/CODES - 3.0L article.

5) Read actual ignition timing value. If actual ignition timing is not within specification, cancel MFI system actuator test. See DTCS P0100, P0105, P0115 and P0335 in appropriate G - TESTS W/CODES - 3.0L article.

IGNITION TIMING TABLE (Degrees BTDC @ RPM)

Application	(1) Basic	(2) (3) Actual
3.0L	2-8 @ 600-800	15 @ 600-800

(1) - With ignition timing adjustment connector grounded or vacuum hose (farthest from distributor) disconnected.
(2) - With ignition timing adjustment connector ungrounded or vacuum hose (farthest from distributor) connected. Actual ignition timing is approximate and may fluctuate.
(3) - If vehicle altitude is more than 2300 feet above sea level, actualtiming may be advanced (5 degrees).

IDLE SPEED & MIXTURE

NOTE: Perform adjustments with engine at normal operating temperature, cooling fan and accessories off, transmission in Park or Neutral, and front wheels in straight-ahead position.

BASIC IDLE SPEED

NOTE: Ensure vehicle is at normal operating temperature with all lights, cooling fan and accessories off. Shift transmission into Neutral or Park position.

NOTE: Basic idle speed should only be adjusted after verifying that spark plugs, fuel injectors, idle air control motor and engine compression are okay.

1) Basic idle speed can only be adjusted using a scan tool to ground Data Link Connector (DLC). Connect scan tool to DLC. DLC is located below dash, near steering column.

2) Start engine and allow it to idle. Using scan tool, select MFI SYSTEM ACTUATOR TEST, then select item 30. Check basic idle speed. See IDLE SPEED SPECIFICATIONS table.

CAUTION: MFI system actuator test must be cancelled or test will continue to run for 27 minutes. Driving vehicle under this condition may damage engine.

3) Cancel MFI system actuator test. If idle speed is not

within specification, turn engine speed adjusting screw until correct engine speed is obtained. See Fig. 1. Access to speed adjusting screw is obtained by removing rubber plug on throttle body.

4) If idle speed cannot be lowered by turning engine speed adjusting screw, determine if fixed Speed Adjusting Screw (SAS). Fixed SAS is stop screw contacting throttle lever. See FIXED SPEED ADJUSTING SCREW for procedure.

5) After all adjustments are verified to be correct, possible cause of incorrect idle speed is deterioration of Idle Air Control (IAC) circuit. See DTC P0505 in appropriate G - TESTS W/CODES - 3.0L article.

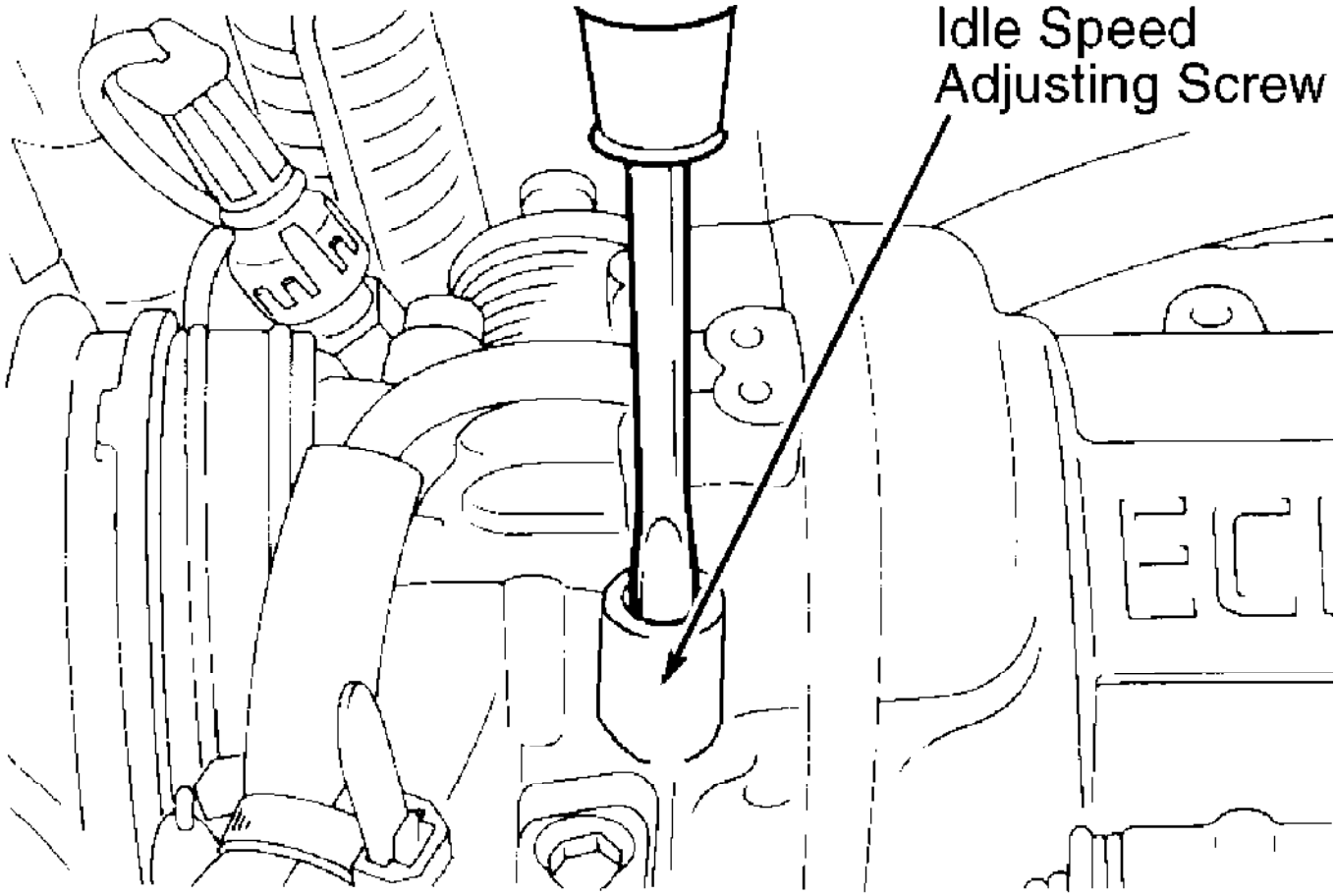

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Fig. 1: Adjusting Idle Speed (Typical)
Courtesy of Mitsubishi Motor Sales of America.

IDLE SPEED SPECIFICATIONS TABLE

Application	Curb Idle	Basic Idle
3.0L	600-800	650-750

(1) - Information is not available from manufacturer.

CURB (SLOW) IDLE SPEED

NOTE: Curb idle speed is controlled by Idle Air Control (IAC) motor. Adjustment is usually not necessary. For curb idle speed specifications, see IDLE SPEED SPECIFICATIONS table under BASIC IDLE SPEED.

1) Check ignition timing and adjust if necessary. See IGNITION TIMING. Run engine at 2000-3000 RPM for more than 5 seconds. Allow engine to idle for 2 minutes. Check curb idle speed.

2) If curb idle speed is not within specification, check IAC system. See DTC P0505 in appropriate G - TESTS W/CODES - 3.0L article. If IAC system is okay, adjust basic idle speed. See BASIC IDLE SPEED.

FIXED SPEED ADJUSTING SCREW

NOTE: Fixed Speed Adjusting Screw (SAS) is preset by manufacturer and usually does not require adjustment. Only adjust fixed SAS if other adjustment procedures require it, or if manufacturer's original setting has been changed.

1) Loosen throttle cable. Loosen fixed SAS lock nut. See Fig. 2. Turn fixed SAS counterclockwise until throttle valve is fully closed. Turn fixed SAS clockwise until throttle valve begins to open. Turn fixed SAS clockwise 1 1/4 turns after throttle valve begins to open.

2) Tighten lock nut while holding fixed SAS in position. Adjust throttle cable. Adjust basic idle speed. See BASIC IDLE SPEED. Adjust Throttle Position (TP) sensor. See TP SENSOR ADJUSTMENT under THROTTLE POSITION (TP) SENSOR.

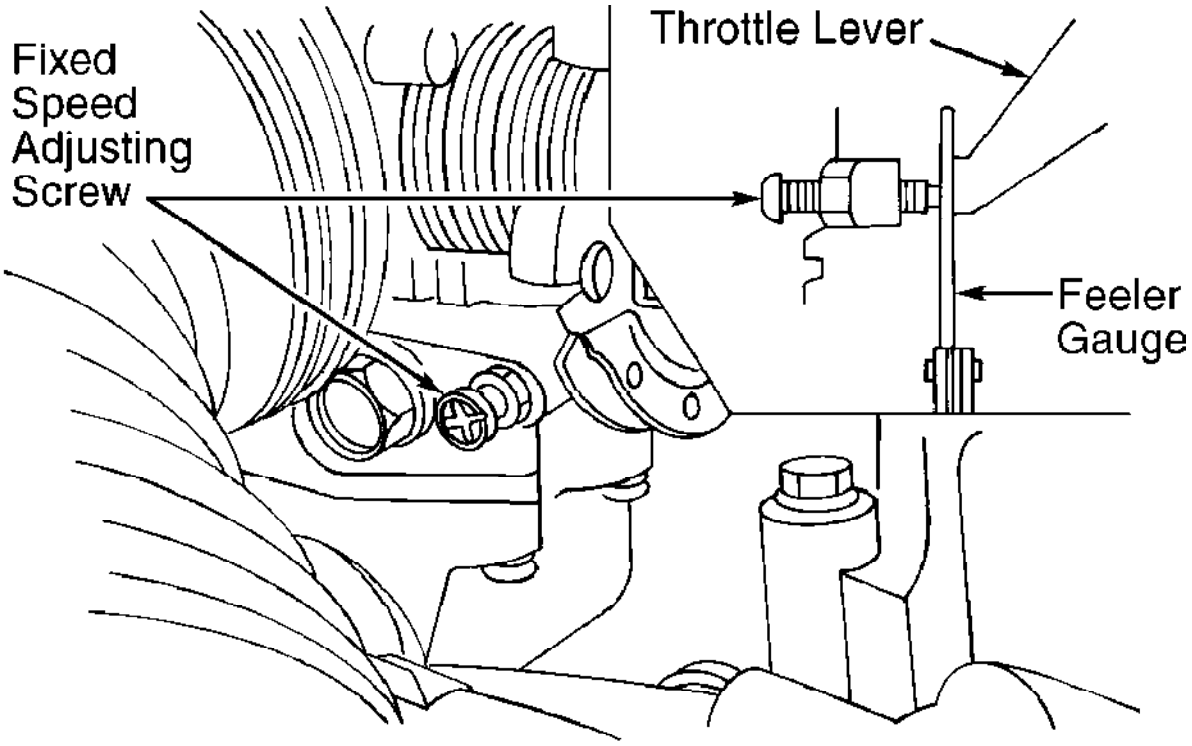

Fig. 2: Adjusting Fixed Speed Adjusting Screw (Typical)
Courtesy of Mitsubishi Motor Sales of America.

IDLE MIXTURE

NOTE: Idle mixture is computer controlled on fuel injected engines and is nonadjustable. CO level should not exceed .5%. HC level should not exceed 100 ppm. If mixture levels exceed limits, see appropriate G - TESTS W/CODES - 3.0L article.

THROTTLE POSITION (TP) SENSOR

TP SENSOR ADJUSTMENT

NOTE: Ensure basic idle speed is set to specification before adjusting TP sensor. See BASIC IDLE SPEED under IDLE SPEED & MIXTURE. Perform all adjustments with engine at normal operating temperature, front wheels in straight-ahead position, cooling fan and all accessories off, and transmission in Park or Neutral.

1) Disconnect TP sensor connector. Using jumper wires, connect an external ohmmeter between TP sensor terminals No. 3 and 4. Insert .018" (.45 mm) feeler gauge between fixed speed adjusting screw and throttle lever.

2) Loosen TP sensor mounting screws and rotate TP sensor fully counterclockwise. Ensure there is continuity between terminals No. 3 and 4. Rotate TP sensor clockwise until there is no continuity and tighten screws. Install Test Harness (MB991348) between TP sensor and harness connector.

3) Turn ignition on. Using external voltmeter, measure TP sensor output voltage between terminals No. 2 and 4. If voltage is not .4-1.0 volt, check harness and sensor. See DTC P0120 in appropriate G - TESTS W/CODES - 3.0L article.

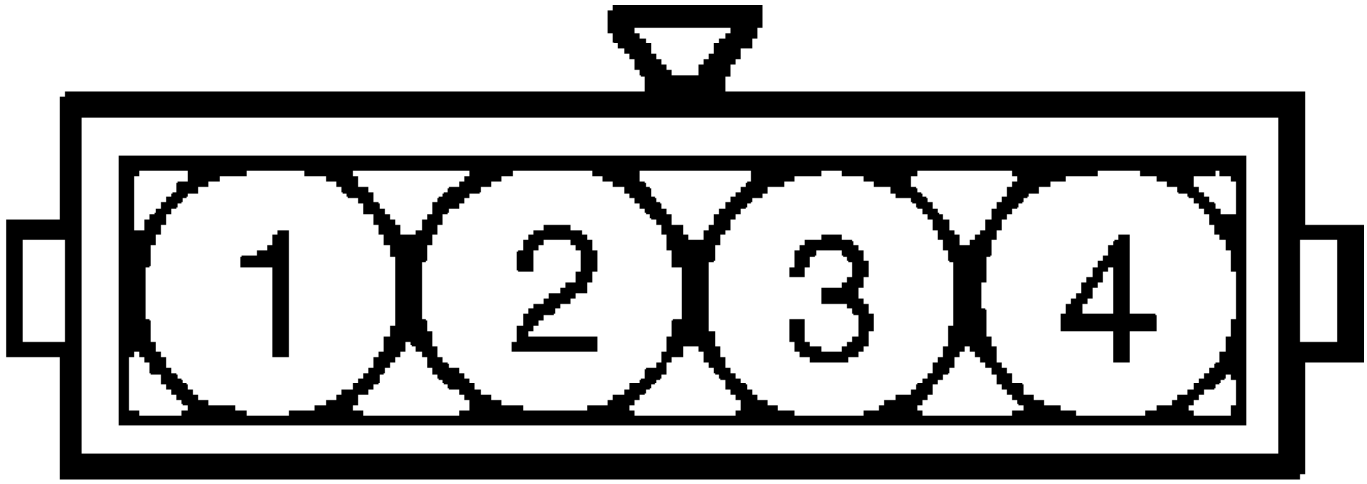

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Fig. 3: Identifying TP Sensor Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

AIR BAG RESTRAINT SYSTEM

1997-99 Mitsubishi Montero Sport

1997-99 ACCESSORIES/SAFETY EQUIPMENT
Chrysler/Mitsubishi - Air Bag Restraint System

Mitsubishi; Montero Sport

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all WARNINGS and SERVICE PRECAUTIONS.

DESCRIPTION & OPERATION

Supplemental Restraint System (SRS) consists of an SRS warning light, driver-side and passenger-side air bag module, clockspring, right and left front impact sensors, and SRS Air Bag Control Unit (ECU). The SRS-ECU contains an analog and a safing impact sensor. See Fig. 1.

Air bags are designed to deploy in a frontal or near frontal impact of moderate to severe force. For air bags to deploy, ignition must be on and safing impact sensor and at least one front impact sensor must activate simultaneously.

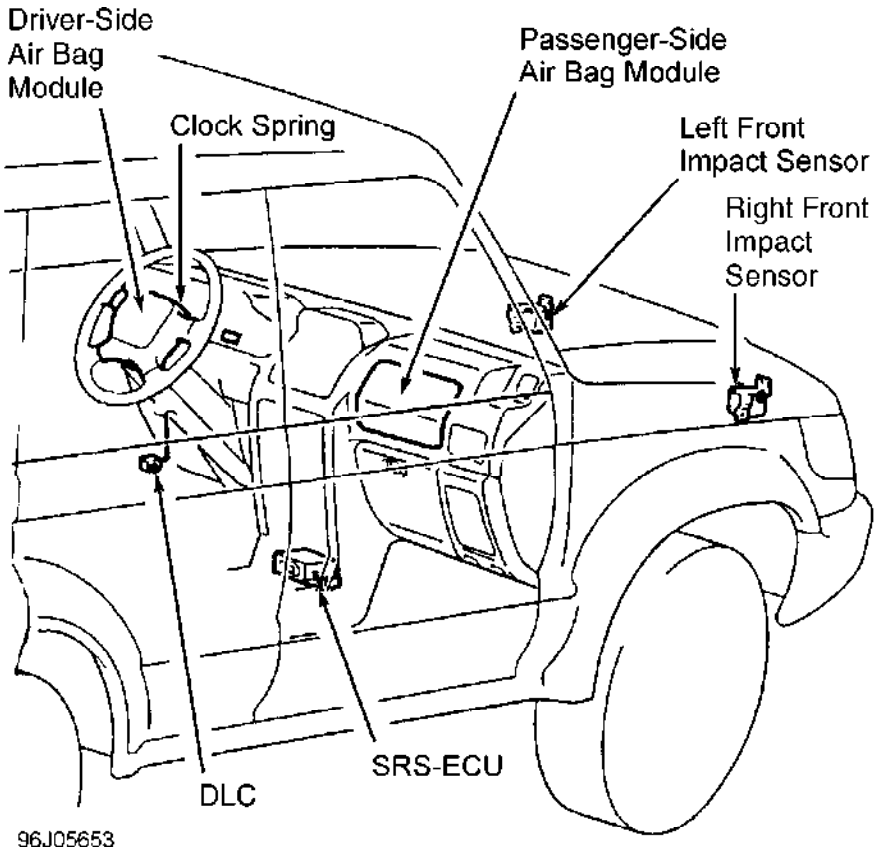

Fig. 1: Locating SRS Components
Courtesy of Mitsubishi Motor Sales of America.

SRS WARNING LIGHT

When ignition switch is turned to ON or START position, SRS warning light on instrument panel should come on for about 7 seconds and then go off. This indicates SRS-ECU has determined SRS is functioning properly. If SRS warning light flashes, stays on all the time, or does not come on, a fault exists in SRS. See DIAGNOSIS & TESTING.

FRONT IMPACT SENSORS

Sensors are inertia switches that verify direction and severity of impact. If impact is great enough, switch contacts close, completing an electrical circuit. Front impact sensors are located under front fenders. See Fig. 1.

AIR BAG MODULE(S)

An inflator assembly in the air bag module produces nitrogen gas to fill air bag. See Fig. 1. When a small amount of current from SRS-ECU is applied, ignitor starts a thermal reaction, which spreads to a pellet-filled canister that produces nitrogen gas. Gas pressure builds and discharges from inflator through a diffuser and screen assembly, forcing trim cover to burst along its seams until air bag is fully inflated. When air bag is fully inflated, gas escapes through vents on sides of air bag.

SRS AIR BAG CONTROL UNIT (ECU)

SRS-ECU (with integral safing and analog impact sensor) is located behind front floor console assembly. See Fig. 1. If a system fault occurs, SRS-ECU memory stores a diagnostic trouble code (DTC).

DATA LINK CONNECTOR (DLC)

DLC is located under left side of dash. See Fig. 1. DLC is used to access SRS self-diagnostics through Mitsubishi Multi-Use Tester II (MUT-II) (MB991502).

CLOCKSPRING

Clockspring connects driver-side air bag module to steering column wiring, forming SRS circuit. See Fig. 1. Clockspring is a flat, ribbon-like cable that winds and unwinds when steering wheel is turned. Because of clockspring's constant movement, it is the most fragile part in the system.

SERVICING

To ensure long-term operation, SRS system must be inspected 10 years from vehicle manufacture date (date is on driver-side center pillar, on certification label). To inspect, perform procedure under POST-COLLISION INSPECTION.

SYSTEM OPERATION CHECK

WARNING: After servicing, always turn ignition on from passenger-side of vehicle in case of accidental air bag deployment.

Turn ignition switch to ON position. SRS warning light on instrument panel should come on for about 7 seconds and then turn off. This indicates SRS is functioning properly. If SRS warning light does not come on, stays on, or comes on while driving, SRS is

malfunctioning and needs repair. See DIAGNOSIS & TESTING.

SERVICE PRECAUTIONS

Observe the following precautions when working with SRS:

* Disable SRS before servicing any SRS or steering column component. Failure to do this may result in accidental air bag deployment and possible personal injury. Refer to DISABLING & ACTIVATING AIR BAG SYSTEM.
* For about 60 SECONDS after air bag system is disabled, it retains enough voltage to deploy air bags. After disabling system, wait at least 60 SECONDS before servicing.
* After servicing, always turn ignition on from passenger-side of vehicle in case of accidental air bag deployment.
* After servicing, check SRS warning light to verify system operation. See SYSTEM OPERATION CHECK.
* Always wear safety glasses when servicing or handling an air bag.
* The SRS-ECU must be stored in its original special container until used for service. It must be stored in a clean, dry place, away from sources of extreme heat, sparks and high electrical energy.
* DO NOT expose air bag module and clockspring to temperatures greater than 200°F (93°C).
* When placing a live air bag module on a bench or other surface, always face air bag module and trim cover up, away from surface. This will reduce motion of module if air bag accidentally deploys.
* After air bag deploys, air bag surface may contain deposits of sodium hydroxide, which irritates skin. Always wear safety glasses, rubber gloves and long-sleeved shirt during clean-up. Wash hands using mild soap and water. Follow correct clean-up and disposal procedures. Refer to DISPOSAL PROCEDURES.
* Because of critical system operating requirements, DO NOT service any SRS components. Repairs are only made by replacing defective part(s).
* DO NOT allow any electrical source near inflator on the back of air bag module.
* When carrying a live (undeployed) air bag module, trim cover must be pointed away from body to minimize injury in case of accidental air bag deployment.
* DO NOT probe wire harness connector terminals. Instead, use SRS Check Harness (MB991530).
* DO NOT probe a wire through insulator, as this will damage it and eventually cause failure due to corrosion.
* When performing electrical tests, prevent accidental shorting of terminals. Such shorts can damage fuses or components and may cause a second fault code to set, making diagnosis of original problem more difficult.
* Never use an analog volt/ohm meter or test light in place of a Digital Volt/Ohm Meter (DVOM). Use only a DVOM with a maximum test current of 2 mA (milliamps) at minimum range of resistance measurement. Also see SPECIAL TOOLS.
* If SRS is not fully functional for any reason, DO NOT drive vehicle until system is repaired and is fully functional. DO NOT remove bulbs, modules, sensors or other components, or in any way disable system from operating normally. If SRS is not functional, park vehicle until repairs are made.

SPECIAL TOOLS

To avoid air bag deployment when working on SRS, DO NOT use electrical test equipment such as test lights, battery or A/C-powered volt/ohmmeter, or any type of electrical equipment other than those specified by manufacturer. See SRS RECOMMENDED TOOLS table.

SRS RECOMMENDED TOOLS

Tool Name	Tool Number
For Component Replacement	
Steering Wheel Puller	MB990803
For Testing SRS	
Digital Volt-Ohm Meter (DVOM)	(1)
Multi-Use Tester II	MB991502
ROM Pack	(2)
SRS Check Harness	MB991613
For Deploying Air Bags	
SRS Air Bag Adapter Harness "A" (3)	MB686560
SRS Air Bag Adapter Harness "B" (4)	MB628919

(1) - Maximum current output of DVOM must not exceed 2 mA (milliamps) when set on minimum range of resistance measurement.
(2) - ROM pack is used with multi-use tester.
(3) - For on-vehicle deployment of driver-side air bag. For on-vehicle or off-vehicle deployment of passenger-side air bag.
(4) - For off-vehicle deployment of driver-side air bag.

DISABLING & ACTIVATING AIR BAG SYSTEM

WARNING: SRS system voltage is maintained for about 60 seconds after battery cable is disconnected. After disconnecting battery cable, wait at least 60 seconds before servicing SRS. Failure to wait may cause accidental air bag deployment and possible personal injury.

To disable system, turn ignition switch to LOCK position. Disconnect negative battery cable. Shield cable end. Wait at least 60 seconds before servicing. To activate system, reconnect negative battery cable.

DISPOSAL PROCEDURES

* PLEASE READ THIS FIRST *

WARNING: Undeployed air bag must be deployed before disposal. Disposing of an undeployed air bag may violate federal, state and/or local laws. This also applies to vehicles that are to be scrapped. Never sell a used air bag module.

UNDEPLOYED AIR BAG

WARNING: Deploy air bag outdoors and away from people. Air bag deployment makes a loud noise. NEVER deploy air bag module with trim cover face down.

NOTE: If replacing a deployed air bag, both front impact sensors and SRS-ECU must also be replaced. If vehicle is to be

scrapped, perform PROCEDURE 1 (ON-VEHICLE DEPLOYMENT) below. If vehicle will continue to be operated, perform PROCEDURE 2 (OFF-VEHICLE DEPLOYMENT) below.

Procedure 1 (On-Vehicle Deployment)

1) Before proceeding, follow air bag service precautions. See SERVICE PRECAUTIONS. Open all doors and windows. Move vehicle to an isolated area. Disconnect negative battery cable and wrap tape around cable terminal.

2) Disconnect positive battery cable. Remove battery. Wait at least 60 seconds before continuing. Remove steering column lower cover. Disconnect clockspring 2-pin Red connector.

3) Make a harness with two 20-foot (or longer) wires. Connect wires at one end of this harness to SRS Air Bag Adapter Harness "A" (MB686560). Wrap connections with insulating tape. See Fig. 2.

4) Temporarily connect other end of harness wires together to prevent unexpected air bag deployment. Connect SRS air bag adapter harness "A" to clockspring 2-pin Red connector. Run 20-foot wires outside of vehicle as far away as possible from vehicle.

5) Ensure there are no loose parts in passenger compartment and no one is within 20 feet of vehicle.

6) Deploy air bag by connecting ends of 20-foot wires to terminals of a 12-volt battery. If air bags fail to deploy, go to PROCEDURE 2 below. After deployment, allow air bag modules to cool and dust to settle for at least 30 minutes before approaching vehicle.

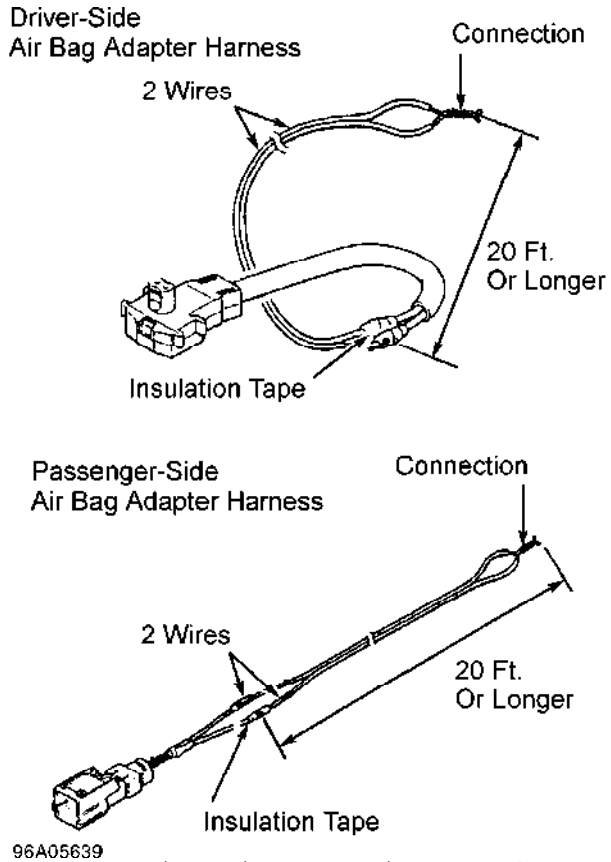

Fig. 2: Connecting Wires To Air Bag Adapter Harness
Courtesy of Mitsubishi Motor Sales of America.

Procedure 2 (Off-Vehicle Deployment)

1) Before proceeding, follow air bag service precautions. See

SERVICE PRECAUTIONS. Turn ignition switch to LOCK position. Disconnect negative battery cable. Shield cable end. Disconnect positive battery cable. Remove battery. Wait at least 60 seconds before continuing.

2) Remove air bag module. Place air bag module on ground at least 20 feet away from people or objects. Air bag module face (trim cover) must face upward to prevent movement of air bag module when it is deployed.

3) Make a harness with two 20-foot (or longer) wires. Connect wires at one end of this harness to stripped wires of SRS Air Bag Adapter Harness "B" (MB628919) for driver-side air bag, or SRS Air Bag Adapter Harness "A" (MB686560) for passenger-side air bag. See Fig. 2.

4) Wrap connections with insulating tape. Temporarily connect other end of harness wires together to prevent unexpected air bag deployment. Connect appropriate adapter harness to air bag module connector. Place a tire without a rim over the air bag module so rim hole surrounds air bag module. Stack 3 more tires on top of first tire. Connect ends of 20-foot wires to terminals of a 12-volt battery.

5) After air bag module deploys, let it cool off and allow dust to settle for at least 30 minutes before approaching. Tightly seal deployed air bag module in a strong vinyl bag and dispose of air bag as you would any other part.

DEPLOYED AIR BAG CLEAN-UP

WARNING: Vehicle interior will contain sodium hydroxide powder, a by-product of air bag deployment. Since this powder can irritate skin, eyes, nose and throat, wear safety glasses, rubber gloves and long-sleeved shirt during clean-up.

1) Avoid breathing powder from air bag deployment. Begin clean-up by putting tape over air bag exhaust vent to prevent additional powder from escaping into vehicle interior. Use a vacuum cleaner to remove any residual powder from A/C-heater outlets and vehicle interior.

2) Turn blower motor to low for a few minutes and exit vehicle. Turn blower motor off. Vacuum any other powder expelled from plenum. Vacuum interior a second time to recover all powder. Avoid kneeling or sitting on unclean areas. Wrap deployed air bag in heavy vinyl plastic and dispose of it as you would any other part.

POST-COLLISION INSPECTION

POST-COLLISION AIR BAG SAFETY INSPECTION TABLE

Replace After Deployment	* Air Bag Module(s) * SRS Control Unit * Front Impact Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Steering Column & Intermediate Joint * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: Follow air bag service precautions to prevent accidental air bag deployment and personal injury. See SERVICE PRECAUTIONS. Replace faulty SRS components; DO NOT repair or disassemble. Handle all SRS components carefully.

DRIVER-SIDE AIR BAG MODULE & CLOCKSPRING

NOTE: If replacing deployed air bag module, SRS-ECU must be replaced.

Removal

1) Before proceeding, see SERVICE PRECAUTIONS. Reactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Ensure front wheels are in straight-ahead position. Remove lower covers from air bag module. Remove air bag module mounting nut and screws. See Fig. 3. Lift air bag module for access to clockspring connector at air bag module and disconnect clockspring connector. Remove air bag module. See Fig. 4.

3) Place air bag module on flat surface with trim cover facing up. Remove steering wheel with Steering Wheel Puller (MB990803). Remove lower column cover. Disconnect clockspring lower connectors. Remove clockspring mounting screws. Remove clockspring.

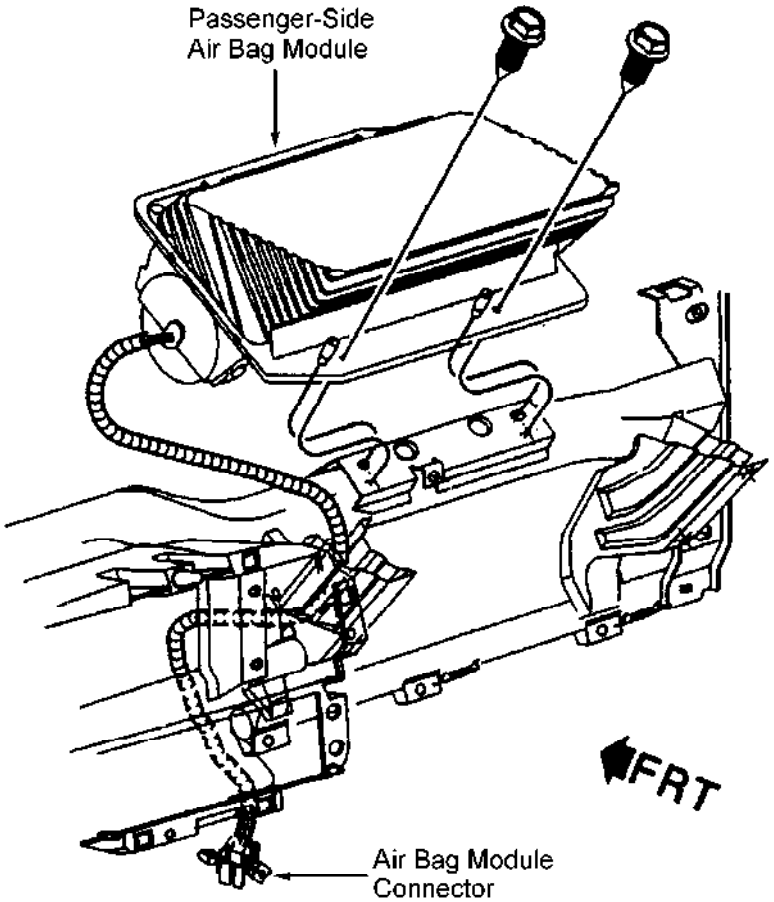

Fig. 3: Removing Driver-Side Air Bag & Clockspring
Courtesy of Mitsubishi Motor Sales of America.

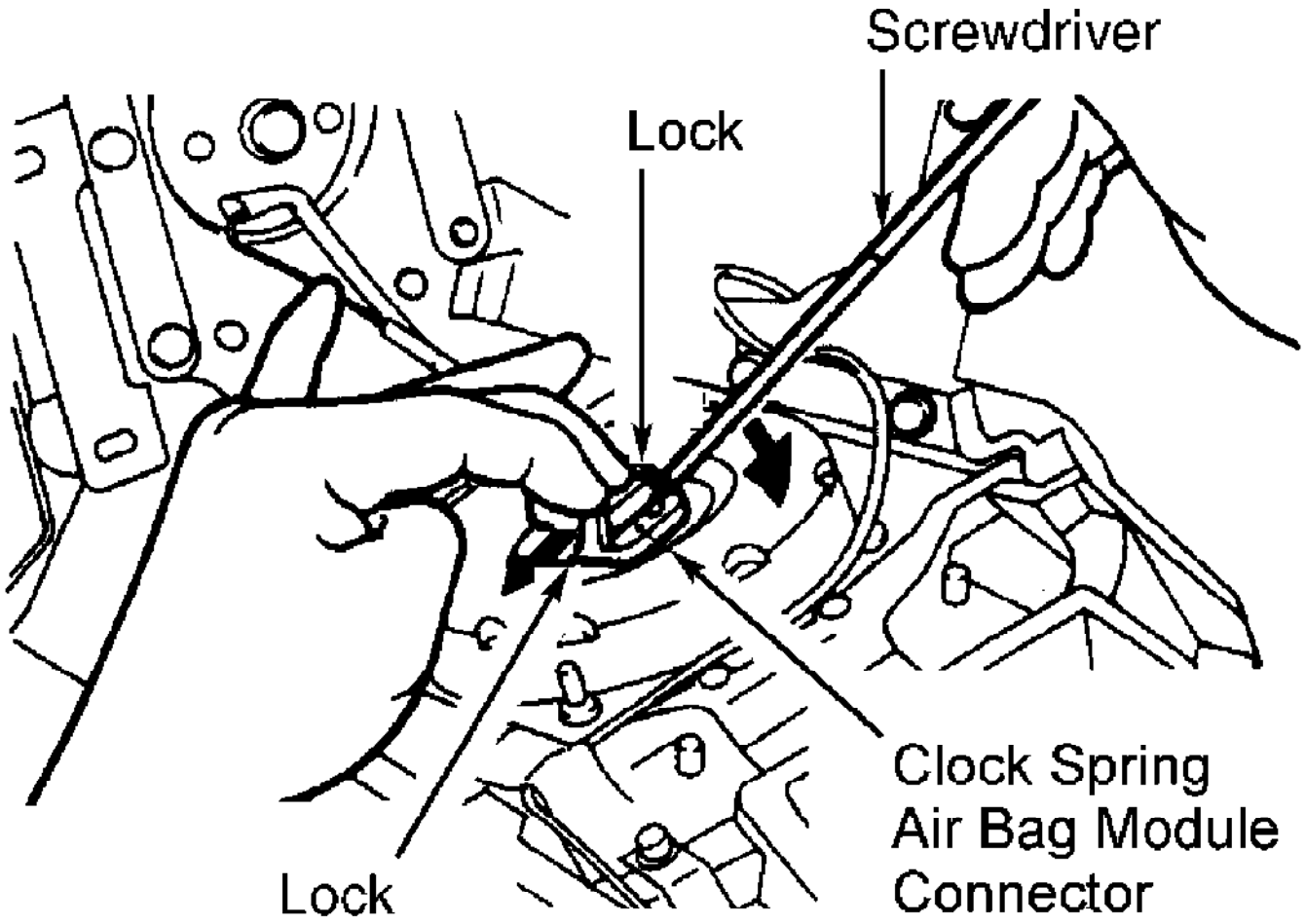

Fig. 4: Disconnecting Clockspring Connector From Air Bag Module
Courtesy of Mitsubishi Motor Sales of America.

WARNING: If front wheels are not in straight-ahead position or clockspring mating marks are not aligned before installing clockspring, the steering wheel may not turn completely, or flat cable inside clockspring may be severed, disabling SRS system and possibly causing serious injury to driver.

Installation

1) Ensure front wheels are in straight-ahead position. Align mating marks on clockspring. See CLOCKSPRING CENTERING under ADJUSTMENTS. Install clockspring. To install remaining components, reverse removal procedure. Before installing air bag module, ensure horn switch wiring is positioned so that it will not be pinched.

2) Tighten fasteners to spec. See TORQUE SPECIFICATIONS. Activate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM. Check AIR BAG warning light for proper system function. SYSTEM OPERATION CHECK.

PASSENGER-SIDE AIR BAG MODULE

NOTE: If replacing deployed air bag module, SRS-ECU must be replaced.

Removal & Installation

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Open glove box door. Remove two stoppers on inside of glove box door. Disconnect air bag module connector. Remove retaining bolts and passenger-side air bag module. See Fig. 5.

3) To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Activate SRS. See procedures under DISABLING & ACTIVATING AIR BAG SYSTEM. Check AIR BAG warning light for proper system function. SYSTEM OPERATION CHECK.

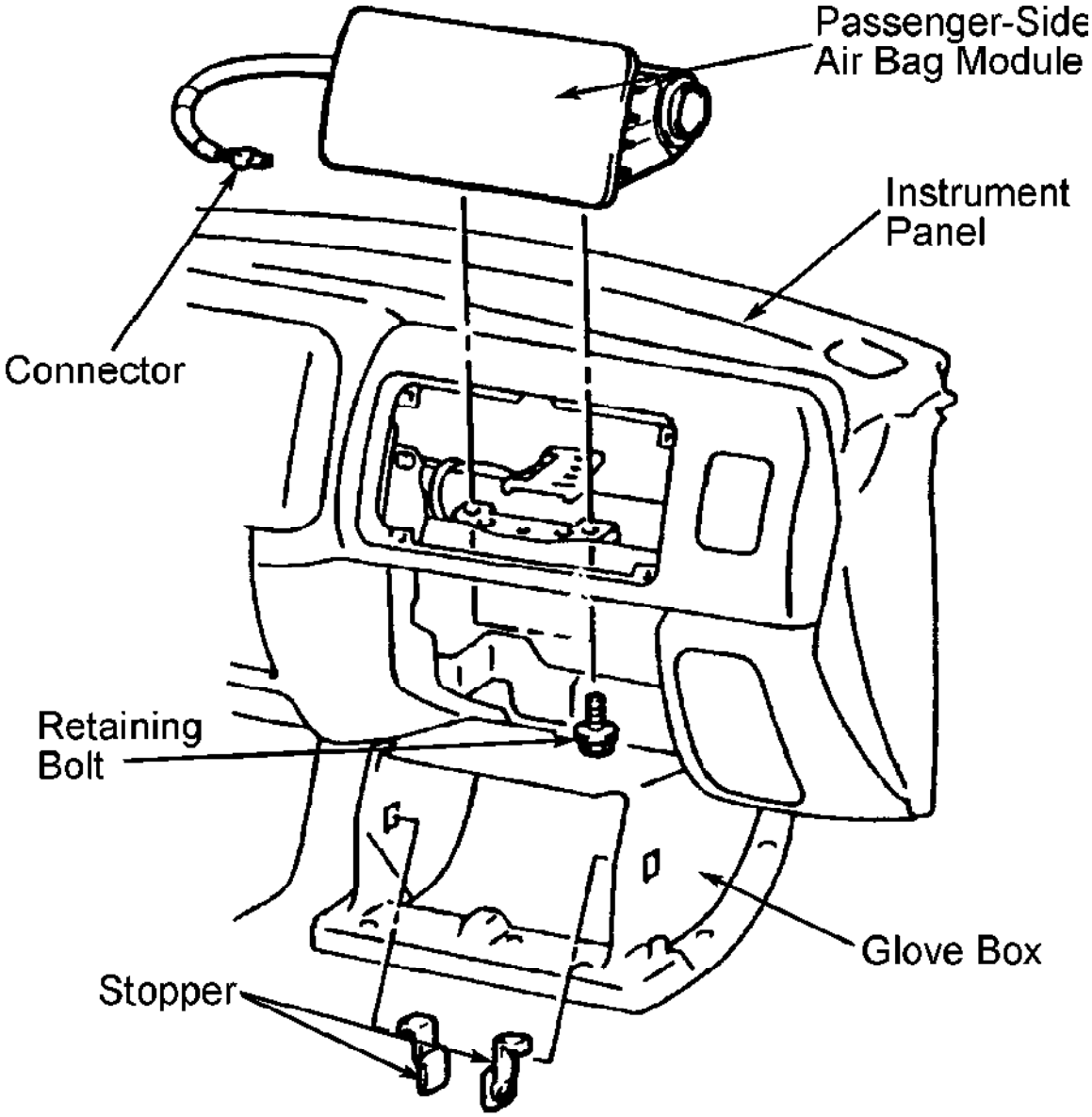

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Fig. 5: Removing Passenger-Side Air Bag Module
Courtesy of Mitsubishi Motor Sales of America.

SRS AIR BAG CONTROL UNIT (ECU)

CAUTION: SRS-ECU connector is a double-locking mechanism. DO NOT use excessive force when disconnecting connector.

Removal & Installation

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Remove rear floor console assembly. Remove console lid assembly, rear heater control panel, and foot grill. Remove shift lever knob, front floor console assembly, and applicable console panels. Remove shift and transfer reinforcement and lever boot. Remove console panel and box. Disconnect SRS-ECU connector. Remove mounting bolts, bracket and SRS-ECU. See Fig. 6.

3) To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Activate SRS. See procedures under DISABLING & ACTIVATING AIR BAG SYSTEM. Check AIR BAG warning light for proper system function. SYSTEM OPERATION CHECK.

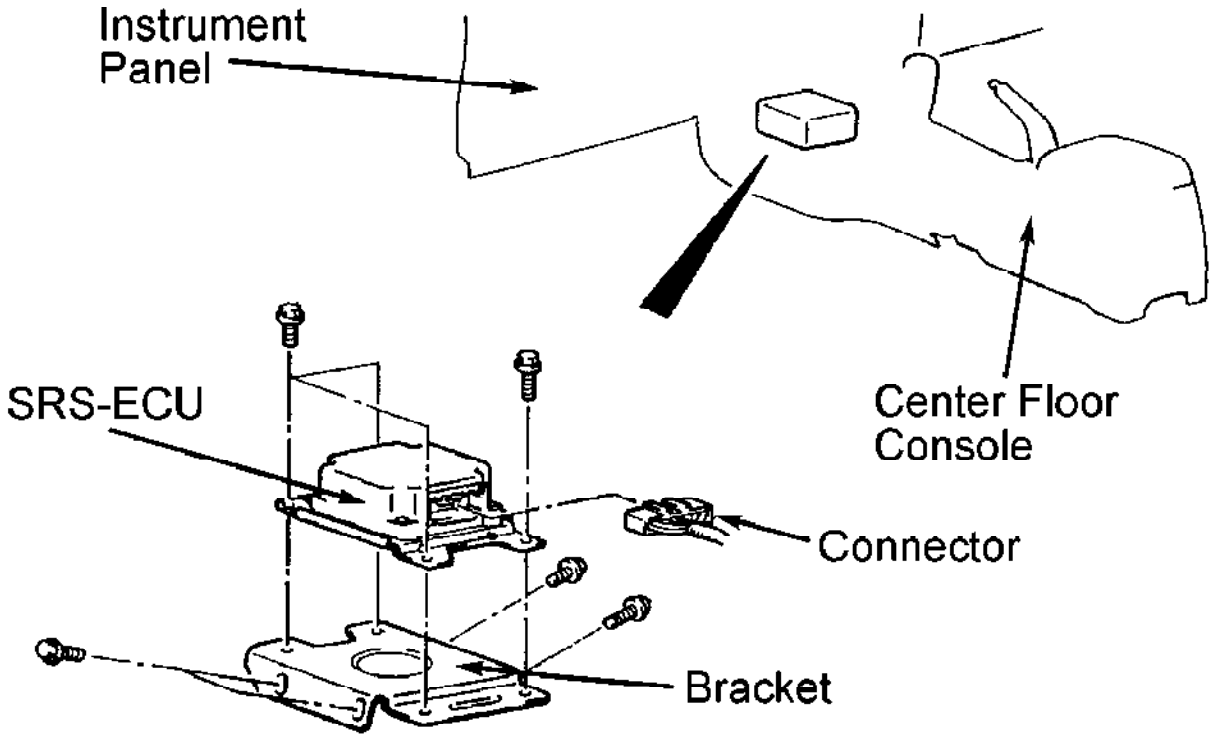


Fig. 6: Removing SRS Air Bag Control Unit (ECU) Courtesy of Mitsubishi Motor Sales of America.

FRONT IMPACT SENSORS

Removal & Installation

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Remove components as necessary to access front impact sensor(s). Disconnect sensor electrical connector. Remove mounting bolts and front impact sensor. See Fig. 7.

3) To install, reverse removal procedure. Position sensor with arrow facing toward front of vehicle. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Activate SRS. See procedures under DISABLING & ACTIVATING AIR BAG SYSTEM. Check AIR BAG warning

light for proper system function. SYSTEM OPERATION CHECK.

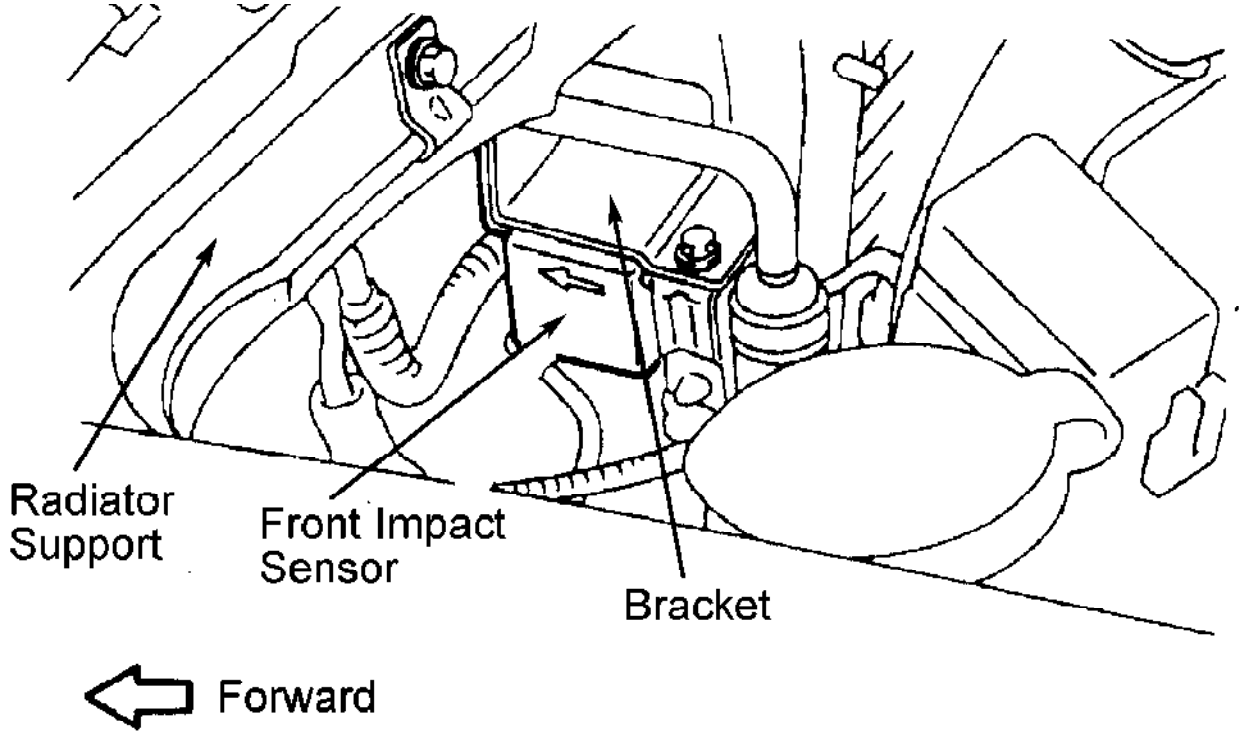


Fig. 7: Locating Impact Sensors
Courtesy of Mitsubishi Motor Sales of America.

ADJUSTMENTS

CLOCKSPRING CENTERING

WARNING: If front wheels are not in straight-ahead position or clockspring mating marks are not aligned before installing clockspring, the steering wheel may not turn completely, or flat cable inside clockspring may be severed, disabling SRS system and possibly causing serious injury to driver.

With clockspring removed, ensure front wheels are in straight-ahead position. Turn clockspring fully clockwise, and then turn it back approximately 3.75 turns counterclockwise to align mating marks. See Fig. 8.

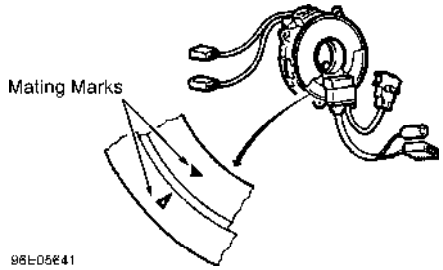


Fig. 8: Aligning Clockspring Mating Marks
Courtesy of Mitsubishi Motor Sales of America.

WIRE REPAIR

DO NOT repair SRS wiring or harness connectors. If SRS wiring or harness connectors are faulty, replace faulty wiring harness.

DIAGNOSIS & TESTING

INITIAL SRS DIAGNOSTIC PROCEDURE

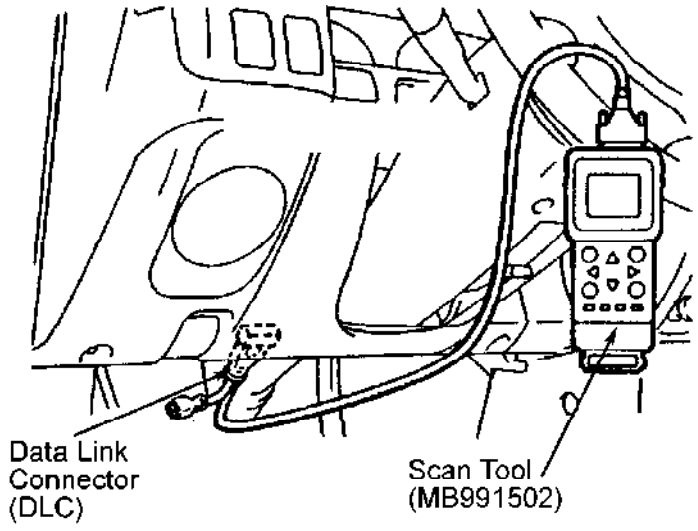
WARNING: Follow air bag service precautions to prevent accidental air bag deployment and personal injury. See SERVICE PRECAUTIONS.

NOTE: Ensure battery is fully charged. If battery voltage is too low, SRS warning light will come on. When battery voltage is restored to normal, light will go out. Codes remain stored for no more than about 7 days. Codes can be stored no more than 250 times. After servicing, reconnect negative battery cable. Erase codes using Multi-Use Tester II (MUT-II, MB991502). Check SRS warning light to verify system operation. See SYSTEM OPERATION CHECK.

CAUTION: Ensure ignition is off before connecting or disconnecting scan tool at DLC.

1) Before proceeding, follow service precautions. See SERVICE PRECAUTIONS. Turn ignition on. If SRS warning light comes on for about 7 seconds and turns off, SRS is functioning properly at this time.

2) If SRS warning light does not come on, or comes on and stays on, turn ignition switch to LOCK position. Connect scan tool to Data Link Connector (DLC). See Fig. 9. Turn ignition on. Use scan tool to retrieve code(s). Special tools MUT II and SRS Check Harness (MB991613) are required for diagnosis and testing.



97H05906 Courtesy of Mitsubishi Motor Sales of America

Fig. 9: Connecting Scan Tool To Data Link Connector (DLC) Courtesy of Mitsubishi Motor Sales of America.

TROUBLE SYMPTOMS TABLE

Symptom	Inspection Procedure
Communication With All Systems Not Possible	1
Communication With SRS Only Not Possible	2
Ignition Switch On (Engine Stopped)	
SRS Warning Light Does Not Come On	DTC 43
SRS Warning Light Stays On After 7 Seconds	DTC 43

INSPECTION PROCEDURE 1

The cause is probably in power supply system (including ground circuit of diagnostic line). Check connectors and harness, and repair if necessary.

INSPECTION PROCEDURE 2

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Measure SRS Check Harness (MB991613) connector No. 5. Disconnect SRS-ECU connector C-24 and connect SRS check harness connector No. 3 to C-24. Check continuity between terminal No. 20, 21 and ground. If there is no continuity, go to next step. If there is continuity, go to step 4).

3) Check harness wires between SRS-ECU connector C-24 and ground, and repair if necessary. If harness wires are OK, check for trouble symptoms. If fault exists, ensure harness wires are normal.

4) Measure SRS check harness connector No. 5. Disconnect SRS-ECU connector C-24 and connect SRS harness check connector No. 3 to C-24. Turn ignition switch to ON position. Measure voltage between terminal No. 13 and 14, and body ground. If voltage at terminals is 9 volts or more, check harness wire between SRS-ECU and Data Link Connector (DLC) C-69, and repair if necessary. If harness wire is OK, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION. If voltage is not as specified, check harness wires between IG1 (ignition switch) and SRS-ECU connector C-24, and repair if necessary. If harness wires are OK, check for trouble symptoms. If fault exists, ensure harness wires are normal.

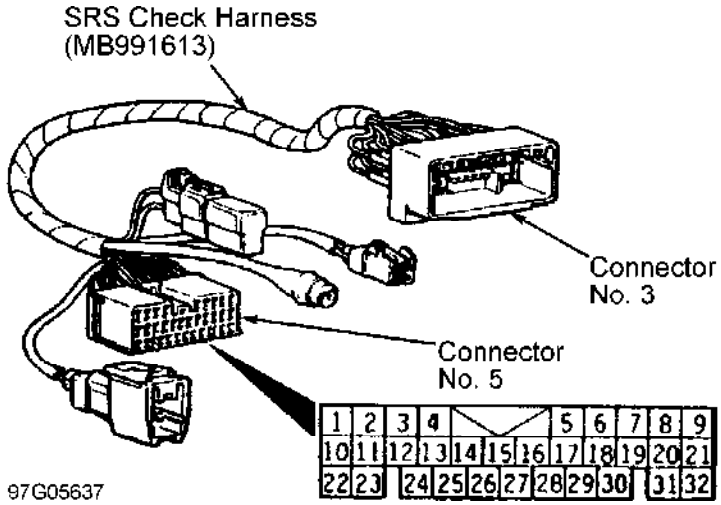


Fig. 10: Identifying SRS Check Harness (MB991613) Connectors
Courtesy of Mitsubishi Motor Sales of America.

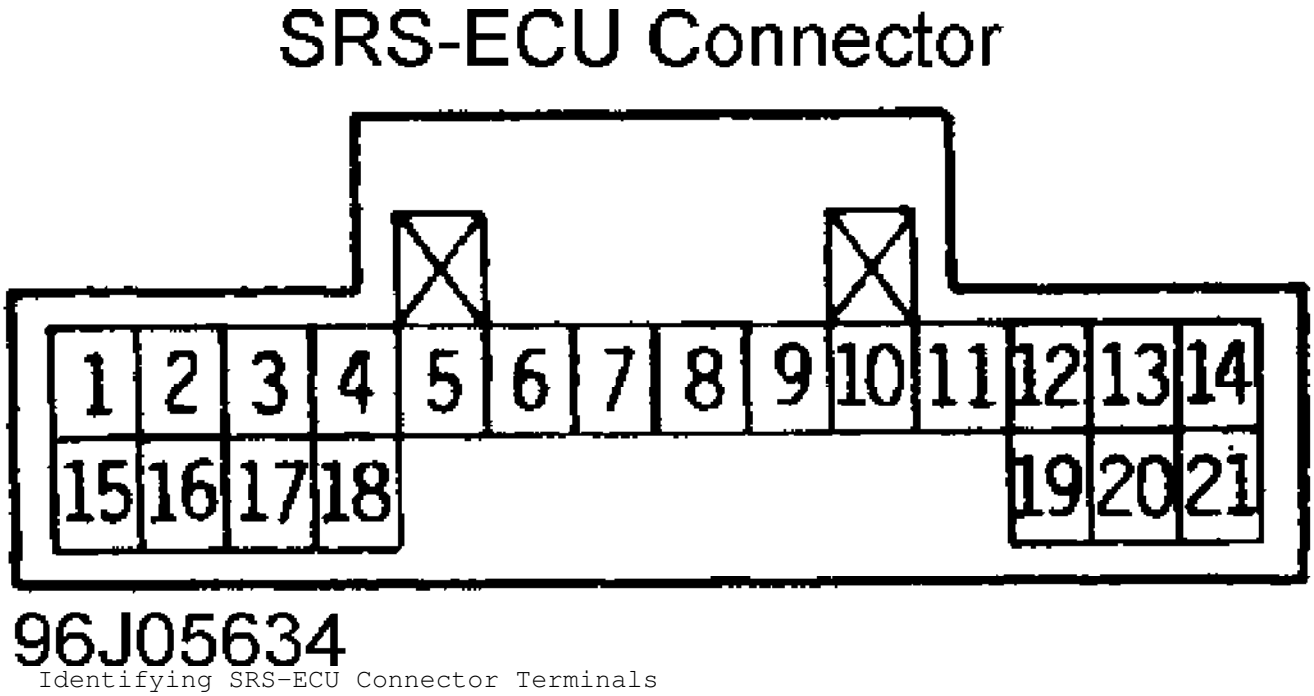


Fig. 11: Identifying SRS-ECU Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

DTC 11, 12 & 13 - FRONT IMPACT SENSOR SYSTEM

NOTE: When any of these codes are set, the condition that causes Code 21, 22, 24 or 25 may also exist (condition may exist even if code did not set).

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.
2) Check front impact sensor. Measure resistance between terminals for normal value of 1,960-2,040 ohms. Check that no continuity exists between terminal and bracket. If resistance and continuity are as specified, go to next step. If resistance or continuity is not as specified, replace front impact sensor. See FRONT IMPACT SENSORS under REMOVAL & INSTALLATION. Check for DTCs. See SYSTEM OPERATION CHECK.
3) Check left front impact sensor line at SRS Check Harness (MB991613) connector No. 5. Disconnect SRS-ECU connector C-24 and connect SRS check harness connector No. 3 to C-24. Measure resistance between terminal No. 12 and 17. If resistance is 1,960-2,040 ohms, go to next step. If resistance is not as specified, check harness wires between SRS-ECU connector C-24 and left front impact sensor connector A-18, and repair if necessary or install sensor cable. If harness wires are OK, check for DTCs. See SYSTEM OPERATION CHECK.
4) Check right front impact sensor line at SRS Check Harness (MB991613) connector No. 5. Disconnect SRS-ECU connector C-24 and connect SRS check harness connector No. 3 to C-24. Measure resistance between terminal No. 18 and 19. If resistance is 1,960-2,040 ohms, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION. Check for DTCs. See SYSTEM OPERATION CHECK. If resistance is not as specified, check harness wires between SRS-ECU connector C-24 and right front impact sensor connector A-32, and repair if necessary or install sensor cable. If harness wires are OK, check for DTCs.

DTC 14 - ANALOG IMPACT SENSOR

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 15 & 16 - SAFING IMPACT SENSOR

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 21, 22, 61, 62 - DRIVER-SIDE AIR BAG MODULE SYSTEM

WARNING: During the following procedure, never measure circuit resistance of air bag module (squib), even when using specified DVOM. If circuit resistance is measured, it may cause accidental air bag deployment and personal injury.

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.
2) Disconnect clockspring connector D-18. Connect SRS Check Harness (MB991613) connector No. 1 to clockspring connector. Connect negative battery cable. Erase DTC memory and check if DTCs 21, 22, 61, or 62 are set. If any of these DTCs are output, go to next step. If DTCs are not output, go to step 4).
3) Check connectors D-18 and C-24, and repair if necessary. If connectors are OK, check trouble symptoms. If fault is still present, check harness wire between SRS-ECU and clockspring, and repair if necessary. If harness wire is OK, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.
4) Check clockspring and replace if necessary. See DRIVER-SIDE AIR BAG MODULE & CLOCKSPRING under REMOVAL & INSTALLATION. If clockspring is OK, replace driver-side air bag module. Check for DTCs. See SYSTEM OPERATION CHECK.

DTC 24, 25, 64, 65 - PASSENGER-SIDE AIR BAG MODULE SYSTEM

WARNING: During the following procedure, never measure circuit resistance of air bag module (squib), even when using specified DVOM. If circuit resistance is measured, it may cause accidental air bag deployment and personal injury.

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.
2) Disconnect passenger-side air bag connector C-49. Connect SRS Check Harness (MB991613) connector No. 1 to passenger-side air bag connector. Connect negative battery cable. Erase DTC memory and check if DTCs 24, 25, 64, or 65 are set. If any of these DTCs are output, go to next step. If DTCs are not output, replace passenger-side air bag module. See PASSENGER-SIDE AIR BAG MODULE under REMOVAL & INSTALLATION.
3) Check connectors C-49 and C-24, and repair if necessary. If connectors are OK, check trouble symptoms. If fault is still present, check harness wire between passenger-side air bag module and SRS-ECU, and repair if necessary. Check for DTCs. See SYSTEM OPERATION CHECK.

DTC 31 & 32 - SRS-ECU CAPACITOR SYSTEM

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 34 - CONNECTOR LOCK SYSTEM

NOTE: If vehicle condition returns to normal, DTC will be erased and SRS warning light will return to normal.

Before proceeding, see SERVICE PRECAUTIONS. Check connector C-24 and repair if necessary. If connector is OK, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 35 - SRS-ECU AIR BAG SYSTEM/AIR BAG DEPLOYMENT

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 41 & 42 - IG1 (A) & (B) POWER CIRCUIT SYSTEM

NOTE: If vehicle condition returns to normal, DTC will be erased and SRS warning light will return to normal.

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.
2) Check ground line at SRS Check Harness (MB991613) connector No. 5. Disconnect SRS-ECU connector C-24 and connect SRS check harness connector No. 3 to C-24. Measure resistance between ground, and terminal No. 20 and 21. If there is continuity, go to next step. If there is no continuity, check harness wires between SRS-ECU connector C-24 and ground, and repair if necessary. Check for DTCs. See SYSTEM OPERATION CHECK. If wires are OK, check for DTCs.
3) Check IG1 line (ignition switch) at SRS check harness connector No. 5. Disconnect SRS-ECU connector C-24 and connect SRS check harness connector No. 3 to C-24. Turn ignition switch to ON position. Measure voltage between terminal No. 14 (DTC 41) or 13 (DTC 42) and ground. If voltage is 9 volts or more, go to next step. If voltage is not as specified, check harness wires between SRS-ECU connector C-24 and IG1, and repair if necessary. Check for DTCs. See SYSTEM OPERATION CHECK. If wires are OK, check for DTCs.

DTC 43 - SRS WARNING LIGHT DOES NOT COME ON

Light Does Not Come On
1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate SRS. See DISABLING & ACTIVATING AIR BAG SYSTEM.
2) Measure SRS Check Harness (MB991613) connector No. 5. Disconnect SRS-ECU connector C-24 and connect SRS check harness connector No. 3 to C-24. Check terminal No. 20 and 21 for continuity to ground. If there is no continuity, go to next step. If there is continuity, go to step 4).
3) Check connector C-24 to ground, and repair if necessary. If connector is OK, check for trouble symptoms. If fault still exists, check harness wire between SRS-ECU and ground, and repair if necessary.
4) Measure SRS check harness connector No. 5. Disconnect SRS-ECU connector C-24 and connect SRS harness check connector No. 3 to C-24. Turn ignition switch to ON position. Connect terminal No. 15 to body ground. If SRS warning light comes on, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION. If SRS warning light does not come on, inspect for blown bulb and repair if necessary. If bulb is OK, check connector C-02, C-04, C-24, D-06, and D-08, and repair if necessary. If connectors are OK, check for trouble symptoms. If fault still exists, check harness wire between SRS-ECU and ignition switch IG1, and repair if necessary. If harness wire is OK, replace combination meter. Check for DTCs. See SYSTEM OPERATION CHECK.

Light Does Not Turn Off

1) Before proceeding, see SERVICE PRECAUTIONS. Turn ignition switch to ON position. If SRS warning light stays on when C-24 is disconnected, go to next step. If SRS warning light turns off when C-24 is disconnected, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

2) Check connector C-02 and C-24, and repair if necessary. If connectors are OK, check trouble symptoms. If fault still exists, check wire harness between SRS-ECU and combination meter, and repair if necessary. Check for DTCs. See SYSTEM OPERATION CHECK.

DTC 44 - SRS WARNING LIGHT DRIVE CIRCUIT SYSTEM

NOTE: If vehicle condition returns to normal, DTC will be erased and SRS warning light will return to normal.

Before proceeding, see SERVICE PRECAUTIONS. Check SRS warning light drive circuit system. If warning light drive system is OK, replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION. Check for DTCs. See SYSTEM OPERATION CHECK.

DTC 45 - SRS-ECU EEPROM AND A/D CONVERTER SYSTEM

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 51 & 52 - SRS-ECU EEPROM AND A/D CONVERTER SYSTEM

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

DTC 54 & 55 - PASSENGER-SIDE AIR BAG MODULE IGNITION DRIVE CIRCUIT

Before proceeding, see SERVICE PRECAUTIONS. Replace SRS-ECU. See SRS AIR BAG CONTROL UNIT (ECU) under REMOVAL & INSTALLATION.

COMPONENT TESTING

CLOCKSPRING TEST

1) Before proceeding, see SERVICE PRECAUTIONS. Deactivate system. See DISABLING & ACTIVATING AIR BAG SYSTEM.

2) Remove driver-side air bag module and clockspring. See DRIVER-SIDE AIR BAG MODULE & CLOCKSPRING under REMOVAL & INSTALLATION. Check connectors, protective tubing, and case for damage, and terminals for deformities. Check for continuity between No. 1 connector of clockspring and connectors No. 3 and 4. See Figs. 12 and 13.

3) Align paint mark of SRS Check Harness (MB991613) connector No. 4 with notch in clockspring connector No. 2 and connect. See Fig. 14. Check continuity between terminals No. 22 and 23 of SRS check harness connector No. 5. See Fig. 13.

4) Replace clockspring if any damage was found or continuity does not exist between specified terminals. See DRIVER-SIDE AIR BAG MODULE & CLOCKSPRING under REMOVAL & INSTALLATION.

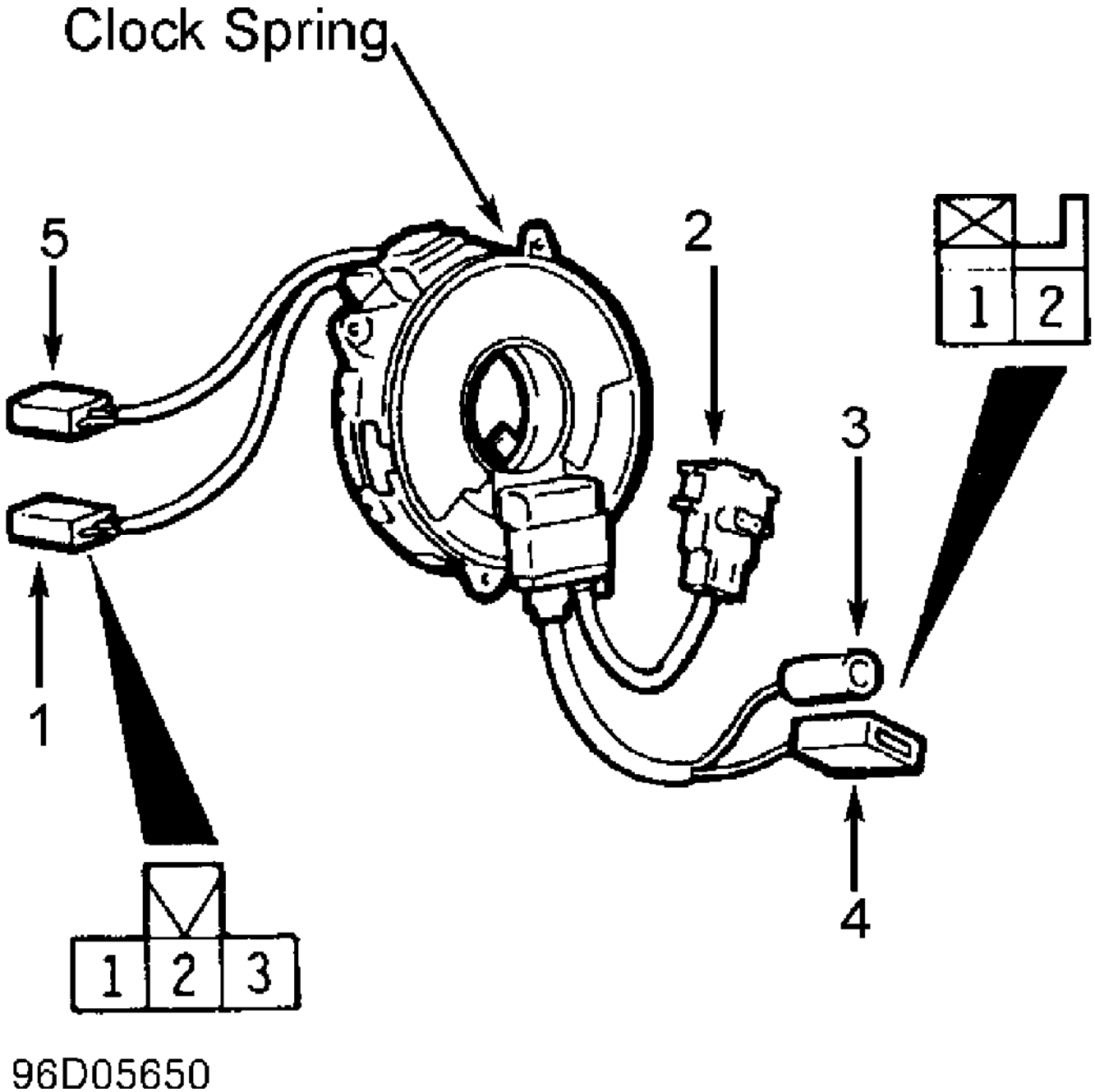


Fig. 12: Identifying Clockspring Connectors
Courtesy of Mitsubishi Motor Sales of America.

No.1 connector			No.3 connector	No.4 connector	
Terminal 1	Terminal 2	Terminal 3	Terminal 3	Terminal 1	Terminal 2
To auto-cruise control unit	To ACC power	To horn relay	To horn switch	To auto-cruise control switch	

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Fig. 13: Checking Continuity Between Clockspring Connectors
Courtesy of Mitsubishi Motor Sales of America.

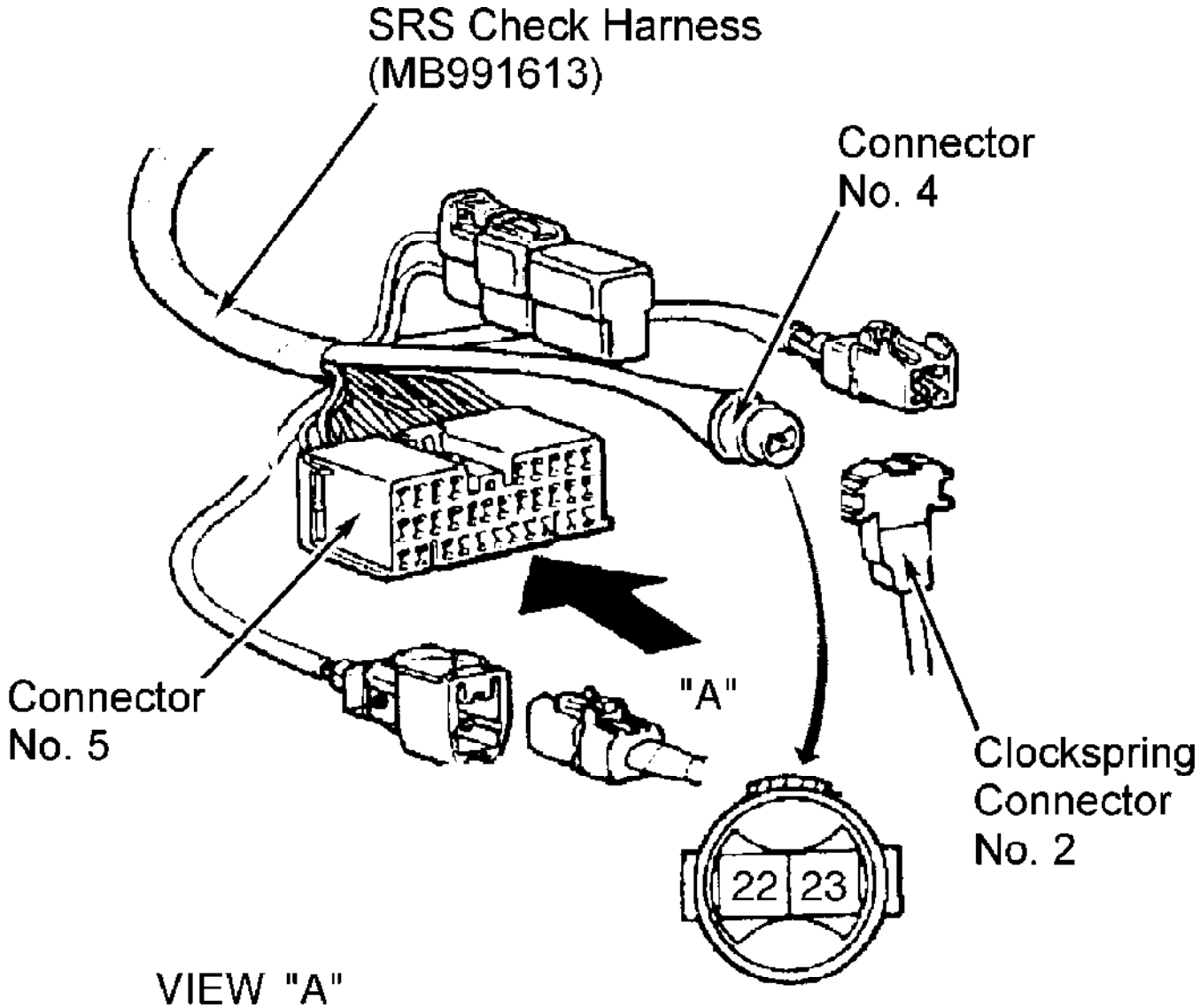


Fig. 14: Using SRS Check Harness To Test Clockspring
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Steering Wheel Nut	29 (39)
	INCH Lbs. (N.m)
Air Bag Module Bolt/Nut	
Driver-Side	78 (8.8)
Passenger-Side	(1)
Clockspring Screw	(1)
Front Impact Sensor Bolt	43 (4.9)
SRS-ECU (Air Bag Control Unit) Bolt	43 (4.9)

(1) - Information not available at time of publication.

WIRING DIAGRAM

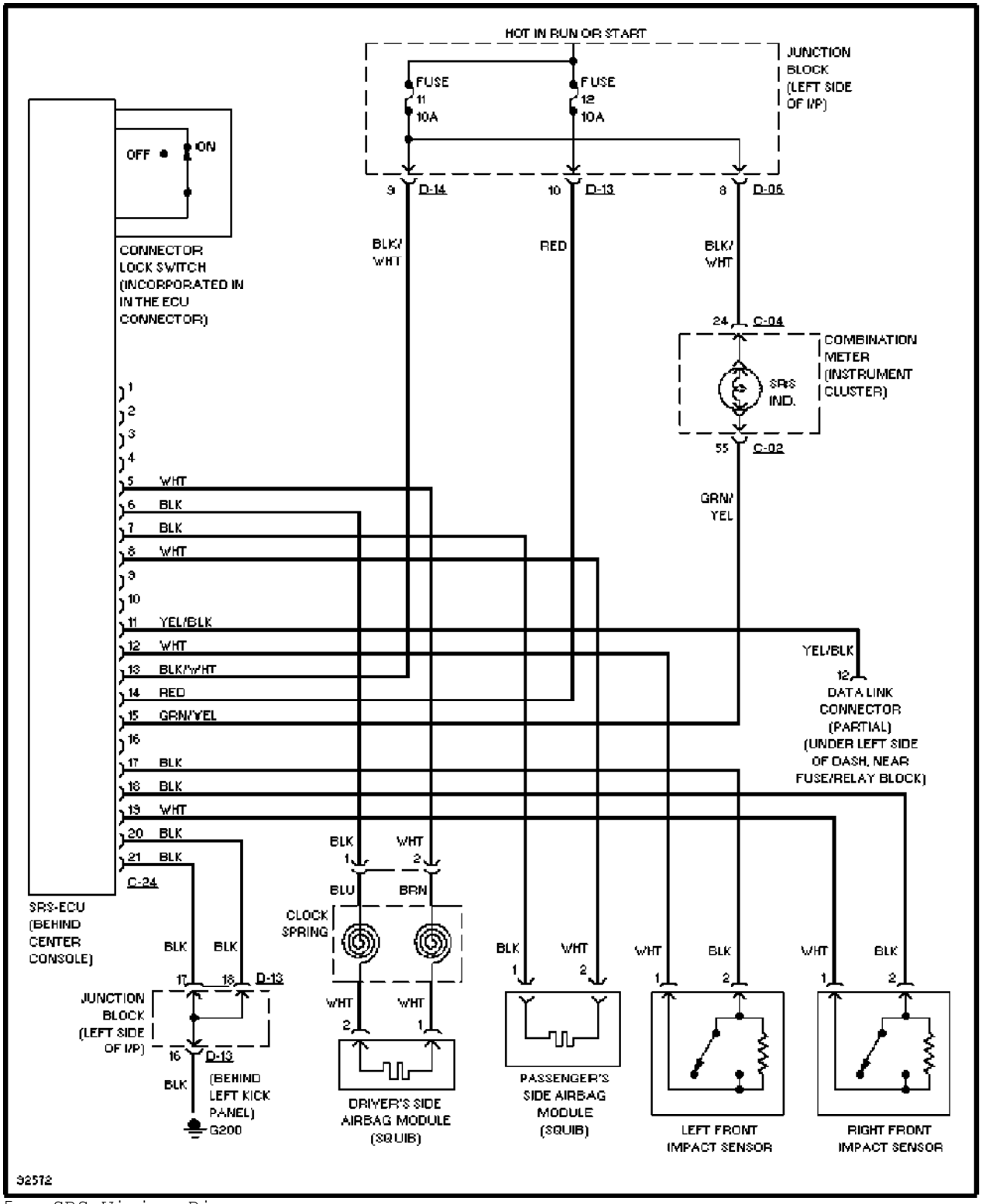


Fig. 15: SRS Wiring Diagram

ANTI-LOCK BRAKE SAFETY PRECAUTIONS

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Anti-Lock Brake Safety Precautions

* PLEASE READ THIS FIRST *

This article is intended for general information purposes only. This information may not apply to all makes and models. If vehicle is equipped with Anti-Lock Brake System (ABS), refer to appropriate ANTI-LOCK BRAKE SYSTEM article in the BRAKES section for description, operation, depressurizing, testing, system bleeding, trouble shooting and servicing of specific system.

WARNING: Failure to depressurize ABS could lead to physical injury.

ANTI-LOCK BRAKE SAFETY PRECAUTIONS

WARNING: Failure to depressurize ABS could lead to physical injury.

* NEVER open a bleeder valve or loosen a hydraulic line while ABS is pressurized.
* NEVER disconnect or reconnect any electrical connectors while ignition is on. Damage to ABS control unit may result.
* DO NOT attempt to bleed hyudarulic system without first referring to the appropriate ANTI-LOCK BRAKE SYSTEM article in the BRAKES section.
* Only use specially designed brake hoses/lines on ABS equipped vehicles.
* DO NOT tap on speed sensor components (sensor, sensor rings). Sensor rings must be pressed into hubs, NOT hammered into hubs. Striking these components can cause demagnetization or a loss of polarization, affecting the accuracy of the speed signal returning to the ABS control unit.
* DO NOT mix tire sizes. Increasing the width, as long as tires remain close to the original diameter, is acceptable. Rolling diameter must be identical for all 4 tires. Some manufacturers recommend tires of the same brand, style and type. Failure to follow this precaution may cause inaccurate wheel speed readings.
* DO NOT contaminate speed sensor components with grease. Only use recommended coating, when system calls for an anti-corrosion coating.
* When speed sensor components have been removed, ALWAYS check sensor-to-ring air gaps when applicable. These specifications can be found in each appropriate article.
* ONLY use rocommended brake fluids. DO NOT use silicone brake fluids in an ABS equipped vehicle.
* When instlling transmittion devices (CB's, telephones, etc.) on ABS equipped vehicles, DO NOT locate the antenna near the ABS control unit (or any control unit).
* Disconnect all on-board computers, when using electric welding equipment.
* DO NOT expose the ABS control unit to prolonged periods of high heat (185 °F/85°C for 2 hours is generally considered a maximum limit).

ANTI-LOCK BRAKE SYSTEM - 2WD

1997-99 Mitsubishi Montero Sport

1997-99 BRAKES
Mitsubishi - Anti-Lock - 2WD

Montero Sport

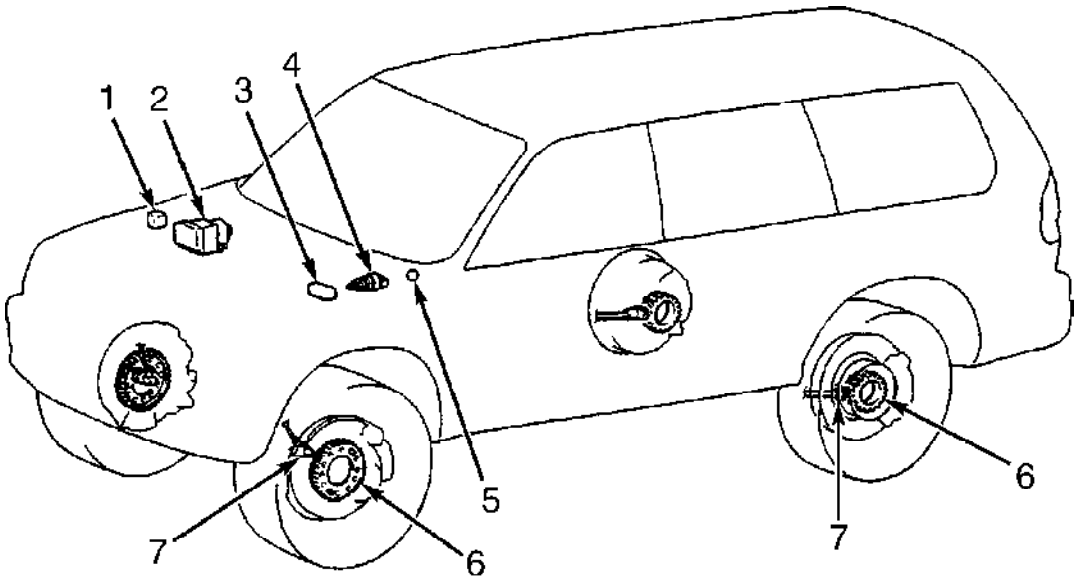
DESCRIPTION

CAUTION: See ANTI-LOCK BRAKE SAFETY PRECAUTIONS article in GENERAL INFORMATION.

NOTE: For more information on brake system, see BRAKE SYSTEM article.

The Rear Wheel Anti-Lock Brake System (ABS) is designed to control braking force of rear wheels. This serves to eliminate wheel lock and maintain directional stability during hard brake application. System consists of Wheel Speed Sensors (WSS), ABS rotors, brakelight switch, a hydraulic unit assembly integrated with ABS Electronic Control Unit (ECU), ABS relay, Data Link Connector (DLC), ANTI-LOCK warning light and connecting wiring harness. See Fig. 1.

ABS also has a self-diagnostic function, which enables technician to quickly trouble shoot system by monitoring stored ABS Diagnostic Trouble Codes (DTCs). See RETRIEVING DTCS under SELF-DIAGNOSTIC SYSTEM.



1. ABS Relay
2. ABS ECU/Hydraulic Unit
3. Data Link Connector
4. Brakelight Switch
5. ANTI-LOCK Warning Light
6. ABS Rotor
7. Wheel Speed Sensor

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Fig. 1: Locating ABS Components
Courtesy of Mitsubishi Motor Sales of America.

OPERATION

Each wheel sensor sends an AC electrical signal to the Electronic Control Unit (ECU). The ECU translates this information as wheel speed. When any decelerating wheel speed rate is determined to be excessive in comparison to other monitored wheels, the hydraulic unit cycles hydraulic brake pressure to each wheel to equalize speed of all wheels. ABS turns off when vehicle reaches 4 MPH. Minor lock-up may occur at this point.

With engine running and vehicle speed more than 4 MPH, pump motor will operate for a short period of time and may be heard inside vehicle. During pump motor operation, ABS system completes a self-check. During ABS system operation, brake pedal pulsation and steering wheel and vehicle body vibration may be experienced. These conditions are normal.

BLEEDING BRAKE SYSTEM

BLEEDING PROCEDURES

CAUTION: When adding brake fluid, ensure filter is properly fitted on reserve tank.

ABS system is bled using conventional method. Start engine and manually bleed system using foot method with an assistant. For bleeding order see BRAKE LINE BLEEDING SEQUENCE table. Ensure all air is removed from brake system. Refill brake fluid reservoir after bleeding procedure is complete.

BRAKE LINE BLEEDING SEQUENCE

Application	Sequence
All Models	RR, LR, RF, LF

ADJUSTMENTS

For adjustment information on parking brake, pedal free play, pedal height, pedal travel and brakelight switch, see BRAKE SYSTEM article.

TROUBLE SHOOTING

* PLEASE READ FIRST *

NOTE: To trouble shoot electronic portion of ABS, see RETRIEVING DTCS. To trouble shoot hydraulic portion of system, see BRAKE SYSTEM article.

ANTI-LOCK WARNING LIGHT

NOTE: ANTI-LOCK warning light illuminates (continuously) when there is a system malfunction or low system voltage. Ensure battery is fully charged.

Ignition Switch In On Position (Engine Off), Warning Light Does Not Illuminate

1) Turn ignition on. If warning light illuminates for 2 seconds and then goes out (circuit self-check), system is operating properly at this time. If warning light does not illuminate, check

condition of fuse No. 11. If fuse is blown, go to next step. If fuse is okay, go tostep 3).

2) Check wiring harness for the following:

* Being pinched by vehicle body.
* Damage to outer casing due to wear or heat.
* Water entry into connector or circuitry.
* A short circuit.

Repair wiring harness as necessary. See WIRING DIAGRAMS. Replace fuse.

3) Disconnect intermediate connector C17. See WIRING DIAGRAMS. Ground intermediate connector C17 (male side), terminal No. 7. See Fig. 2. If warning light does not illuminate, go to next step. If warning light illuminates, go to step 5).

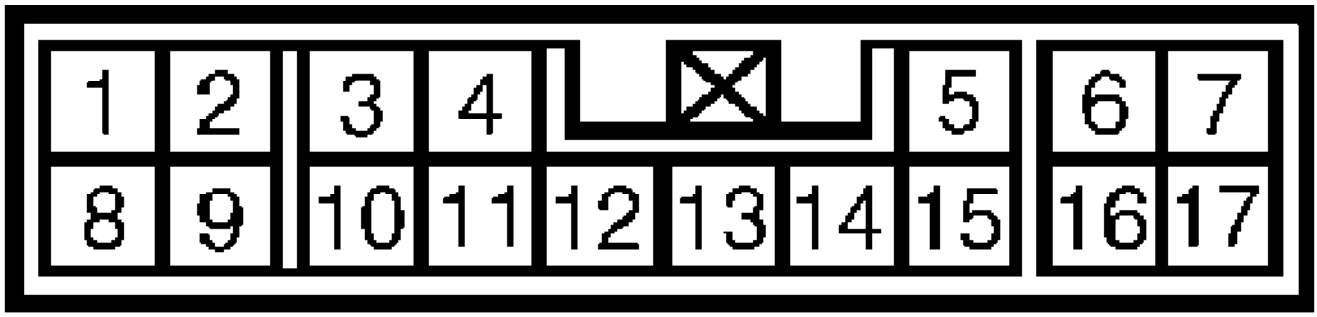

Fig. 2: Identifying Intermediate Connector C17 Terminals
Courtesy of Mitsubishi Motor Sales of America.

4) Turn ignition off. Remove instrument panel and inspect condition of warning light bulb. Replace bulb if needed. If bulb is okay, go tostep 6).

5) Remove ABS relay. See Fig. 3. Ground ABS relay connector terminal No. 1. Apply battery voltage to ABS relay connector terminal No. 2. Check for continuity between ABS relay connector terminals No. 3 and 4. If continuity does not exist, replace ABS relay. If continuity exists, go to step 7).

6) Check for faulty wiring harness and connectors between ignition switch (1G1) and intermediate connector C17. See WIRING DIAGRAMS. Repair or replace as necessary. If wiring harness and connectors are okay, replace combination meter.

7) Turn ignition on. With ABS relay removed, check voltage between ground and ABS relay connector terminal No. 3. If battery voltage does not exist, go to next step. If battery voltage exists, go to step 10).

8) Check ABS relay connector and intermediate connector C17 for damage. See WIRING DIAGRAMS. Repair or replace connectors as necessary. If connectors are okay, go to next step.

9) Check for faulty wiring harness between ABS relay connector and intermediate connector C17. See WIRING DIAGRAMS. Repair wiring harness as necessary.

10) Check ABS relay connector for damage. Repair or replace connector as necessary. If connector is okay, go to next step.

11) Check for faulty wiring harness between ground and ABS relay connector. See WIRING DIAGRAMS. Repair wiring harness as necessary.

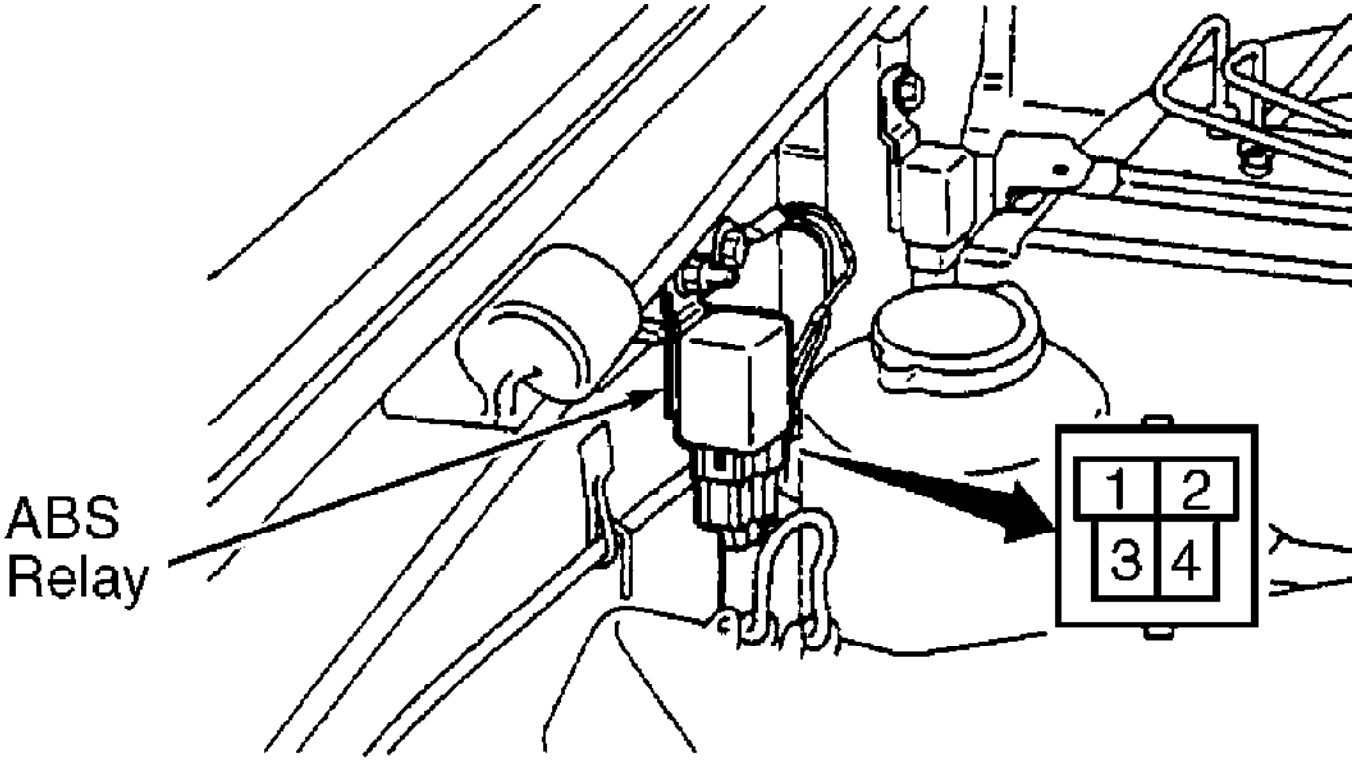

Fig. 3: Locating ABS Relay
Courtesy of Mitsubishi Motor Sales of America.

Ignition Switch In On Position (Engine Running), Warning Light Remains Illuminated

1) Turn ignition switch to ON position. If warning light illuminates and goes off after 2 seconds, warning light is functioning properly at this time. If warning light does not illuminate, see IGNITION SWITCH IN ON POSITION (ENGINE OFF), WARNING LIGHT DOES NOT ILLUMINATE. If warning light illuminates and does not go off after 2 seconds, go to next step.

2) Remove ABS relay. See Fig. 3. Ground ABS relay connector terminal No. 1. Apply battery voltage to ABS relay connector terminal No. 2. Check for continuity between ABS relay connector terminals No. 3 and 4. If continuity does not exist, replace ABS relay. If continuity exists, go to next step.

3) Turn ignition off. Disconnect ABS ECU connector. Turn ignition on. Check voltage between ground and ABS ECU harness connector terminal No. 16. See Fig. 4. If battery voltage exists, replace hydraulic unit. If battery voltage does not exist, go to next step.

4) Check ABS ECU connector and ABS relay connector for damage. Repair or replace connectors as necessary. If connectors are okay, go to next step.

5) Check for faulty wiring harness between ABS ECU connector and ABS relay connector. Repair wiring harness as necessary.

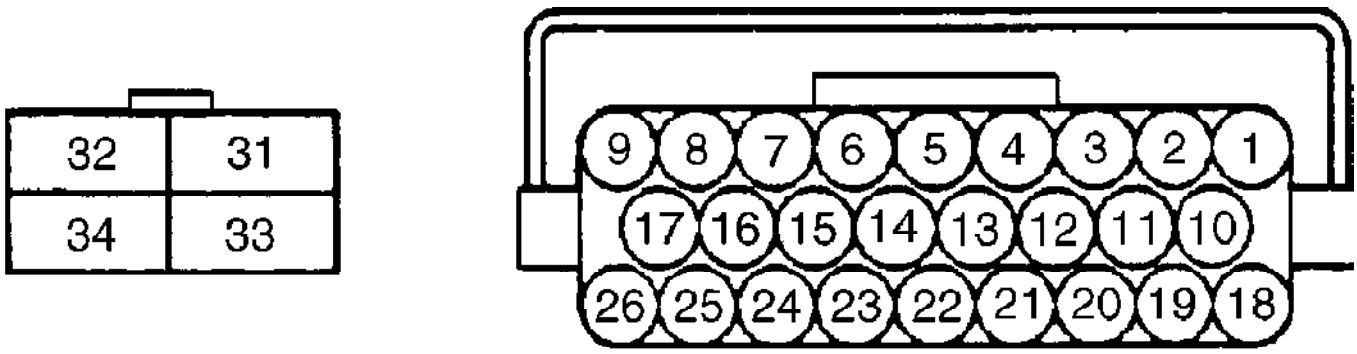

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Fig. 4: Identifying ABS ECU Harness Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

SELF-DIAGNOSTIC SYSTEM

RETRIEVING DTCS

Using Scan Tool

1) Turn ignition off. Connect Multi-Use Tester II (MUT II) to Data Link Connector (DLC). See Fig. 5.

2) Turn ignition on. ANTI-LOCK Warning light should come on as ABS goes into self-diagnostic mode. Read and record all Diagnostic Trouble Codes (DTCs) from ABS ECU memory. Refer to MUT II manufacturer's instructions for specific DTC retrieval procedure.

3) After all DTCs have been retrieved and recorded, turn ignition off and disconnect MUT II. See ABS DTCS table and appropriate DTC under DIAGNOSTIC TESTS for servicing procedure. After repairs, repeat RETRIEVING DTCS to confirm that failure has been corrected.

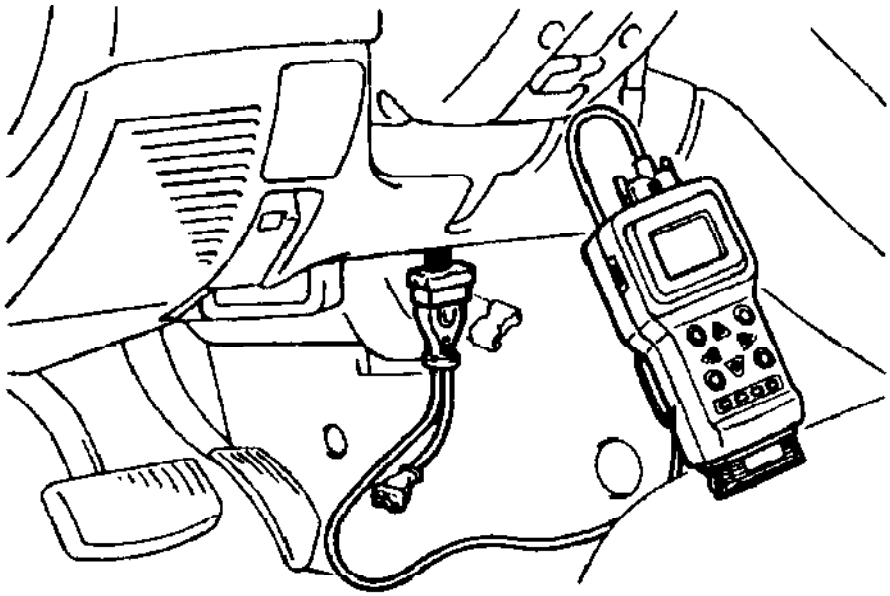

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Fig. 5: Connecting Scan Tool (Typical)
Courtesy of Mitsubishi Motor Sales of America.

Using ANTI-LOCK Warning Light

1) Turn ignition off. Using a jumper wire, ground Data Link

Connector (DLC) terminal No. 1. See Fig. 6.

2) Turn ignition on. If Diagnostic Trouble Codes (DTCs) are stored in ABS ECU memory, ANTI-LOCK warning light will began to flash intermittently. Long flashes represent first digit of DTC; short flashes represent second digit. For example, 4 long flashes and 3 short flashes indicate DTC 43. If 2 or more DTCs are stored, lower number DTC will be displayed first. If no DTCs are stored, warning light will flash constantly.

3) After all DTCs have been retrieved and recorded, turn ignition off and disconnect jumper wire from DLC. See ABS DTCS table and appropriate DTC under DIAGNOSTIC TESTS for servicing procedure. After repairs, repeat RETRIEVING DTCS to confirm that failure has been corrected.

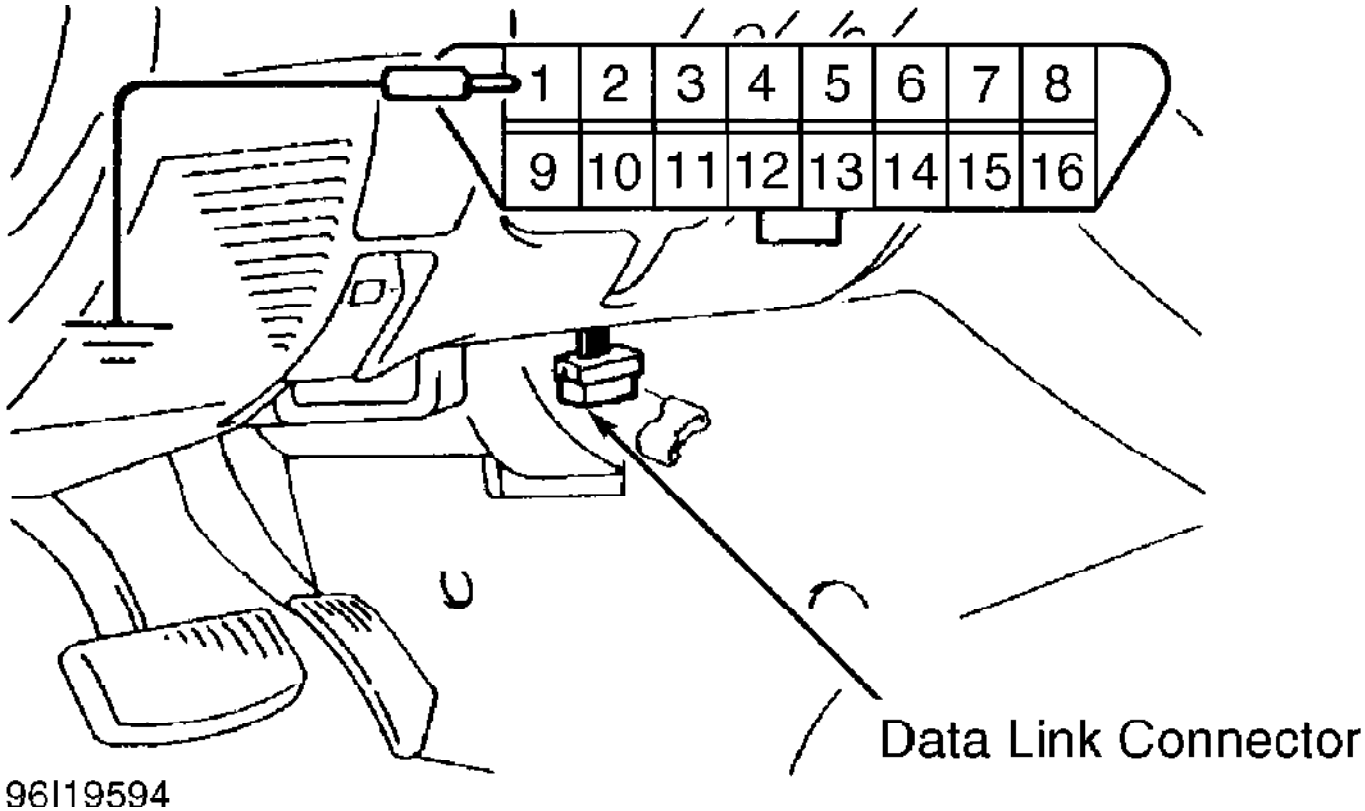


Fig. 6: Grounding Data Link Connector Terminal
Courtesy of Mitsubishi Motor Sales of America.

ABS DTCS

DTC	Condition/Circuit
11	RF Wheel Speed Sensor
12	LF Wheel Speed Sensor
13	RR Wheel Speed Sensor
14	LR Wheel Speed Sensor
15	Wheel Speed Sensor Output Signal Fault
16	ABS ECU Power Supply
21	RF Wheel Speed Sensor
22	LF Wheel Speed Sensor
23	RR Wheel Speed Sensor
24	LR Wheel Speed Sensor
33	Brakelight Switch Circuit
41 (1)	RF Solenoid Valve

42 (1)	LF Solenoid Valve
43 (1)	Rear Solenoid Valve
51 (1)	Valve Transistor
53 (1)	Motor Relay/Motor
63 (1)	ABS ECU

(1) - Replace ABS ECU.

CLEARING DTCS

Using Scan Tool

1) Turn ignition off. Connect Multi-Use Tester II (MUT II) to Data Link Connector (DLC). See Fig. 5.

2) Turn ignition on. Refer to MUT II manufacturer's instructions for specific DTC clearing procedure. Turn ignition off. Disconnect MUT II.

Using ANTI-LOCK Warning Light

1) Turn ignition off. Using a jumper wire, ground Data Link Connector (DLC) terminal No. 1. See Fig. 6.

2) Depress brake pedal and hold it down. Turn ignition on and release brake pedal. Continue to depress and release brake pedal once per second for 9 more cycles. Turn ignition off. Disconnect jumper wire.

DIAGNOSTIC TESTS

DTCS 11-14: WHEEL SPEED SENSOR CIRCUIT (OPEN OR SHORT)

NOTE: DTCs 11, 12, 13 and 14 are displayed when sensor with open or short circuit is identified.

1) Inspect condition of suspected speed sensor. Ensure tip of speed sensor is clean. Ensure sensor is properly installed. If speed sensor is okay, go to next step.

2) Turn ignition off. Disconnect ABS ECU connector. Check resistance between specified ABS ECU harness connector terminals. See WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION table. See Fig. 4. If resistance is 1300-1500 ohms, go to step 4). If resistance is not as specified, go to next step.

WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION

Application	Terminals No.
Left Front	20 & 21
Right Front	18 & 19
Left Rear	3 & 4
Right Rear	1 & 2

3) Check suspected wheel speed sensor connector and ABS ECU connector for damage. Repair or replace connector(s) as necessary. If connectors are okay, go to step 5).

4) Raise and support vehicle. Disconnect ABS ECU connector. Using DVOM, backprobe specified ECU connector terminals. See WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION table. See Fig. 4. Check voltage between each harness connector terminal while rotating wheel at 1/2 to one rotation per second. If pulse voltage is 70 mV or more, go to step 7). If voltage is not as specified, go to step 6).

5) Check for faulty wiring harness and connectors between ABS

ECU and suspected wheel speed sensor connector. See WIRING DIAGRAMS. Repair or replace as necessary.

6) Disconnect sensor connector. Using DVOM, check resistance across sensor terminals. Resistance should be 1300-1500 ohms. Check resistance between each sensor terminal and sensor body. Resistance should be 100,000 ohms. If resistance is as specified, go to step 8). If resistance is not as specified, replace sensor.

7) Check ABS ECU connector for damage. Repair or replace connector as necessary.

8) Inspect condition of toothed rotor. Check for broken or deformed teeth. Replace toothed rotor if necessary. If toothed rotor is okay, go to next step.

9) Inspect condition of wheel bearing. Replace or adjust wheel bearing.

DTC 15: WHEEL SPEED SENSOR OUTPUT SIGNAL (ABNORMAL)

NOTE: DTC will set if ECU detects a wheel speed sensor fault other than an open or short circuit.

1) Ensure sensor is properly installed. See WHEEL SPEED SENSOR (WSS) under REMOVAL & INSTALLATION. Correct installation if necessary. If installation is okay, go to next step.

2) Raise and support vehicle. Disconnect ABS ECU connector. Using DVOM, backprobe specified ECU connector terminals. See WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION table. See Fig. 4. Check voltage between each harness connector terminal while rotating wheel at 1/2 to one rotation per second. If pulse voltage is 70 mV or more, go to step 4). If voltage is not as specified, go to next step.

3) Disconnect sensor connector. Using DVOM, check resistance across sensor terminals. Resistance should be 1300-1500 ohms. Check resistance between each sensor terminal and sensor body. Resistance should be 100,000 ohms. If resistance is as specified, go to step 5). If resistance is not as specified, replace sensor.

4) Check ABS ECU connector for damage. Repair or replace connector as necessary.

5) Inspect condition of toothed rotor. Check for broken or deformed teeth. Replace toothed rotor if necessary. If toothed rotor is okay, go to next step.

6) Inspect condition of wheel bearing. Replace or adjust wheel bearing.

DTC 16: ABS ECU POWER SUPPLY

NOTE: DTC will set if ECU power supply voltage is not within standard value. If voltage returns to normal, DTC will be erased. Ensure battery is fully charged.

1) Ensure battery voltage is 10-17 volts. Turn ignition off. Disconnect ABS ECU connector. Start engine. Using DVOM, check voltage between ABS ECU terminal No. 9 and ground. See Fig. 4. If battery voltage exists, go to step 3). If battery voltage does not exist, go to next step.

2) Check and repair connectors and related wiring between junction block and ABS ECU. See WIRING DIAGRAMS. If connectors and wiring are okay, go to step 4).

3) Check ABS ECU connector for damage. Repair or replace connector as necessary.

4) Check and repair connectors and related wiring between ignition switch and ABS ECU. See WIRING DIAGRAMS.

DTCS 21-24: WHEEL SPEED SENSOR CIRCUIT (OPEN OR SHORT)

NOTE: DTCs 21, 22, 23 and 24 are displayed when sensor does not output a signal when driving, and an open or short circuit cannot be found.

1) Inspect condition of suspected speed sensor. Ensure tip of speed sensor is clean. Ensure sensor is properly installed. If speed sensor is okay, go to next step.
2) Turn ignition off. Disconnect ABS ECU connector. Check resistance between specified ABS ECU harness connector terminals. See WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION table. See Fig. 4. If resistance is 1300-1500 ohms, go to step 4). If resistance is not as specified, go to next step.
3) Check suspected wheel speed sensor connector and ABS ECU connector for damage. Repair or replace connector(s) as necessary. If connectors are okay, go to step 5).
4) Raise and support vehicle. Disconnect ABS ECU connector. Using DVOM, backprobe specified ECU connector terminals. See WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION table. See Fig. 4. Check voltage between each harness connector terminal while rotating wheel at 1/2 to one rotation per second. If pulse voltage is 70 mV or more, go to step 7). If voltage is not as specified, go to step 6).
5) Check for faulty wiring harness and connectors between ABS ECU and suspected wheel speed sensor connector. See WIRING DIAGRAMS. Repair or replace as necessary.
6) Disconnect sensor connector. Using DVOM, check resistance across sensor terminals. Resistance should be 1300-1500 ohms. Check resistance between each sensor terminal and sensor body. Resistance should be 100,000 ohms. If resistance is as specified, go to step 8). If resistance is not as specified, replace sensor.
7) Check ABS ECU connector for damage. Repair or replace connector as necessary.
8) Inspect condition of toothed rotor. Check for broken or deformed teeth. Replace toothed rotor if necessary. If toothed rotor is okay, go to next step.
9) Inspect condition of wheel bearing. Replace or adjust wheel bearing.

DTC 33: BRAKELIGHT SWITCH CIRCUIT

NOTE: DTC is set if ABS ECU detects brakelight switch stays on for 15 minutes or more, or an open circuit in stoplight switch system.

1) Check if brakelights are functioning correctly. If brakelights do not function correctly, go to next step. If brakelights function correctly, go to step 3).
2) Ensure brakelight switch is properly installed. Correct brakelight switch installation if necessary. If brakelight switch is properly installed, go to step 4).
3) Turn ignition off. Disconnect ABS ECU connector. Using DVOM, measure voltage between ABS ECU connector terminal No. 14 and ground while depressing brake pedal. See Fig. 4. If battery voltage is not present, go to step 5). If battery voltage is present, go to step 6).
4) On vehicles without cruise control, go to next step. On vehicles with cruise control, remove brakelight switch. Using DVOM, check continuity between brakelight switch terminals "A" and "B" while pressing brakelight switch plunger. See Fig. 7. Continuity should not exist with plunger depressed, and should exist with plunger released. If continuity is not as specified, replace brakelight switch. If continuity is as specified, go to step 7).
5) Check and repair connectors between brakelight switch and ABS ECU. See WIRING DIAGRAMS. If connectors are okay, go to step 8).

6) Check ABS connector for damage. Repair or replace connector as necessary. If connector is okay, replace hydraulic unit.
7) Check and repair connectors between brakelight switch and ABS ECU. See WIRING DIAGRAMS. If connectors are okay, go to step 9).
8) Check and repair connectors between brakelight switch and ABS ECU. See WIRING DIAGRAMS.
9) Check and repair related wiring harness between fuse No. 8 and ABS ECU. See WIRING DIAGRAMS.

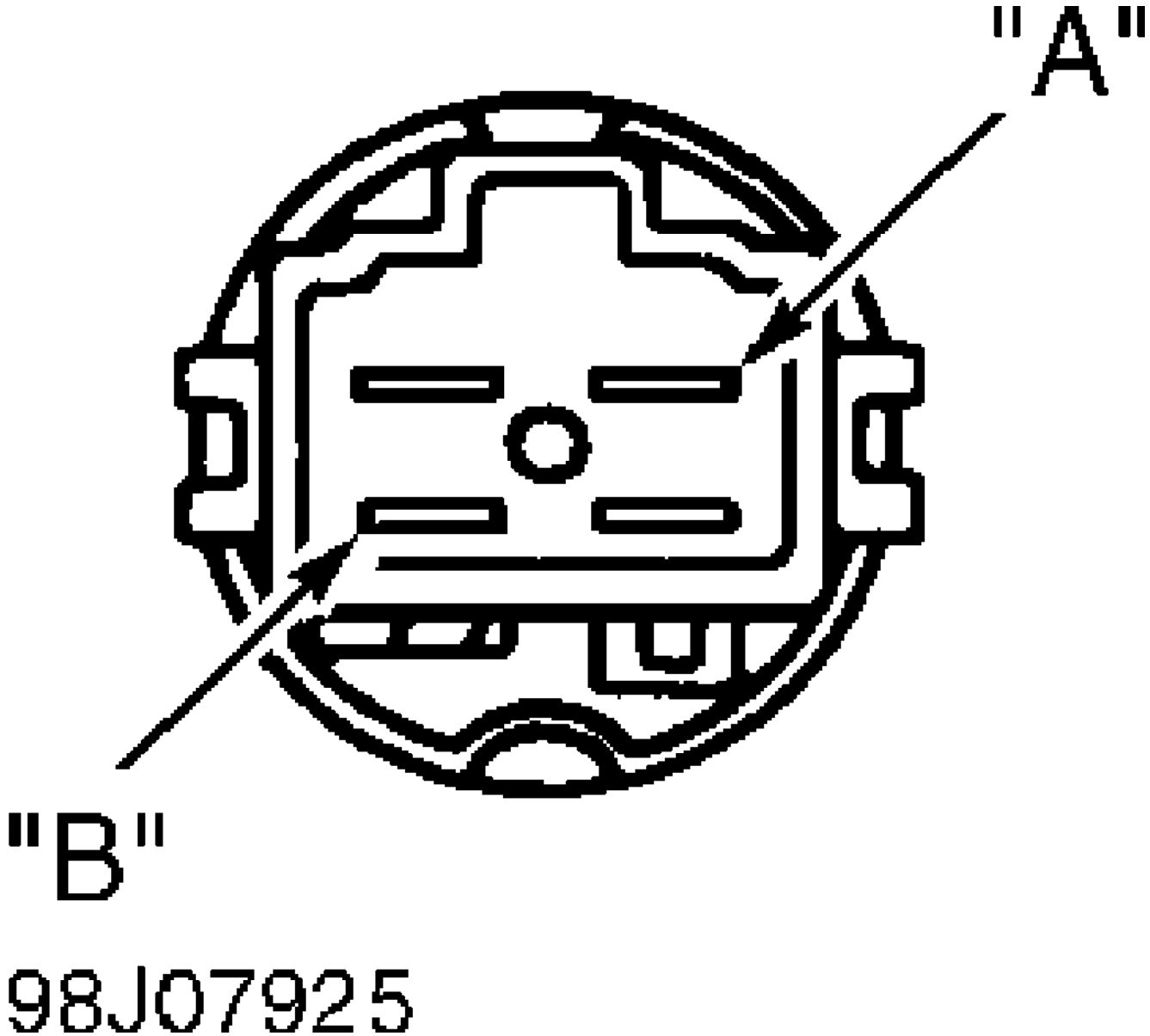


Fig. 7: Testing Brakelight Switch (Models Equipped With Cruise Control)
Courtesy of Mitsubishi Motor Sales of America.

DTC 41: RF SOLENOID VALVE

If DTC 41 is present, replace faulty ECU.

DTC 42: LF SOLENOID VALVE

If DTC 42 is present, replace faulty ECU.

DTC 43: REAR SOLENOID VALVE

If DTC 43 is present, replace faulty ECU.

DTC 51: VALVE TRANSISTOR

If DTC 51 is present, replace faulty ECU.

DTC 53: MOTOR RELAY/MOTOR

If DTC 53 is present, replace faulty ECU.

DTC 63: ABS ECU

If DTC 63 is present, replace faulty ECU.

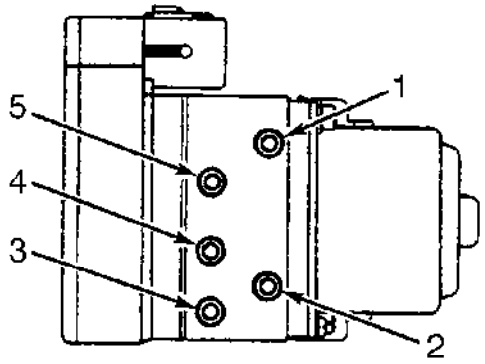
REMOVAL & INSTALLATION

HYDRAULIC UNIT

CAUTION: DO NOT turn hydraulic unit upside down or lay unit on its side. DO NOT drop hydraulic unit. DO NOT disassemble unit. Replace hydraulic unit as an assembly. If unit is replaced, slowly release internal gas.

Removal & Installation

Disconnect brakelines. Turn harness connector lock lever counterclockwise. Remove harness connector. Remove hydraulic unit from hydraulic unit bracket assembly. To install, reverse removal procedure. Ensure brakelines are correctly installed. See Fig. 8.



1. To RF Brake
2. To LF Brake
3. Proportioning Valve-To-Rear Brakes
4. To Master Cylinder
5. Proportioning Valve-To-Front Brakes

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Fig. 8: Identifying Brakeline Connections To Hydraulic Unit
Courtesy of Mitsubishi Motor Sales of America.

WHEEL SPEED SENSOR

NOTE: Before removing wheel speed sensor, note sensor wiring harness routing for installation reference.

Removal (Front)

Raise vehicle and remove wheel. Remove splash shield. Remove retaining clips from speed sensor wiring harness. Disconnect wiring harness connector. Remove sensor mounting bolt. Note sensor wiring harness routing, and remove sensor.

Removal (Rear)

Raise and support vehicle. Remove rear wheel. Remove retaining clips and band from speed sensor wiring harness. Disconnect speed sensor connector. Remove sensor mounting bolt. Note sensor wiring harness routing, and remove sensor.

Installation

Temporarily install speed sensor. Route speed sensor wiring harness in its original location, and ensure no twists exist in harness. Ensure sensor harness is not in contact with trailing arm. Reverse removal procedure to complete installation.

WHEEL SENSOR ROTOR

NOTE: For more information on front or rear brake assembly, see BRAKE SYSTEM article.

Removal & Installation

Remove brake disc. Remove disc assembly. Remove wheel bearings. Remove axle hub. Remove bolts attaching sensor rotor to hub assembly. To install, reverse removal procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Brakeline Flare Nuts	11 (15)
Wheel Lug Nuts	
With 6" Wide Wheels (6JJ)	87-101 (118-137)
With 7" Wide Wheels (7JJ)	73-86 (99-117)

WIRING DIAGRAMS

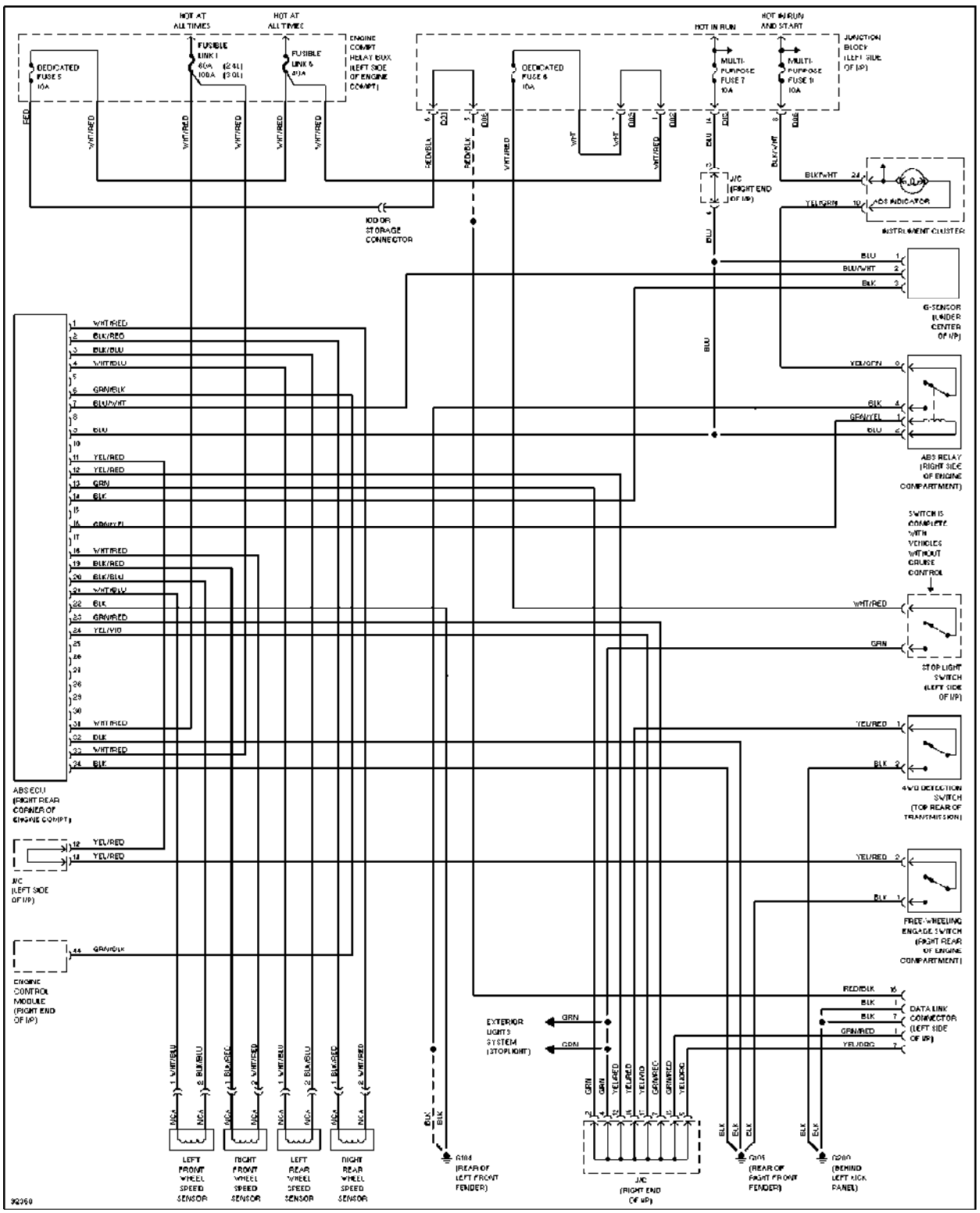


Fig. 9: Anti-Lock Brake System Wiring Diagram (1997 Montero Sport - 2WD)

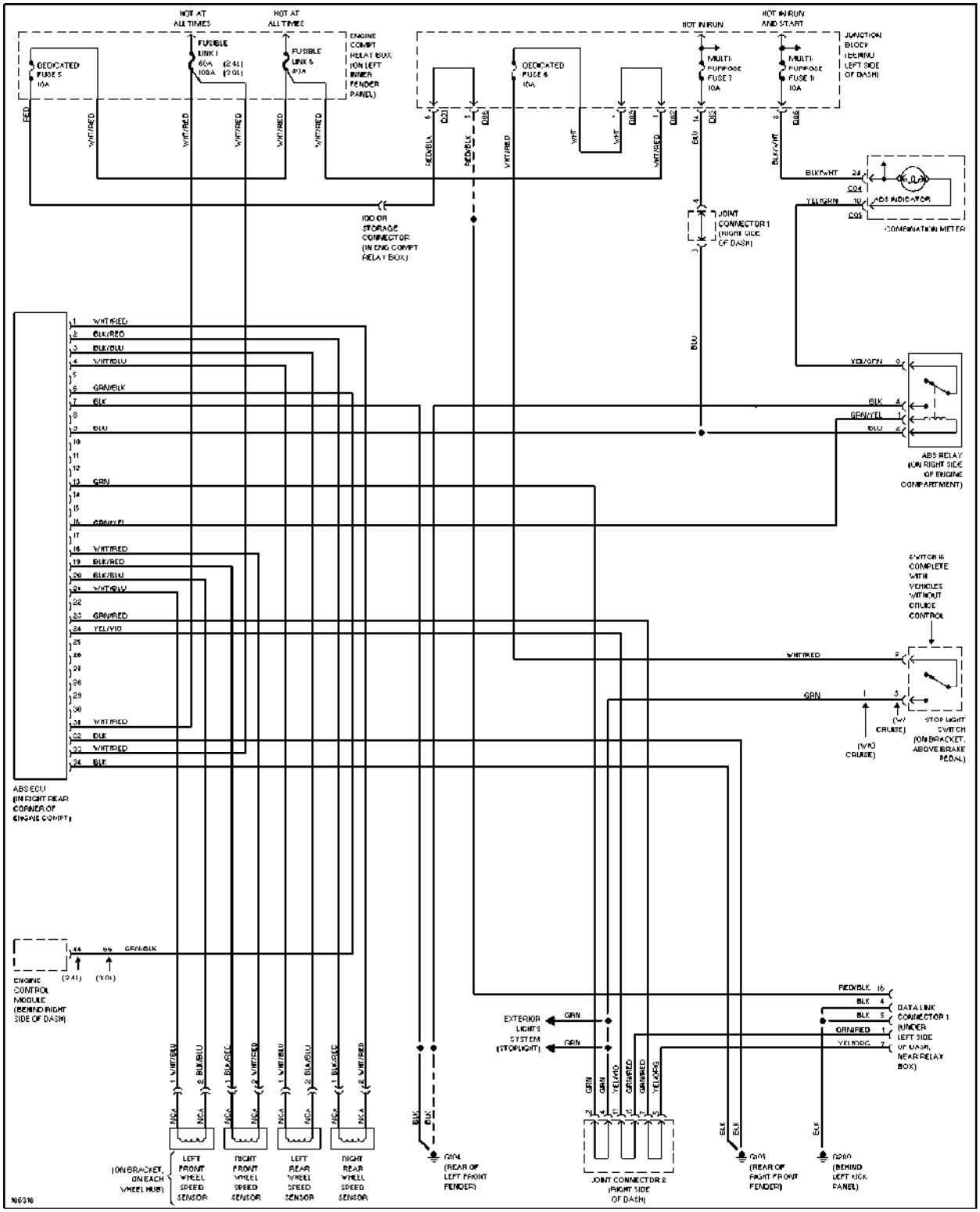


Fig. 10: Anti-Lock Brake System Wiring Diagram (1998 Montero Sport - 2WD)

ANTI-LOCK BRAKE SYSTEM - 4WD

1997-99 Mitsubishi Montero Sport

1997-99 BRAKES
Anti-Lock - 4WD

Montero Sport

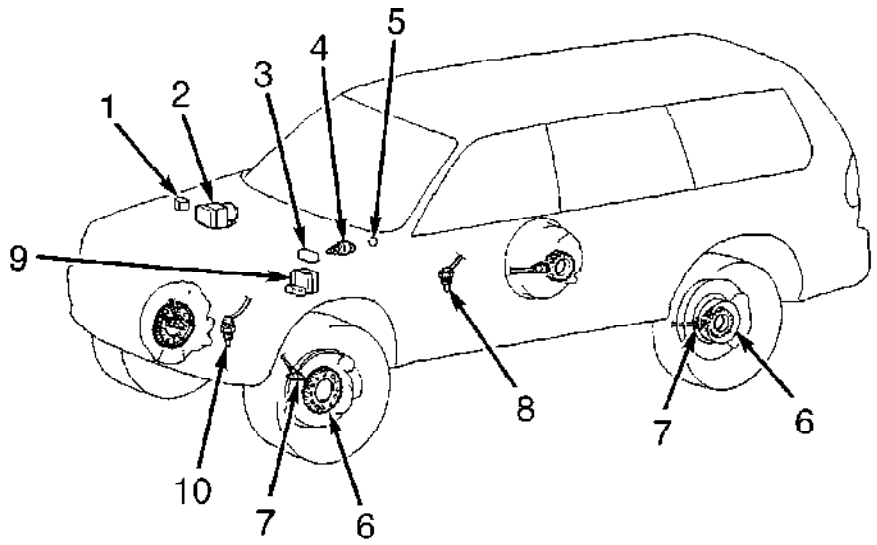
DESCRIPTION

CAUTION: See ANTI-LOCK BRAKE SAFETY PRECAUTIONS article in GENERAL INFORMATION.

NOTE: For more information on brake system, see BRAKE SYSTEM article.

The Anti-Lock Brake System (ABS) is designed to prevent wheel lock-up during heavy braking. This allows operator to maintain steering control while stopping vehicle in shortest distance possible. Major components are a hydraulic unit assembly integrated with ABS Electronic Control Unit (ECU), wheel speed sensors, ABS rotors, "G" sensor, 4WD detection switch, free-wheel detection switch, ABS relay and ANTI-LOCK warning light. See Fig. 1.

ABS also has a self-diagnostic function, which enables technician to quickly trouble shoot system by monitoring stored ABS Diagnostic Trouble Codes (DTCs). See RETRIEVING DTCS under SELF-DIAGNOSTIC SYSTEM.



1. ABS Relay
2. ABS ECU/Hydraulic Unit
3. Data Link Connector
4. Brakelight Switch
5. ANTI-LOCK Warning Light
6. ABS Rotor
7. Wheel Speed Sensor
8. 4WD Detection Switch
9. "G" Sensor
10. Free-Wheel Engage Switch

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Fig. 1: Locating ABS Components
Courtesy of Mitsubishi Motor Sales of America.

OPERATION

Each wheel sensor sends an AC electrical signal to the Electronic Control Unit (ECU). The ECU translates this information as wheel speed. When any decelerating wheel speed rate is determined to be excessive in comparison to other monitored wheels, the hydraulic unit cycles hydraulic brake pressure to each wheel to equalize speed of all wheels. ABS turns off when vehicle reaches 4 MPH. Minor lock-up may occur at this point.

With engine running and vehicle speed more than 4 MPH, pump motor will operate for a short period of time and may be heard inside vehicle. During pump motor operation, ABS system completes a self-check. During ABS system operation, brake pedal pulsation and steering wheel and vehicle body vibration may be experienced. These conditions are normal.

BLEEDING BRAKE SYSTEM

BLEEDING PROCEDURES

CAUTION: When adding brake fluid, ensure filter is properly fitted on reserve tank.

ABS system is bled using conventional method. Start engine and manually bleed system using foot method with an assistant. For bleeding order see BRAKELINE BLEEDING SEQUENCE table. Ensure all air is removed from brake system. Refill brake fluid reservoir after bleeding procedure is complete.

BRAKELINE BLEEDING SEQUENCE

Application	Sequence
All Models	RR, LR, RF, LF

ADJUSTMENTS

For adjustment information on parking brake, pedal free play, pedal height, pedal travel and brakelight switch, see appropriate BRAKE SYSTEM article.

TROUBLE SHOOTING

* PLEASE READ FIRST *

NOTE: To trouble shoot electronic portion of ABS, see RETRIEVING DTCS. To trouble shoot hydraulic portion of system, see appropriate BRAKE SYSTEM article.

ANTI-LOCK WARNING LIGHT

NOTE: ANTI-LOCK warning light illuminates (continuously) when there is a system malfunction or low system voltage. Ensure battery is fully charged.

Ignition Switch In On Position (Engine Off), Warning Light Does Not Illuminate

1) Turn ignition switch on. If warning light illuminates for 2 seconds and then goes out (circuit self-check), system is operating properly at this time. If warning light does not illuminate, check

condition of fuse No. 11. If fuse is blown, go to next step. If fuse is okay, go to step 3).

2) Check wiring harness for the following:

* Being pinched by vehicle body.
* Damage to outer casing due to wear or heat.
* Water entry into connector or circuitry.
* A short circuit.

Repair wiring harness as necessary. See WIRING DIAGRAMS. Replace fuse.

3) Disconnect intermediate connector C17. See WIRING DIAGRAMS. Ground intermediate connector C17 (male side), terminal No. 7. See Fig. 2. If warning light does not illuminate, go to next step. If warning light illuminates, go to step 5).

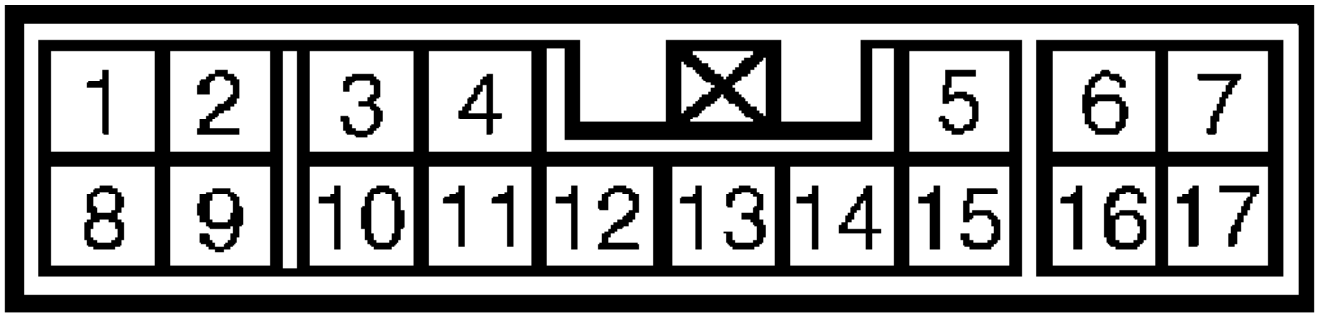


Fig. 2: Identifying Intermediate Connector C17 Terminals
Courtesy of Mitsubishi Motor Sales of America.

4) Turn ignition switch off. Remove instrument panel and inspect condition of warning light bulb. Replace bulb if needed. If bulb is okay, go to step 6).

5) Remove ABS relay. See Fig. 3. Ground ABS relay connector terminal No. 1. Apply battery voltage to ABS relay connector terminal No. 2. Check for continuity between ABS relay connector terminals No. 3 and 4. If continuity does not exist, replace ABS relay. If continuity exists, go to step 7).

6) Check for faulty wiring harness and connectors between ignition switch (1G1) and intermediate connector C17. See WIRING DIAGRAMS. Repair or replace as necessary. If wiring harness and connectors are okay, replace combination meter.

7) Turn ignition switch on. With ABS relay removed, check voltage between ground and ABS relay connector terminal No. 3. If battery voltage does not exist, go to next step. If battery voltage exists, go to step 10).

8) Check ABS relay connector and intermediate connector C17 for damage. See WIRING DIAGRAMS. Repair or replace as necessary. If connectors are okay, go to next step.

9) Check for faulty wiring harness between ABS relay connector and intermediate connector C17. See WIRING DIAGRAMS. Repair wiring harness as necessary.

10) Check ABS relay connector for damage. Repair or replace connector as necessary. If connector is okay, go to next step.

11) Check for faulty wiring harness between ground and ABS relay connector. See WIRING DIAGRAMS. Repair wiring harness as necessary.

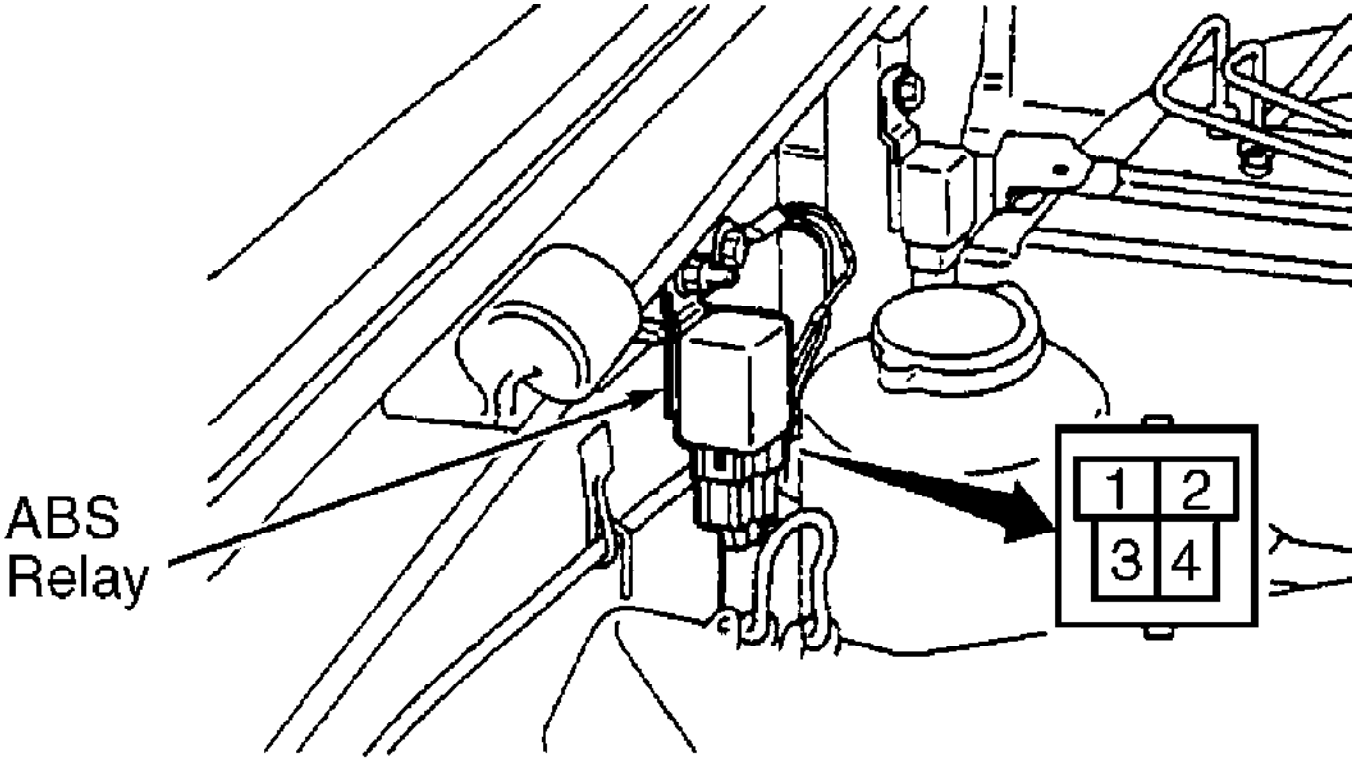


Fig. 3: Locating ABS Relay
Courtesy of Mitsubishi Motor Sales of America.

Ignition Switch In On Position (Engine Running), Warning Light Remains Illuminated

1) Turn ignition to ON position. If warning light illuminates and goes off after 2 seconds, warning light is functioning properly at this time. If warning light does not illuminate, see IGNITION SWITCH IN ON POSITION (ENGINE OFF), WARNING LIGHT DOES NOT ILLUMINATE. If warning light illuminates and does not go off after 2 seconds, go to next step.

2) Remove ABS relay. See Fig. 3. Ground ABS relay connector terminal No. 1. Apply battery voltage to ABS relay connector terminal No. 2. Check for continuity between ABS relay connector terminals No. 3 and 4. If continuity does not exist, replace ABS relay. If continuity exists, go to next step.

3) Turn ignition switch off. Disconnect ABS ECU connector. Turn ignition switch on. Check voltage between ground and ABS ECU harness connector terminal No. 16. See Fig. 4. If battery voltage exists, replace hydraulic unit. If battery voltage does not exist, go to next step.

4) Check ABS ECU connector and ABS relay connector for damage. Repair or replace connectors as necessary. If connectors are okay, go to next step.

5) Check for faulty wiring harness between ABS ECU connector and ABS relay connector. Repair wiring harness as necessary.

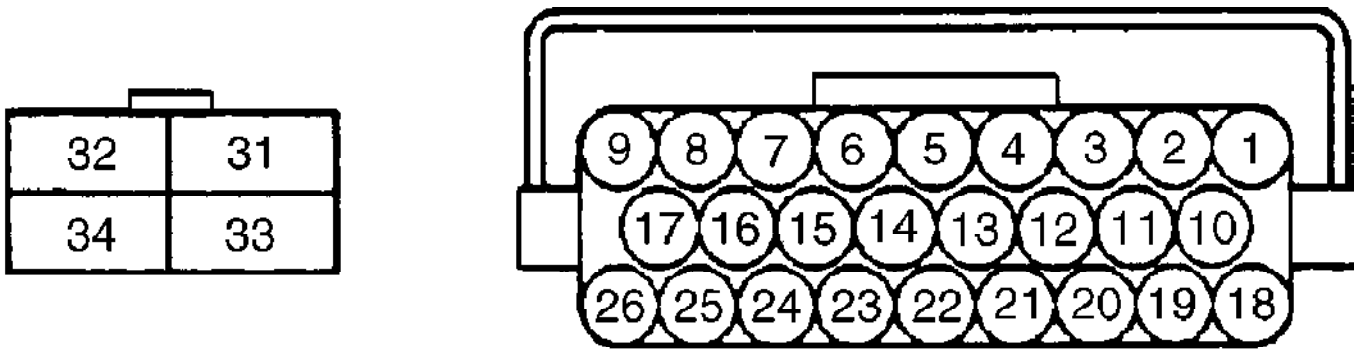


Fig. 4: Identifying ABS ECU Harness Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

SELF-DIAGNOSTIC SYSTEM

RETRIEVING DTCS

Using Scan Tool

1) Turn ignition switch off, connect Multi-Use Tester II (MUT II) to Data Link Connector (DLC). See Fig. 5.

2) Turn ignition switch on. ANTI-LOCK warning light should come on as ABS goes into self-diagnostic mode. Read and record all Diagnostic Trouble Codes (DTCs) from ABS ECU memory. Refer to MUT II manufacturer's instructions for specific DTC retrieval procedure.

3) After all DTCs have been retrieved and recorded, turn ignition switch off and disconnect MUT II. See ABS DTCS table and appropriate DTC under DIAGNOSTIC TESTS for servicing procedure. After repairs, repeat RETRIEVING DTCS to confirm that failure has been corrected.

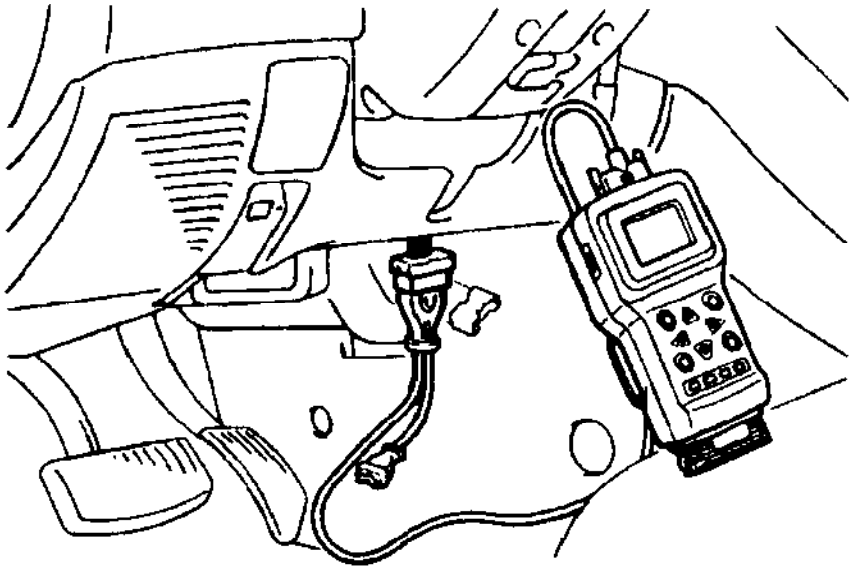


Fig. 5: Connecting Scan Tool (Typical)
Courtesy of Mitsubishi Motor Sales of America.

Using ANTI-LOCK Warning Light

1) Turn ignition switch off. Using a jumper wire, ground Data

Link Connector (DLC) terminal No. 1. See Fig. 6.

2) Turn ignition switch on. If Diagnostic Trouble Codes (DTCs) are stored in ABS ECU memory, ANTI-LOCK warning light will began to flash intermittently. Long flashes represent first digit of DTC; short flashes represent second digit. For example, 4 long flashes and 3 short flashes indicate DTC 43. If 2 or more DTCs are stored, lower number DTC will be displayed first. If no DTCs are stored, warning light will flash constantly.

3) After all DTCs have been retrieved and recorded, turn ignition switch off and disconnect jumper wire from DLC. See ABS DTCS table and appropriate DTC under DIAGNOSTIC TESTS for servicing procedure. After repairs, repeat RETRIEVING DTCS to confirm that failure has been corrected.

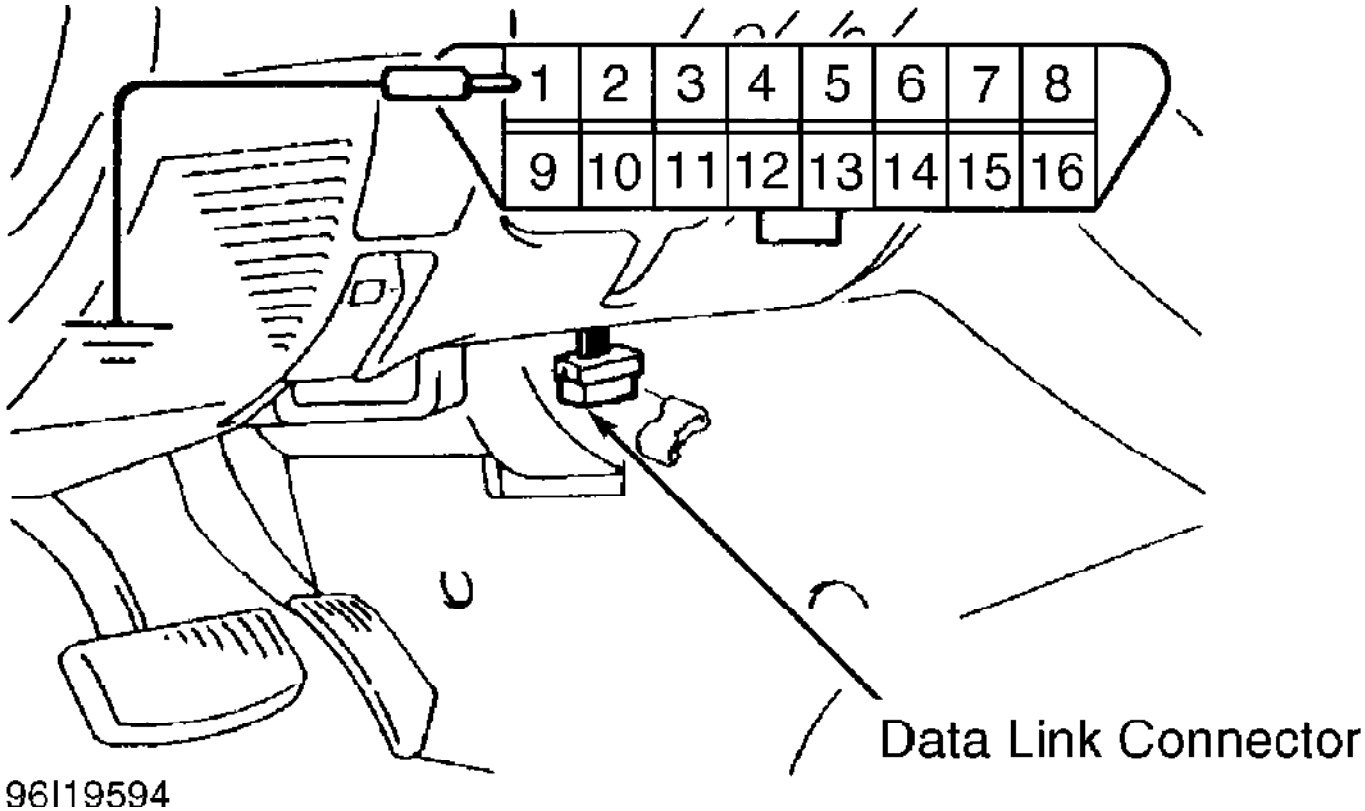


Fig. 6: Grounding Data Link Connector Terminal
Courtesy of Mitsubishi Motor Sales of America.

ABS DTCS

DTC	Condition/Circuit
11	RF Wheel Speed Sensor
12	LF Wheel Speed Sensor
13	RR Wheel Speed Sensor
14	LR Wheel Speed Sensor
15	Wheel Speed Sensor Output Signal Fault
16	ABS ECU Power Supply
21	RF Wheel Speed Sensor
22	LF Wheel Speed Sensor
23	RR Wheel Speed Sensor
25	4WD Detection Switch
26	Free-Wheel Engage Switch
32	"G" Sensor

33		Brakelight Switch Circuit
41	(1)	RF Solenoid Valve
42	(1)	LF Solenoid Valve
43	(1)	Rear Solenoid Valve
51	(1)	Valve Transistor
53	(1)	Motor Relay/Motor
63	(1)	ABS ECU

(1) - Replace ABS ECU.

CLEARING DTCS

Using Scan Tool

1) Turn ignition switch off, connect Multi-Use Tester II (MUT II) to Data Link Connector (DLC). See Fig. 5.

2) Turn ignition switch on. Refer to MUT II manufacturer's instructions for specific DTC clearing procedure. Turn ignition switch off. Disconnect MUT II.

Using ANTI-LOCK Warning Light

1) Turn ignition switch off. Using a jumper wire, ground Data Link Connector (DLC) terminal No. 1. See Fig. 6.

2) Depress brake pedal and hold it down. Turn ignition switch on and release brake pedal. Continue to depress and release brake pedal once per second for 9 more cycles. Turn ignition switch off. Disconnect jumper wire.

DIAGNOSTIC TESTS

DTCS 11-14: WHEEL SPEED SENSOR CIRCUIT (OPEN OR SHORT)

NOTE: DTCs 11, 12, 13 and 14 are displayed when sensor with open or short circuit is identified.

1) Inspect condition of suspected speed sensor. Ensure tip of speed sensor is clean. Ensure sensor is properly installed. If speed sensor is okay, go to next step.

2) Turn ignition switch off. Disconnect ABS ECU connector. Check resistance between specified ABS ECU harness connector terminals. See WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION table. See Fig. 4. If resistance is 1300-1500 ohms, go to step 4). If resistance is not as specified, go to next step.

WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION

Application	Terminals No.
Left Front	20 & 21
Right Front	18 & 19
Left Rear	3 & 4
Right Rear	1 & 2

3) Check suspected wheel speed sensor connector and ABS ECU connector for damage. Repair or replace connector(s) as necessary. If connectors are okay, go to step 5).

4) Raise and support vehicle. Disconnect ABS ECU connector. Using DVOM, backprobe specified ECU connector terminals. See WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION table. See Fig. 4. Check voltage between each harness connector terminal while rotating wheel at 1/2 to one rotation per second. If pulse voltage is 70 mV or more,

go to step 7). If voltage is not as specified, go to step 6).

5) Check for faulty wiring harness and connectors between ABS ECU and suspected wheel speed sensor connector. See WIRING DIAGRAMS. Repair or replace as necessary.

6) Disconnect sensor connector. Using DVOM, check resistance across sensor terminals. Resistance should be 1300-1500 ohms. Check resistance between each sensor terminal and sensor body. Resistance should be 100,000 ohms. If resistance is as specified, go to step 8). If resistance is not as specified, replace sensor.

7) Check ABS ECU connector for damage. Repair or replace connector as necessary.

8) Inspect condition of toothed rotor. Check for broken or deformed teeth. Replace toothed rotor if necessary. If toothed rotor is okay, go to next step.

9) Inspect condition of wheel bearing. Replace or adjust wheel bearing.

DTC 15: WHEEL SPEED SENSOR OUTPUT SIGNAL (ABNORMAL)

NOTE: DTC will set if ECU detects a wheel speed sensor fault other than an open or short circuit.

1) Ensure sensor is properly installed. See WHEEL SPEED SENSOR (WSS) under REMOVAL & INSTALLATION. Correct installation if necessary. If installation is okay, go to next step.

2) Raise and support vehicle. Disconnect ABS ECU connector. Using DVOM, backprobe specified ECU connector terminals. See WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION table. See Fig. 4. Check voltage between each harness connector terminal while rotating wheel at 1/2 to one rotation per second. If pulse voltage is 70 mV or more, go to step 4). If voltage is not as specified, go to next step.

3) Disconnect sensor connector. Using DVOM, check resistance across sensor terminals. Resistance should be 1300-1500 ohms. Check resistance between each sensor terminal and sensor body. Resistance should be 100,000 ohms. If resistance is as specified, go to step 5). If resistance is not as specified, replace sensor.

4) Check ABS ECU connector for damage. Repair or replace connector as necessary.

5) Inspect condition of toothed rotor. Check for broken or deformed teeth. Replace toothed rotor if necessary. If toothed rotor is okay, go to next step.

6) Inspect condition of wheel bearing. Replace or adjust wheel bearing.

DTC 16: ABS ECU POWER SUPPLY

NOTE: DTC will set if ECU power supply voltage is not within standard value. If voltage returns to normal, DTC will be erased. Ensure battery is fully charged.

1) Ensure battery voltage is 10-17 volts. Turn ignition switch off. Disconnect ABS ECU connector. Start engine. Using DVOM, check voltage between ABS ECU terminal No. 9 and ground. See Fig. 4. If battery voltage exists, go to step 3). If battery voltage does not exist, go to next step.

2) Check and repair connectors and related wiring between junction block and ABS ECU. See WIRING DIAGRAMS. If connectors and wiring are okay, go to step 4).

3) Check ABS ECU connector for damage. Repair or replace connector as necessary.

4) Check and repair connectors and related wiring between ignition switch and ABS ECU. See WIRING DIAGRAMS.

DTCS 21-24: WHEEL SPEED SENSOR CIRCUIT (OPEN OR SHORT)

NOTE: DTCs 21, 22, 23 and 24 are displayed when sensor does not output a signal when driving, and an open or short circuit cannot be found.

1) Inspect condition of suspected speed sensor. Ensure tip of speed sensor is clean. Ensure sensor is properly installed. If speed sensor is okay, go to next step.

2) Turn ignition switch off. Disconnect ABS ECU connector. Check resistance between specified ABS ECU harness connector terminals. See WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION table. See Fig. 4. If resistance is 1300-1500 ohms, go to step 4). If resistance is not as specified, go to next step.

3) Check suspected wheel speed sensor connector and ABS ECU connector for damage. Repair or replace connector(s) as necessary. If connectors are okay, go to step 5).

4) Raise and support vehicle. Disconnect ABS ECU connector. Using DVOM, backprobe specified ECU connector terminals. See WHEEL SPEED SENSOR CIRCUIT IDENTIFICATION table. See Fig. 4. Check voltage between each harness connector terminal while rotating wheel at 1/2 to one rotation per second. If pulse voltage is 70 mV or more, go to step 7). If voltage is not as specified, go to step 6).

5) Check for faulty wiring harness and connectors between ABS ECU and suspected wheel speed sensor connector. See WIRING DIAGRAMS. Repair or replace as necessary.

6) Disconnect sensor connector. Using DVOM, check resistance across sensor terminals. Resistance should be 1300-1500 ohms. Check resistance between each sensor terminal and sensor body. Resistance should be 100,000 ohms. If resistance is as specified, go to step 8). If resistance is not as specified, replace sensor.

7) Check ABS ECU connector for damage. Repair or replace connector as necessary.

8) Inspect condition of toothed rotor. Check for broken or deformed teeth. Replace toothed rotor if necessary. If toothed rotor is okay, go to next step.

9) Inspect condition of wheel bearing. Replace or adjust wheel bearing.

DTC 25: 4WD DETECTION SWITCH

NOTE: DTC sets if ABS ECU detects an open in 4WD detection switch circuit.

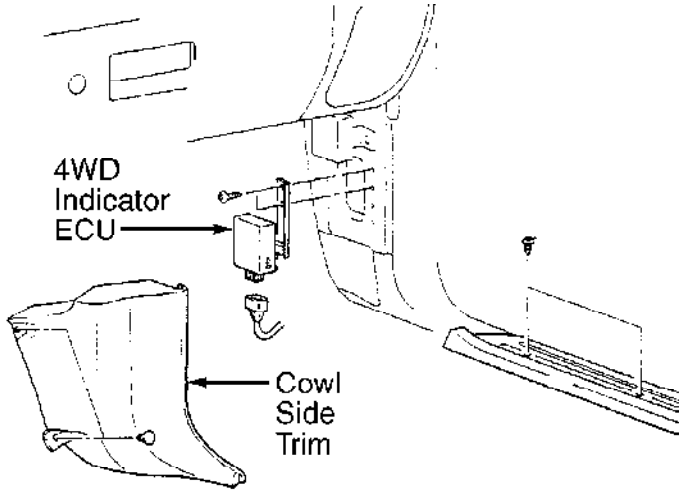
1) Start engine. Ensure 4WD indicator light operates correctly when transfer case shift lever is moved to desired 4WD position ("4H" or "4L"). If indicator light operates correctly, go to step 4). If indicator light does not operate correctly, go to next step.

2) Turn engine off. Access 4WD indicator ECU, located behind right front cowl side trim. See Fig. 8. With 4WD indicator ECU connector connected, ground 4WD ECU terminal No. 8. See Fig. 9. Using DVOM, check voltage at specified 4WD indicator ECU terminal. See Fig. 7. If voltage is not as specified, go to next step. If voltage is as specified, go to step 4).

TERMINAL NO.	INSPECTION ITEM	INSPECTION CONDITION 1: IGNITION SWITCH	INSPECTION CONDITION 2: TRANSFER LEVER POSITION	TERMINAL VOLTAGE
1	Free-wheel engage switch	ON	2H	System voltage
			4H [1]	0V
2	4WD detection switch	ON	2H	System voltage
			4H, 4L	0V
3	Ignition switch	OFF	–	0V
		ON	–	System voltage
6	High/low detection switch	ON	Shifting from 4H to 4L or vice versa	System voltage
			2H, 4H, 4L	0V
7	Free-wheel clutch changeover solenoid valve	ON	4H, 4L	0V
			2H [2]	System voltage
10	4WD indicator light	ON	2H	0V
			4H, 4L	System voltage

NOTE
1: When vehicle has been moved once.
2: Shift the lever from 4H, to 2H, and then turn the ignition switch to OFF and then back to ON.

98J07930
Fig. 7: 4WD ECU Indicator Pin Voltage Chart
Courtesy of Mitsubishi Motor Sales of America.



98F07928
Fig. 8: Locating 4WD Indicator ECU
Courtesy of Mitsubishi Motor Sales of America.

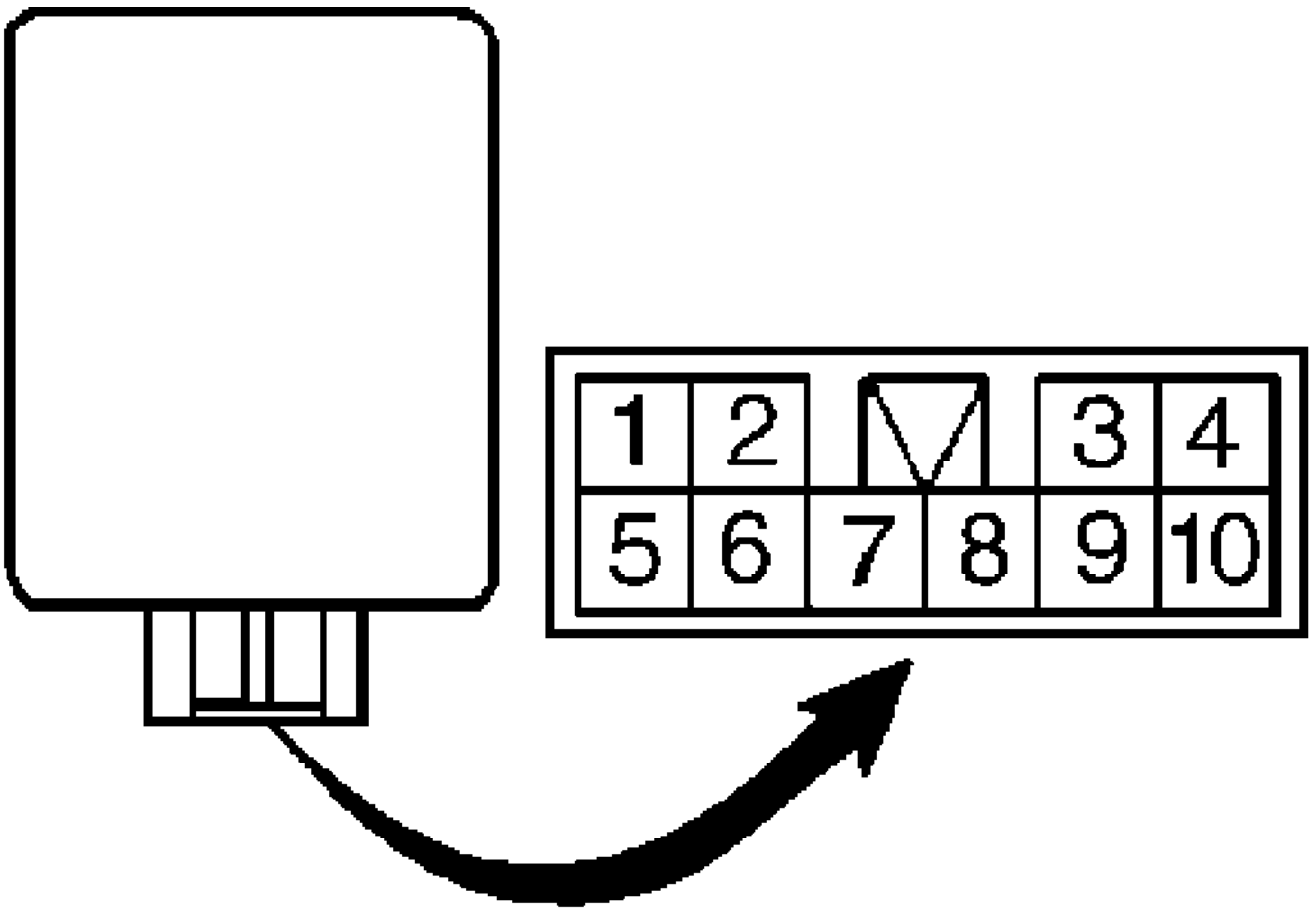


Fig. 9: Identifying 4WD Indicator ECU Terminals
Courtesy of Mitsubishi Motor Sales of America.

3) Check and repair connectors and related wiring between 4WD indicator ECU and ABS ECU. See WIRING DIAGRAMS. If connectors and wiring are okay, replace 4WD indicator ECU.

4) Turn ignition switch off. Disconnect ABS ECU connector. Turn ignition switch on. Using DVOM, check voltage between ground and ABS ECU connector terminal No. 12. See Fig. 4. If battery voltage exists, go to next step. If battery voltage does not exist, go to step 6).

5) Check and repair ABS ECU connector. If connector is okay, replace hydraulic unit.

6) Check ABS ECU connector and 4WD detection switch connector for damage. Repair or replace connectors as necessary. If connectors are okay, go to next step.

7) Check for faulty wiring harness between ABS ECU connector and 4WD detection switch connector. See WIRING DIAGRAMS. Repair wiring harness as necessary.

DTC 26: FREE-WHEEL ENGAGE SWITCH

NOTE: DTC sets if ECU detects an open circuit in free-wheel engage switch circuit.

1) Start engine. Ensure 4WD indicator light operates correctly when transfer case shift lever is moved to desired 4WD position ("4H" or "4L"). If indicator light operates correctly, go to next step. If indicator light does not operate correctly, go to step 3).

2) Turn ignition switch off. Disconnect ABS ECU connector. Turn ignition switch on. Place transfer case shift lever in "4H" position. Using DVOM, check voltage between ground and ABS ECU connector terminal No. 11. See Fig. 4. If battery voltage exists, go to step 4). If battery voltage does not exist, go to step 5).

3) Check for faulty wiring harness between 4WD indicator ECU connector and free-wheel engagement switch connector. Repair wiring harness as necessary. If wiring harness is okay, replace free-wheel engagement switch.

4) Check ABS ECU connector and free-wheel engage switch connector for damage. Repair or replace connectors as necessary. If connectors are okay, go to step 6).

5) Check and repair ABS ECU connector. If connector is okay, replace hydraulic unit.

6) Check for faulty wiring harness between ABS ECU connector and free-wheel engage switch connector. Repair wiring harness as necessary.

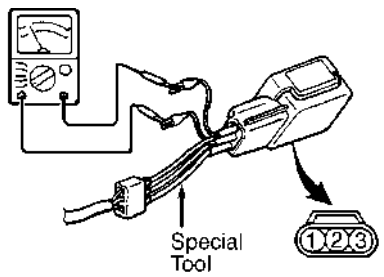
DTC 32: "G" SENSOR SYSTEM

NOTE: DTC is set if ECU detects "G" sensor output voltage less than 0.5 volt or more than 4.5 volts for 2 seconds, or an open or short circuit in "G" sensor system.

1) Remove front and rear floor console assemblies. Turn ignition switch off. Disconnect "G" sensor connector. Sensor is located on bracket under center console. Connect Special Tool (MB991348) between sensor and connector. See Fig. 10. Go to next step.

2) Turn ignition switch on. Using a DVOM, check voltage special tool terminals No. 2 and No. 3. Voltage should be 2.4-2.6 volts. If voltage is as specified, reconnect sensor connector and go to step 4). If voltage is not as specified, leave special tool and DVOM connected and go to next step.

3) Note top center position of sensor, and remove sensor. See "G" SENSOR under REMOVAL & INSTALLATION. Secure sensor so that arrow on sensor is facing straight down. Voltage should be 3.4-3.6 volts. If voltage is as specified, reinstall sensor and go to next step. If voltage is not as specified, replace sensor.



98B07931

Fig. 10: Testing "G" Sensor
Courtesy of Mitsubishi Motor Sales of America.

4) Turn ignition switch off. Disconnect ABS ECU connector. Turn ignition switch on. Check voltage between ABS ECU connector

terminals No. 7 and 14. See Fig. 4. Voltage should be 2.4-2.6 volts. If voltage is as specified, go to next step. If voltage is not as specified, go tostep 6).

5) Check ABS ECU connector for damage. Repair or replace connector as necessary. If connector is okay, replace hydraulic unit.

6) Check ABS ECU and "G" sensor connectors for damage. Repair or replace connectors as necessary. If connector are okay, go to next step.

7) Check and repair connectors and related wiring harness between ABS ECU and "G" sensor. See WIRING DIAGRAMS.

DTC 33: BRAKELIGHT SWITCH CIRCUIT

NOTE: DTC is set if ABS ECU detects brakelight switch stays on for 15 minutes or more, or an open circuit in stoplight switch system.

1) Check if brakelights are functioning correctly. If brakelights do not function correctly, go to next step. If brakelights function correctly, go to step 3).

2) Ensure brakelight switch is properly installed. Correct brakelight switch installation if necessary. If brakelight switch is properly installed, go to step 4).

3) Turn ignition switch off. Disconnect ABS ECU connector. Using DVOM, measure voltage between ABS ECU connector terminal No. 13 and ground while depressing brake pedal. See Fig. 4. If battery voltage is not present, go to step 5). If battery voltage is present, go to step 6).

4) On vehicles without cruise control, go to next step. On vehicles with cruise control, remove brakelight switch. Using DVOM, check continuity between brakelight switch terminals "A" and "B" while pressing brakelight switch plunger. See Fig. 11. Continuity should not exist with plunger depressed, and should exist with plunger released. If continuity is not as specified, replace brakelight switch. If continuity is as specified, go to step 7).

5) Check and repair connectors between brakelight switch and ABS ECU. See WIRING DIAGRAMS. If connectors are okay, go to step 8).

6) Check ABS connector for damage. Repair or replace connector as necessary. If connector is okay, replace hydraulic unit.

7) Check and repair connectors between brakelight switch and ABS ECU. See WIRING DIAGRAMS. If connectors are okay, go to step 9).

8) Check and repair connectors between brakelight switch and ABS ECU. See WIRING DIAGRAMS.

9) Check and repair related wiring harness between fuse No. 8 and ABS ECU. See WIRING DIAGRAMS.

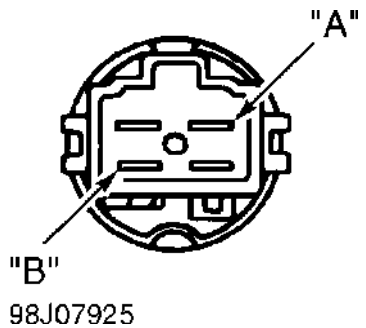


Fig. 11: Testing Brakelight Switch (Models Equipped With Cruise Control)
Courtesy of Mitsubishi Motor Sales of America.

DTC 41: RF SOLENOID VALVE

If DTC 41 is present, replace faulty ECU.

DTC 42: LF SOLENOID VALVE

If DTC 42 is present, replace faulty ECU.

DTC 43: REAR SOLENOID VALVE

If DTC 43 is present, replace faulty ECU.

DTC 51: VALVE TRANSISTOR

If DTC 51 is present, replace faulty ECU.

DTC 53: MOTOR RELAY/MOTOR

If DTC 53 is present, replace faulty ECU.

DTC 63: ABS ECU

If DTC 63 is present, replace faulty ECU.

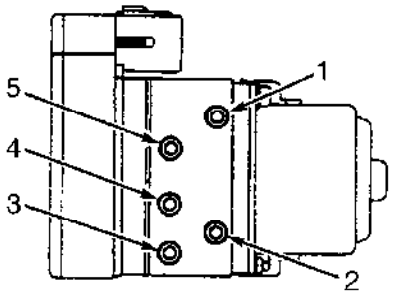
REMOVAL & INSTALLATION

HYDRAULIC UNIT

CAUTION: DO NOT turn hydraulic unit upside down or lay unit on its side. DO NOT drop hydraulic unit. DO NOT disassemble unit. Replace hydraulic unit as an assembly. If unit is replaced, slowly release internal gas.

Removal & Installation

Disconnect brakelines. Turn harness connector lock lever counterclockwise. Remove harness connector. Remove hydraulic unit from hydraulic unit bracket assembly. To install, reverse removal procedure. Ensure brakelines are correctly installed. See Fig. 12.



1. To RF Brake
2. To LF Brake
3. Proportioning Valve-To-Rear Brakes
4. To Master Cylinder
5. Proportioning Valve-To-Front Brakes

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Fig. 12: Identifying Brakeline Connections To Hydraulic Unit
Courtesy of Mitsubishi Motor Sales of America.

WHEEL SPEED SENSOR

NOTE: Before removing wheel speed sensor, note sensor wiring harness routing for installation reference.

Removal (Front)

Raise vehicle and remove wheel. Remove splash shield. Remove retaining clips from speed sensor wiring harness. Disconnect wiring harness connector. Remove sensor mounting bolt. Note sensor wiring harness routing, and remove sensor.

Removal (Rear)

Raise and support vehicle. Remove rear wheel. Remove retaining clips and band from speed sensor wiring harness. Disconnect speed sensor connector. Remove sensor mounting bolt. Note sensor wiring harness routing, and remove sensor.

Installation

Temporarily install speed sensor. Route speed sensor wiring harness in its original location, and ensure no twists exist in harness. Ensure sensor harness is not in contact with trailing arm. Reverse removal procedure to complete installation.

WHEEL SENSOR ROTOR

NOTE: For more information on front or rear brake assembly, see BRAKE SYSTEM article.

Removal & Installation

Remove brake disc. Remove disc assembly. Remove wheel bearings. Remove axle hub. Remove bolts attaching sensor rotor to hub assembly. To install, reverse removal procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Brakeline Flare Nuts	11 (15)
Wheel Lug Nuts	
With 6" Wide Wheels (6JJ)	87-101 (118-137)
With 7" Wide Wheels (7JJ)	73-86 (99-117)

WIRING DIAGRAMS

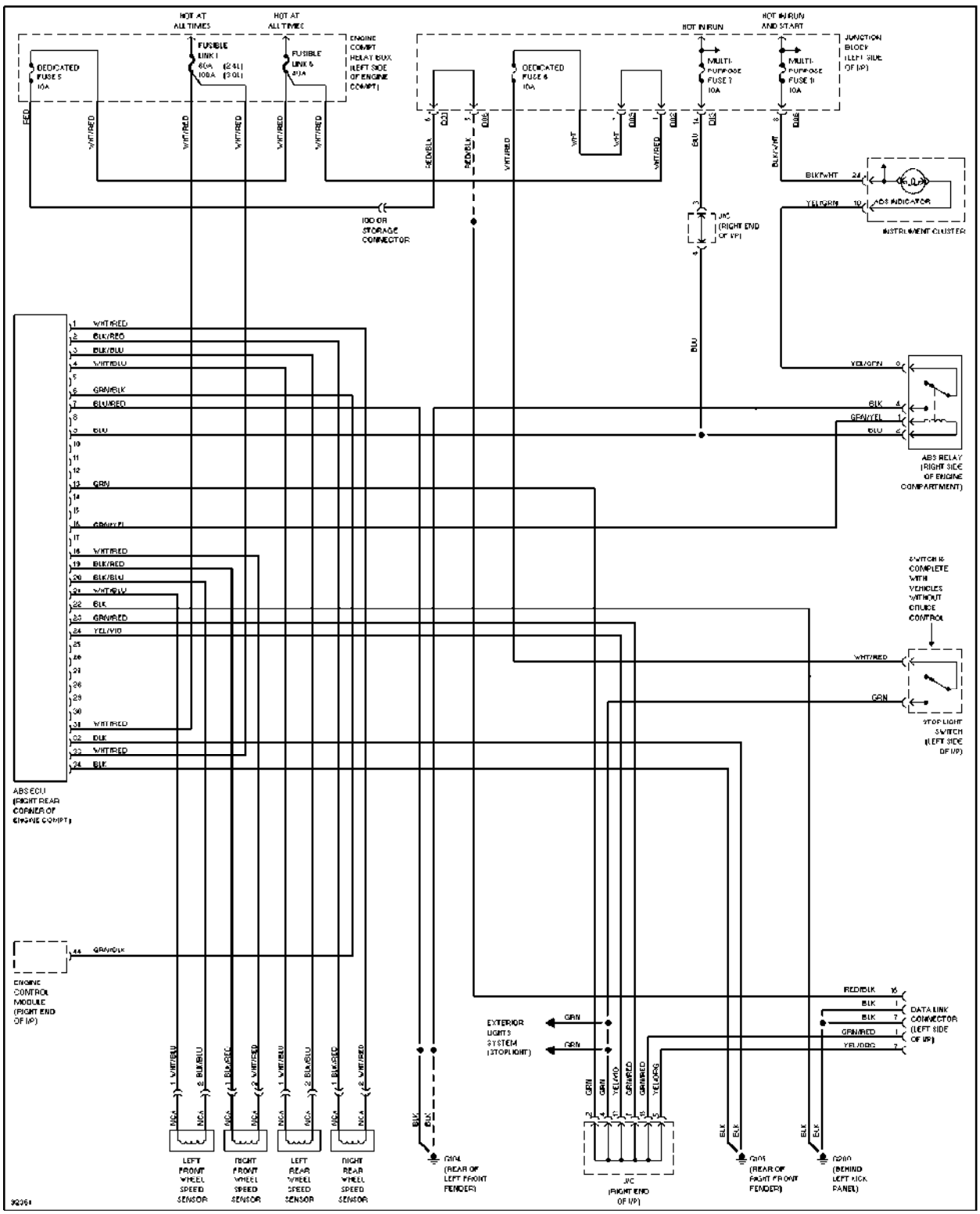


Fig. 13: Anti-Lock Brake System Wiring Diagram (1997 Montero Sport - 4WD)

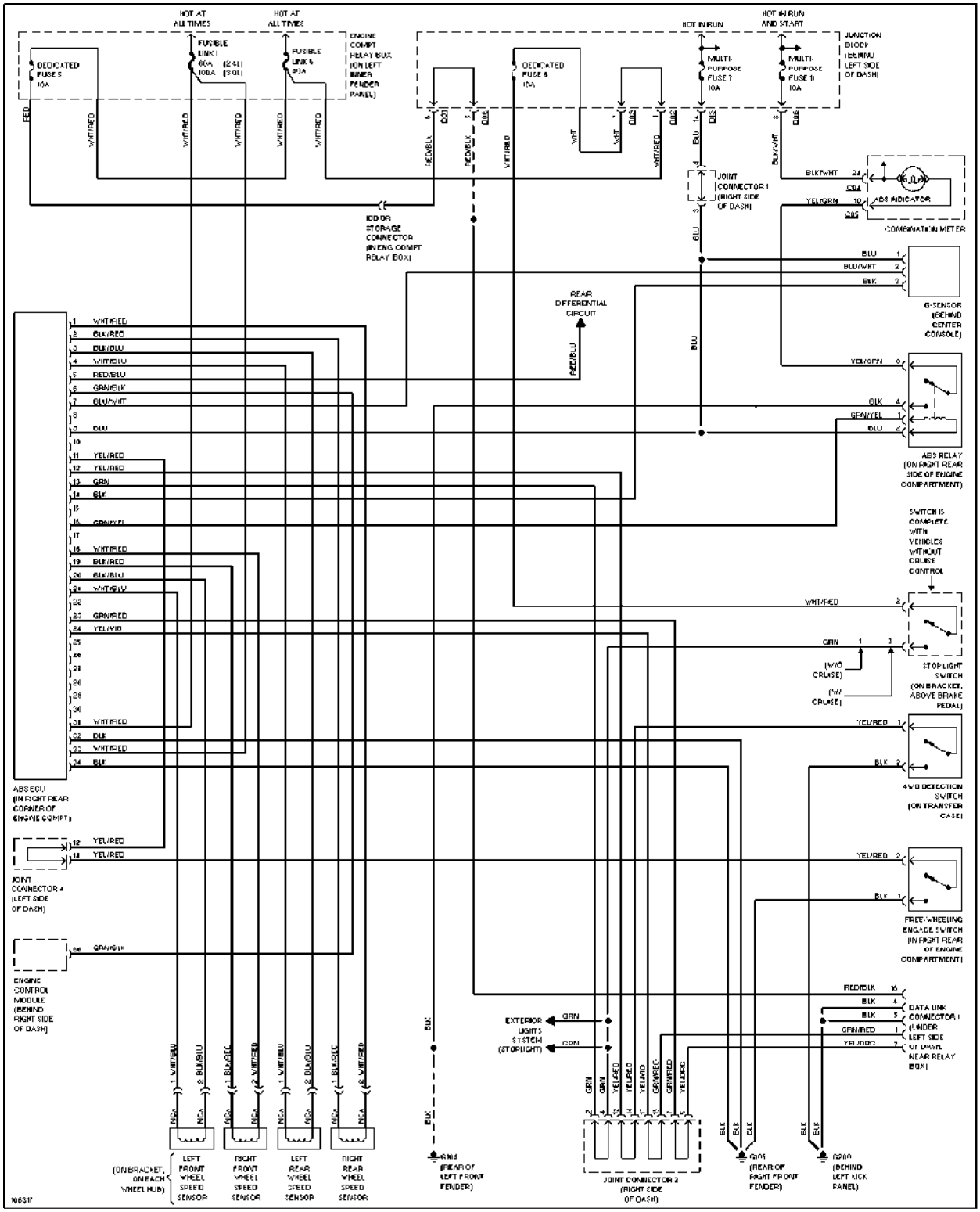


Fig. 14: Anti-Lock Brake System Wiring Diagram (1998 Montero Sport - 4WD)

AUTO TRANS DIAGNOSIS - R4AW3 & V4AW3

1997-99 Mitsubishi Montero Sport

1997-99 AUTOMATIC TRANSMISSIONS
Mitsubishi R4AW3 & V4AW3 Electronic Controls

Montero, Montero Sport

APPLICATION

TRANSMISSION APPLICATION

Vehicle	Transmission Model
Montero Sport 2WD	R4AW3
Montero & Montero Sport 4WD	V4AW3

CAUTION: Vehicle is equipped with Supplemental Restraint System (SRS). When servicing vehicle, use care to avoid accidental air bag deployment. SRS-related components are located in steering column, center console, instrument panel and lower panel on instrument panel. DO NOT use electrical test equipment on these circuits. If necessary, deactivate SRS before servicing components. See AIR BAG SERVICING article in APPLICATIONS & IDENTIFICATION.

DESCRIPTION

Automatic transmission is a 4-speed electronically controlled transmission. Solenoids that control shift changes are located in valve body. Solenoids are controlled by a Transmission Control Module (TCM). TCM receives information from various input devices and uses this information to control shift solenoids for transmission shifting and lock-up solenoid for torque converter lock-up.

An Overdrive (OD) switch is mounted on the shift lever. When OD switch is depressed to ON position, transmission will shift into 4th gear when shift lever is in "D" position, and OD OFF light on instrument panel will go off. When OD switch is released to OFF position, transmission will shift into 3rd gear, and OD OFF light on instrument panel will illuminate.

A pattern select switch is located near shift lever on center console. Pattern select switch contains a NORMAL and a HOLD operating position. When pattern select switch is depressed (HOLD position) with shift lever in Drive position, transmission starts in 2nd gear. Upshifts and downshifts will occur at a higher vehicle speed than with switch in NORMAL position. See MITSUBISHI R4AW3 & V4AW3 OVERHAUL article. Indicator light on instrument panel indicates pattern select switch is in HOLD position.

Transmission is equipped with a shift lock and key interlock system. Shift lock system prevents shift lever from being moved from Park unless brake pedal is depressed. Key interlock system prevents ignition key from being moved from ACC to LOCK position on ignition switch unless shift lever is in Park. See MITSUBISHI SHIFT LOCK SYSTEMS article.

OPERATION

TCM

TCM receives information from various input devices and uses

this information to control solenoids on transmission valve body. TCM controls transmission shifting and torque converter lock-up.

TCM contains a self-diagnostic system, which will store Diagnostic Trouble Codes (DTC) if failure or problem exists in electronic control system. DTC can be retrieved to determine problem area. See SELF-DIAGNOSTIC SYSTEM. TCM is located under left side of instrument panel, left of steering column. See Fig. 1.

TCM INPUT DEVICES

Brakelight Switch Signal

Brakelight switch delivers input signal to TCM, indicating vehicle braking. Brakelight switch is located on brake pedal support.

Cruise Control Electronic Control Unit (ECU)

Cruise control ECU delivers an input signal to control overdrive operation in accordance with vehicle speed when cruise control is operating. When in overdrive with cruise control on, if vehicle speed drops 2 MPH less than the set speed, overdrive is released to prevent reduction in vehicle speed. Once vehicle speed is more than the set speed, overdrive function is resumed. If coolant temperature is low, transmission will not shift into overdrive. Cruise control ECU is located below center A/C vent, behind temperature control panel on Montero. On Montero Sport, cruise control ECU is located behind driver’s kick panel.

Engine Coolant Temperature Sensor (ECT) Signal

Engine coolant temperature sensor delivers input signal to TCM, indicating engine coolant temperature. Coolant temperature sensor is located on engine.

Input & Output Shaft Speed Sensors

Sensors are magnetic pick-ups that monitor input and output shaft speeds. AC waveforms are input to TCM by sensors. Sensors are located on front and rear side of transmission case.

OD Switch Signal

The OD switch provides an input signal to TCM to indicate when overdrive is selected by operator. When OD switch is depressed to ON position, transmission will shift into 4th gear when shift lever is in "D" position, and OD OFF light on instrument panel will go off. When OD switch is released to OFF position, transmission will shift into 3rd gear, and OD OFF light on instrument panel will come on. The OD switch is mounted on shift lever.

Oil Temperature Sensor Signal

Oil temperature sensor provides TCM with ATF temperature values. TCM uses this information to control shift points for maximum performance. If transmission oil temperature exceeds standard values, instrument panel ATF - TEMP light will come on. Sensor is mounted to cooler line at transmission.

Park/Neutral Position (PNP) Switch Signal

PNP switch delivers an input signal to TCM indicating shift lever position. Switch is located on side of transmission.

Throttle Position (TP) Sensor Signal

TP sensor delivers closed throttle and variable throttle position input signals to TCM. TP sensor is located on side of throttle body.

4WD Low Range Detection Switch

4WD low range detection switch provides information to TCM

when transfer case is in 4WD low-lock range.

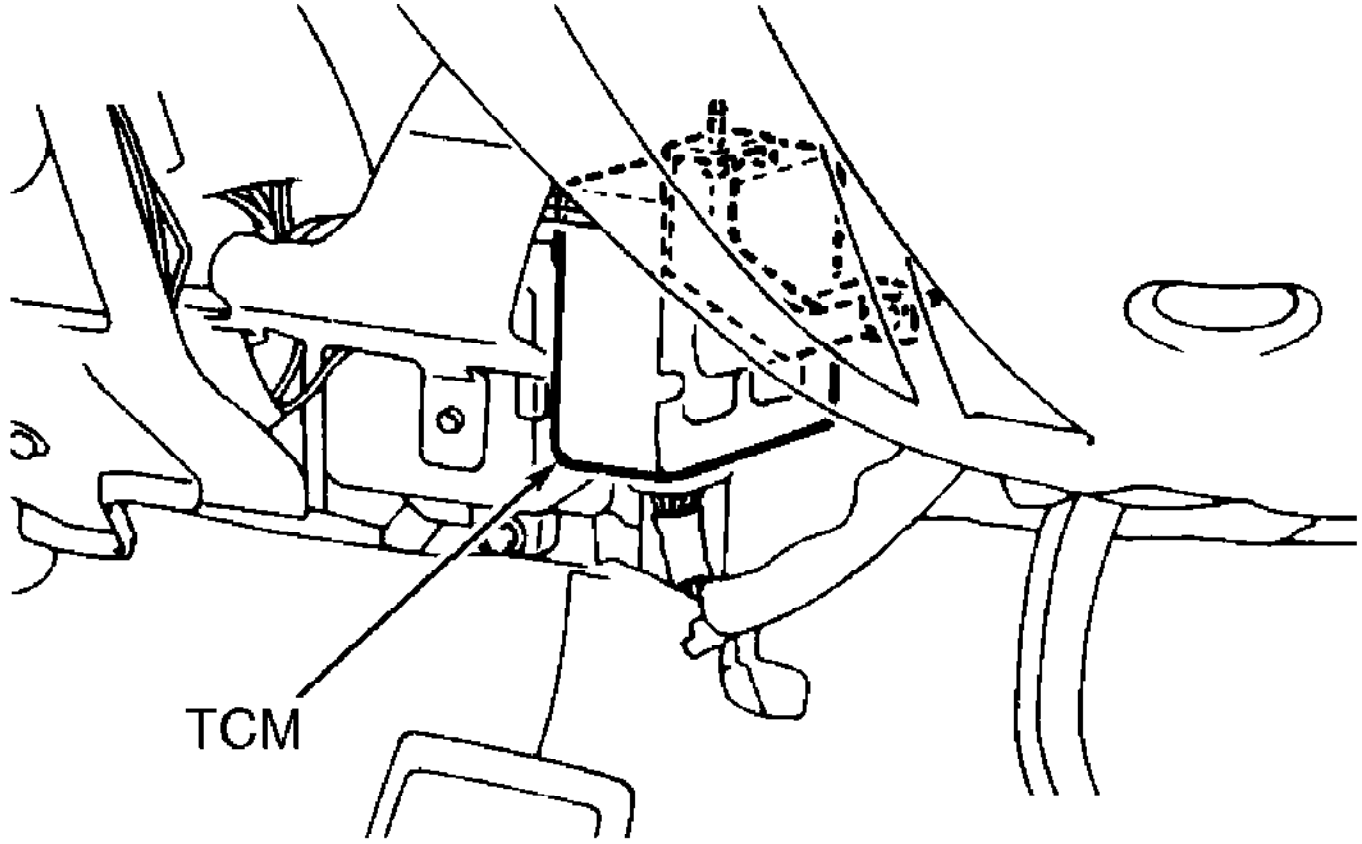


Fig. 1: Locating Transmission Control Module (Montero)
Courtesy of Mitsubishi Motor Sales of America.

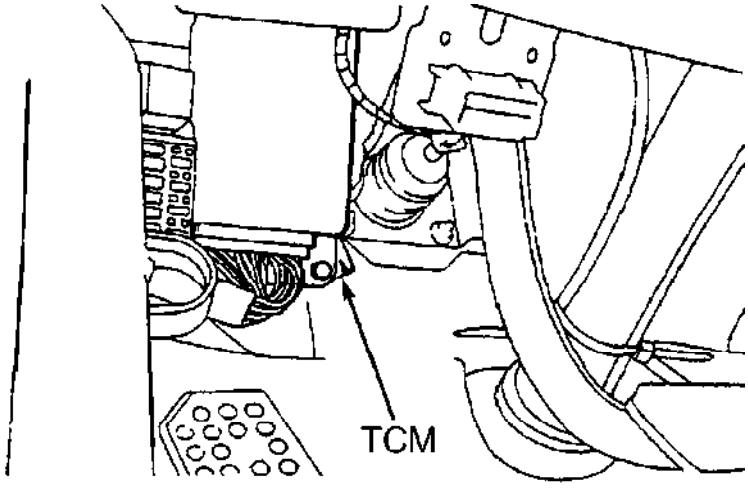


Fig. 2: Locating Transmission Control Module (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America.

TCM OUTPUT DEVICES

Shift Solenoids No. 1 & No. 2

TCM controls transmission shifting by delivering an output signal to operate proper solenoid. Solenoids are located on transmission valve body. See Fig. 3. Solenoids are operated in accordance with shift lever range. If a solenoid malfunctions, TCM may select a preselected gear. See Fig. 4.

NOTE: TCM provides a fail-safe system which will place transmission in preselected gear depending on solenoid failure. In other gears, fail-safe system will not be activated and transmission will be placed in a specified gear. See Fig. 4.

Lock-Up Solenoid

TCM controls torque converter lock-up by delivering an output signal to lock-up solenoid. Lock-up solenoid is activated when shift lever is in "D" position and vehicle is at specified speed. Solenoid is located on transmission valve body. See Fig. 3.

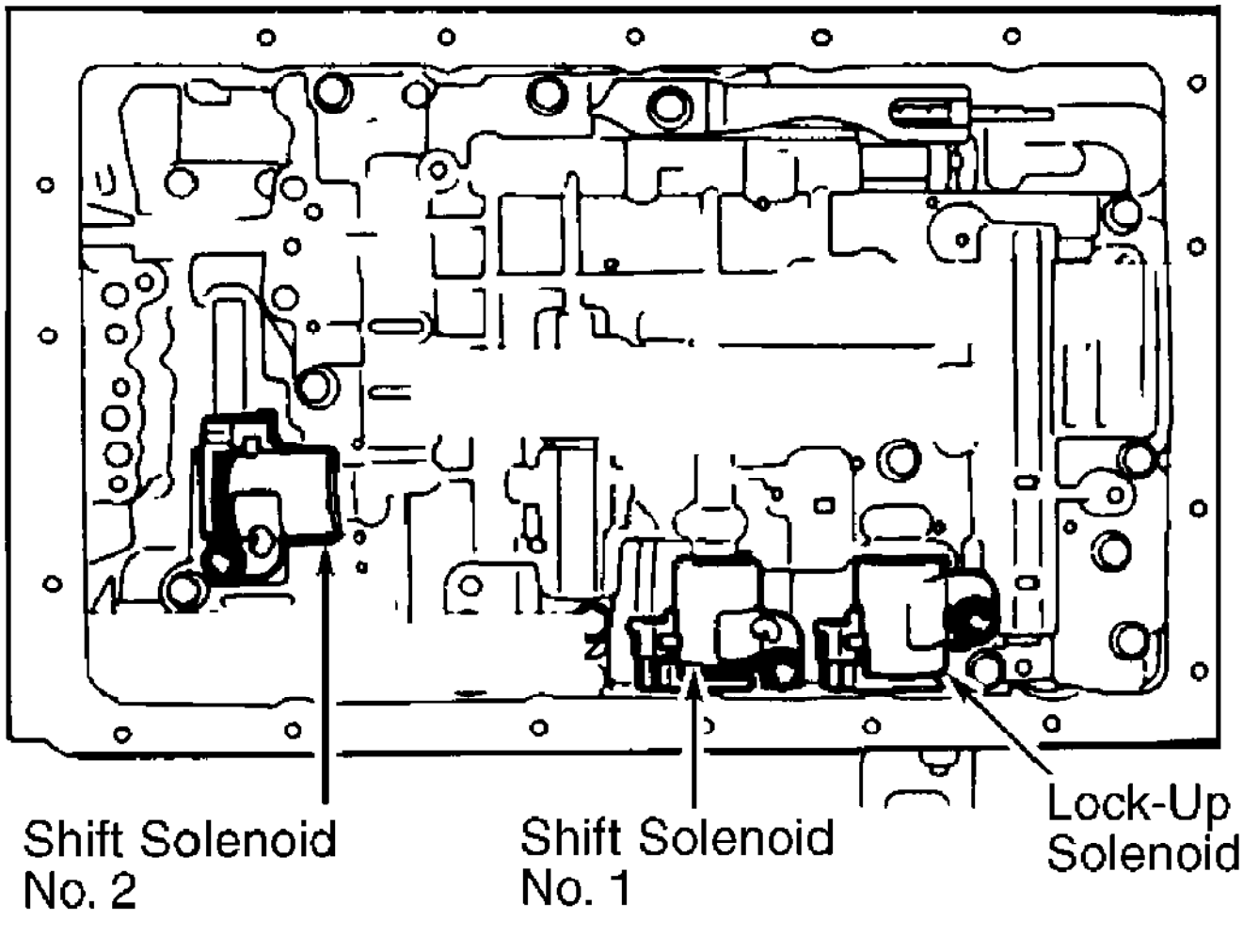


Fig. 3: Locating Lock-Up & Shift Solenoids
Courtesy of Mitsubishi Motor Sales of America.

Range	NORMAL			NO. 1 SOLENOID MALFUNCTIONING			NO. 2 SOLENOID MALFUNCTIONING			BOTH SOLENOIDS MALFUNCTIONING		
	Solenoid Valve		Gear Position	Solenoid Valve		Gear Position	Solenoid Valve		Gear Position	Solenoid Valve		Gear Position
	No. 1	No. 2		No. 1	No. 2		No. 1	No. 2		No. 1	No. 2	
D range	ON	OFF	1st	X	ON (OFF)	3rd (O/D)	ON	X	1st	X	X	O/D
	ON	ON	2nd	X	ON	3rd	OFF (ON)	X	O/D (1st)	X	X	O/D
	OFF	ON	3rd	X	ON	3rd	OFF	X	O/D	X	X	O/D
	OFF	OFF	O/D	X	OFF	O/D	OFF	X	O/D	X	X	O/D
2 range	ON	OFF	1st	X	ON (OFF)	3rd (O/D)	ON	X	1st	X	X	3rd
	ON	ON	2nd	X	ON	3rd	OFF (ON)	X	3rd (1st)	X	X	3rd
	OFF	ON	3rd	X	ON	3rd	OFF	x	3rd	X	X	3rd
L range	ON	OFF	1st	X	OFF	1st	ON	X	1st	X	X	1st
	ON	ON	2nd	X	ON	2nd	ON	X	1st	X	X	1st

( ): No fail-safe function X: Malfunctions

93E25019

Fig. 4: Checking Operation Of Shift Solenoids No. 1 & No. 2
Courtesy of Mitsubishi Motor Sales of America.

SELF-DIAGNOSTIC SYSTEM

SYSTEM DIAGNOSIS

NOTE: Before testing transmission, ensure fluid level is correct and throttle and shift cables are properly adjusted. Ensure engine starts with shift lever in Park and Neutral to ensure proper adjustment of park/neutral position switch. Transmission must first be tested by checking for stored codes. See RETRIEVING DIAGNOSTIC TROUBLE CODES (DTC).

TCM monitors transmission operation and contains a self-diagnostic system which stores a DTC if an electronic control system failure or problem exists. If a problem exists in any of the solenoids or speed sensors and a DTC is set, TCM delivers a signal to blink the ATF TEMP light on instrument panel to warn the driver. DTC may be set if a failure exists and can be retrieved for transmission diagnosis.

RETRIEVING DIAGNOSTIC TROUBLE CODES (DTC)

NOTE: Before retrieving DTC, ensure proper battery voltage exists for proper self-diagnosis system operation. DO NOT disconnect battery or ECM connectors before retrieving DTC.

Retrieving Codes Using Scan Tool

Ensure ignition switch is in OFF position. Connect scan tool to Data Link Connector (DLC). See Fig. 5. Turn ignition switch to ON position. Check for stored DTC and record code(s). See DIAGNOSTIC TROUBLE CODE IDENTIFICATION table.

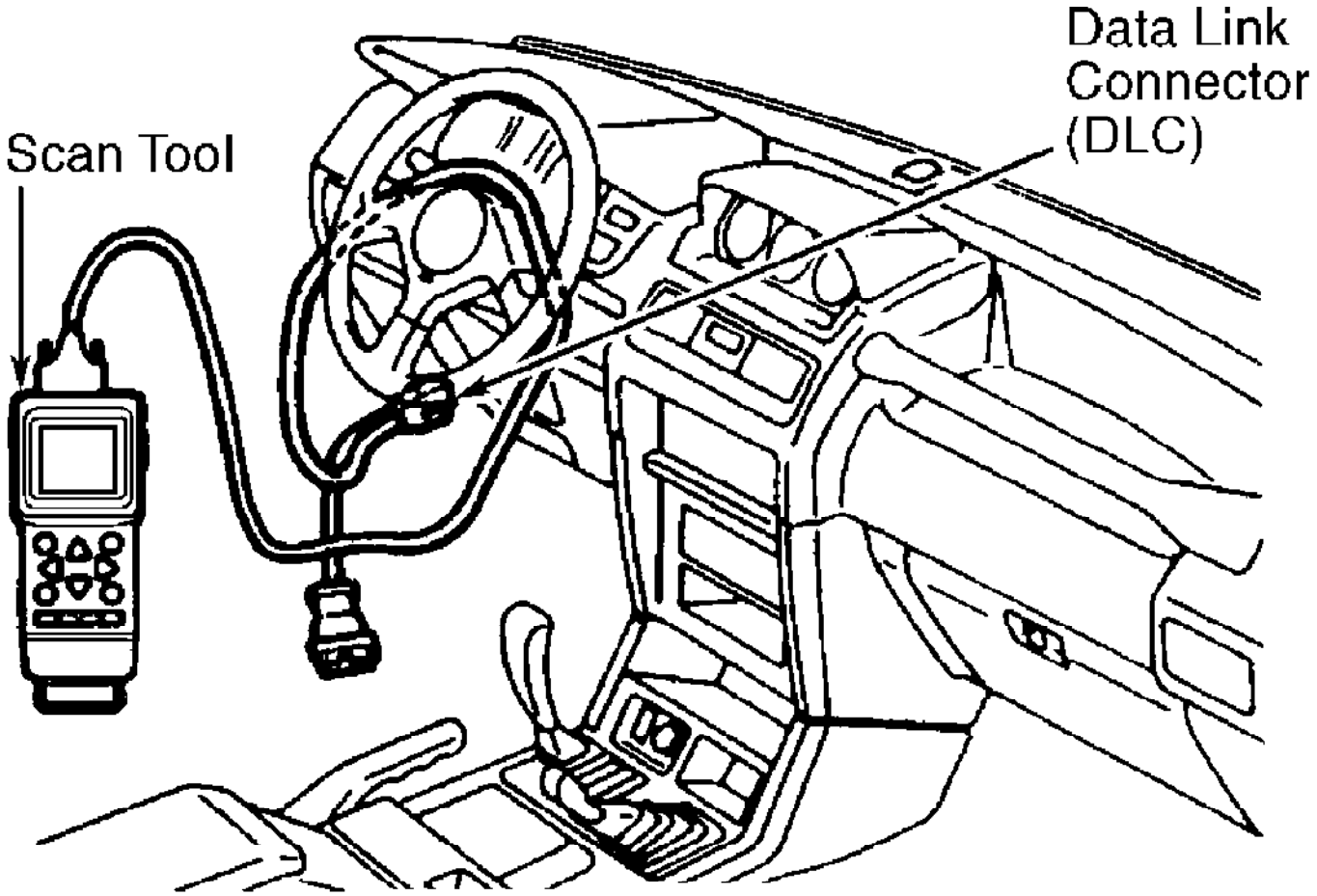


Fig. 5: Retrieving Codes Using Scan Tool
Courtesy of Mitsubishi Motor Sales of America.

Retrieving Codes Using Oil Temperature Warning Light

1) Using jumper wire, ground DLC terminal No. 1. See Fig. 6. Note number of flashes from oil temperature warning light on instrument panel. See Fig. 7. If normal system operation exists, oil temperature warning light will blink 2 times per second. See Fig. 8.

2) If system is operating correctly and no DTC exists, turn ignition off and remove jumper wire. If DTC exists, oil temperature warning light will flash once every 2 seconds. The number of flashes will equal first digit of DTC. After a pause of 2 seconds, second digit will be displayed. Oil temperature warning light will flash once every half second for second digit. See Fig. 8.

3) If more than one DTC exists, next DTC will be displayed after pause of 3 seconds. Smallest DTC number will be first. DTCs will be repeated.

4) Once DTC is obtained, determine probable cause and symptom. See DIAGNOSTIC TROUBLE CODE IDENTIFICATION table. To trouble shoot DTC, see DIAGNOSTIC TESTS. Turn ignition off and remove jumper wire.

NOTE: Once repairs have been performed, DTCs must be cleared from TCM memory. See CLEARING DIAGNOSTIC TROUBLE CODES (DTC).

DIAGNOSTIC TROUBLE CODE IDENTIFICATION

DIAGNOSTIC TROUBLE CODE IDENTIFICATION

DTC	(1) Probable Cause
11	Defective TP Sensor Or TP Sensor Circuit
15	Open Oil Temperature Sensor Circuit
16	Short Oil Temperature Sensor Circuit
21	Short Ignition Signal Circuit
22	Open Ignition Signal Circuit
23	Open Signal Line (ECT) From ECM To TCM
24	Short Signal Line (ECT) From ECM To TCM
29	Short Neutral Safety Switch Circuit
30	Open Neutral Safety Switch Circuit
31	Open No. 2 Speed Sensor Circuit
32	Open No. 1 Speed Sensor Circuit
41	Open Solenoid No. 1 Circuit
42	Short Solenoid No. 1 Circuit
43	Open Solenoid No. 2 Circuit
44	Short Solenoid No. 2 Circuit
47	Open Lock-Up Solenoid Circuit
48	Short Lock-up Solenoid Circuit
49	(2) Torque Converter Clutch Engagement Malfunction
50	(2) Torque Converter Clutch Disengagement Malfunction
51	1st Gear Ratio Signal Incorrect
52	2nd Gear Ratio Signal Incorrect
53	3rd Gear Ratio Signal Incorrect
54	4th Gear Ratio Signal Incorrect

(1) - Check listed fault code and component for probable cause. See appropriate fault code listing under DIAGNOSTIC TESTS. Check wiring and connections of specified component.
(2) - Scan tool is required for testing malfunctioning circuit.

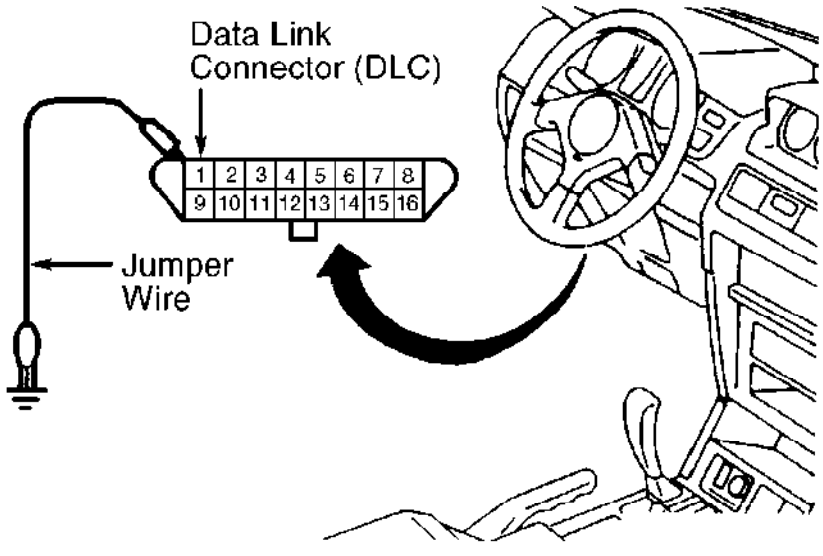


Fig. 6: Identifying Data Link Connector (DLC) Terminals
Courtesy of Mitsubishi Motor Sales of America.

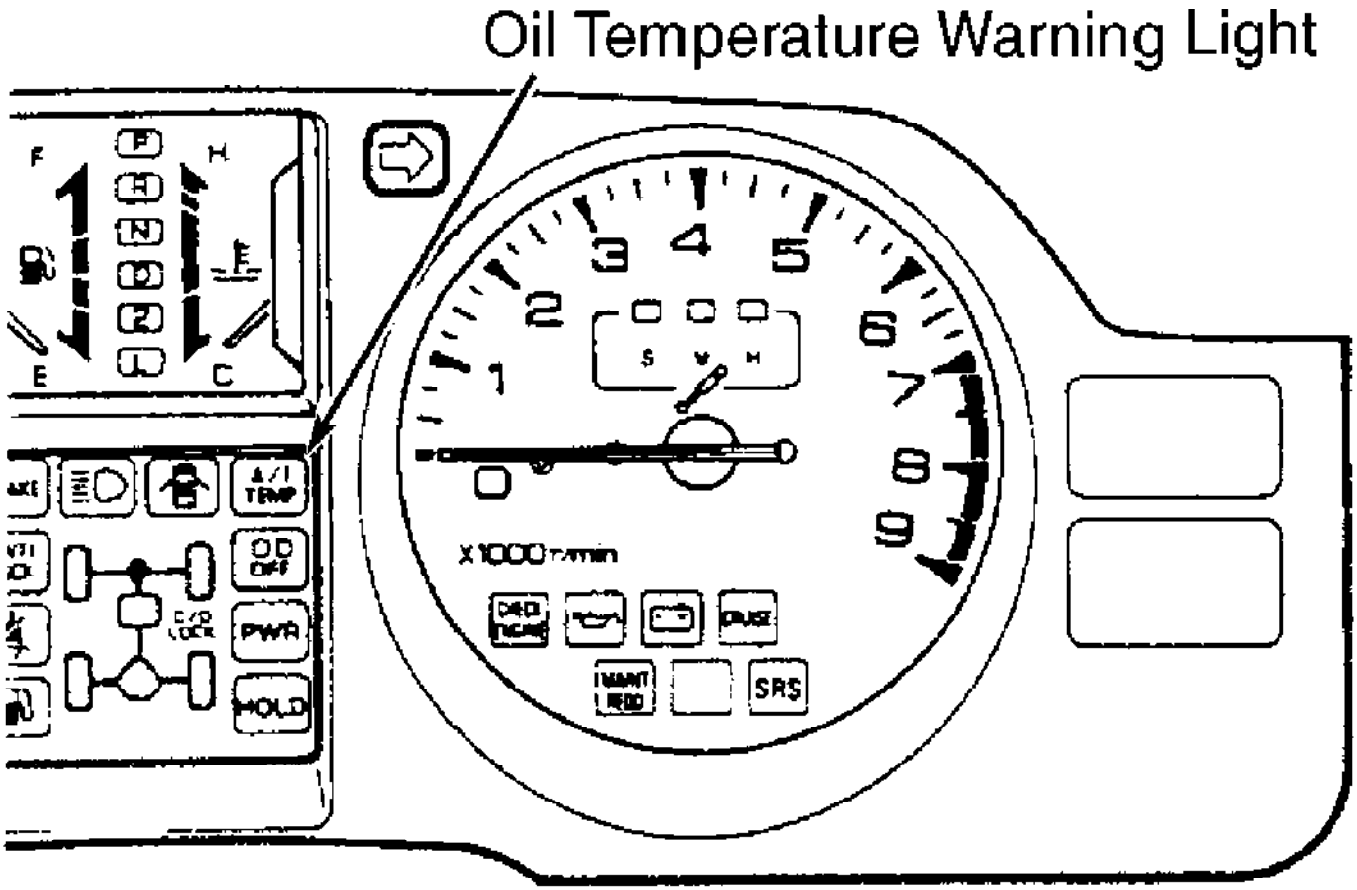


Fig. 7: Locating A/T Temperature Warning Light
Courtesy of Mitsubishi Motor Sales of America.

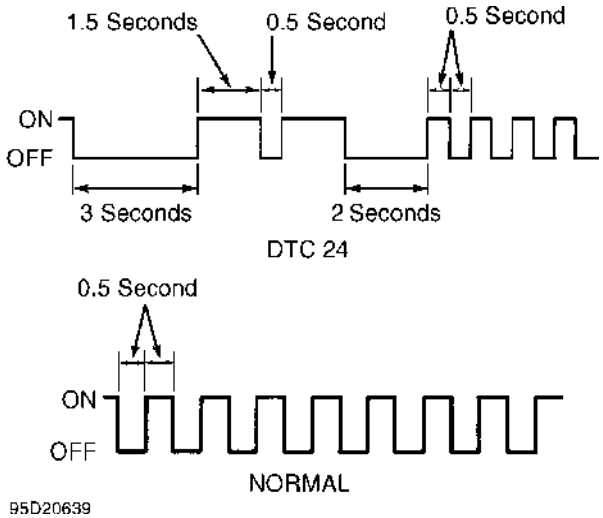


Fig. 8: Identifying DTC Displays
Courtesy of Mitsubishi Motor Sales of America.

CLEARING DIAGNOSTIC TROUBLE CODES (DTC)

Once repairs have been performed, DTCs must be cleared from TCM memory. DTCs may be cleared by disconnecting negative battery cable for 10 seconds or more. Reconnect cable and ensure DTCs have been cleared. Start engine and warm to normal operating temperature. Run engine at idle for 10 minutes. DTCs may also be cleared using scan tool. Refer to manufacturer's instruction manual.

DIAGNOSTIC TESTS

NOTE: For terminal and wire color identification, see WIRING DIAGRAMS.

DTC 11: THROTTLE POSITION (TP) SENSOR

For diagnosis and testing information, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE section. If TP sensor is okay, check wiring harness and connectors between TP sensor and TCM. Repair if necessary. If wiring harness and connectors are okay, replace TCM.

DTC 15 & 16: OPEN OR SHORT IN OIL TEMPERATURE SENSOR CIRCUIT

1) Test oil temperature for proper operation. See OIL TEMPERATURE SENSOR under COMPONENT TESTING. If oil temperature sensor is okay, check wire harness, connectors and ground circuit for poor connections or damage. Go to next step.
2) If wire harness and connectors are okay, check DTCs again and verify code No. 15 or No. 16 still exists. If either code still exists, replace TCM.

DTC 21 & 22: SHORT OR OPEN IN IGNITION SIGNAL CIRCUIT

1) Using an external tachometer, verify vehicles' tachometer is operating accurately. If tachometer is incorrect, check ignition coil and ignition power transistor and circuits for malfunction. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE section.
2) If tachometer is okay, check TCM wire harness connector for poor connection. If wire harness is okay, recheck DTCs. If codes reappear check wire harness between ignition power transistor and TCM. If wire harness is okay, replace TCM.

DTC 23 & 24: OPEN OR SHORT IN SIGNAL LINE (ECT) FROM ECM TO TCM

Check wire harness, connectors and ground circuit for poor connections or damage. Go to next step. If wire harness and connectors are okay, check DTCs again and verify code No. 23 or No. 24 still exists. If either code still exists, replace TCM.

DTC 29 & 30: SHORT OR OPEN IN PARK/NEUTRAL POSITION (PNP) SWITCH CIRCUIT

1) Check PNP switch for correct operation. See. If PNP switch is okay, disconnect switch connector and measure voltage between harness connector terminal No. 1 and ground.
2) If battery voltage does not exist, check wire harness and connectors. See WIRING DIAGRAMS. If battery voltage exists, check wire harness and connectors between PNP switch and TCM. If wire harness is okay, replace TCM.

DTC 31: INPUT SPEED SENSOR

1) Check input speed sensor. See INPUT SPEED SENSOR under COMPONENT TESTING. If resistance is as specified, reconnect speed sensor connector and go to next step. If resistance is not as specified replace input speed sensor and recheck DTCs.

2) Connect voltmeter between solenoid and sensor connector terminals No. 9 and No. 10. See Fig. 9. Lift and support vehicle to allow drive wheels to spin freely. With transmission in "D" position, engine at 1000 RPM and wheel speed at 19 MPH (30 km/h). Measured voltage should be .3-2.5 volts.

3) If voltage is as specified, go to next step. If voltage is not as specified, replace input speed sensor. If DTC still exists, check speed sensor rotor. See MITSUBISHI R4AW3 & V4AW3 OVERHAUL article. If DTC still exists after speed sensor rotor is replaced, check for noise interference and repair.

4) Check and repair wiring harness and connectors between input speed sensor and TCM. If wiring is okay, recheck DTC. If DTC still exists, replace TCM.

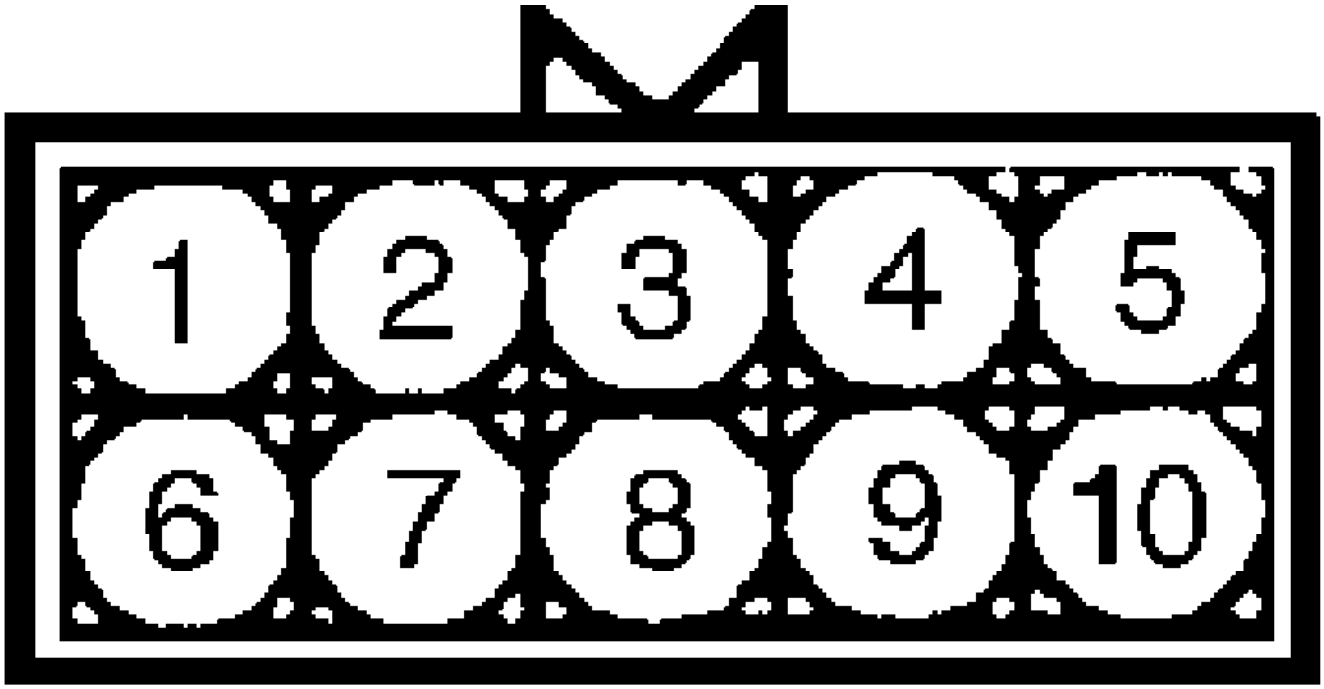


Fig. 9: Identifying Sensor & Solenoid Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

DTC 32: OUTPUT SPEED SENSOR

1) Check output speed sensor. See OUTPUT SPEED SENSOR under COMPONENT TESTING. If resistance is as specified, reconnect speed sensor connector and go to next step. If resistance is not as specified replace output speed sensor and recheck DTCs.

2) Connect voltmeter between solenoid and sensor connector terminals No. 3 and No. 4. See Fig. 9. Lift and support vehicle to allow drive wheels to spin freely. With transmission in "D" position, engine at 1000 RPM and wheel speed at 19 MPH (30 km/h). Measured

voltage should be .3-2.5 volts.

3) If voltage is as specified, go to next step. If voltage is not as specified, replace the output speed sensor. If DTC still exists, check speed sensor rotor. See MITSUBISHI R4AW3 & V4AW3 OVERHAUL article. If DTC exists after speed sensor rotor is replaced, check for noise interference and repair.

4) Check and repair wiring harness and connectors between output speed sensor and TCM. If wiring is okay, recheck DTCs. If DTCs still exists, replace TCM.

DTC 41 & 42: OPEN OR SHORT IN SOLENOID NO. 1 CIRCUIT

NOTE: A stuck solenoid will not set a DTC. DTCs are only set for circuit malfunctions, not mechanical failures.

1) Disconnect solenoid and sensor connector. Using ohmmeter, check resistance between solenoid connector terminal No. 6 and ground. See Fig. 9. Resistance should be 11-15 ohms at 77°F (25°C). If resistance is as specified, go to next step. If resistance is not as specified, replace solenoid No. 1 and recheck DTC.

2) Check wiring harness and connectors between solenoid No. 1 and TCM. If wiring and solenoid No. 1 is okay, replace TCM.

DTC 43 & 44: OPEN OR SHORT IN SOLENOID NO. 2 CIRCUIT

NOTE: A stuck solenoid will not set a DTC. DTCs are only set for circuit malfunctions, not mechanical failures.

1) Disconnect solenoid and sensor connector. Using ohmmeter, check resistance between solenoid connector terminal No. 7 and ground. See Fig. 9. Resistance should be 11-15 ohms at 77°F (25°C). If resistance is as specified, go to next step. If resistance is not as specified, replace solenoid No. 2 and recheck DTC.

2) Check wiring harness and connectors between solenoid No. 2 and TCM. If wiring and solenoid No. 2 is okay, replace TCM.

DTC 47 & 48: OPEN OR SHORT IN LOCK-UP SOLENOID CIRCUIT

NOTE: A stuck solenoid will not set a DTC. DTCs are only set for circuit malfunctions, not mechanical failures.

1) Disconnect solenoid and sensor connector. Using ohmmeter, check resistance between solenoid connector terminal No. 8 and ground. See Fig. 9. Resistance should be 11-15 ohms at 77°F (25°C). If resistance is as specified, go to next step. If resistance is not as specified, replace lock-up solenoid and recheck DTC.

2) Check wiring harness and connectors between lock-up solenoid and TCM. If wiring and lock-up solenoid is okay, replace TCM.

DTC 49: TORQUE CONVERTER CLUTCH (TCC) ENGAGEMENT MALFUNCTION

1) Using scan tool, verify vehicle tachometer and scan tool vehicle RPM values are identical. If tachometer values are identical, go to next step. If tachometer values are different, test ignition signal circuit. See DTC 21 & 22: SHORT OR OPEN IN IGNITION SIGNAL CIRCUIT.

2) Lift and support vehicle to allow drive wheels to spin freely. With transmission in "D" position, run engine to 1300-1900 RPM. Verify scan tool and speedometer read 31 MPH (50 km/h). If values are identical, go to next step. If values are different, test input speed sensor. See DTC 31: INPUT SPEED SENSOR.

3) Check lock-up solenoid for proper operation. See SOLENOIDS

under COMPONENT TESTING. If lock-up solenoid is okay, go to next step. If lock-up solenoid is bad, replace and retest system.

4) Check wiring harness and connectors between lock-up solenoid and TCM. If wiring harness and connectors are okay, check TCC engagement hydraulic pressure, valve body malfunction or TCC slipping.

DTC 50: TCC DISENGAGEMENT MALFUNCTION

1) Using scan tool, verify vehicle tachometer and scan tool vehicle RPM values are identical. If tachometer values are identical, go to next step. If tachometer values are different, test ignition signal circuit. See DTC 21 & 22: SHORT OR OPEN IN IGNITION SIGNAL CIRCUIT.

2) Lift and support vehicle to allow drive wheels to spin freely. With transmission in "D" position, run engine to 1300-1900 RPM. Verify scan tool and speedometer read 31 MPH (50 km/h). If values are identical, go to next step. If values are different, test input speed sensor. See DTC 31: INPUT SPEED SENSOR.

3) Check lock-up solenoid for proper operation. See SOLENOIDS under COMPONENT TESTING. If lock-up solenoid is okay, go to next step. If lock-up solenoid is bad, replace and retest system.

4) Check wiring harness and connectors between lock-up solenoid and TCM. If wiring harness and connectors are okay, check valve body malfunction or TCC sticking.

DTC 51: 1ST GEAR RATIO SIGNAL INCORRECT

1) If DTC 31 is set, go to DTC 31: INPUT SPEED SENSOR. If DTC 31 is not set and DTC 32 is set, go to DTC 32: OUTPUT SPEED SENSOR. If neither DTC 31 nor DTC 32 is set, go to next step.

2) Test input speed sensor. See INPUT SPEED SENSOR under COMPONENT TESTING. If resistance is as specified, go to next step. If resistance is not as specified, replace input speed sensor and recheck DTC. If DTC still exists, go to step 5).

3) Test output speed sensor. See OUTPUT SPEED SENSOR under COMPONENT TESTING. If resistance is as specified, go to next step. If resistance is not as specified, replace output speed sensor and recheck DTC. If DTC still exists, go to step 5).

4) If referenced here from another DTC, go back to referenced DTC. Check No. 2 one-way clutch system. See NO. 2 ONE-WAY CLUTCH in MITSUBISHI R4AW3 & V4AW3 OVERHAUL article.

5) Check output speed sensor and No. 2 speed sensor shielding wire. Repair as necessary. If shielding wire is okay, recheck DTC. If DTC still exists, replace sensor rotor. If DTC still exists after sensor rotor is replaced, check for interference noise and repair.

DTC 52: 2ND GEAR RATIO SIGNAL INCORRECT

If DTC 51 is set also, go to DTC 51: 1ST GEAR RATIO SIGNAL INCORRECT test. If DTC 51 is not set, check 2nd brake and No. 1 one-way clutch systems for a mechanical failure. See 2ND BRAKE and NO. 1 ONE-WAY CLUTCH in MITSUBISHI R4AW3 & V4AW3 OVERHAUL article.

DTC 53: 3RD GEAR RATIO SIGNAL INCORRECT

If DTC 51 is set also, go to DTC 51: 1ST GEAR RATIO SIGNAL INCORRECT test. If DTC 51 is not set, check direct clutch system for a mechanical failure. See DIRECT CLUTCH in MITSUBISHI R4AW3 & V4AW3 OVERHAUL article.

DTC 54: 4TH GEAR RATIO SIGNAL INCORRECT

If DTC 51 is set also, go to DTC 51: 1ST GEAR RATIO SIGNAL INCORRECT test. If DTC 51 is not set, check overdrive brake for a mechanical failure. See OVERDRIVE BRAKE in MITSUBISHI R4AW3 & V4AW3 OVERHAUL article.

SYMPTOM TROUBLE SHOOTING

NOTE: Check system using appropriate scan tool. See WIRING DIAGRAMS for electrical schematics and COMPONENT TESTING.

COMMUNICATION WITH SCAN TOOL NOT POSSIBLE

If scan tool cannot communicate with TCM, check proper connection with DLC. Check TCM power circuits, TCM ground circuits and malfunctioning TCM.

SHIFT POINTS INCORRECT

If shift points are incorrect, check for DTCs. If no DTC is present, check oil temperature sensor, pattern select switch, 4WD low range detection switch and TCM for proper operation.

UPSHIFTS OCCUR SPONTANEOUSLY

If upshifting occurs spontaneously, check park/neutral position switch, overdrive switch and TCM for proper operation.

TCC LOCK-UP MALFUNCTIONING

If TCC lock-up system is not operating properly, check torque converter, valve body, lock-up switch and oil temperature switch.

COMPONENT TESTING

A/T FLUID TEMPERATURE SWITCH

1) Remove fluid temperature switch, located to rear of neutral safety switch. Immerse switch in container of ATF up to top threaded portion of switch. Using a DVOM, check continuity between switch terminals. Continuity should not exist when fluid temperature is 257°F (125°C) or less.

2) When fluid is heated to 289-304°F (143-151°C), continuity should exist. Replace switch if necessary. Apply thread sealant to fluid temperature switch threads and install in transmission.

BRAKELIGHT SWITCH

1) Disconnect electrical connector from brakelight switch, located near brake pedal. Using ohmmeter, ensure continuity exists between terminal No. 2 (White/Red wire) and terminal No. 3 (Green wire) with brake pedal released. Replace brakelight switch if continuity does not exist. Continuity should not exist between terminals No. 2 and No. 3 with brake pedal depressed.

2) If continuity does not exist, ensure brake pedal is properly adjusted so brakelight switch has proper travel for switch operation. If proper brakelight switch travel exists, replace brakelight switch.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Disconnect electrical connector from coolant temperature sensor. Using ohmmeter, check resistance between terminals of coolant temperature sensor. Resistance should be as specified in accordance with the TEMPERATURE-TO-RESISTANCE VALUES table. Replace coolant temperature if resistance is not within specification.

TEMPERATURE-TO-RESISTANCE VALUES

Temperature °F (°C)	Ohms
32 (0)	5.8
68 (20)	2.4
104 (40)	1.1
176 (80)	0.3

INPUT SPEED SENSOR

Disconnect solenoid and sensor connector. Using ohmmeter, measure resistance between terminals No. 9 and No. 10. See Fig. 9. Resistance should be 560-680 ohms at 68°F (20°C). If resistance is not as specified, replace No. 2 speed sensor.

OIL TEMPERATURE SENSOR

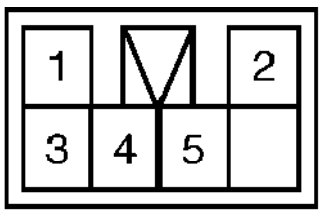
Disconnect solenoid and sensor connector. Using ohmmeter, check resistance between sensor connector terminals No. 1 and No. 2. See Fig. 9. Resistance should be 10 k/ohms when oil temperature is 77°F (25°C). With oil temperature at 248°F (120°C), resistance should be 615 ohms. If resistance is not as specified, replace oil temperature sensor.

OUTPUT SPEED SENSOR

Disconnect solenoid and sensor connector. Using ohmmeter, measure resistance between terminals No. 3 and No. 4. See Fig. 9. Resistance should be 560-680 ohms at 68°F (20°C). If resistance is not as specified, replace output speed sensor.

OVERDRIVE SWITCH

Using a screwdriver, remove overdrive switch from selector lever, located below selector lever button. Using a DVOM, check continuity between overdrive switch terminals No. 3 and 5 with switch in ON position. Continuity should exist. With switch in OFF position, check continuity between terminals No. 3 and 4. Continuity should exist. If continuity is not as specified, replace switch. See Fig. 10.

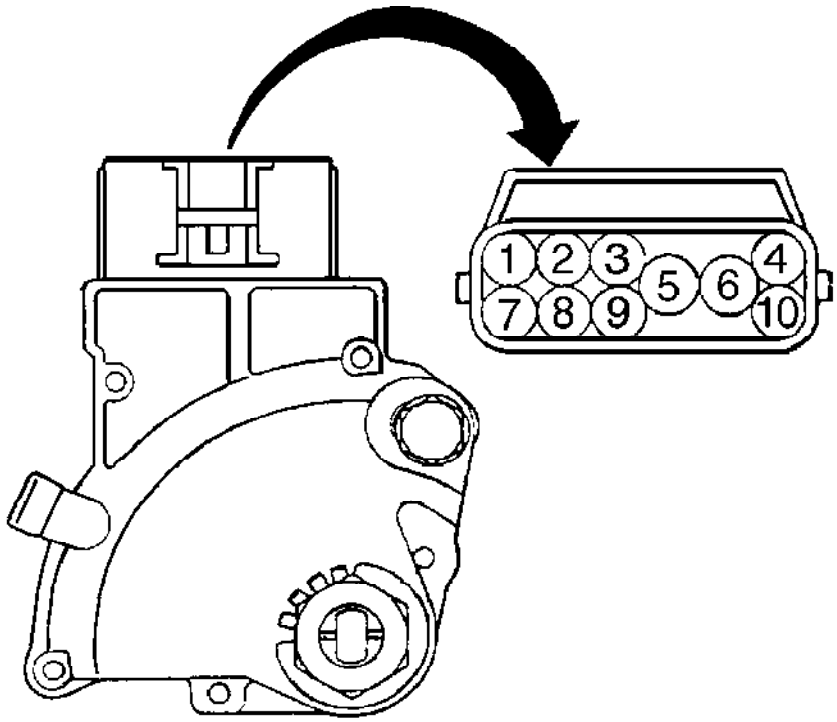


95A20289

Fig. 10: Identifying Overdrive Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

PARK/NEUTRAL POSITION (PNP) SWITCH

Disconnect PNP switch harness connector. Using ohmmeter, check continuity between specified terminals. See Fig. 11. Replace as needed.



Item	Terminal No.								
	1	2	3	5	6	7	8	9	10
P	○			○	○				○
R	○							○	
N	○			○	○	○			
D	○						○		
2	○		○						
L	○	○							

99C04805

Fig. 11: Testing Park/Neutral Position (PNP) Switch
Courtesy of Mitsubishi Motor Sales of America.

PATTERN SELECT SWITCH

Using a screwdriver, remove pattern select switch from console. Switch is located at rear of selector lever, to right of emergency brake handle. Using a DVOM, check continuity between pattern select switch terminals No. 1 and 2, with switch in HOLD position. Continuity should exist. With switch in POWER position, check continuity between terminals No. 1 and 6. Continuity should exist. If continuity is not as specified, replace switch. See Fig. 12.

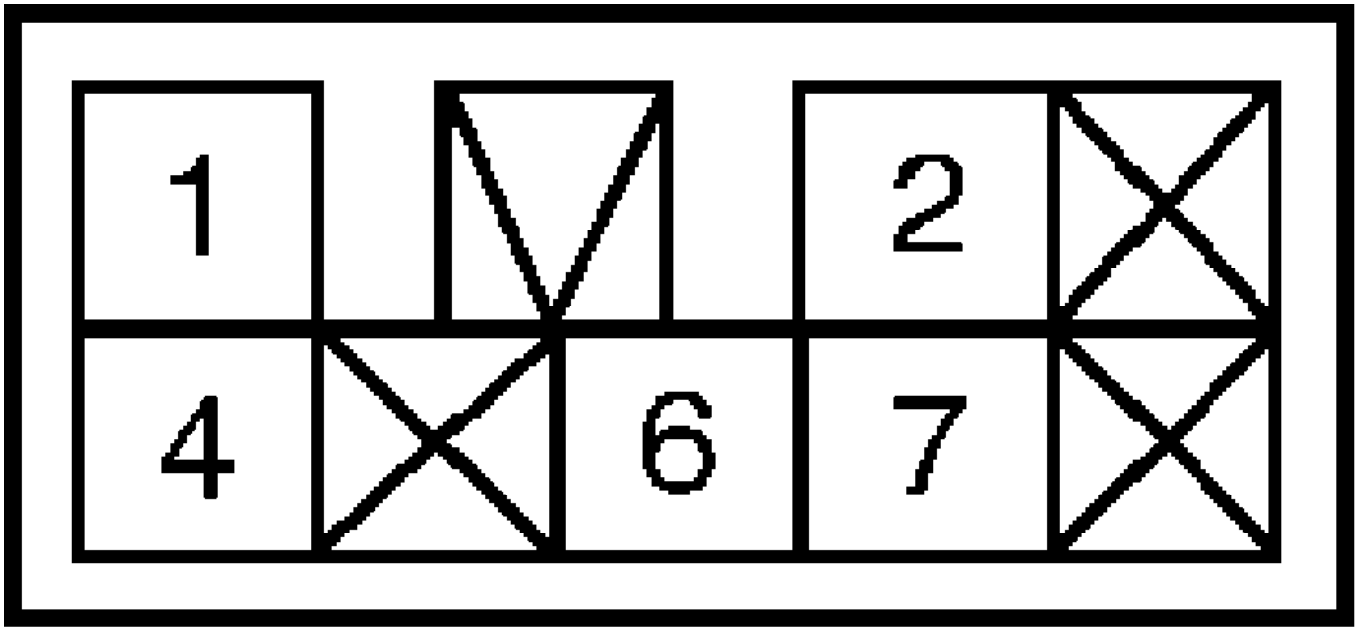


Fig. 12: Identifying Pattern Select Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

SOLENOIDS

For solenoid testing, refer to the appropriate DTC under DIAGNOSTIC TESTS. To check solenoid operation, apply battery voltage to appropriate terminal of TCM connector and ground. Ensure operating sound can be heard when battery voltage is connected. Replace solenoid if operating sound cannot be heard.

THROTTLE POSITION (TP) SENSOR

For diagnostic and testing information, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE section.

4WD LOW RANGE DETECTION SWITCH

For location and testing information on 4WD low range detection switch, see appropriate article in AXLE SHAFTS & TRANSFER CASES.

TCM PIN VOLTAGE CHARTS

Access TCM. See Fig. 1 or 2. Turn ignition on. Using DVOM,

backprobe TCM connector. See Fig. 13. Check voltage between designated terminals on TCM connector and ground. See TCM TERMINAL VOLTAGE SPECIFICATIONS table. Voltage should be as specified.

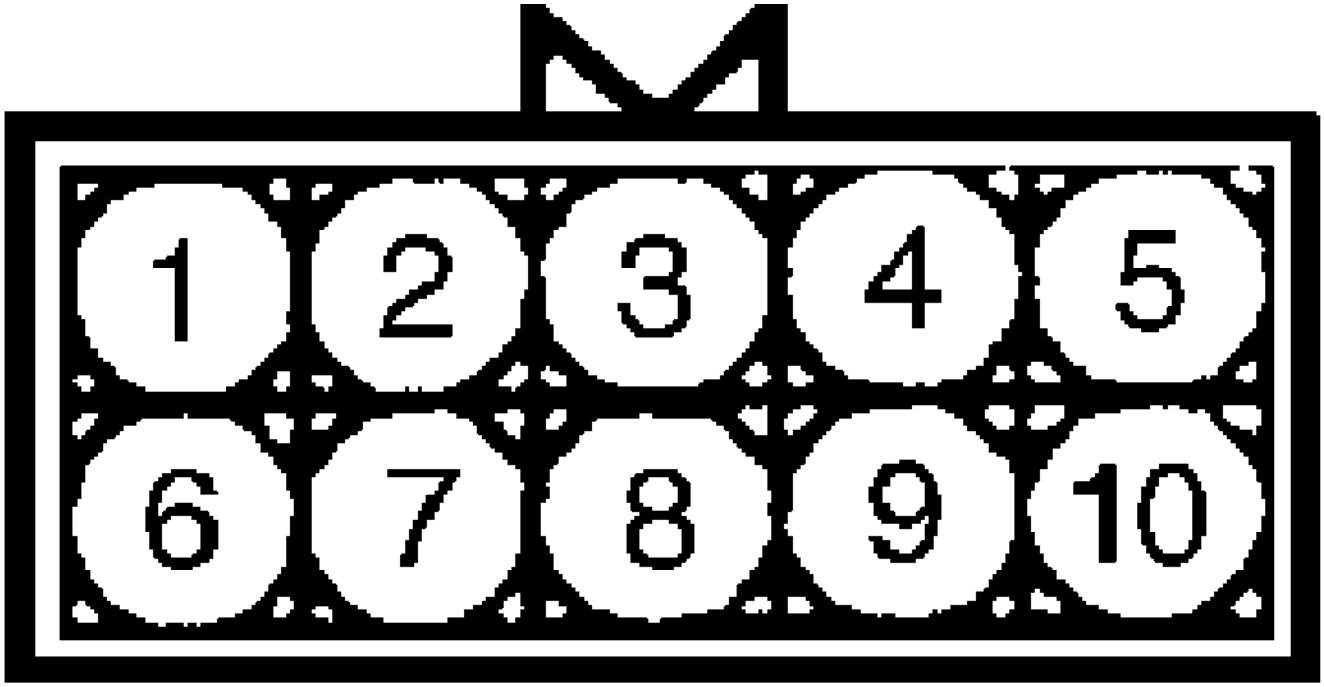


Fig. 13: Identifying TCM Terminals
Courtesy of Mitsubishi Motor Sales of America.

TCM TERMINAL VOLTAGE SPECIFICATIONS

Terminal No.	Circuit	Condition	Voltage
1	Lock-Up Solenoid	Lock-Up Clutch Engaged	Battery
1	Lock-Up Solenoid	Lock-Up Clutch Disengaged	0 Volts
2	Back-Up Power Supply	At All Times	Battery
5	Brakelight Switch	Brake Pedal Depressed	0 Volts
5	Brakelight Switch	Brake Pedal Released	Battery
8	TP Sensor	Throttle Closed (Idle)	.3-1.0
8	TP Sensor	Throttle Wide Open	4.4-5.0
11	Neutral Safety Switch	In "P" Position	Battery
11	Neutral Safety Switch	Except In "P"	0 Volts
12	Ground	Engine Idling	0 Volts

14	No. 1 Shift Solenoid	In 1st Or 2nd	Battery
14	No. 1 Shift Solenoid	In 3rd Or 4th Gear	0 Volts
15	Power Supply	Ignition ON	Battery
15	Power Supply	Ignition OFF	0 Volts
16	No. 2 Shift Solenoid	In 2nd Or 3rd Gear	Battery
16	No. 2 Shift Solenoid	In 1st Or 4th Gear	0 Volts
17	Diagnostic Test Mode	Not Specified	Not Specified
18	Diagnostic Output	Scan Tool Not Connected	Battery
21	Oil Temp Warning Lamp	Normal Temp. Range	0 Volts
21	Oil Temp Warning Lamp	For 5 Seconds After Ign. Is On	Battery
22	Oil Temp Sensor	Temp @ 248°F (120°C)	About 1.9
22	Oil Temp Sensor	Temp @ 302°F (150°C)	About 1.1
23	4WD Low Range Switch	4WD Lever In 4H-Lock	Battery
23	4WD Low Range Switch	4WD Lever In 4L-Lock	0 Volts
24	Neutral Safety Switch	In "R" Position	Battery
24	Neutral Safety Switch	Except In "R"	0 Volts
25	Ground	Engine Idling	0 Volts
26	Ground	Engine Idling	0 Volts
31	Neutral Safety Switch	In "L" Position	Battery
31	Neutral Safety Switch	Except In "L"	0 Volts
32	Neutral Safety Switch	In "N" Position	Battery
32	Neutral Safety Switch	Except In "N"	0 Volts
34	Power Mode	Power Mode Selected	Battery
34 Montero	4WD Detection Switch	2WD	4 Volts Or Greater
34 Montero	4WD Detection Switch	4WD	0-1 Volts
34 Montero Sport	Free Wheel Engage Switch	2WD	4 Volts Or Greater
34 Montero Sport	Free Wheel Engage Switch	4WD	0 Volts

35	Output Speed Sensor Gnd	Ignition Off	0 Volts
35	Output Speed Sensor Gnd	Ignition On	2.5 Volts
36	Input Speed Sensor Gnd	Ignition Off	0 Volts
36	Input Speed Sensor Gnd	Ignition On	2.5 Volts
37	Overdrive OFF Signal	(1) Steady Driving @ 31 MPH (50 km/h)	Battery
37	Overdrive OFF Signal	(1) Climbing Hill @ 31 MPH (50 km/h)	0 - 1
38	Engine Ign. Signal	Engine @ 3000 RPM	.3 - 3.0
39	Neutral Safety Switch	In "D" Position	Battery
39	Neutral Safety Switch	Except In "D"	0 Volts
40	Neutral Safety Switch	In "2" Position	Battery
40	Neutral Safety Switch	Except In "2"	0 Volts
41	HOLD Mode	HOLD Mode Selected	Battery
41	HOLD Mode	HOLD Mode Not Selected	0 Volts
42	Overdrive Switch	Overdrive ON	0 Volts
42	Overdrive Switch	Overdrive OFF	Battery
43	Output Speed Sensor	Vehicle Stopped	About 2.5
43	Output Speed Sensor	Vehicle Moving	Other Than 2.5
44	Input Speed Sensor	Vehicle Stopped	About 2.5
44	Input Speed Sensor	Vehicle Moving	Other Than 2.5
45	Coolant Temp Sensor	Temp @ 86°F (30°C)	2.5
45	Coolant Temp Sensor	Temp @ 158°F (70°C)	0 Volts
46	MIL Signal	Ignition ON	.5 4.5 Volts
(1) - Test circuit with shift lever in "D" position, mode selector normal and cruise control on.			

REMOVAL & INSTALLATION

BRAKELIGHT SWITCH

Removal & Installation

1) Disconnect electrical connector. Remove lock nut, and unscrew brakelight switch. To install, screw brakelight switch inward

until brakelight plunger contacts brake pedal.

2) Loosen brakelight switch 1/2 to one turn. Install and tighten lock nut on brakelight switch. Install electrical connector. Ensure brakelights and cruise control operate properly.

INPUT SPEED SENSOR

Removal & Installation

Disconnect electrical connector. Remove bolt securing sensor to transmission. Remove input speed sensor from transmission. See Fig. 14. To install, reverse removal procedure.

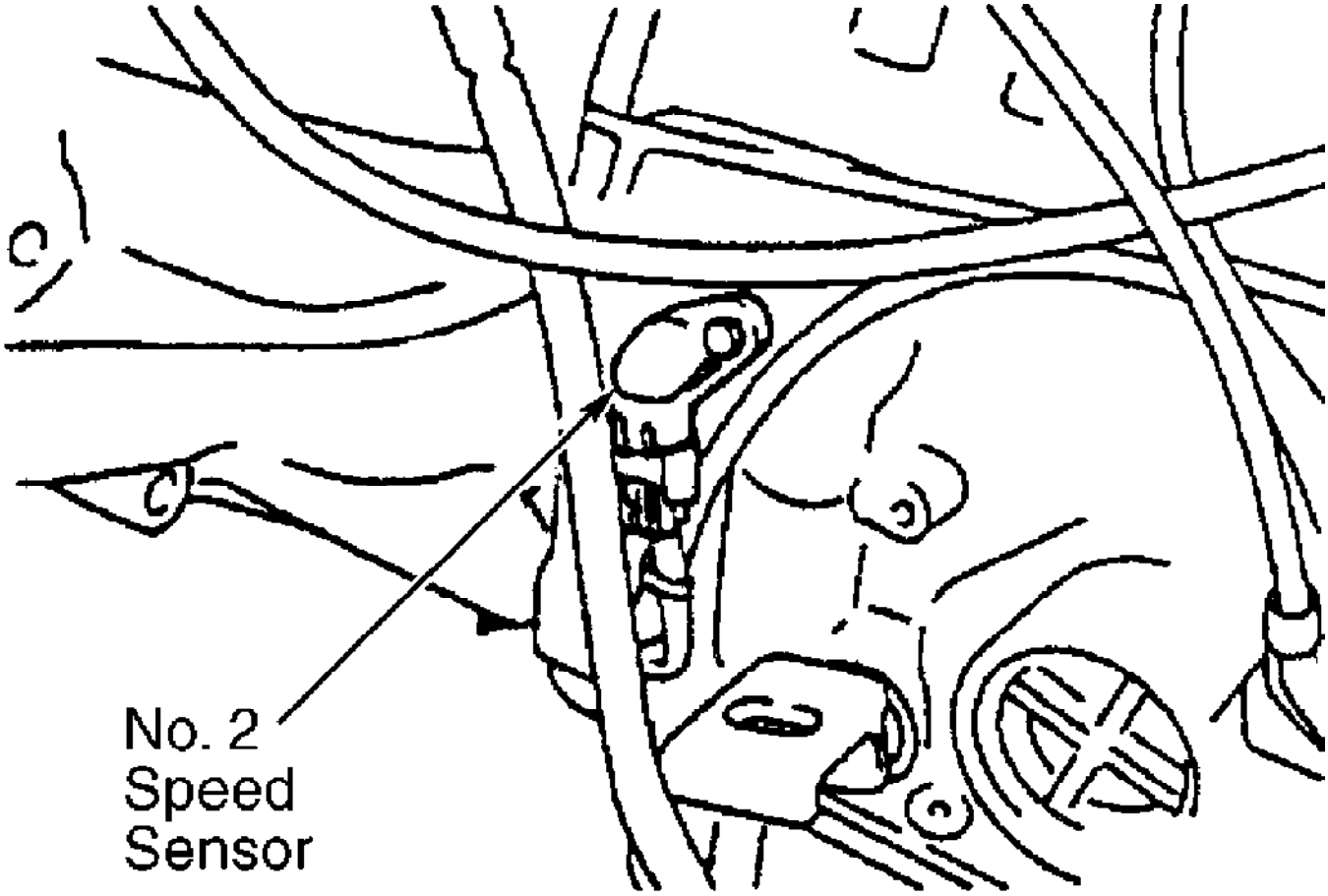


Fig. 14: Locating Input Speed Sensor
Courtesy of Mitsubishi Motor Sales of America.

OIL TEMPERATURE SENSOR

Removal & Installation

Sensor is located on transmission connected to cooler line, near PNP switch. Disconnect electrical connector. Remove oil temperature sensor from transmission. To install, reverse removal procedure using NEW gasket.

OUTPUT SPEED SENSOR

Removal & Installation

Disconnect electrical connector from output speed sensor. See Fig. 15. Remove bolt and output speed sensor. To install, reverse removal procedure.

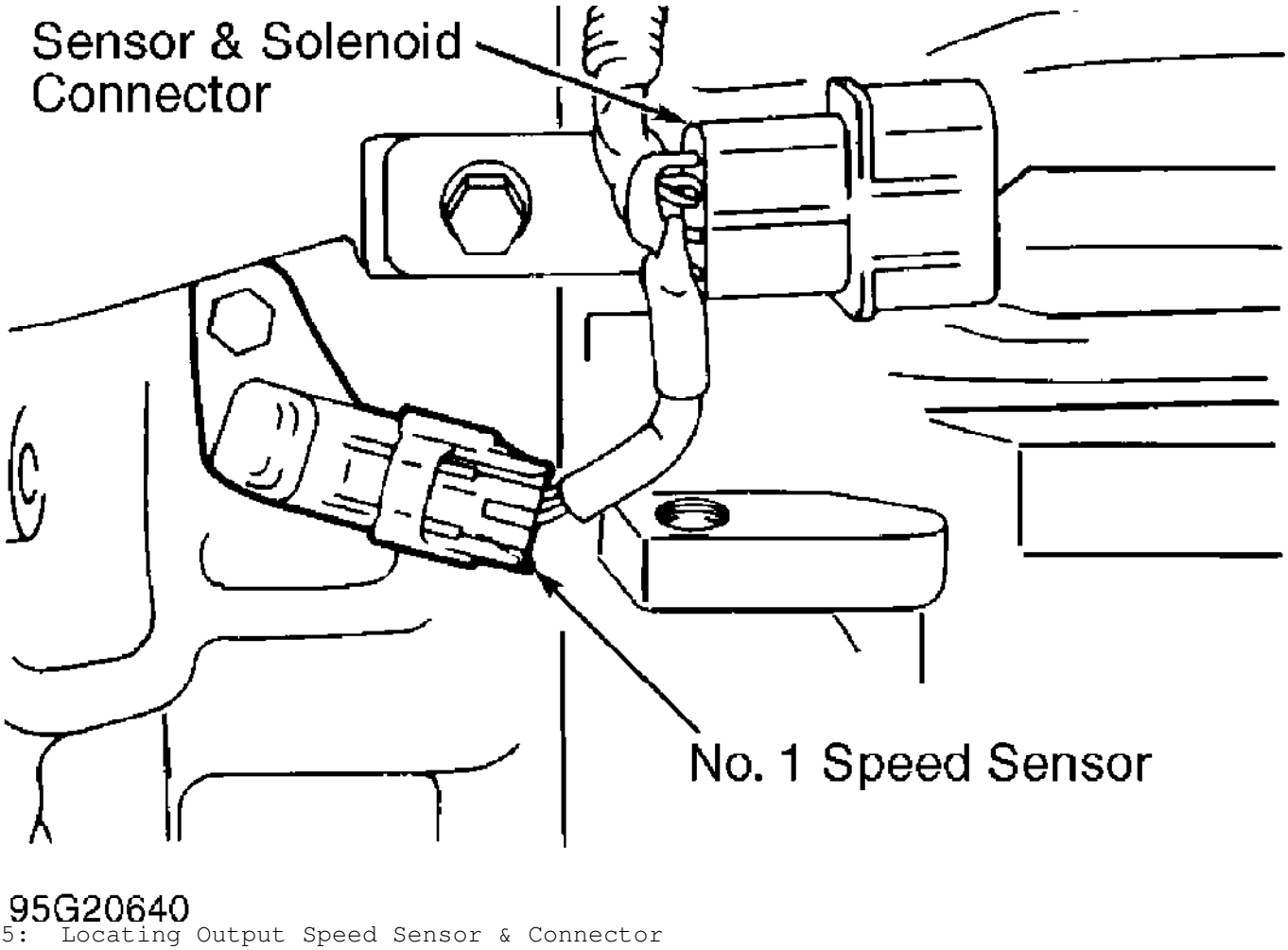


Fig. 15: Locating Output Speed Sensor & Connector
Courtesy of Mitsubishi Motor Sales of America.

PARK/NEUTRAL POSITION (PNP) SWITCH

Removal

Switch is located on side of transmission. Remove manual lever from control shaft on transmission. Bend up tabs on lock washer. Remove lock nut, lock washer and seal from control shaft. Remove retaining bolt and neutral safety switch.

Installation

1) Install switch on control shaft. Loosely install switch retaining bolt. Install seal and lock washer. Install lock nut and tighten to specification. See TORQUE SPECIFICATIONS.

2) Switch must be adjusted. Ensure parking brake is applied. Temporarily install manual lever on control shaft. Place shift lever in Neutral. Remove manual lever. Rotate switch and align reference mark on switch with groove.

3) Hold switch in this position. Tighten retaining bolt to specification. Bend tabs on lock washer over against lock nut. To install remaining components, reverse removal procedure.

SOLENOIDS

Removal & Installation

Solenoids are located on transmission valve body. See Fig. 3. Remove bolt, solenoid and gasket from valve body. To install, reverse removal procedure.

THROTTLE POSITION SENSOR

NOTE: For removal and installation information, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE section.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Park/Neutral Switch Bolt	48 (5.4)
Park/Neutral Switch Lock Nut	35 (4.0)

WIRING DIAGRAMS

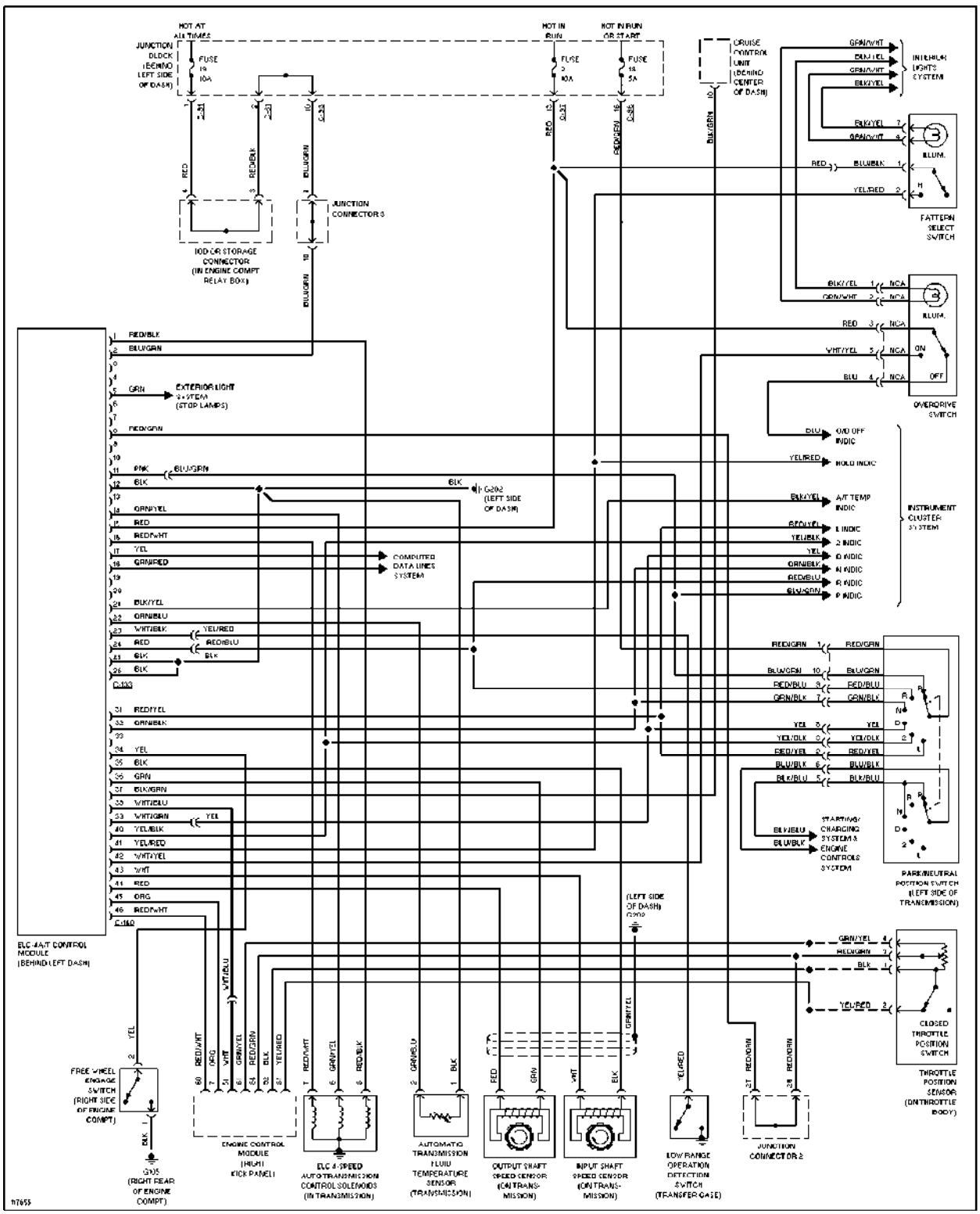


Fig. 16: Transmission Wiring Diagram (1997 Montero)

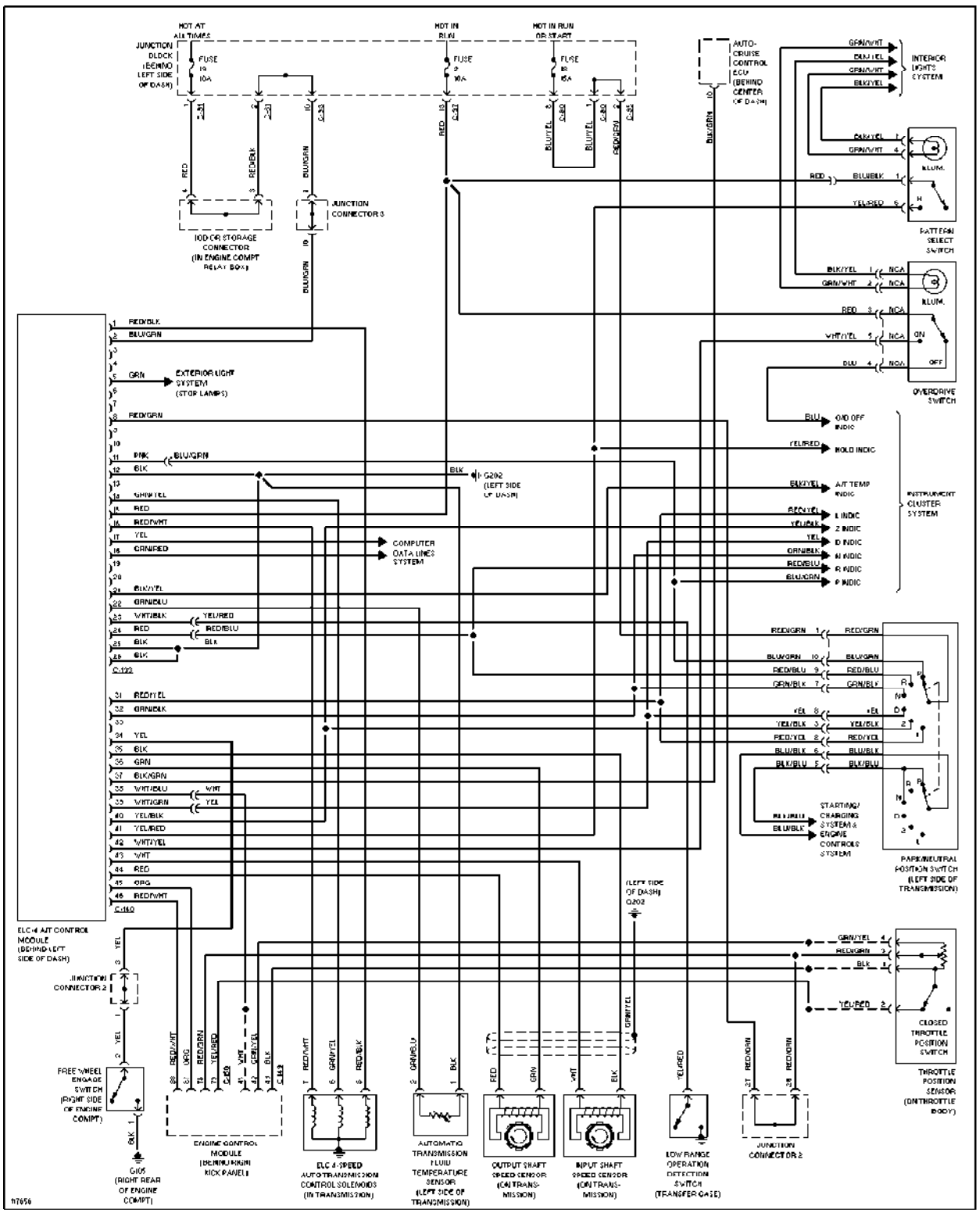


Fig. 17: Transmission Wiring Diagram (1998 Montero)

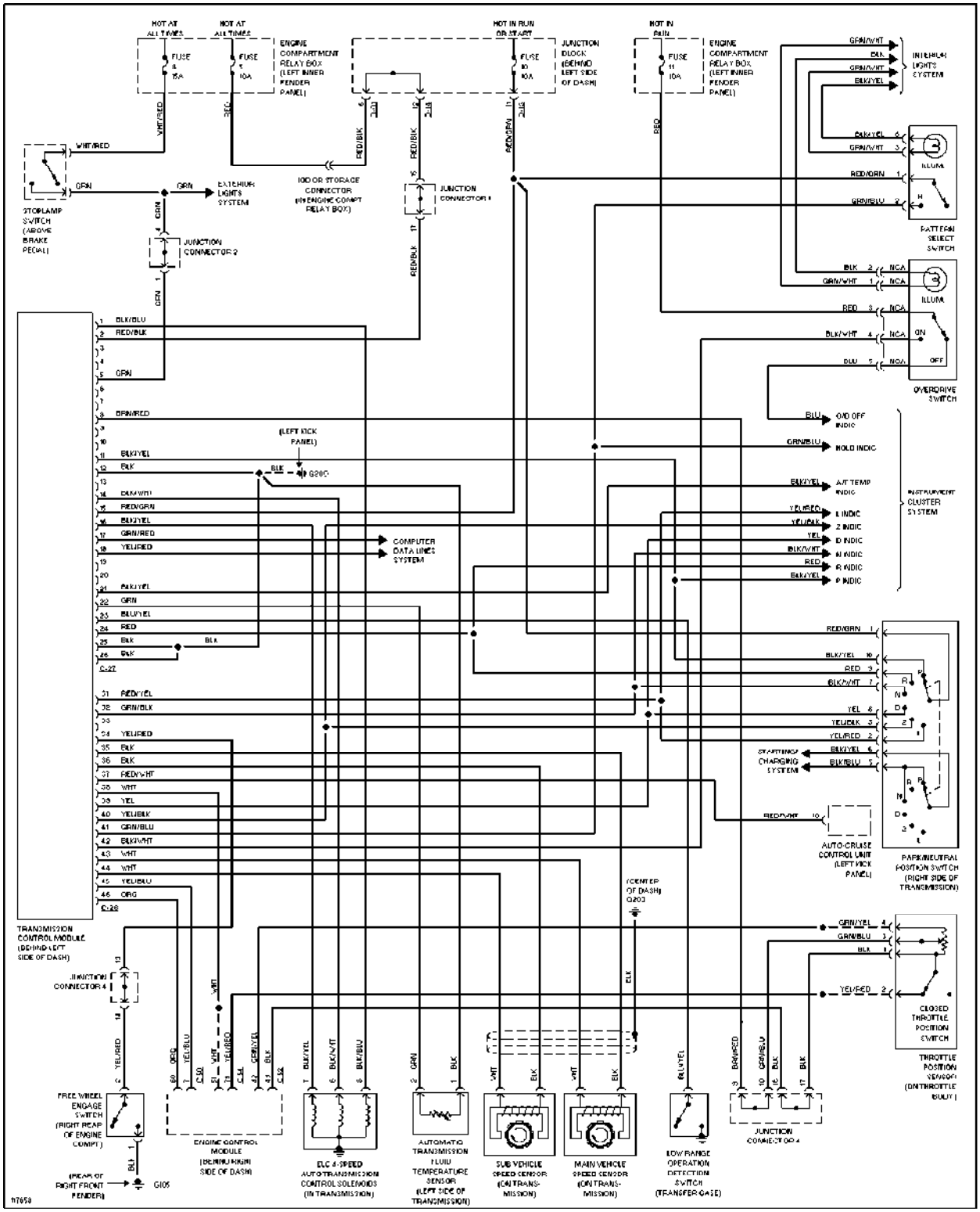


Fig. 18: Transmission Wiring Diagram (1997-98 Montero Sport)

AUTO TRANS DIAGNOSIS

1997-99 Mitsubishi Montero Sport

1997-99 AUTOMATIC TRANSMISSIONS
Mitsubishi Shift Lock Systems

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

DESCRIPTION

Shift interlock system inhibits shift selector lever movement from "P" to drive ranges unless brake pedal is depressed. Key interlock system prevents ignition switch turning to LOCK position unless shift selector lever is in "P" position.

TESTING

KEY INTERLOCK SYSTEM

1) With ignition switch in LOCK position and brake pedal depressed, ensure selector lever cannot be moved from "P" to any other position. Ensure selector lever button cannot be pushed. With ignition switch in ACC position, brake pedal depressed and selector lever button pushed, ensure selector lever can be moved from "P" position to any other position. Ensure selector lever moves smoothly.

2) Ensure ignition key cannot be turned to LOCK position at all selector lever positions other than "P". Ensure ignition key turns smoothly to LOCK position when selector lever is set to "P" and selector lever button is released. If key interlock system is not as specified, adjust key interlock cable. See KEY INTERLOCK CABLE under ADJUSTMENTS.

SHIFT LOCK SYSTEM

1) With ignition switch in ACC position, brake pedal released and selector lever button pushed, ensure selector lever cannot be moved from "P" to any other position. With ignition switch in ACC position, brake pedal depressed and selector lever button pushed, ensure selector lever can be moved from "P" position to any other position.

2) With selector lever in "R" position, ignition switch in ACC position, brake pedal released and selector button pushed, ensure selector lever can be moved from "R" to "P" position. If shift lock system is not as specified, adjust shift lock cable. See SHIFT LOCK CABLE under ADJUSTMENTS.

ADJUSTMENTS

KEY INTERLOCK CABLE

3000GT

Remove front console assembly. Move selector lever to "P". Loosen nut securing key interlock cable. Gently press lock cam "A" down while pushing cable to take up slack. See Fig. 1. Tighten nut to specifications to secure cable. See TORQUE SPECIFICATIONS.

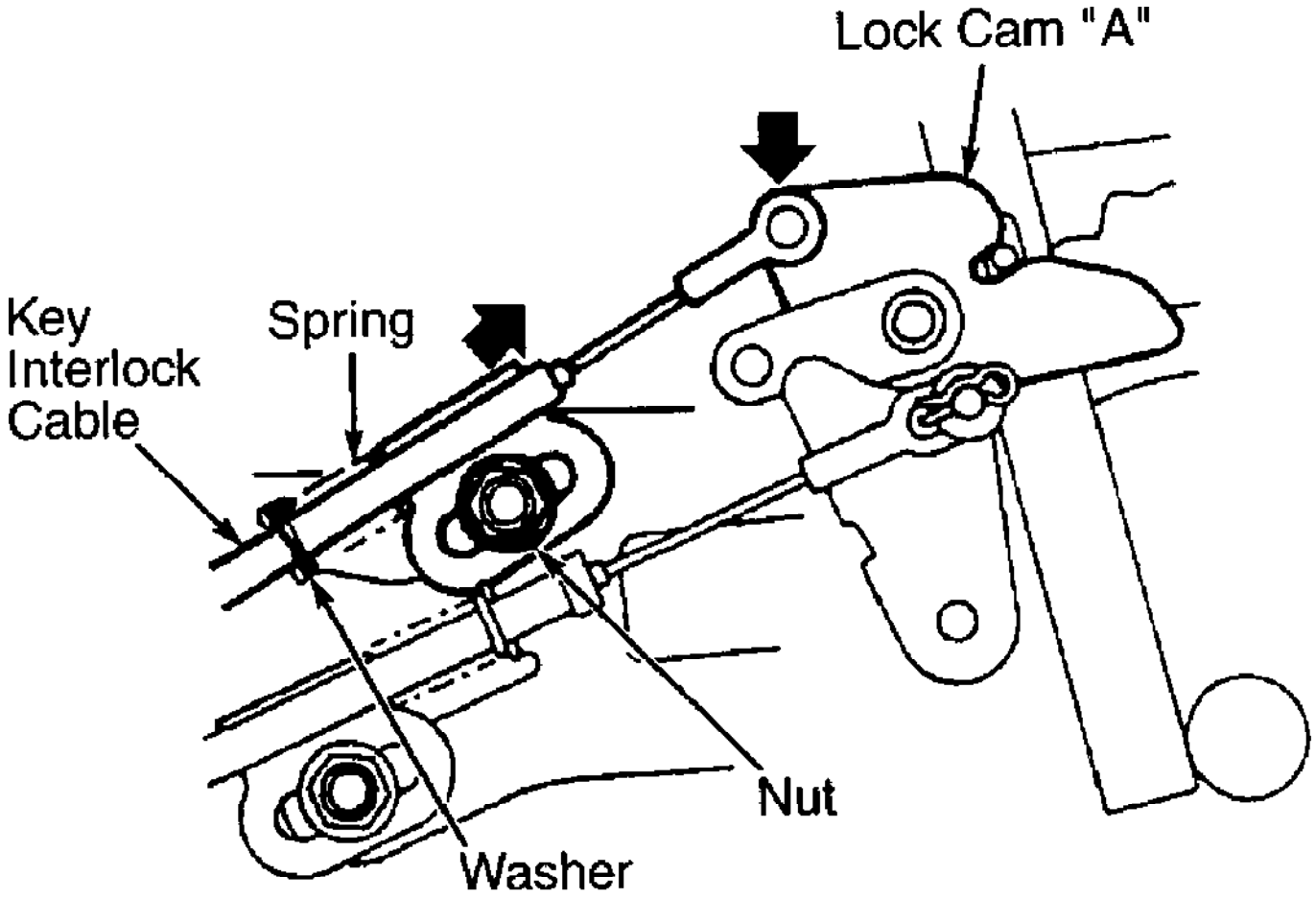


Fig. 1: Adjusting Key Interlock Cable (3000GT)
Courtesy of Mitsubishi Motor Sales of America.

Except 3000GT

Remove front console assembly. Move selector lever to "P". Turn ignition switch to LOCK position. Loosen nut securing key interlock cable. See Fig. 2. Gently push lock cam until pin stops in direction of arrow. Tighten nut to specifications to secure cable. See TORQUE SPECIFICATIONS. Install front console assembly.

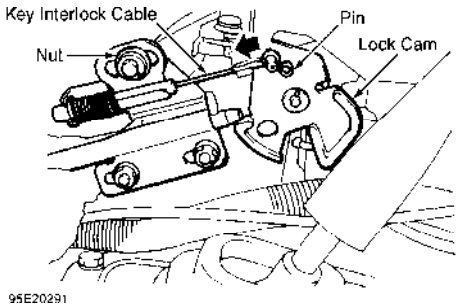


Fig. 2: Adjusting Key Interlock Cable (Except 3000GT)
Courtesy of Mitsubishi Motor Sales of America.

SHIFT LOCK CABLE

3000GT

Remove front console assembly. Move selector lever to "P". Loosen nuts securing shift lock cable and remove washer and cotter pin at cable end. Turn lock cam counterclockwise to move set lever upward. Fit cutout in set lever on pin of lock cam "B". Gently press set lever down while pushing cable to take up slack. See Fig. 3. Tighten nut to specifications to secure cable. See TORQUE SPECIFICATIONS. Ensure that cable end contacts pin on lock cam, then install washer and cotter pin.

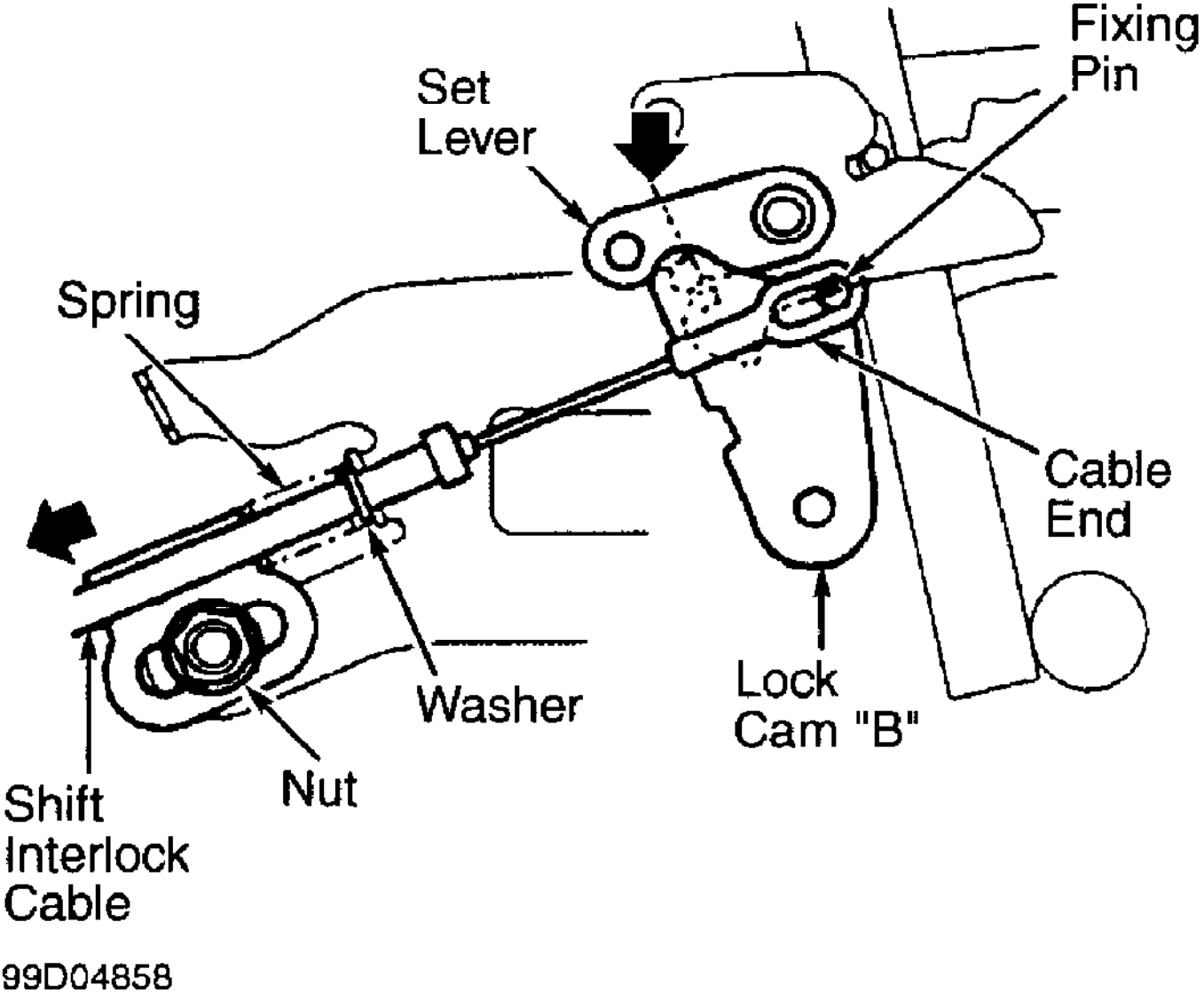


Fig. 3: Adjusting Shift Lock Cable (3000GT)
Courtesy of Mitsubishi Motor Sales of America.

Except 3000GT

Remove front console assembly. Move selector lever to "P". Loosen nuts securing shift lock cable. See Fig. 4. Adjust shift lock cable so end of cable (Red mark) sits between lobe of lock cam, then tighten nut to specifications to secure cable. See TORQUE SPECIFICATIONS. Install front console assembly.

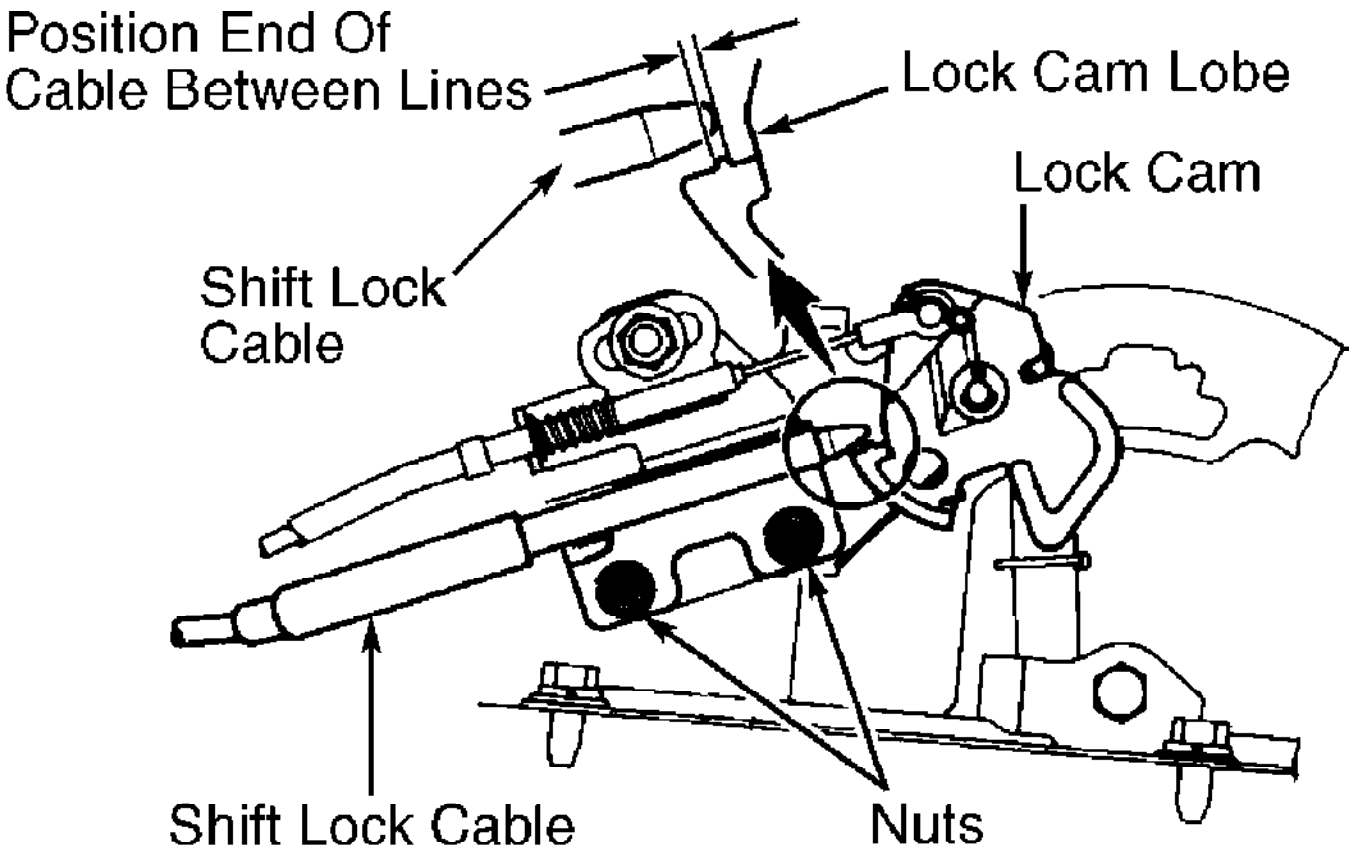


Fig. 4: Adjusting Shift Lock Cable (Except 3000GT)
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Shift Lock Cable-To-Shift Console Assembly	
3000GT	89 (10)
Diamante, Eclipse & Galant	106 (12)
Montero & Montero Sport	44 (5)
Mirage	115 (13)
Key Interlock Cable-To-Shift Console Assembly	
3000GT	89 (10)
Diamante, Eclipse, Galant, Montero & Montero Sport	106 (12)
Mirage	115 (13)

F - BASIC TESTING - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Basic Diagnostic Procedures

Montero Sport - 2.4L

INTRODUCTION

The following diagnostic steps will help prevent overlooking a simple problem. This is also where to begin diagnosis for a no-start condition. The first step in diagnosing any driveability problem is verifying the customer's complaint with a test drive under the conditions the problem reportedly occurred.

Before entering self-diagnostics, perform a careful and complete visual inspection. Most engine control problems result from mechanical breakdowns, poor electrical connections or damaged/misrouted vacuum hoses. Before condemning the computerized system, perform each test listed in this article.

PRELIMINARY INSPECTION & ADJUSTMENTS

VISUAL INSPECTION

Visually inspect all electrical wiring, looking for chafed, stretched, cut or pinched wiring. Ensure electrical connectors fit tightly and are not corroded. Ensure vacuum hoses are properly routed and are not pinched or cut. See M - VACUUM DIAGRAMS - 2.4L article to verify routing and connections (if necessary). Inspect air induction system for possible vacuum leaks.

MECHANICAL INSPECTION

Compression

Check engine mechanical condition with a compression gauge, vacuum gauge, or an engine analyzer. See engine analyzer manual for specific instructions.

WARNING: DO NOT use ignition switch during compression tests on fuel injected vehicles. Use a remote starter to crank engine. Fuel injectors on many models are triggered by ignition switch during cranking mode, which can create a fire hazard or contaminate the engine's oiling system.

Check engine compression with engine at normal operating temperature, all spark plugs removed and throttle wide open.

COMPRESSION SPECIFICATIONS TABLE

Application (1)	Specification
Compression Ratio	
2.4L (VIN G)	9.5:1
Compression Pressure	
2.4L (VIN G)	192 psi (13.4 kg/cm²)

(1) - See A - ENGINE/VIN ID article for VIN information.

Exhaust System Backpressure

The exhaust system can be tested with a vacuum or pressure gauge. If using a pressure gauge, remove HO2S or air injection check valve (if equipped). Connect a 0-5 psi pressure gauge and run engine at 2500 RPM. If exhaust system backpressure is greater than 2 psi, exhaust system or catalytic converter is plugged.

If using a vacuum gauge, connect vacuum gauge hose to intake manifold vacuum port. Start engine. Observe vacuum gauge. Open throttle part way and hold steady. If vacuum gauge indication slowly drops after stabilizing, inspect exhaust system for restriction.

FUEL SYSTEM

WARNING: ALWAYS relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

FUEL PRESSURE

Relieving Fuel Pressure

1) On Montero Sport, remove cargo compartment carpet, remove access plate and disconnect fuel pump harness connector. On all other models, remove rear seat cushion and remove access plate if required to disconnect fuel pump harness connector.

2) On all models, start engine. Let engine run until it stops. Turn ignition off. Disconnect negative battery cable. Connect fuel pump harness connector. Reinstall rear seat (if necessary.)

WARNING: Before disconnecting high pressure fuel hose at fuel delivery pipe, cover fuel hose connection with a rag. Some residual fuel pressure may still be in system.

Pressure Testing

1) Relieve fuel pressure. See RELIEVING FUEL PRESSURE. On models with fuel rail service valve, connect fuel pressure gauge to fuel rail. On models without fuel rail service valve, disconnect high pressure fuel hose at fuel delivery pipe. Remove throttle body bracket (if necessary). Connect fuel pressure gauge with adapter between fuel delivery pipe and high pressure hose. See Fig. 1.

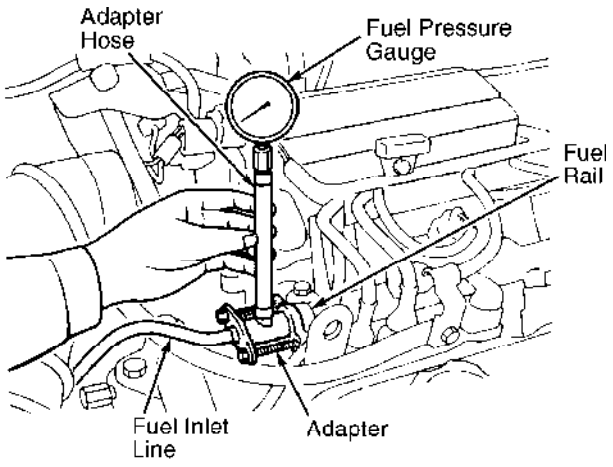


Fig. 1: Installing Fuel Pressure Tester (Typical)
Courtesy of Mitsubishi Motor Sales of America.

2) Operate fuel pump by connecting battery voltage to fuel pump test terminal. See FUEL PUMP TEST TERMINAL LOCATION table. Ensure

no fuel leaks are present. Disconnect battery voltage from fuel pump test terminal.

FUEL PUMP TEST TERMINAL LOCATION TABLE

Application	Wire Color	Location
Montero	White	(1)

(1) - On main wiring harness, near right center of firewall.

3) Start engine and allow it to idle. Measure fuel pressure with vacuum hose connected to fuel pressure regulator. Record fuel pressure reading. See FUEL PUMP PERFORMANCE table. Disconnect and plug vacuum hose from fuel pressure regulator. Record fuel pressure reading.

4) Check for fuel pressure in fuel return hose by gently pinching hose while increasing engine speed. If fuel volume is low, fuel pressure in return hose will not be felt. Increase engine speed to 2500-3000 RPM, 2-3 times. Return engine to idle. Fuel pressure should not drop when engine is returned to idle.

5) Turn ignition off. Ensure fuel pressure reading does not decrease within 2 minutes. If a decrease is noted, monitor speed of decrease.

6) If fuel pressure is lower than specification, fuel pressure drops at idle after increasing engine speed to 2500-3000 RPM, or no fuel pressure in fuel return hose can be felt, check for clogged fuel filter, or faulty fuel pressure regulator or fuel pump.

7) If fuel pressure is greater than specification, check for a faulty fuel pressure regulator or plugged fuel return line. If fuel pressure does not change when vacuum hose to regulator is connected or disconnected, check for a leaking or clogged vacuum hose to fuel pressure regulator or faulty fuel pressure regulator.

8) If fuel pressure decreases suddenly after engine is stopped, check valve in fuel pump is not seated. Replace fuel pump. If fuel pressure drops slowly, fuel injector is leaking or fuel pressure regulator valve seat is leaking. Check for faulty fuel injector or fuel pressure regulator. Repair as necessary.

9) When fuel pressure test is complete, repeat fuel pressure release procedure before disconnecting fuel pressure gauge. Install NEW "O" ring at end of high pressure hose. Check for fuel leaks.

REGULATED FUEL PRESSURE TABLE

Application	At Idle w/Vacuum psi (kg/cm²)	At Idle w/o Vacuum psi (kg/cm²)
Montero Sport	38 (2.7)	47-50 (3.3-3.5)

MFI Control Relay

Multipurpose relay switches power to vehicle sensors and actuators including Volume Airflow (VAF) sensor, crankshaft position sensor, idle speed control, injectors and fuel pump. When ignition switch is turned to ON position, PCM energizes coils controlling injectors, VAF sensor and idle air control. When ignition switch is turned to START position, PCM energizes coils (through park/neutral position switch on A/T models) to supply power to fuel pump. Relay failure will cause a no-start condition. For testing procedure, see I - SYSTEM/COMPONENT TESTS - 2.4L article.

IGNITION CHECKS

NOTE: Perform all circuit tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure.

SPARK

Check for spark at coil wire (if applicable) and at each spark plug wire using a high output spark tester. Check spark plug wire resistance on suspect wires. Wire resistance should not exceed 22,000.

CAMSHAFT POSITION (CMP) SENSOR

For CMP sensor testing procedure, see appropriate G - TESTS W/CODES - 2.4L article.

CRANKSHAFT POSITION (CKP) SENSOR

For CKP sensor testing procedure, see appropriate G - TESTS W/CODES - 2.4L article.

HALL EFFECT IGNITION

Ignition Coil Resistance

Using a DVOM, measure primary coil resistance between positive and negative terminals of coil. See Fig. 2. Measure secondary coil resistance between coil positive terminal and ignition coil tower. Primary and secondary coil resistance should be within specification. See IGNITION COIL RESISTANCE table.

IGNITION COIL RESISTANCE TABLE - Ohms @ 68°F (20°C)

Application	Primary	Secondary
2.4L (VIN G)	.9-1.2	20,000-29,000

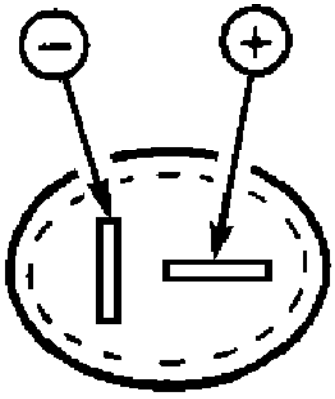


Fig. 2: Identifying Ignition Coil Connectors Terminals
Courtesy of Mitsubishi Motor Sales of America.

IDLE SPEED & IGNITION TIMING

Ensure idle speed and ignition timing are set to specification. See IGNITION TIMING SPECIFICATIONS table. For adjustment procedures, see D - ADJUSTMENTS - 2.4L article.

IGNITION TIMING SPECIFICATIONS TABLE (Degrees BTDC @ RPM)

Application	(1) Basic	(2) (3) Actual
2.4L	2-8 @ 650-850	10 @ 650-850

(1) - With ignition timing adjustment connector grounded or vacuum hose (farthest from distributor) disconnected.
(2) - With ignition timing adjustment connector ungrounded or vacuum hose (farthest from distributor) connected. Actual ignition timing is approximate and may fluctuate.
(3) - If vehicle altitude is more than 2300 feet above sea level, actualtiming may be advanced (5 degrees).

SUMMARY

If no faults were found while performing BASIC DIAGNOSTIC PROCEDURES, proceed to appropriate G - TESTS W/CODES - 2.4L article. If no hard codes are found in self-diagnostics, proceed to H - TESTS W/O CODES - 2.4L article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

F - BASIC TESTING - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Basic Diagnostic Procedures

Montero Sport - 3.0L

INTRODUCTION

The following diagnostic steps will help prevent overlooking a simple problem. This is also where to begin diagnosis for a no-start condition. The first step in diagnosing any driveability problem is verifying the customer's complaint with a test drive under the conditions the problem reportedly occurred.

Before entering self-diagnostics, perform a careful and complete visual inspection. Most engine control problems result from mechanical breakdowns, poor electrical connections or damaged/misrouted vacuum hoses. Before condemning the computerized system, perform each test listed in this article.

PRELIMINARY INSPECTION & ADJUSTMENTS

VISUAL INSPECTION

Visually inspect all electrical wiring, looking for chafed, stretched, cut or pinched wiring. Ensure electrical connectors fit tightly and are not corroded. Ensure vacuum hoses are properly routed and are not pinched or cut. See M - VACUUM DIAGRAMS - 3.0L article to verify routing and connections (if necessary). Inspect air induction system for possible vacuum leaks.

MECHANICAL INSPECTION

Compression

Check engine mechanical condition with a compression gauge, vacuum gauge, or an engine analyzer. See engine analyzer manual for specific instructions.

WARNING: DO NOT use ignition switch during compression tests on fuel injected vehicles. Use a remote starter to crank engine. Fuel injectors on many models are triggered by ignition switch during cranking mode, which can create a fire hazard or contaminate the engine's oiling system.

Check engine compression with engine at normal operating temperature, all spark plugs removed and throttle wide open.

COMPRESSION SPECIFICATIONS TABLE

Application (1)	Specification
Compression Ratio	
3.0L	
(VIN H & J)	10.0:1
(VIN K)	8.0:1
(VIN P)	9.0:1
Compression Pressure	
3.0L	
(VIN H & P)	171 psi (12.0 kg/cm²)
(VIN J)	185 psi (13.0 kg/cm²)

(VIN K) ..... 156 psi (10.9 kg/cm²)

(1) - See A - ENGINE/VIN ID article for VIN information.

Exhaust System Backpressure

The exhaust system can be tested with a vacuum or pressure gauge. If using a pressure gauge, remove HO2S or air injection check valve (if equipped). Connect a 0-5 psi pressure gauge and run engine at 2500 RPM. If exhaust system backpressure is greater than 2 psi, exhaust system or catalytic converter is plugged.

If using a vacuum gauge, connect vacuum gauge hose to intake manifold vacuum port. Start engine. Observe vacuum gauge. Open throttle part way and hold steady. If vacuum gauge indication slowly drops after stabilizing, inspect exhaust system for restriction.

FUEL SYSTEM

WARNING: ALWAYS relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

FUEL PRESSURE

Relieving Fuel Pressure

1) On Montero Sport, remove cargo compartment carpet, remove access plate and disconnect fuel pump harness connector. On all other models, remove rear seat cushion and remove access plate if required to disconnect fuel pump harness connector.

2) On all models, start engine. Let engine run until it stops. Turn ignition off. Disconnect negative battery cable. Connect fuel pump harness connector. Reinstall rear seat (if necessary.)

WARNING: Before disconnecting high pressure fuel hose at fuel delivery pipe, cover fuel hose connection with a rag. Some residual fuel pressure may still be in system.

Pressure Testing

1) Relieve fuel pressure. See RELIEVING FUEL PRESSURE. On models with fuel rail service valve, connect fuel pressure gauge to fuel rail. On models without fuel rail service valve, disconnect high pressure fuel hose at fuel delivery pipe. Remove throttle body bracket (if necessary). Connect fuel pressure gauge with adapter between fuel delivery pipe and high pressure hose. See Fig. 1.

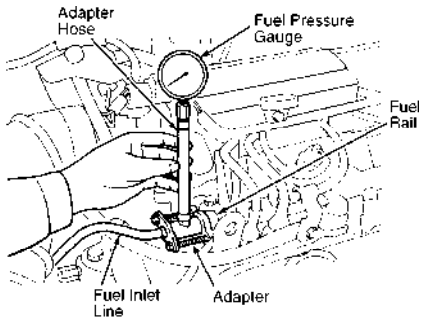


Fig. 1: Installing Fuel Pressure Tester (Typical)
Courtesy of Mitsubishi Motor Sales of America.

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Application	Wire Color	Location
Montero	White	(1)

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9) When fuel pressure test is complete, repeat fuel pressure release procedure before disconnecting fuel pressure gauge. Install NEW "O" ring at end of high pressure hose. Check for fuel leaks.

REGULATED FUEL PRESSURE TABLE

Application	At Idle w/Vacuum psi (kg/cm²)	At Idle w/o Vacuum psi (kg/cm²)
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MFI Control Relay

Multipurpose relay switches power to vehicle sensors and actuators including Volume Airflow (VAF) sensor, crankshaft position sensor, idle speed control, injectors and fuel pump. When ignition switch is turned to ON position, PCM energizes coils controlling injectors, VAF sensor and idle air control. When ignition switch is turned to START position, PCM energizes coils (through park/neutral position switch on A/T models) to supply power to fuel pump. Relay failure will cause a no-start condition. For testing procedure, see I - SYSTEM/COMPONENT TESTS - 3.0L article.

IGNITION CHECKS

NOTE: Perform all circuit tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure.

SPARK

Check for spark at coil wire (if applicable) and at each spark plug wire using a high output spark tester. Check spark plug wire resistance on suspect wires. Wire resistance should not exceed 22,000.

CAMSHAFT POSITION (CMP) SENSOR

For CMP sensor testing procedure, see appropriate G - TESTS W/CODES - 3.0L article.

CRANKSHAFT POSITION (CKP) SENSOR

For CKP sensor testing procedure, see appropriate G - TESTS W/CODES - 3.0L article.

DISTRIBUTORLESS IGNITION SYSTEM (DIS - V6)

Ignition Coil Resistance

1) Measure primary coil resistance between terminal No. 1 (power terminal) and each individual coil terminal using a DVOM. See Fig. 2. To check secondary coil resistance, measure resistance between towers of each individual coil.

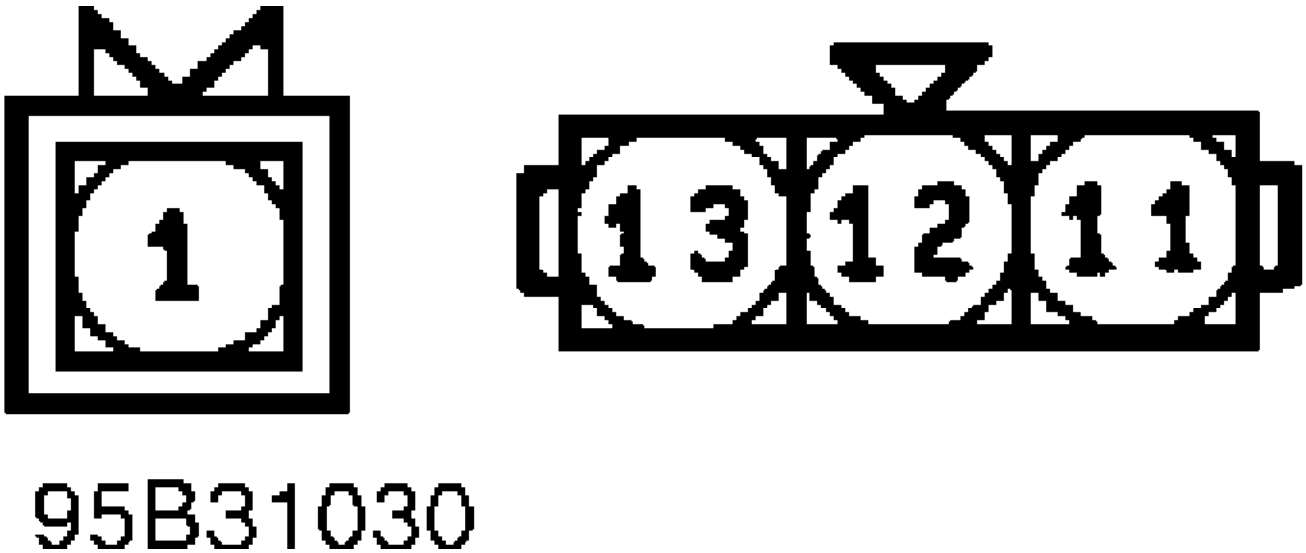

Fig. 2: Identifying Ignition Coil Connector Terminals (DIS)
Courtesy of Mitsubishi Motor Sales of America.

2) Replace coil if primary and secondary coil resistances are not within specification. See IGNITION COIL RESISTANCE (V6) table.

IGNITION COIL RESISTANCE TABLE (V6) - Ohms @ 68°F (20°C)

Application	Primary	Secondary

3.0L			
(VIN H)	.72-.88	.....	10,300-13,920
(VIN J & K)	.67-.81	.....	11,300-15,300

Power Transistor

1) To test section of power transistor that controls cylinders No. 1 and 4 of ignition coil, disconnect power transistor connector. Using a 1.5-volt dry cell battery, connect negative end of 1.5-volt battery to terminal No. 4 of power transistor and positive end to terminal No. 3. See Fig. 3.

2) Using an analog ohmmeter, check for continuity between terminals No. 4 and 13 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

3) To test section of power transistor that controls cylinders No. 2 and 5 of ignition coil, connect negative end of 1.5-volt battery to terminal No. 4 of power transistor and positive end to terminal No. 2.See Fig. 3.

4) Using an analog ohmmeter, check for continuity between terminals No. 4 and 12 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

5) To test section of power transistor that controls cylinders No. 3 and 6 of ignition coil, connect negative end of 1.5-volt battery to terminal No. 4 of power transistor and positive end to terminal No. 1.See Fig. 3.

6) Using an analog ohmmeter, check for continuity between terminals No. 4 and 11 of power transistor. Continuity should exist. With positive end of 1.5-volt battery disconnected, there should be no continuity. Replace power transistor if it fails test.

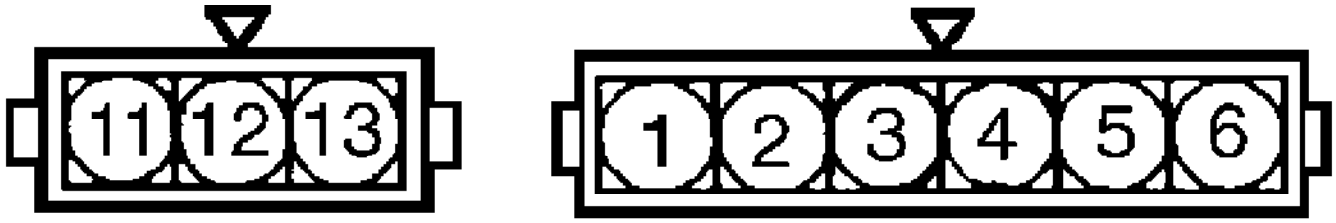

Fig. 3: Identifying Power Transistor Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

IDLE SPEED & IGNITION TIMING

Ensure idle speed and ignition timing are set to specification. See IGNITION TIMING SPECIFICATIONS table. For adjustment procedures, see D - ADJUSTMENTS - 3.0L article.

IGNITION TIMING SPECIFICATIONS TABLE (Degrees BTDC @ RPM)

Application	(1) Basic	(2) (3) Actual
3.0L	2-8 @ 600-800	15 @ 600-800

(1) - With ignition timing adjustment connector grounded or vacuum hose (farthest from distributor) disconnected.
(2) - With ignition timing adjustment connector ungrounded or vacuum hose (farthest from distributor) connected.

Actual ignition timing is approximate and may fluctuate.
(3) - If vehicle altitude is more than 2300 feet above sea level, actualtiming may be advanced (5 degrees).

SUMMARY

If no faults were found while performing BASIC DIAGNOSTIC PROCEDURES, proceed to appropriate G - TESTS W/CODES - 3.0L article. If no hard codes are found in self-diagnostics, proceed to H - TESTS W/O CODES - 3.0L article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

* BRAKE SYSTEM UNIFORM INSPECTION GUIDELINES *

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Brake Systems - Motorist Assurance Program
Standards For Automotive Repair

All Makes & Models

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OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS
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ACCUMULATORS
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ANTI-LOCK BRAKE SYSTEMS
BACKING PLATES
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BRAKE STOPLIGHT SWITCHES
BULB SOCKETS
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CALIPER HARDWARE
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HOSES
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HYDRO-BOOSTERS
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PRESSURE SWITCHES
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VACUUM BOOSTERS
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VALVES
WHEEL ATTACHING HARDWARE
WHEEL BEARINGS, RACES AND SEALS
WHEEL CYLINDERS
WIRING HARNESSES

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt:

1) a Pledge of Assurance to their Customers and
2) the Motorist Assurance Program Standards of Service.

All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not

satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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Washington, DC 20005
Phone (202) 712-9042 Fax (202) 216-9646
January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer’s best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer’s recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer’s design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer’s discard specifications.

Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement
A - Part no longer performs intended purpose
B - Part does not meet a design specification (regardless of performance)
C - Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement
1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions

and make an informed decision about how to proceed.

BRAKES

SERVICE PROCEDURES REQUIRED & SUGGESTED FOR PROPER VEHICLE OPERATION

Some states may have specifications that differ from OEM. Check your local/state regulations. Where state or local laws are stricter, they take precedence over these guidelines.

ACCELEROMETERS (G SENSOR OR LATERAL)

ACCELEROMETER INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Loose	B	Require repair or replacement.
Missing	C	Require replacement.
Out of position	B	Require re-positioning to vehicle manufacturer's specifications.
Output signal incorrect	B	Require replacement.

ACCUMULATORS

ACCUMULATOR INSPECTION

Condition	Code	Procedure
Leaking	B	Require replacement.
Missing	C	Require replacement.
Pre-charge incorrect	B	Require replacement.

ANCHOR PINS

See BACKING PLATES.

ANTI-LOCK BRAKE SYSTEMS

NOTE: Anti-lock brakes are an integral part of the brake system. It is essential that the anti-lock brakes function properly when brake service is performed.

Anti-lock brake systems are commonly referred to as "ABS" and will be referred to as "ABS" throughout these guidelines. Some ABS components also function as part of a traction control system (TCS).

WARNING: When diagnosing and servicing high pressure components, observe safety procedures and equipment requirements established by the vehicle manufacturer to reduce the possibility of serious personal injury.

NOTE: Intermittent electrical conditions are often caused by a loss of ground, poor connection, or water intrusion into the wiring harness.

NOTE: Electro-magnetic interference (EMI) may be caused by incorrect installation of accessories or components. EMI can result in improper system operation.

BACKING PLATES

BACKING PLATE INSPECTION

Condition	Code	Procedure
Anchor pin bent	B	Require repair or replacement.
Anchor pin broken	A	Require replacement.
Anchor pin worn, affecting structural integrity	B	Require replacement.
Backing plate bent	B	Require repair or replacement.
Backing plate broken	A	Require replacement.
Backing plate cracked	B	Require repair or replacement.
Corroded, affecting structural integrity	A	Require replacement.
Loose	B	Require repair or replacement.
Missing	C	Require replacement.
Shoe lands worn	A	Require repair or replacement.

BRAKE FLUID

CAUTION: Most manufacturers prohibit the use of DOT 5 brake fluid in a system equipped with ABS.

DOT 3, DOT 4, and DOT 5.1 brake fluids are clear or light amber in color. DOT 5 brake fluid is violet in color. Correct fluid required for the brake system is stamped on the master cylinder cover.

BRAKE FLUID INSPECTION

Condition	Code	Procedure
Beyond service interval	3	Suggest flushing and refilling with correct fluid.
Brake fluid type incorrect	B	Require flushing and refilling with correct fluid.
Contaminated, for example, fluid other than brake fluid present	A or B	(1) Require service.
Hydraulic component overhaul or replacement	3	Suggest flushing and refilling with correct fluid.
Rubber master cylinder cover gasket distorted and gummy	A	(2) Require replacement of gasket.

(1) - If a fluid other than brake fluid is present in the brake system which DOES affect the rubber parts, the required service is to:

* Remove all components having rubber parts from the system.
* Flush lines with denatured alcohol or brake cleaner
* Repair or replace all components having rubber parts
* Flush and fill with correct brake fluid. (Code A)

If a fluid other than brake fluid is present in the brake

system which DOES NOT affect the rubber parts, the required service is to flush and fill with the correct brake fluid. (Code B)

(2) - This condition may indicate contaminated brake fluid.

BRAKE FRICTION MATERIAL

See FRICTION MATERIAL.

BRAKE PADS

See FRICTION MATERIAL.

BRAKE PEDALS

BRAKE PEDAL INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Pedal pad missing	C	Require replacement of pedal pad.
Pedal pad worn	1	Suggest replacement.
Pivot bushings worn, affecting performance	A	Require replacement of pivot bushings.

BRAKE SHOES

See FRICTION MATERIAL.

BRAKE SHOE HARDWARE

See also SELF-ADJUSTING SYSTEMS.

BRAKE SHOE HARDWARE INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Distorted	A	Require replacement.
Missing	C	Require replacement.
Surfaces rust-pitted	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

BRAKE STOPLIGHT SWITCHES

BRAKE STOPLIGHT INSPECTION

Condition	Code	Procedure
Bent	B	Require replacement.
Broken	A	Require replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.

Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require adjustment or replacement.
Output signal incorrect	B	Require replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Determine cause and correct prior to repair or replacement of part.

BULB SOCKETS

BULB SOCKET INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair or replacement.
Bulb seized in socket	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Connector broken	A	Require repair or replacement.
Connector missing	C	Require replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Leaking	A	Require repair or replacement.
Melted	A	(2) Require replacement.

Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of socket.
(2) - Determine cause and correct prior to repair or replacement of part.

BULBS AND LEDS

NOTE: Copied from Electrical UIGs and modified. Does not include soldered-in components.

BULB AND LED INSPECTION

Condition	Code	Procedure
Application incorrect	B	(1) Require replacement.
Base burned, affecting performance	A	(2) Require repair or replacement.
Base burned, not affecting performance	2	(2) Suggest repair or replacement.
Base corroded, affecting performance	A	Require repair or replacement.
Base corroded, not affecting performance	2	Suggest repair or replacement.
Base loose, affecting performance	B	Require repair or replacement.
Base loose, not affecting performance	1	Suggest repair or replacement.
Burned out	A	Require replacement.
Intermittent	A	Require replacement.
Missing	C	Require replacement.
Seized in socket	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	(2) Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.

Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - Application incorrect includes wrong bulb coating or color.
(2) - Determine cause and correct prior to repair or replacement of part.

CALIPER HARDWARE

CALIPER HARDWARE INSPECTION

Condition	Code		Procedure
Bent	A	..	Require repair or replacement.
Broken	A	..	Require repair or replacement.
Corroded, affecting performance	A	..	Require repair or replacement.
Dust boots on slider pin (bolt) missing	C	...	Require replacement of boots.
Dust boots on slider pin (bolt) torn	A	...	Require replacement of boots.
Missing	C	.....	Require replacement.
Shim bent	A	.....	(1) Require removal or replacement.
Shim (OE standard) missing	C	.....	(2) Require replacement.
Shim out of position	B	.....	(1) Require removal or replacement.
Shim worn	A	.....	(1) Require removal or replacement.
Slider pin (bolt) bent	B	...	Require replacement of slider pin or bolt and lubricants.
Slider pin (bolt) rust-pitted	A	...	Require replacement of slider pin or bolt and lubricants.
Slider pin (bolt) worn	A	...	Require replacement of slider pin or bolt and lubricants.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Worn, affecting performance	A	.....	Require replacement.

(1) - Removal is acceptable if shim is not OE.
(2) - Aftermarket shims may be suggested to reduce noise.

CALIPERS

You are not required to replace or rebuild calipers in axle sets. However, when replacing or rebuilding a caliper due to the conditions that follow, you may suggest servicing, rebuilding, or replacement of the other caliper (on the same axle) for improved performance and preventive maintenance (for example, the part is close to the end of its useful life, replacing the caliper may extend pad life, or contribute to more balanced braking).

CAUTION: When installing loaded calipers, it is required that friction material be matched in axle sets for consistent braking characteristics.

CALIPER INSPECTION

Condition	Code	Procedure
Bleeder port damaged	A	Require repair or replacement of caliper.
Bleeder screw broken off in caliper	A	(1) Require repair or replacement of caliper.
Bleeder screw plugged	A	(1) Require repair or replacement of bleeder screw.
Bleeder screw seized	A	(2) Require replacement of caliper.
Casting corroded, affecting structural integrity	A	Require replacement.
Casting damaged, affecting structural integrity	A	Require replacement.
Dust boot around caliper torn	A	Require replacement of dust boot.
Leaking	A	Require repair or replacement.
Mounting pin threads damaged	A	Require repair or replacement of component with damaged threads.
Mounting pin threads stripped in caliper bracket (threads missing)	A	Require repair or replacement of caliper bracket.
Mounting pin threads stripped in steering knuckle (threads missing)	A	Require repair or replacement of steering knuckle.
Mounting pin threads stripped (threads missing)	A	Require repair or replacement of component with stripped threads.
Parking brake cable support, lever, or return spring bent	A	Require replacement of parts.
Parking brake cable support, lever, or return spring broken	A	Require replacement of parts.
Parking brake mechanism in caliper inoperative	A	Require repair or replacement.
Piston corroded (pitted or peeling chrome plating)	B	Require replacement of piston and rebuilding or replacement of caliper.
Piston damaged, affecting performance	B	Require replacement of piston and rebuilding or replacement of caliper.
Piston damaged, not affecting performance		No service suggested or required.
Piston finish worn off	B	Require replacement of piston and rebuilding or replacement

			of caliper.
Piston sticking	A	.....	Require rebuilding or replacement of caliper.
Slide mechanism sticking	A	...	Require repair or replacement of slide mechanism.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as a bleeder screw that cannot be removed after a practical attempt at removing. Only required if the hydraulic system must be opened.

CONTROLLERS

See ELECTRONIC CONTROLLERS.

DIGITAL RATIO AXLE CONTROLLERS AND BUFFERS (DRAC AND DRAB)

DIGITAL RATIO AXLE CONTROLLER AND BUFFER INSPECTION

Condition	Code	Procedure
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	..... (1) Require replacement.
Connector missing	C	..... Require replacement.
Missing	C	..... Require replacement.
Output signal incorrect .	B	.. Require repair or replacement.
Terminal burned, affecting performance	A	..... (2) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Determine cause and correct prior to repair or replacement of part.

DISABLE SWITCHES

See SWITCHES.

DRUMS

Determine the need to recondition based upon individual drum conditions that follow. Friction material replacement does not require drum reconditioning unless other justifications exist. DO NOT recondition new drums unless they are being pressed or bolted onto an existing hub. It is not necessary to replace drums in axle sets. However, when replacing or reconditioning a drum due to the conditions that follow, you may suggest reconditioning of the other drum on the

same axle to eliminate uneven braking behavior. Always wash drums after servicing or before installing.

DRUM INSPECTION

Condition	Code	Procedure
Balance weight missing		No service suggested or required.
Bell-mouthed, affecting performance	A	Require reconditioning or replacement.
Cooling fin broken		No service suggested or required.
Cracked	B	Require replacement.
Drum diameter is greater than OEM "machine to" specifications but less than "discard at" specifications, and the drum does not require reconditioning	1	(1) Suggest replacement.
Drum diameter will exceed OEM "machine to" specifications after required reconditioning	B	(2) Require replacement.
Hard-spotted	2	Suggest reconditioning or replacement.
Measured diameter is greater than OEM discard specifications	B	Require replacement.
Out-of-round (runout), affecting performance	A	Require reconditioning or replacement.
Out-of-round (runout), exceeding manufacturer's specifications	B	Require reconditioning or replacement.
Scored	B	Require reconditioning or replacement.
Surface threaded due to improper machining	B	Require reconditioning or replacement.
Tapered, affecting performance	A	Require reconditioning or replacement.

(1) - Only applies to vehicles for which OEM "machine to" specifications exist. If OEM does not supply "machine to" specifications, the drum may be worn to discard specifications.
(2) - If OEM does not supply "machine to" specifications, you may machine to discard specifications.

ELECTRICAL PUMPS AND MOTORS

Copied fuel pump conditions from engine UIGs & deleted pulsator from leaking conditions.

ELECTRICAL PUMP AND MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require replacement.
Inoperative	A	(3) Require repair or replacement.
Leaking externally	A	Require repair or replacement.
Leaking internally	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specifications.

ELECTRONIC CONTROLLERS

ELECTRONIC CONTROLLER INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of

			hardware.
Attaching hardware threads damaged	A	...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	...	Require repair or replacement of hardware.
Code set (if applicable)	A	.....	(1) Further inspection required.
Connector broken	A	..	Require repair or replacement.
Connector melted	A	.....	(2) Require repair or replacement.
Connector missing	A	.....	Require repair.
Contaminated	A	..	Require repair or replacement.
Inoperative	B	..	Require repair or replacement. (3) Further inspection required.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable. Check for accepted cleaning procedure.

FLUID

See BRAKE FLUID.

FLUID LEVEL SENSOR SWITCHES

See SWITCHES.

FOUR WHEEL DRIVE SWITCHES

See SWITCHES.

FRICTION MATERIAL

NOTE: Original Equipment Manufacturer (OEM) specifications designate replacement at different thicknesses.

CAUTION: It is required that friction material be matched in axle sets for consistent braking characteristics.

FRICTION MATERIAL INSPECTION

Condition	Code	Procedure
Contaminated, for example, fluid that leaked from caliper, wheel cylinder, or axle seal	A	(1) Require replacement.
Cracked through	B	Require replacement.
Flaking or chunking	B	Require replacement.
Glazed (shiny)	..	No service suggested or required.
Grooves or ridges	..	(2) No service suggested or required.
Permanently attached hardware bent	A	Require replacement.
Permanently attached hardware broken	A	Require replacement.
Permanently attached hardware loose	A	Require replacement.
Permanently attached hardware missing	C	Require replacement.
Permanently attached hardware seized	A	.. Require repair or replacement.
Rivets loose	B	Require replacement.
Separating from backing	B	Require replacement.
Shoe table or web bent	B	Require replacement.
Shoe table or web cracked	A	Require replacement.
Shoe table or web worn, affecting performance	A	Require replacement.
Surface cracking	..	No service suggested or required. Further inspection may be necessary to determine cause.
Tapered wear	B	(3) Suggest replacement.
Thickness of one pad is greater than opposite pad in the same caliper (uneven wear)	..	(4) Replacement of friction material not suggested or required. Further inspection required. See CALIPERS and CALIPER HARDWARE.
Wear indicator device (electronic) contacts rotor	B	(5) Require replacement of appropriate parts.
Wear indicator device (mechanical) bent	..	(6) Further inspection required.
Wear indicator device (mechanical) broken	..	(6) Further inspection required.

Wear indicator device (mechanical) contacts rotor	..	(6) Further inspection required.
Worn close to minimum specifications	1	(7) Suggest replacement.
Worn to, or below minimum specifications	B	Require replacement.

(1) - Identify and repair cause of contamination prior to replacing friction material.
(2) - When reconditioning or replacing drums or rotors, replacement of friction material may be suggested depending on the severity of the grooves or ridges.
(3) - Some vehicles use pads that are tapered by design. Refer to specific vehicle application. If not normal, require replacement of pads and correction of cause.
(4) - Uneven pad thickness is normal on some vehicles. Refer to specific vehicle applications.
(5) - The pad wear indicator light may come on due to other electrical problems.
(6) - Explain to the customer that the purpose of the wear indicator is to alert him or her to check for friction wear. Wear indicators may be bent or broken. Therefore, the friction material must be measured. The need for friction material replacement is determined based upon the conditions stated in this section. Periodic inspection is suggested.
(7) - When the part appears to be close to the end of its useful life, replacement may be suggested.

G SENSORS

See ACCELEROMETERS.

HOSES

HOSE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Blistered	B	Require replacement.
Fitting threads damaged	A	Require repair or replacement.
Fitting threads stripped (threads missing)	A	Require replacement.
Incorrectly secured	B	Require repair.
Inner fabric (webbing) cut	B	Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Outer covering is cracked to the extent that inner fabric of hose		

is visible	B	Require replacement.
Restricted	A	Require replacement.
Routed incorrectly	B	Require repair.

HYDRAULIC MODULATORS

NOTE: Many modulators can only be replaced as complete assemblies. Whenever possible, replace the failed component part. If replacement of the failed part is not possible, then replace the modulator assembly.

HYDRAULIC MODULATOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Disabled	A	Require repair or replacement.
Electrical failure	A	Require repair or replacement.
External leak	A	Require repair or replacement.
Housing cracked	B	Require repair or replacement.
Inoperative (2)	A	Require repair or replacement.
Internal leak	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Valve stuck	A	Require repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

HYDRO-BOOSTERS

NOTE: Hydro-boosters and hydro-electric boosters are combined.

HYDRO-BOOSTER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require replacement.
Connector missing	C	Require replacement.
Does not apply assist, or inadequate assist	A	Require repair or replacement.
Leaking	B	Require repair or replacement.
Leaks fluid at fitting	B	Require tightening or replacement.
Leaks fluid at unit	B	Require repair or replacement.
Leaks fluid from pressure hose(s)	B	Require replacement of hose(s).
Leaks fluid into passenger compartment	B	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to replacement of part.

HYDRO-ELECTRIC BOOSTERS (POWERMASTER)

See HYDRO-BOOSTERS.

IGNITION DISABLE SWITCHES

See SWITCHES.

LATERAL ACCELERATION SWITCHES

See ACCELEROMETERS.

LEDS

See BULBS AND LEDS.

LENSES

LENSE INSPECTION

Condition	Code	Procedure
Application incorrect	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken, affecting performance	A	Require replacement.
Broken, not affecting performance	..	No service suggested or required.
Cracked	A	Require replacement.
Discolored	A	Require replacement.
Leaking	A	Require repair or replacement.
Melted, affecting performance	A	Require replacement.
Melted, not affecting performance	2	Suggest replacement.
Missing	C	Require replacement.

MASTER CYLINDERS

MASTER CYLINDER INSPECTION

Condition	Code	Procedure
Brake fluid leaking from rear of master cylinder bore	B	Require repair or replacement.
Brake pedal drops intermittently	A	(1) Require repair or replacement.
Fluid level low	..	(2) Further inspection required.
Internal valve failure	A	Require repair or replacement.
Master cylinder leaking brake fluid internally	A	Require repair or replacement.
Piston does not return	A	Require repair or replacement.
Ports plugged	A	Require repair or replacement.
Rubber master cylinder cover gasket distorted and gummy	A	(3) Require replacement of the gasket.

(1) - This condition may be normal on some vehicles equipped with anti-lock brakes.
(2) - Refer to OEM procedures for adjusting low fluid level. Inspect for brake hydraulic system leaks and friction material wear.
(3) - This condition may indicate contaminated brake fluid. See BRAKE FLUID.

MODULATORS

See HYDRAULIC MODULATORS.

MOTORS

See ELECTRICAL PUMPS AND MOTORS.

PARKING BRAKE SWITCHES

See SWITCHES.

PARKING BRAKE SYSTEMS

NOTE: The parking brake is an integral part of the brake system. It is important that the parking brake function properly when brake service is performed.

PARKING BRAKE SYSTEM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cable improperly adjusted	B	Require cable adjustment.
Cable or individual wires in the cable are broken	A	Require replacement of cable assembly.
Cable sticking	A	Require cable lubrication.
Cable stuck inside conduit and cannot be lubricated so that parking brake functions properly	A	Require replacement of cable assembly.
Inoperative (1)	A	Require replacement of inoperative parts.
Parking brake parts bent	B	Require repair or replacement of bent parts.
Parking brake parts broken	A	Require replacement of broken parts.
Parking brake parts		

missing	C	..	Require replacement of missing parts.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

(1) - Inoperative includes intermittent operation.

PADS

See FRICTION MATERIAL.

PEDAL TRAVEL SWITCHES

See SWITCHES.

PEDALS

See BRAKE PEDALS.

POWERMASTER

See HYDRO-BOOSTERS.

PUMPS

See ELECTRICAL PUMPS AND MOTORS.

PRESSURE DIFFERENTIAL SWITCHES

See SWITCHES.

PRESSURE SWITCHES

See SWITCHES.

RELAYS

NOTE: Copied from Electrical UIGs

RELAY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Housing broken	A	..... Require replacement.
Housing cracked	2	..... Suggest replacement.
Inoperative (1)	A	..... Require replacement.
Missing	C	..... Require replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance ..	A	..... (2) Require repair or replacement.

Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

ROTORS

Determine the need to recondition based upon individual rotor conditions that follow. Friction material replacement does not require rotor reconditioning unless other justifications exist. DO NOT recondition new rotors unless they are being pressed or bolted onto an existing hub. It is not necessary to replace rotors in axle sets. However, when replacing or reconditioning a rotor due to the conditions that follow, you may suggest reconditioning of the other rotor on the same axle to eliminate uneven braking behavior.

Determine the need to replace based upon the individual rotor conditions that follow. Reconditioning is defined as machining and block sanding, or block sanding only. Block sanding is defined as using 120-150 grit sandpaper with moderate to heavy force for 60 seconds per side. Always wash rotors after servicing or before installing.

ROTOR INSPECTION

Condition	Code	Procedure
Corrosion affecting structural integrity	A	(1) Require replacement.
Cracked	B	Require replacement.
Hard spots	2	Suggest reconditioning or replacement of rotor according to OEM specifications.
Lateral runout (wobble) exceeds OEM specifications	B	Require re-indexing, reconditioning, or replacement according to specifications.
Measured thickness is less than OEM discard specifications	B	Require replacement.
Rotor thickness is less than OEM "machine to" specifications but thicker than "discard at" specifications, and the rotor does not require reconditioning	1	(2) Suggest replacement.
Rotor thickness will be less than OEM "machine to" specifications after required		

reconditioning	B	..... (3) Require replacement.
Surface is rust-pitted ..	B	..... Require reconditioning or replacement of rotor according to OEM specifications.
Surface is scored	B	... (4) Require reconditioning or replacement of rotor according to OEM specifications.
Thickness variation (parallelism) exceeds OEM specifications	B	..... Require reconditioning or replacement of rotor according to OEM specifications.

(1) - Examples of severe corrosion are: composite plate separated from friction surfaces and cooling fins cracked or missing.
(2) - Only applies to vehicles for which OEM "machine to" specifications exist. If OEM does not supply "machine to" specifications, the rotor may be worn to discard specifications.
(3) - If OEM does not supply "machine to" specifications, you may machine to discard specifications.
(4) - Scoring is defined as grooves or ridges in the friction contact surface. Some vehicle manufacturers require machining when scoring exceeds their allowable specifications.

SELF-ADJUSTING SYSTEMS

SELF-ADJUSTING SYSTEM INSPECTION

Condition	Code	Procedure
Bent	A	... Require repair or replacement of bent part.
Broken	A	... Require repair or replacement of broken part.
Inoperative	A	..... (1) Require repair or replacement of inoperative parts.
Missing	C	..... Require replacement of missing part.
Star wheel does not turn freely	A	.. Require repair or replacement.

(1) - Inoperative includes intermittent operation.

SHOE HARDWARE

See BRAKE SHOE HARDWARE.

SHOES

See FRICTION MATERIAL.

SOCKETS

See BULB SOCKETS.

SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE)

NOTE: Copied Vehicle Speed Sensors from Engine UIGs & added Air Gap incorrect, loose, and wire lead misrouted. For "contaminated" removed coolant & fuel examples from note.

SPEED SENSOR INSPECTION

Condition	Code	Procedure
Air gap incorrect	B	(1) Require adjustment or replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(3) Require repair or replacement.
Inoperative	B	(4) Require repair or replacement. Further inspection required.
Lead routing incorrect	B	Require rerouting according to vehicle manufacturer's specifications.
Leaking	A	Require repair or replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Sensor housing cracked	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead misrouted	B	Require re-routing according to vehicle manufacturer's

specifications.
Wire lead open ..... A .. Require repair or replacement.
Wire lead shorted ..... A .. Require repair or replacement.

(1) - If a sensor is not adjustable, further inspection is required to identify and correct cause.
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as metal particles or water. Require repair or replacement.
(4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

STEEL BRAKE LINES

STEEL BRAKE LINE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Corroded, affecting structural integrity ...	A	Require replacement.
Fitting incorrect (for example, compression fitting)	B	Require replacement.
Flare type incorrect	B ..	Require repair or replacement.
Leaking	A ..	Require repair or replacement.
Line material incorrect (copper, etc.)	B	Require replacement.
Restricted	A	Require replacement.
Routed incorrectly	B	Require routing correction.
Rust-pitted	1	Suggest replacement.
Threads damaged	A ..	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

STOPLIGHT SWITCHES

See BRAKE STOPLIGHT SWITCHES.

SWITCHES

NOTE: Copied from Electrical UIGs & added "float saturated" from old fluid level sensor switches.

STEEL BRAKE LINE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Float saturated	A	Require replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Won’t return	A	Require repair or replacement.
Worn	1	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

TIRES

Consult the vehicle owner’s manual or vehicle placard for correct size, speed ratings, and inflation pressure of the original tires.

TIRE INSPECTION

Condition	Code	Procedure
Tire diameter incorrect, affecting ABS or TCS	A	Require replacement.
Tire pressure incorrect, affecting ABS or TCS	A	Require repair or replacement.
Tire size incorrect, affecting ABS or TCS	A	Require replacement.

TOOTHED RINGS (TONE WHEEL)

NOTE: Copied from Drivetrain UIGs.

If the toothed ring requires replacement and cannot be replaced as a separate component, replace the assembly of which the ring is a part.

TOOTHED RING INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Bent	B	Require replacement.
Contaminated, affecting performance	A	Require repair. Identify and correct cause.
Cracked	B	Require replacement.
Loose	A	Require replacement of worn parts.
Missing	C	Require replacement.
Number of teeth incorrect	B	Require replacement.
Teeth broken	A	Require replacement.
Teeth damaged, affecting performance	A	Require replacement.

VACUUM BOOSTERS

VACUUM BOOSTER INSPECTION

Condition	Code	Procedure
Applies too much assist (oversensitive)	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Auxiliary vacuum pump inoperative	A	(1) Require repair or replacement.
Check valve grommet deteriorated, affecting performance	A	Require replacement of grommet.

Condition	Code	Procedure
Check valve grommet deteriorated, not affecting performance	1	Suggest replacement of grommet.
Check valve inoperative	A	(2) Require repair or replacement.
Check valve leaking	A	Require replacement of check valve.
Check valve missing	C	Require replacement of check valve.
Check valve noisy	2	Suggest replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(3) Require replacement.
Connector missing	C	Require replacement.
Leaking	A	Require replacement.
Terminal burned, affecting performance	A	(3) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Vacuum hose filter leaking	A	Require replacement of filter.
Vacuum hose filter restricted	A	Require replacement of filter.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Inoperative includes intermittent operation.
(3) - Determine cause and correct prior to replacement of part.

VACUUM HOSES

See HOSES.

VALVES

VALVE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of

			hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Leaking	B	..	Require repair or replacement.
Linkage bent (rear load valves)	A	...	Require repair or replacement of linkage.
Linkage broken (rear load valves)	A	...	Require repair or replacement of linkage.
Linkage disconnected (rear load valves)	C	...	Require repair or replacement of linkage.
Pressure out of specification	B	.....	Require adjustment. If not possible, require replacement.
Seized	A	.....	Require replacement.
Sticking	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead burned	A	..	Require repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

WHEEL ATTACHING HARDWARE

For conditions noted below, also check condition of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow manufacturer's torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHING HARDWARE INSPECTION

Condition	Code		Procedure
Bent	A	.....	Require replacement.
Broken	A	.....	(1) Require replacement.
Loose	B	...	Require repair or replacement of affected component.

Lug nut flats rounded	A	Require replacement of nut.
Lug nut installed backward	B	Require repair.
Lug nut mating surface dished	A	Require replacement of nut.
Lug nut mating type incorrect	B	Require replacement of nut.
Lug nut seized	A	Require replacement of nut and/or stud.
Stud incorrect	B	Require replacement of stud.
Threads damaged	A	Require repair or replacement of component with damaged threads.
Threads stripped (threads missing)	A	Require replacement of component with stripped threads.

(1) - Some manufacturers require replacement of all studs on any wheel if two or more studs or nuts on the same wheel are broken or missing.

WHEEL BEARINGS, RACES AND SEALS

NOTE: Grease seal replacement is required if seal is removed. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

WHEEL BEARINGS, RACES AND SEALS INSPECTION

Condition	Code	Procedure
Axle seal on drive axle leaking	A	Require replacement of seal and inspection of axle, bearing, housing, and vent tube.
Bearing end-play exceeds specifications	B	Require adjustment of bearing, if possible. If proper adjustment cannot be obtained, require replacement of bearing assembly.
Bearing rollers, balls or races are worn, pitted, or feel rough when rotated as an assembly	B	Require replacement of bearing assembly.
Seal leaking	A	(1) Require replacement of seal and inspection of bearings.
Spindle worn	B	Require replacement of spindle and bearings.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary. Check vent. A plugged vent may force fluid past the seal.

WHEEL CYLINDERS

You are not required to replace or rebuild wheel cylinders in axle sets. However, when rebuilding or replacing a wheel cylinder due

to the conditions that follow, you may suggest rebuilding or replacement of the other wheel cylinder (on the same axle) for preventive maintenance, for example, the part is close to the end of its useful life.

Determine the need to rebuild or replace based upon the individual wheel cylinder conditions that follow.

WHEEL CYLINDER INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require replacement of bent parts.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded parts.
Attaching hardware loose	A	Require repair or replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bleeder port damaged (if non-repairable)	A	Require replacement.
Bleeder screw broken off in wheel cylinder (if non-repairable)	A	(1) Require replacement.
Bleeder screw plugged	A	(1) Require repair or replacement of bleeder screw.
Bleeder screw seized	A	(2) Require replacement.
Bore corroded (pitted)	B	Require replacement.
Bore grooved	A	Require replacement.
Bore oversized	B	Require replacement.
Dust boot missing	C	Require replacement of dust boot.
Dust boot torn	A	(3) Require replacement of dust boot.
Leaking	A	(4) Require rebuilding or replacement.
Piston corroded, affecting performance	B	Require replacement of piston and rebuilding or replacement of wheel cylinder.
Piston finish worn off	B	Require replacement of piston and rebuilding or replacement of wheel cylinder.
Piston stuck in bore	A	Require replacement of wheel cylinder.
Loose	B	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as bleeder screw that cannot be removed after a practical attempt at removing. Only required if the hydraulic system must be opened.

(3) - Inspect for conditions related to wheel cylinder.
(4) - Leaking is defined as a drop or more. Dampness is normal.

WIRING HARNESSES

NOTE: Copied from Electrical UIGs.

WIRING HARNESS INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

BRAKE SYSTEM

1997-99 Mitsubishi Montero Sport

1997-99 BRAKES
Mitsubishi - Disc & Drum

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

INTRODUCTION

This article contains information on repair and service of basic hydraulic brake system. If vehicle is equipped with anti-lock brakes, also see appropriate ANTI-LOCK article.

DESCRIPTION

Brake system consists of a master cylinder, vacuum power brake booster, proportioning valve and self-adjusting assembly. Montero has a Load-Sensing Proportioning Valve (LSPV). All models are equipped with front disc brakes and either rear disc or drum brakes. Parking brake assembly activates rear brakes.

BLEEDING BRAKE SYSTEM

BLEEDING PROCEDURES

Bleed brakes whenever hydraulic lines are opened or pedal feels spongy. Bleed system in appropriate sequence. See BRAKE LINE BLEEDING SEQUENCE table. Use only DOT 3 or DOT 4 approved fluid and DO NOT mix fluid types.

BRAKE LINE BLEEDING SEQUENCE

Application	Sequence
Diamante, Eclipse, Galant, Mirage & 3000GT	RR, LF, LR, RF
Montero	RR, LR, LSPV, RF, LF
Montero Sport	RR, LR, RF, LF

ADJUSTMENTS

BRAKE PEDAL HEIGHT, FREE PLAY & CLEARANCE

1) To measure brake pedal height, pull up carpet under brake pedal. Measure distance between floor board and middle of brake pedal pad surface with brake pedal released. See BRAKE PEDAL HEIGHT SPECIFICATIONS table.

2) To adjust pedal height, separate connector from stoplight switch, and loosen switch lock nut. Back-off switch so it does not contact brake pedal arm. Loosen master cylinder push rod lock nut. Adjust brake pedal height by rotating master cylinder push rod until brake pedal height is within specification.

BRAKE PEDAL HEIGHT SPECIFICATIONS

Application	Pedal Height: In. (mm)

Diamante, Eclipse, Montero Sport & Galant	6.9-7.1 (175-181)
Mirage	6.4-6.6 (164-167)
Montero	7.3-7.5 (186-191)
3000GT	7.0-7.2 (177-182)

3) Tighten lock nut, and ensure brake pedal height is within specification. Start engine to evacuate brake booster chamber. Stop engine, and apply brake several times to remove vacuum from brake booster.

4) Using hand pressure, depress brake pedal to measure free play before resistance is felt. Free play distance for all models is 0.10-0.31" (3-8 mm). If distance is not within specification, it is probably caused by excessive play between the brake pedal arm and the clevis pin. Check and replace as necessary.

5) Start engine and apply 110 lbs. (490 N) of pressure to brake pedal. With the carpet pulled back, measure the distance between the brake pedal and the floorboard. If the distance is not 3.1-3.5" (80-90 mm) check for air in brake hydraulic system, brake adjustment or defective parking brake component or adjustment. Adjust or repair as necessary.

LOAD-SENSING PROPORTIONING VALVE (LSPV)

Montero

1) Park vehicle on level surface. Remove excess weight from vehicle. Make sure the lever is all the way towards the valve side. Measure length of entire spring. See Fig. 1.

If spring length is not within specification, adjust spring support until correct length is obtained. See LSPV SPRING LENGTH table.

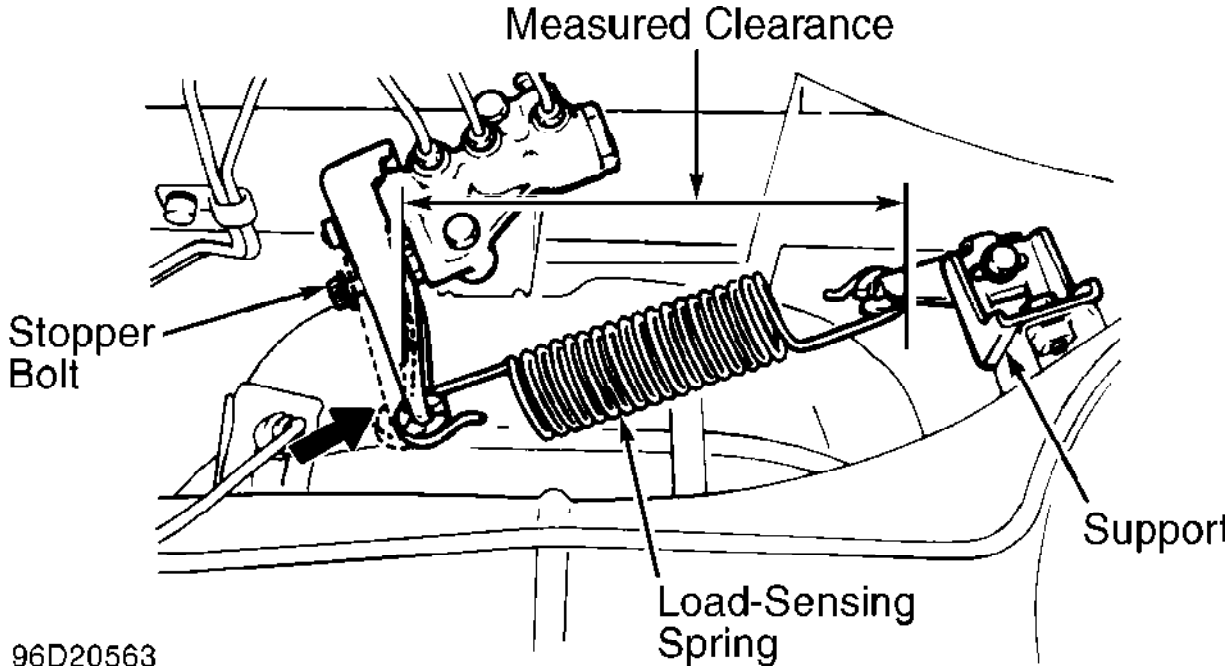


Fig. 1: Adjusting Load-Sensing Proportioning Valve Spring (Montero) Courtesy of Mitsubishi Motor Sales of America.

BRAKE BOOSTER PUSH ROD

Adjustment (Except Diamante)

1) Place the Push Rod Adjusting Gauge (MB991714) in the master cylinder, position gauge shaft so it contacts master cylinder piston and tighten wing bolt.

2) Apply a vacuum of 9.7 psi (-66.7 kPa) for Eclipse, Galant, Montero and 3000GT and 19.6 psi (-66.7 kPa) for Mirage and Montero Sport to the brake booster using a hand held vacuum pump.

3) Rotate the gauge tool so it is positioned offset from center of the brake booster. See Fig. 2.

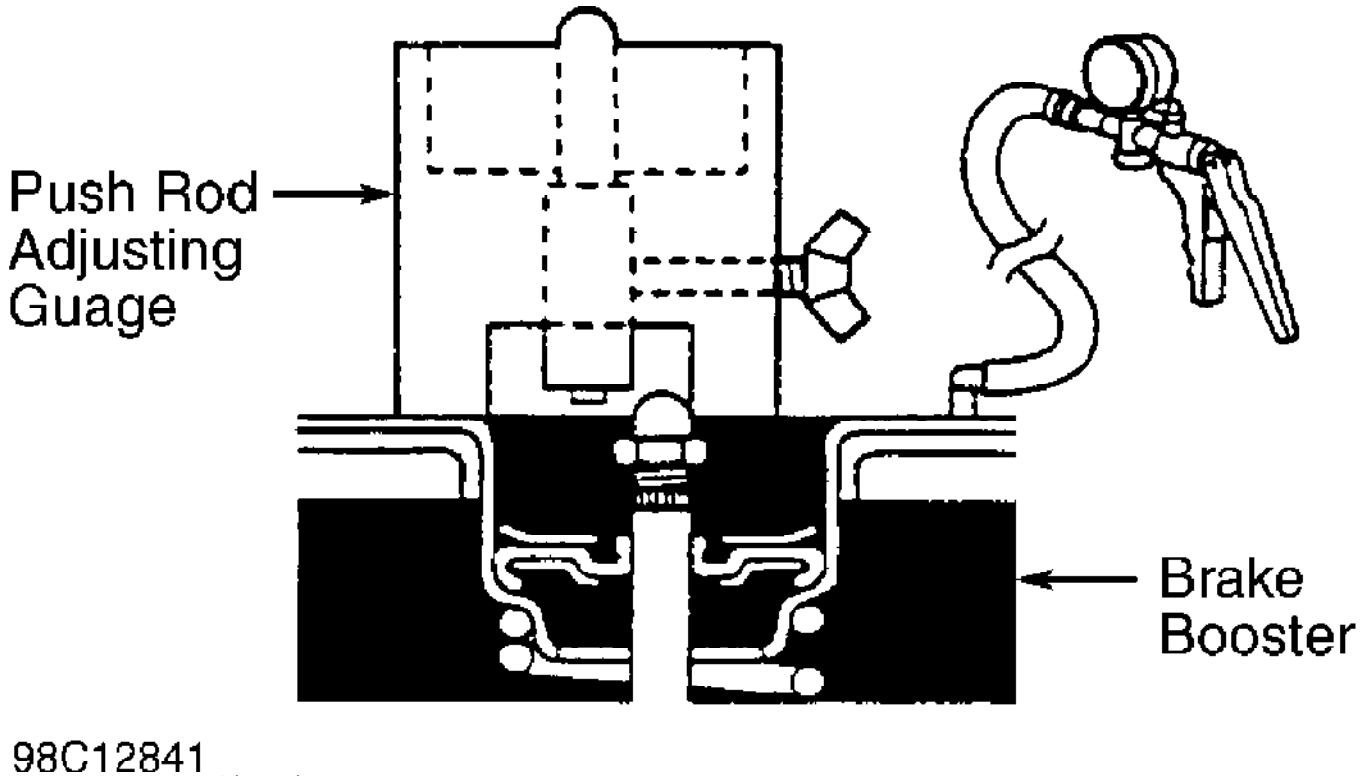


Fig. 2: Push Rod Adjusting Gauge Setup.
Courtesy of Mitshbishi Motor Sales of America.

4) Move the gauge tool towards the center so the shaft contacts the end of the brake booster push rod. If contact is not as shown in position "A", shorten the rod if position "B" is present, or lengthening it if position "C" is present. See Fig. 3.

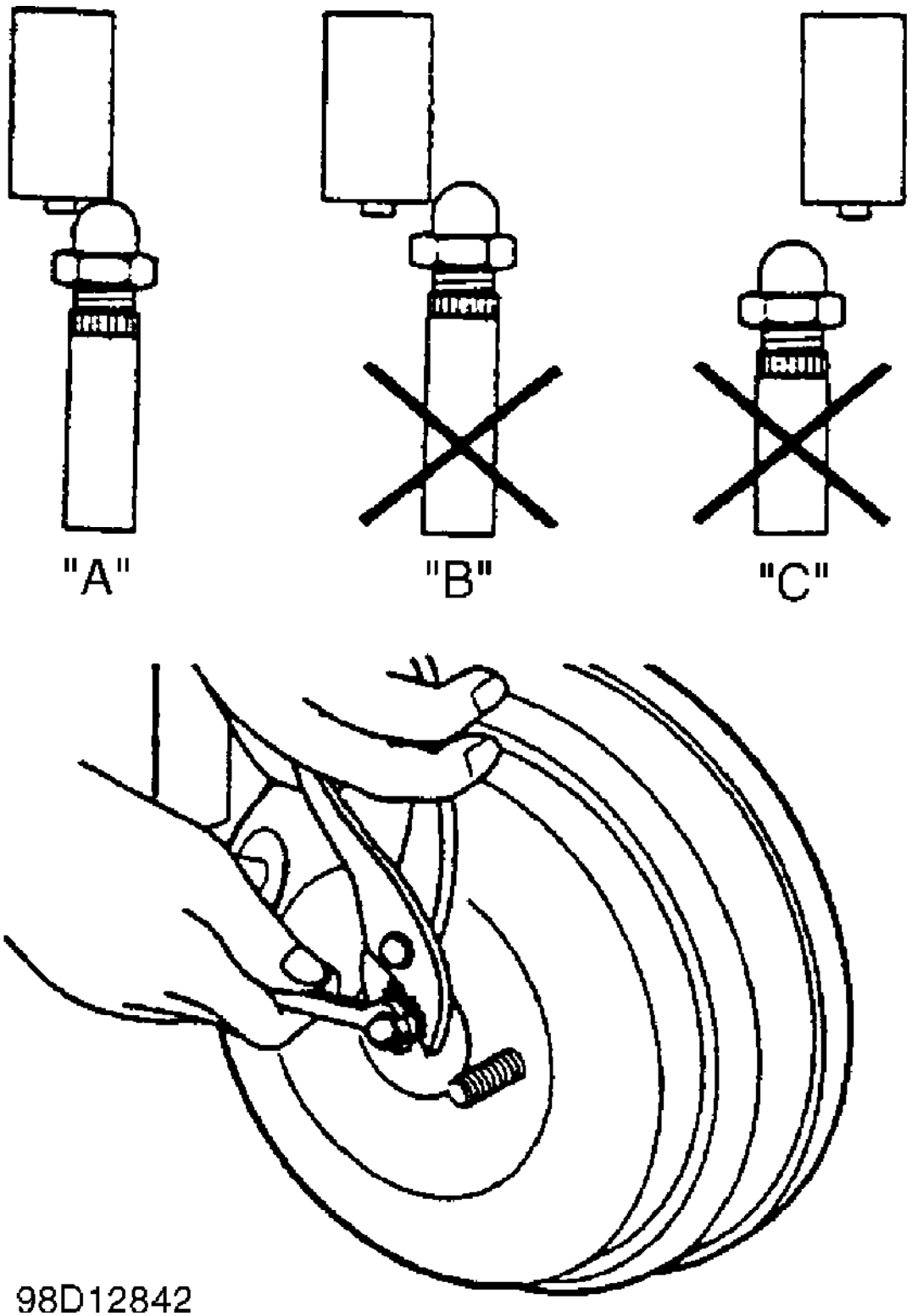


Fig. 3: Adjusting Brake Booster Push Rod Clearance
Courtesy of Mitshbishi Motor Sales of America.

Adjustment (Diamante)
1) Start engine and depress the brake pedal at least two

times then switch the engine off.

2) Remove the master cylinder from the brake booster making sure the push rod is not disturbed and the brake pedal is not depressed after master cylinder removal.

3) Using a Vernier Caliper and Block Gauge, measure the thickness of the block gauge and add .366" (9.3 mm) to the gauge thickness and set the caliper to this dimension. See Fig. 4.

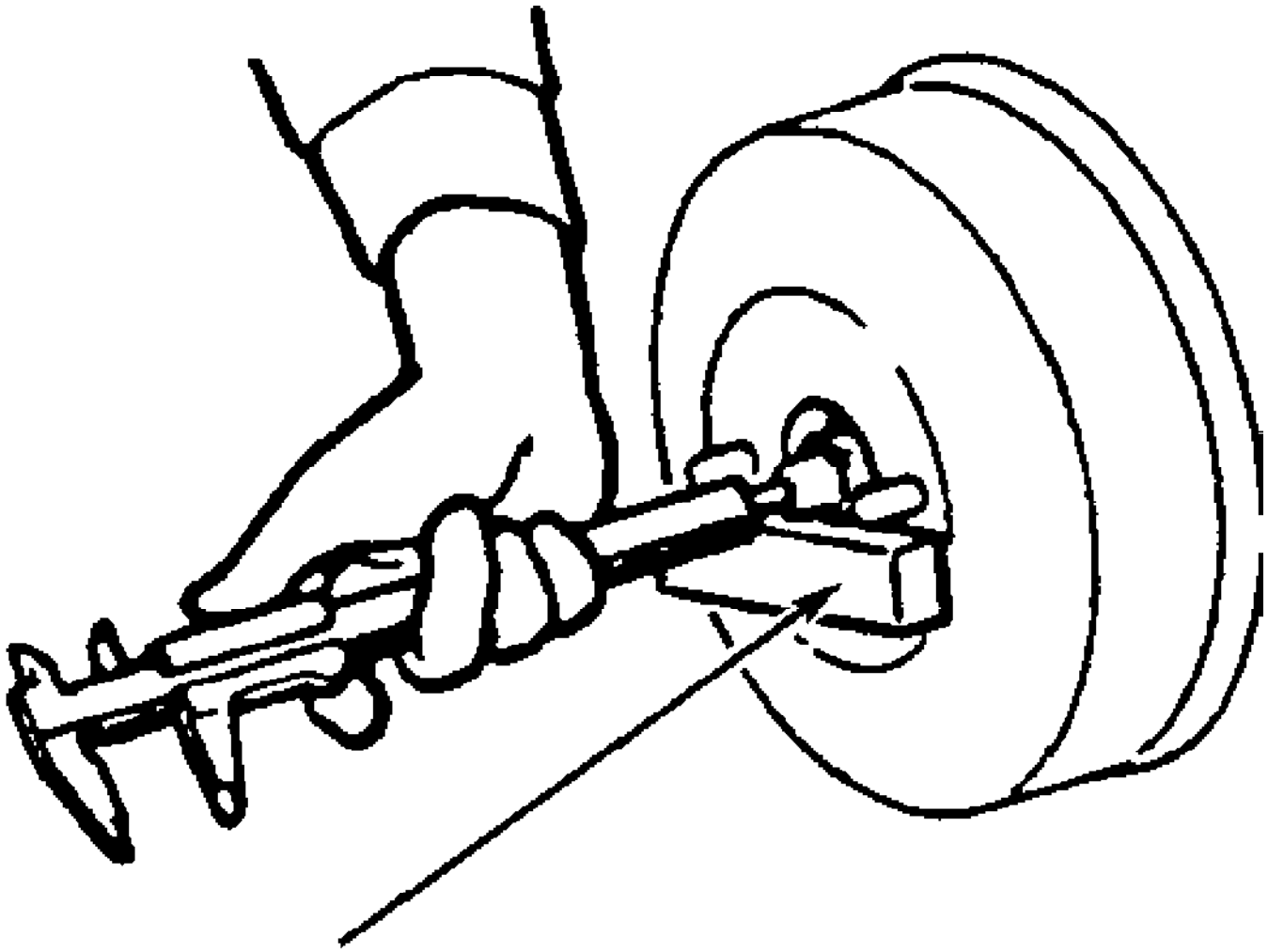


Fig. 4: Setting Caliper And Block Gauge (Diamante)
Courtesy of Mitshbishi Motor Sales of America.

4) Check the push rod position with vernier caliper set to the calculated dimension. Specification range .362"-.370" (9.2-9.4 mm). See Fig. 5.

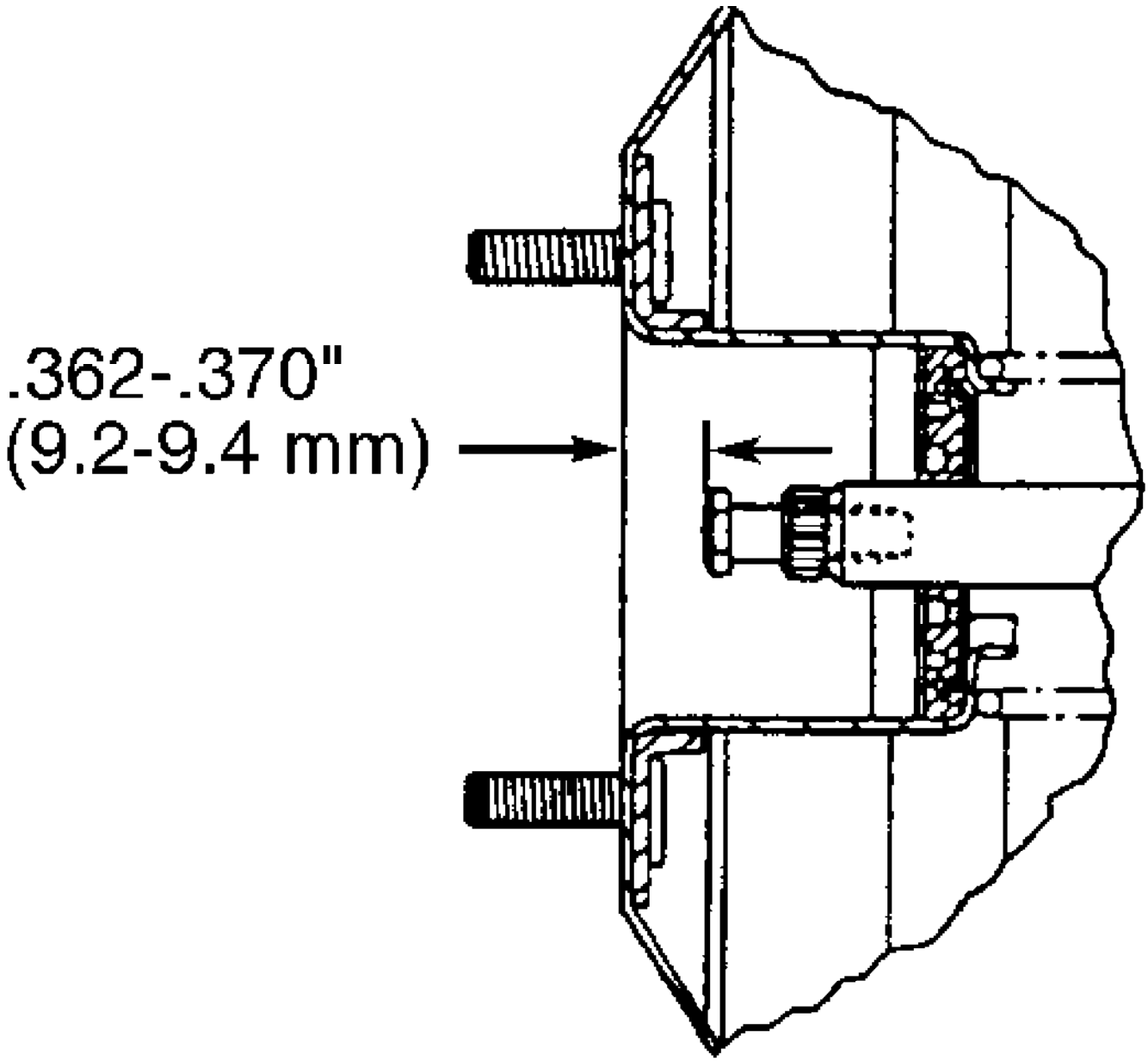


Fig. 5: Push Rod Setting (Diamante)
Courtesy of Mitshbishi Motor Sales of America.

5) If clearance is NOT within range, turn push rod screw to correct length.

NOTE: This measurement is taken on the radial face of the push rod, .085" (2.15 mm) from the center of the radial face. This adjusting procedure MUST be done with 18-22 in. Hg

(62-73 kPa) of vacuum applied to the brake booster.

PARKING/EMERGENCY BRAKE

NOTE: Adjust service brakes before adjusting parking brake.

Start engine, and apply brake pedal. Pull parking brake lever with a force of 44-45 lbs. (196-200 N). Parking brake lever should move up 3-5 notches on Diamante, Stealth and 3000GT, 4-6 notches on Montero, and 5-7 notches on all other models. If adjustment is necessary, turn adjusting nut located under console or at end of cable rod. See Fig. 6.

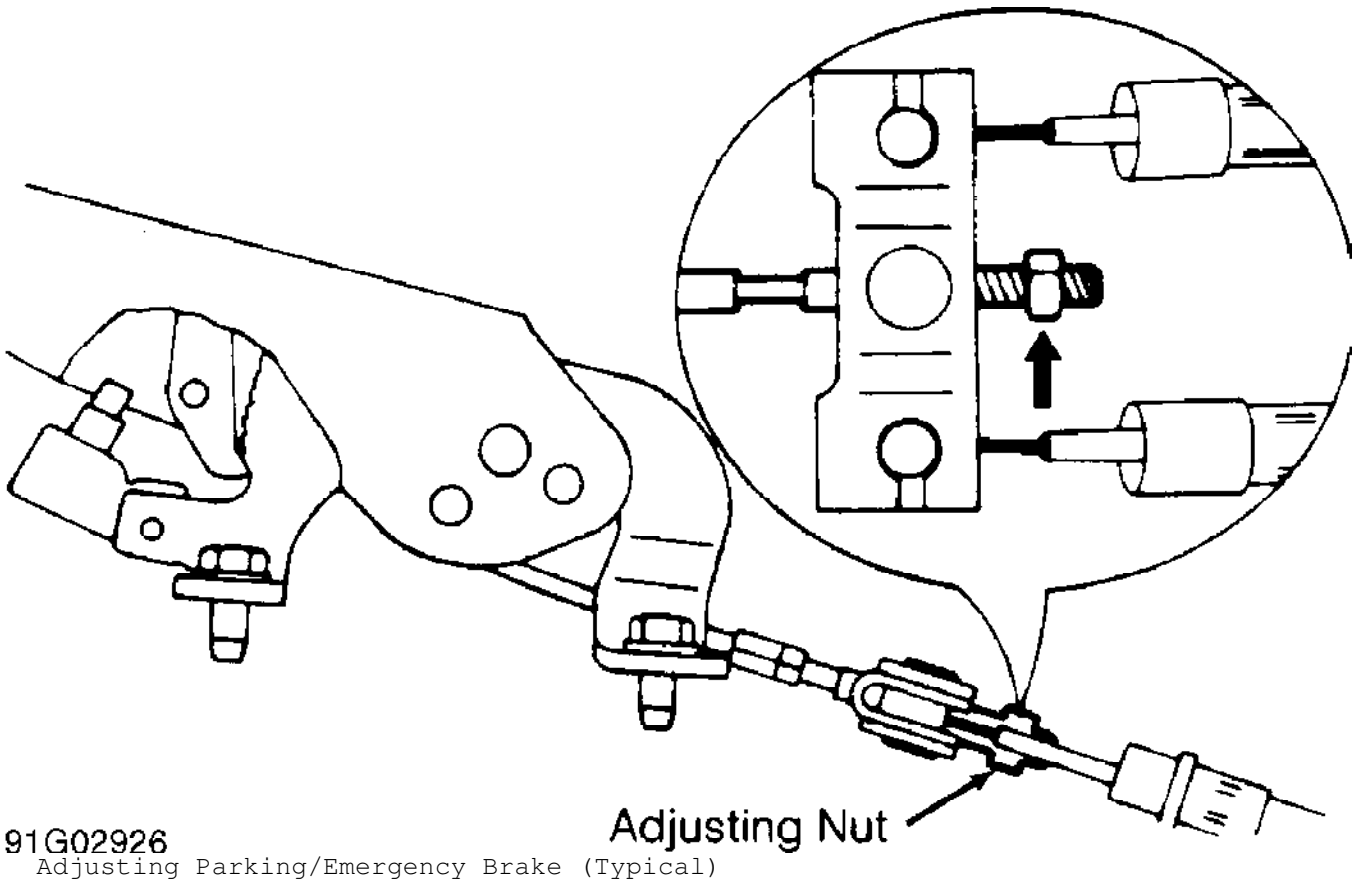


Fig. 6: Adjusting Parking/Emergency Brake (Typical)
Courtesy of Mitsubishi Motor Sales of America.

REAR BRAKE SHOES

Fully release parking brake and depress brake pedal several times to center shoes and adjust brake shoe clearance. Adjust shoes so brake shoes lightly contact brake drum. Adjust parking brake, and check pedal travel. Rotate brake drum to verify free movement.

STOPLIGHT SWITCH

Loosen lock nut, and adjust switch-to-pedal arm clearance to 0.02-0.04" (0.5-1.0 mm). Tighten lock nut. DO NOT depress master cylinder push rod during stoplight switch adjustment.

TESTING

POWER BRAKE BOOSTER

System Check

1) Run engine for 1-2 minutes. Shut engine off, and depress brake pedal several times with normal pressure. If pedal height gradually becomes higher with successive applications, power brake booster is okay. If pedal height remains steady, power brake booster is not operating properly, go to next step.

2) With engine stopped, depress brake pedal repeatedly until pedal height no longer falls. Hold brake pedal down, and start engine. If pedal moves downward slightly, power brake booster is okay. If pedal height does not change, power brake booster is not operating properly, go to next step.

3) With engine running, press and hold brake pedal. Shut off engine. Hold brake pedal for 30 seconds. Brake pedal height should not change. If pedal rises, power brake booster is not operating properly, go to next step.

4) If brake booster operation is not as specified in each step, disconnect vacuum hose at brake booster and check for sufficient vacuum with engine running. Also check brake booster check valve operation. Repair or replace as necessary.

Check Valve Inspection

Remove vacuum hose from power brake booster. Do not remove check valve from hose. Check valve should hold vacuum in one direction and allow air to pass in other direction.

LOAD-SENSING PROPORTIONING VALVE (LSPV)

Montero

1) Before diagnosing Load-Sensing Proportioning Valve (LSPV), ensure all other brake components are operating properly. When all other brake system components are determined to be okay, ensure LSPV spring length is within specification. See Fig. 1. See LOAD-SENSING PROPORTIONING VALVE (LSPV) under ADJUSTMENTS.

2) After spring length is determined to be within specification, connect pressure gauges to input and output ports of LSPV. See Fig. 7. Bleed brake system. See BLEEDING BRAKE SYSTEM.

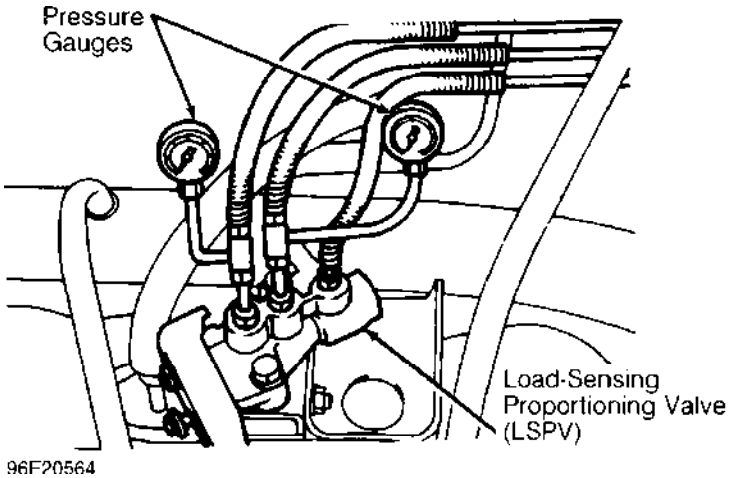


Fig. 7: Connecting Pressure Gauges To LSPV (Montero)
Courtesy of Mitsubishi Motor Sales of America.

3) With vehicle unloaded at correct ride height and LSPV spring correctly adjusted to 8.9" (227 mm), slowly depress brake pedal

and check fluid input and output pressures at LSPV. See LSPV PRESSURE SPECIFICATIONS table.

4) Disconnect spring at support and pull spring and lever toward support until spring length is 10.1" (257 mm). See Fig. 1. Slowly depress brake pedal and check input and output pressures at LSPV. See LSPV PRESSURE SPECIFICATIONS table. If fluid input pressure is okay and output pressure is not within specification, replace LSPV assembly. Remove gauges and bleed brake system.

LSPV PRESSURE SPECIFICATIONS

LSPV Spring Length	Inlet Pressure psi (kg/cm²)	Outlet Pressure psi (kg/cm²)
8.9" (227 mm)	1422 (100)	873-1002 (61-70)
8.9" (227 mm)	2560 (180)	1129-1314 (79-92)
10.1" (257 mm)	2560 (180)	1863-2148 (131-151)

NON-LOAD-SENSING PROPORTIONING VALVE

Pressure Test (Except Montero)

1) Connect pressure gauges to input and output ports of proportioning valve. See Fig. 8. Bleed brake system. See BLEEDING BRAKE SYSTEM.

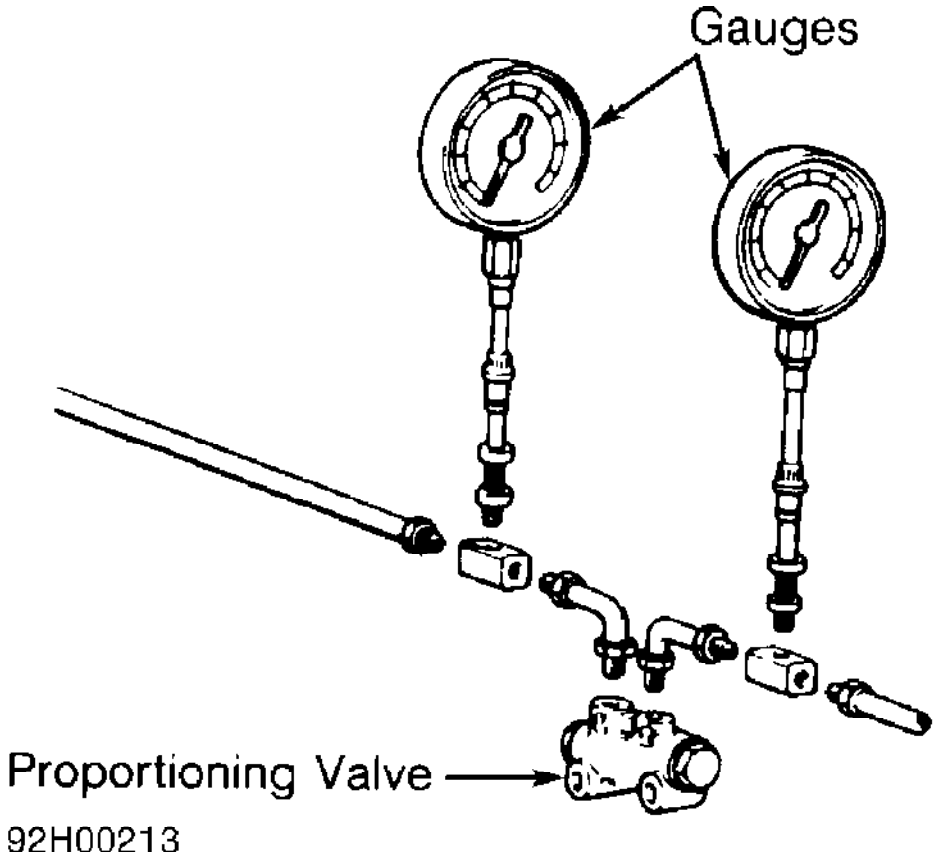


Fig. 8: Connecting Pressure Gauges To Proportioning Valve (Typical)
Courtesy of Mitsubishi Motor Sales of America.

2) Slowly depress brake pedal. Check readings on pressure gauges. Ensure output pressure begins to drop relative to input

pressure at specified pressure range (split point). See SPLIT POINT PRESSURE SPECIFICATIONS table.

SPLIT POINT PRESSURE SPECIFICATIONS

Application	psi (kg/cm²)
Diamante	312-383 (22-27)
Eclipse	
Without ABS	320-391 (22-27)
With ABS	320-391 (22-27)
Galant	462-533 (33-38)
Mirage	
2-Door	320-392 (22-26)
4-Door	391-463 (27-32)
Montero Sport	(1)

(1) - Information not available from manufacturer.

3) Continue depressing brake pedal, and check readings on pressure gauges. See PROPORTIONING VALVE PRESSURE SPECIFICATIONS table. If fluid pressures or split point are not within specification, replace proportioning valve.

PROPORTIONING VALVE PRESSURE SPECIFICATIONS

Application/ Model	Inlet Pressure psi (kg/cm²)	(1) Outlet Pressure psi (kg/cm²)
Diamante	1138 (80)	676-747 (48-53)
Eclipse		
With ABS	996 (69)	569-640 (39-44)
Without ABS	925 (61)	462-533 (32-37)
Galant	996 (69)	604 (43)
Mirage		
2-Door	1422 (98)	566-680 (39-47)
4-Door	1422 (98)	619-733 (43-51)
3000GT		
Hatchback	906 (64)	651-723 (46-51)
Convertible	1117 (79)	846-917 (60-65)
Montero Sport	(1)	(1)

(1) - Information is not available from manufacturer.

REMOVAL & INSTALLATION

FRONT DISC BRAKE PADS

CAUTION: DO NOT remove or contaminate special grease coating on lock pins.

Removal & Installation (Except 3000GT AWD)

1) Raise and support vehicle. Remove front wheels. Remove lower lock pin or sleeve bolt. See Figs. 13-15. Lift caliper body upward. Support caliper aside. Remove shims and pads from support mounting. Remove pad clips.

2) If installing new pads, compress piston to bottom of bore. Install retaining clips, pads and shims. Start engine and depress brake pedal several times to expand caliper piston. Check brake fluid level.

Removal & Installation (3000GT AWD)

1) Raise and support vehicle. Remove front wheels. Remove clip, brake pad retaining pins and spring. See Fig. 17. Remove shims and pads from caliper. Keep track of location of shims for reassembly.

2) Compress caliper pistons fully in bores. Install shims on brake pads. Install brake pads. Install spring clip, pad retaining pins and clip. Start engine and depress brake pedal several times to expand caliper piston. Check brake fluid level.

FRONT BRAKE CALIPER

Removal

Raise and support vehicle. Remove front wheels. Remove hose clip from brake hose mount (if equipped). Disconnect brake hose from caliper. Remove upper and lower caliper-to-steering knuckle bolts. Lift caliper body upward. Remove caliper.

Installation

To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Bleed brake system. See BLEEDING BRAKE SYSTEM.

FRONT BRAKE ROTOR

Removal & Installation (Except Montero & Montero Sport)

Raise vehicle, and remove wheel(s). Remove caliper. See FRONT BRAKE CALIPER. Slide rotor off hub. To install, reverse removal procedure.

Removal (Montero & Montero Sport)

Raise and support vehicle. Remove brake caliper. See FRONT BRAKE CALIPER. On 4WD, remove Remove bearing grease cap, snap ring, shim, 6 bolts and drive flange from axle shaft. On 2WD remove 6 bolts and hub cover. Remove screw(s) from lock washer. Remove lock washer. Remove lock nut using Lock Nut Wrench (MB990954). Remove hub assembly. Place match marks on rotor and hub. Remove rotor from front hub.

Installation

1) Install rotor on hub. Service wheel bearings and seals as necessary. Install front hub assembly. Install lock nut, and tighten it to 119 ft. lbs. (165 N.m). Loosen lock nut, and retighten it to 18 ft. lbs. (24 N.m). Loosen lock nut 30-40 degrees. Install lock washer and screw(s).

2) On 2WD, reverse removal procedure for remaining components. On 4WD, install drive flange, shim and snap ring. Using feeler gauge, check axle shaft-to-hub clearance. Clearance should be 0.016-0.028" (0.41-0.71 mm). Use appropriate shim to obtain correct clearance. Shim is located behind snap ring on end of axle shaft. Recheck clearance if necessary. Install remaining components.

PARKING BRAKE SHOES

Removal & Installation (Diamante)

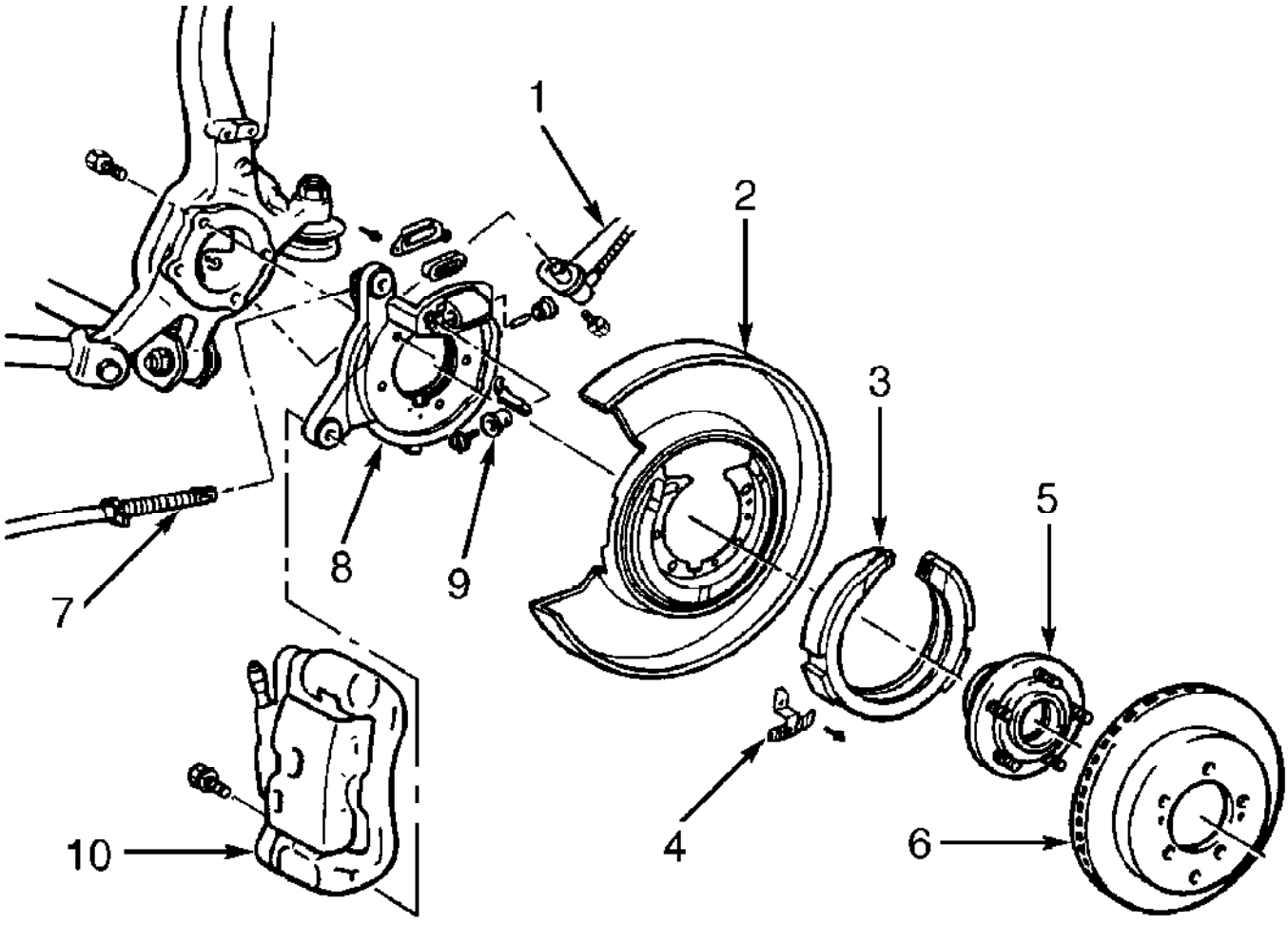
1) Raise and support vehicle. Remove rear wheels. Remove rear disc brake caliper and rotor. If rotor removal is difficult, rotate rotor until hole in rotor is upward. Back-off brake shoe adjustment with a flat blade screwdriver through hole in rotor.

2) Disconnect rear speed sensor. See Fig. 9. Remove 4 bolts and hub. Remove screw and shoe hold-down spring. Remove shoe. To install, reverse removal procedure. Adjust brake shoe by turning adjuster star wheel.

Removal (Eclipse, Montero & Montero Sport)

1) Raise and support vehicle. Remove rear wheels. Disconnect rear speed sensor (if equipped). Remove rear disc brake calipers and rotors. See REAR BRAKE CALIPER.

2) Remove adjuster spring. Remove shoe hold-down cup, spring and pin. See Fig. 10. Note how shoe-to-anchor spring is installed, and then remove adjuster and shoe-to-anchor spring. Remove strut and return spring. Remove clip and shoe and lining assembly.



1. Wheel Speed Sensor
2. Splash Shield
3. Brake Shoe
4. Shoe Hold-Down Spring
5. Hub
6. Rotor
7. Parking Brake Cable
8. Backing Plate
9. Star Wheel Adjuster
10. Caliper

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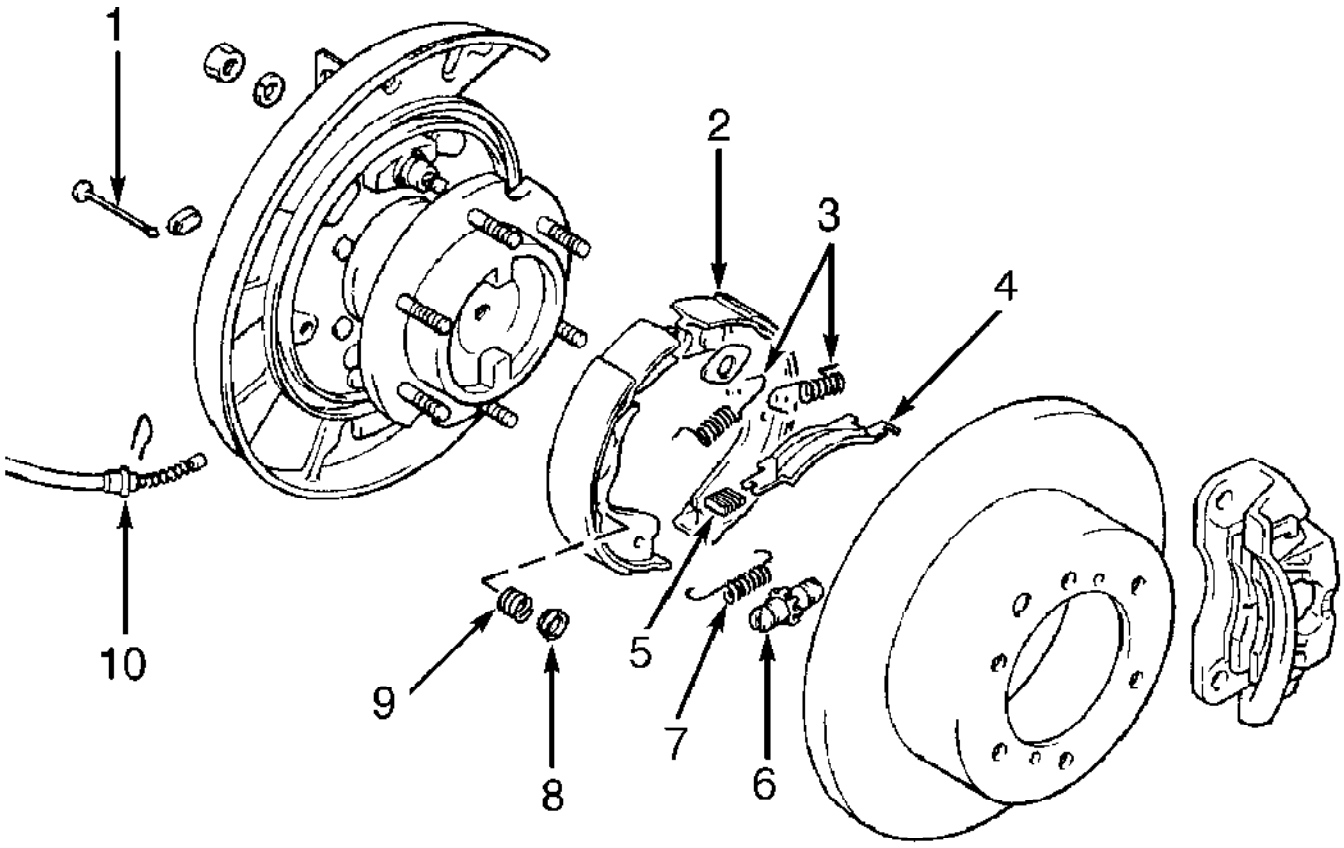
Fig. 9: Exploded View Of Parking Brake Assembly (Diamante)
Courtesy of Mitsubishi Motor Sales of America.



1. Hold-Down Pin
2. Brake Shoe
3. Shoe Return Spring
4. Strut
5. Strut Spring
6. Adjuster Assembly
7. Lower Shoe Spring
8. Spring Retainer
9. Hold-Down Spring
10. Parking Brake Cable

97G08650

Fig. 10: Exploded View Of Parking Brake Assembly (Typical With Rear Disc Brakes - Except Diamante)
Courtesy of Mitsubishi Motor Sales of America.

CAUTION: Shoe-to-anchor spring must be installed correctly for proper functioning of parking brakes.

Installation

1) To install, reverse removal procedure. When installing shoe-to-anchor spring, ensure spring is installed correctly. When installing adjuster, install left adjuster with adjusting bolt facing vehicle front and right adjuster with adjusting bolt facing vehicle rear.

2) On models with ABS, ensure gap between rotor teeth and speed sensor pole piece is 0.008-0.039" (0.20-1.00 mm).

Removal (3000GT)

1) Raise and support vehicle. Remove rear wheel(s). Disconnect rear speed sensor. Remove rear disc brake calipers and

rotors. See REAR BRAKE CALIPER.

2) On FWD models, remove grease cap, hub nut and hub. On AWD models, disconnect rear axle from companion flange at hub. Remove axle hub nut. Using slide hammer and Hub Adapter (MB991354), remove axle from knuckle.

3) On all models, remove adjusting wheel spring. Remove shoe hold-down cup, spring and pin. Note how shoe-to-anchor spring is installed, and then remove adjuster and shoe-to-anchor spring. Remove strut and return spring. Remove clip and shoe and lining assembly.

CAUTION: Shoe-to-anchor spring must be installed correctly for proper functioning of parking brakes.

Installation

To install, reverse removal procedure. When installing shoe-to-anchor spring, ensure spring is installed correctly. When installing adjuster, install left adjuster with adjusting bolt facing vehicle front and right adjuster with adjusting bolt facing vehicle rear. On AWD, tighten companion flange nut to 188-217 ft. lbs. (260-300 N.m).

REAR DISC BRAKE PADS

NOTE: Replace inner and outer pads at same time.

Removal

Raise and support vehicle. Remove rear wheels, and disconnect parking brake cable. Remove lower lock pin bolt. Lift caliper body upward. Using a wire, support caliper aside. Remove inner shims, anti-squeak shim and pad assembly from support mounting. Remove pad clips.

Installation

Rotate piston to align notches in piston projection on back of pads (if equipped). Install retaining clips, pad assembly, inner shims and anti-squeak shim onto support mounting. Lower caliper body, and install lock pin.

REAR BRAKE CALIPER

Removal

Raise and support vehicle. Remove rear wheels. Disconnect brake hose from caliper. Cap end of brake line to prevent spillage. Remove upper and lower caliper mounting bolts. Lift caliper body upward. Remove caliper.

Installation

To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Bleed brake system. See BLEEDING BRAKE SYSTEM.

REAR BRAKE ROTOR

Removal & Installation

Raise and support vehicle. Remove rear caliper. See REAR BRAKE CALIPER. Remove rotor. To install, reverse removal procedure.

REAR BRAKE DRUM & SHOES

Removal

1) Raise and support vehicle. Remove wheels. Remove brake drum from hub. If drum is difficult to remove, back-off shoe adjuster

and remove drum. Remove shoe return springs and shoe hold-down springs. See Fig. 11.

2) Disconnect parking brake cable from lever. Remove brake shoes and adjuster assembly. Remove parking brake lever snap ring, and disengage lever from brake shoe.

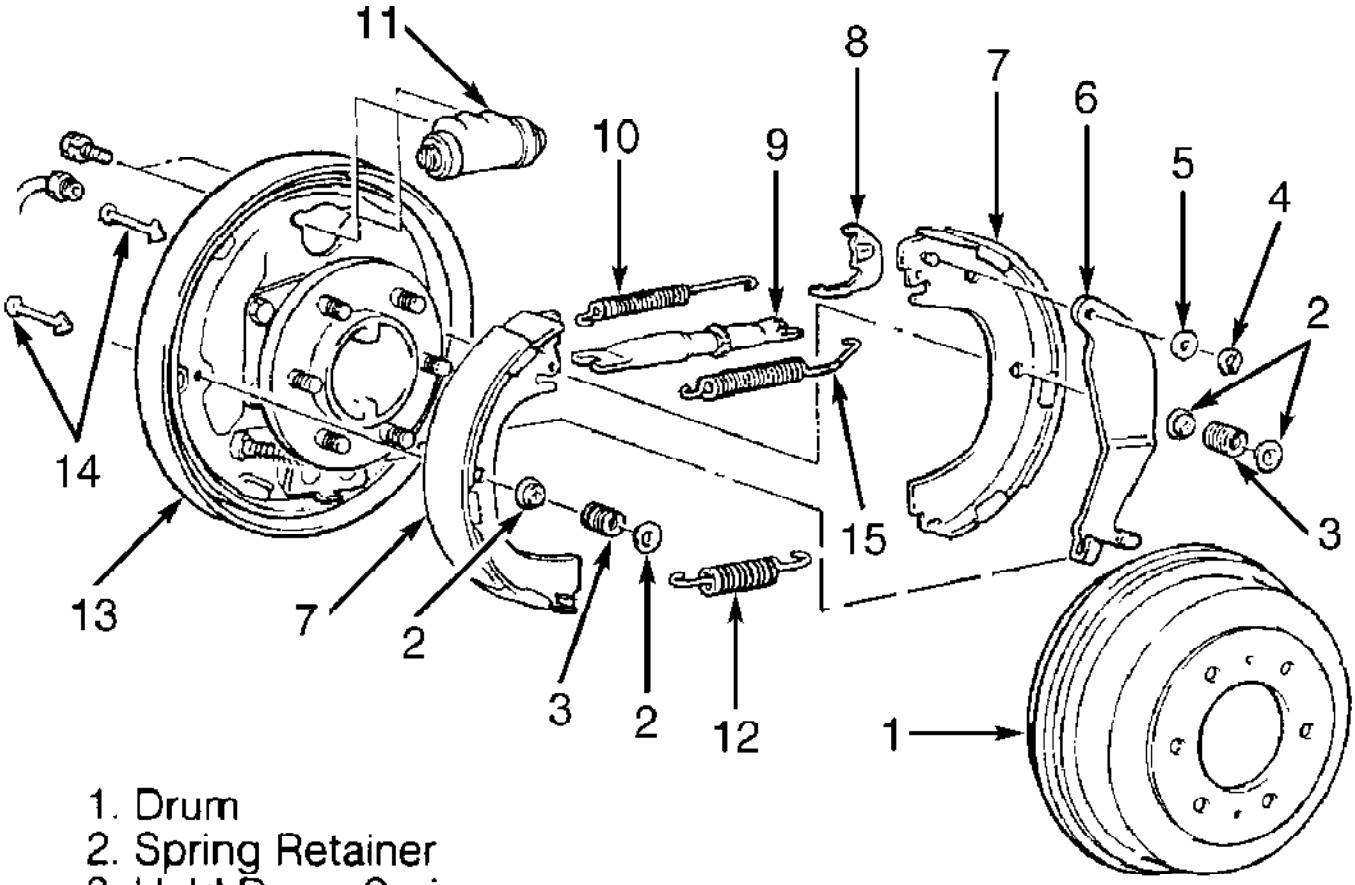


Fig. 11: Exploded View Of Rear Drum Brake Assembly (Montero Sport Shown, Others Similar)
Courtesy of Mitsubishi Motor Sales of America.

Installation

1) To install, reverse removal procedure. Apply Lubriplate to shoe-to-backing plate bosses, adjuster assembly threads and parking brake lever pin.

2) Adjust shoes to lightly contact brake drum. See REAR BRAKE SHOES under ADJUSTMENTS. Depress brake pedal to center shoes, and check pedal travel. Rotate brake drum to ensure free movement.

WHEEL CYLINDERS

Removal & Installation

Raise and support vehicle. Remove rear brake drum and shoes. See REAR BRAKE DRUM & SHOES. Remove wheel cylinder and seal assembly. To install, reverse removal procedure. Bleed brakes. See BLEEDING BRAKE SYSTEM.

MASTER CYLINDER

Removal

Drain brake fluid from master cylinder. Remove sensor connector (if equipped). Disconnect brake lines from master cylinder, and install plugs to prevent brake fluid spillage. Remove master cylinder from booster and separate reservoirs from housing (if necessary).

Installation

To install, reverse removal procedure. Before installation, check and adjust clearance between back of master cylinder piston and power brake push rod. See MASTER CYLINDER PUSH ROD under ADJUSTMENTS. After installation, adjust pedal height. See BRAKE PEDAL HEIGHT & FREE PLAY under ADJUSTMENTS. Bleed brake system.

POWER BRAKE BOOSTER

Removal

Remove brake master cylinder. See MASTER CYLINDER. Disconnect vacuum hose from power brake booster. Disconnect clevis pin attaching brake pedal to power brake booster push rod. From inside vehicle, remove 4 nuts attaching power brake booster to firewall. Remove power brake booster.

Installation

To install, reverse removal procedure. Install master cylinder. Bleed brake system if necessary.

POWER BRAKE BOOSTER CHECK VALVE

NOTE: To test check valve before removal, see POWER BRAKE BOOSTER under TESTING.

Removal & Installation

Remove vacuum hose with check valve from power brake booster. Loosen hose clamp(s) and remove check valve from hose on Mirage and Summit. On all models, coat end(s) of check valve with sealant before installation. Install valve with arrow (identification mark) pointing toward intake manifold. Install and secure hose clamp(s).

REAR AXLE BEARINGS & OIL SEAL

Removal (Montero & Montero Sport)

1) With disc or drum removed, disconnect brake line from caliper or wheel cylinder. Disconnect parking brake cable end, and remove cable attaching bolts. Remove brake backing plate, bearing case and axle shaft as an assembly. If axle shaft binds, use slide hammer and puller to remove.

2) Remove shims, "O" ring and snap ring. Retain shims for installation. Secure axle shaft assembly in a vise, and remove one retainer bolt from backing plate. Push bearing case completely to side of dust cover. Place adhesive tape around edge of bearing case at

retainer bolt hole to prevent damage.

CAUTION: DO NOT damage bearing case or axle shaft when grinding or chiseling retainer ring.

3) Secure axle shaft, and grind retainer ring until retainer ring wall thickness is 0.04-0.06" (1.0-1.5 mm) on axle shaft side and 0.08" (2.0 mm) on bearing side (FIRST CUT). See Fig. 9.

4) Change angle of grind, and remove remaining 0.08" (2.0 mm) of retainer ring wall on bearing side (SECOND CUT). Using a chisel, cut retainer ring. Remove ring. DO NOT damage axle shaft.

5) Install Puller (MB990787-01) to remove bearing case from axle shaft. Rotate nuts with equal force to remove wheel bearing. Remove bearing outer race using a hammer and drift. Remove oil seal from axle housing using a slide hammer and hook.

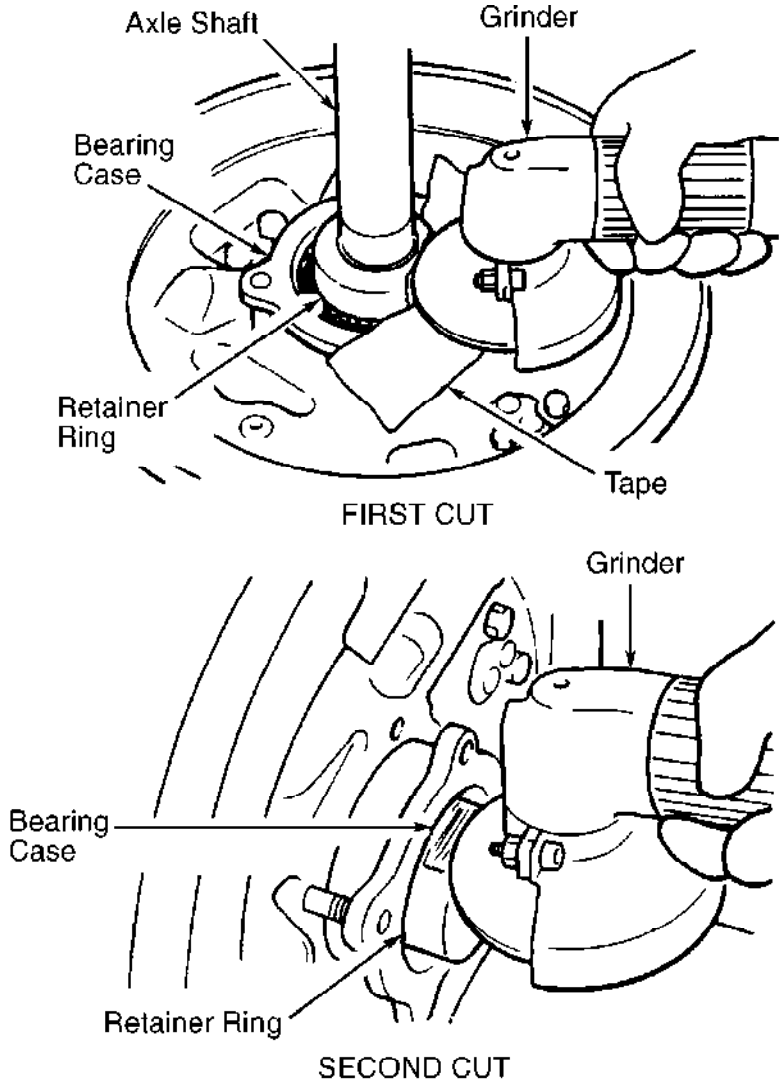


Fig. 12: Grinding Bearing Retainer Ring (Montero & Montero Sport) Courtesy of Mitsubishi Motor Sales of America.

Installation

1) Apply Multipurpose Grease (SAE J310) to oil seal, oil seal

cavity and contact surfaces. Install oil seal using seal driver. Press new oil seal into bearing case until it is flush with face of bearing case. Install backing plate and bearing case.

2) Apply grease to external surfaces of bearing outer race. Press bearing outer race into bearing case. Install rear brake assembly and bearing case. Pack bearing case and axle threads with grease. Install new retainer ring and snap ring.

3) Using a feeler gauge, measure clearance between snap ring and new retainer ring. Clearance should be less than 0.0065" (0.165 mm). If clearance exceeds specification, install a new selective snap ring to bring clearance to specification. See SNAP RING THICKNESS SPECIFICATION table.

SNAP RING THICKNESS SPECIFICATION

Thickness: In. (mm)	Color
0.060 (1.52)	Red
0.067 (1.70)	Purple
0.073 (1.85)	Blue
0.079 (2.01)	Yellow
0.085 (2.16)	Neutral

4) Check condition of oil seal and replace as necessary. Install axle shaft assembly into axle housing. Tighten bearing retainer bolts to 65 ft. lbs (15 N.m.). To complete installation, reverse removal procedure.

REAR AXLE HUB BEARINGS

NOTE: Rear hub bearings are not serviceable on FWD models.

Removal & Installation (FWD Models)

1) Raise and support vehicle. Remove wheels. Remove wheel speed sensor (if equipped). On models with drum brakes, remove brake drum and shoes. See REAR BRAKE DRUM & SHOES.

2) On models with disc brakes, remove caliper and rotor. On all models, remove hub bolts or spindle nut and hub assembly. To install, reverse removal procedure. Tighten hub bolts or spindle nut to specification. See HUB TIGHTENING TORQUE table. Rotate brake drum or disc to ensure free movement.

NOTE: Rear hub bearings are not serviceable on Eclipse AWD models.

Removal & Installation (Eclipse AWD)

1) Raise and support vehicle. Remove wheels. Remove wheel speed sensor (if equipped). On models with drum brakes, remove brake drum and shoes. See REAR BRAKE DRUM & SHOES.

2) On models with disc brakes, remove caliper and rotor. On all models, remove axle nut. Remove 4 hub bolts and hub assembly. To install, reverse removal procedure. Tighten hub bolts to specification. See HUB TIGHTENING TORQUE table. Rotate brake drum or disc to ensure free movement.

HUB TIGHTENING TORQUE

Application	Ft. Lbs. (N.m)
Hub Mounting Bolts	54-65 (74-85)
Spindle Nut	
Mirage	127 (172)
3000GT FWD	170 (230)

Removal & Installation (3000GT AWD Models)

1) Raise and support vehicle. Remove wheels. Remove wheel speed sensor (if equipped). Remove caliper and rotor.

2) Remove 4 bolts and separate rear drive axle from hub companion flange. Using Yoke Holder (MB990767), hold rear axle hub and remove axle nut at companion flange.

3) Using slide hammer and Hub Adapter (MB991354), remove axle shaft from knuckle. Place axle in hydraulic press. Using an appropriate bearing splitter, remove ABS rotor (if equipped) and outer axle bearing.

4) Remove inner bearing and seal from axle. Using Bearing Installer Handle (MB990938) and Adapter (MB990931), install bearing and axle seal.

5) Using Installer (MB990799), install dust shield onto axle shaft. Using hydraulic press, install outer axle bearing onto axle shaft so seal lip is facing towards axle shaft. Press on wheel speed sensor rotor (if equipped) with groove on speed sensor rotor is facing towards axle shaft flange.

6) Install axle shaft assembly into knuckle and tighten axle nut to 188-217 ft. lbs. (260-300 N.m.). To complete installation, reverse removal procedure. Tighten bolts to specification.

OVERHAUL

NOTE: For exploded views of calipers, see Figs. 13 through 17. For exploded view of master cylinder, see Fig. 18.

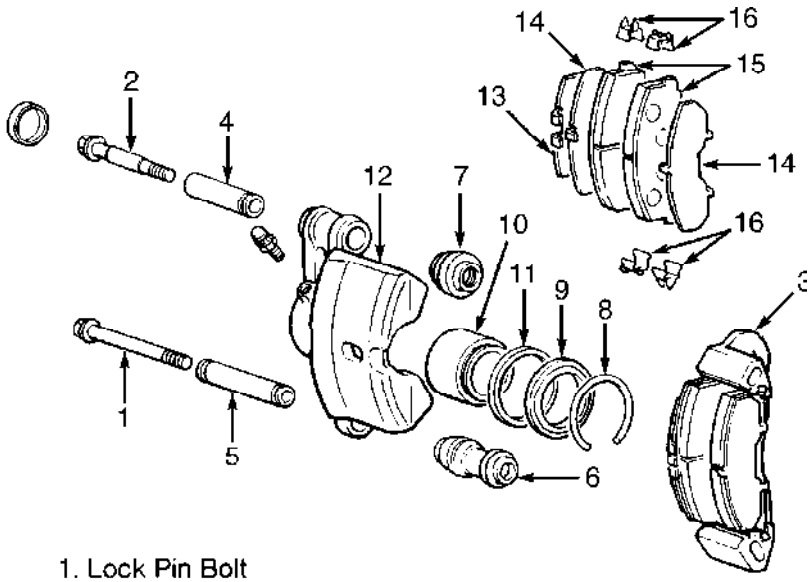


Fig. 13: Exploded View Of Single Piston Caliper Assembly (Except Montero Sport)
Courtesy of Mitsubishi Motor Sales of America.

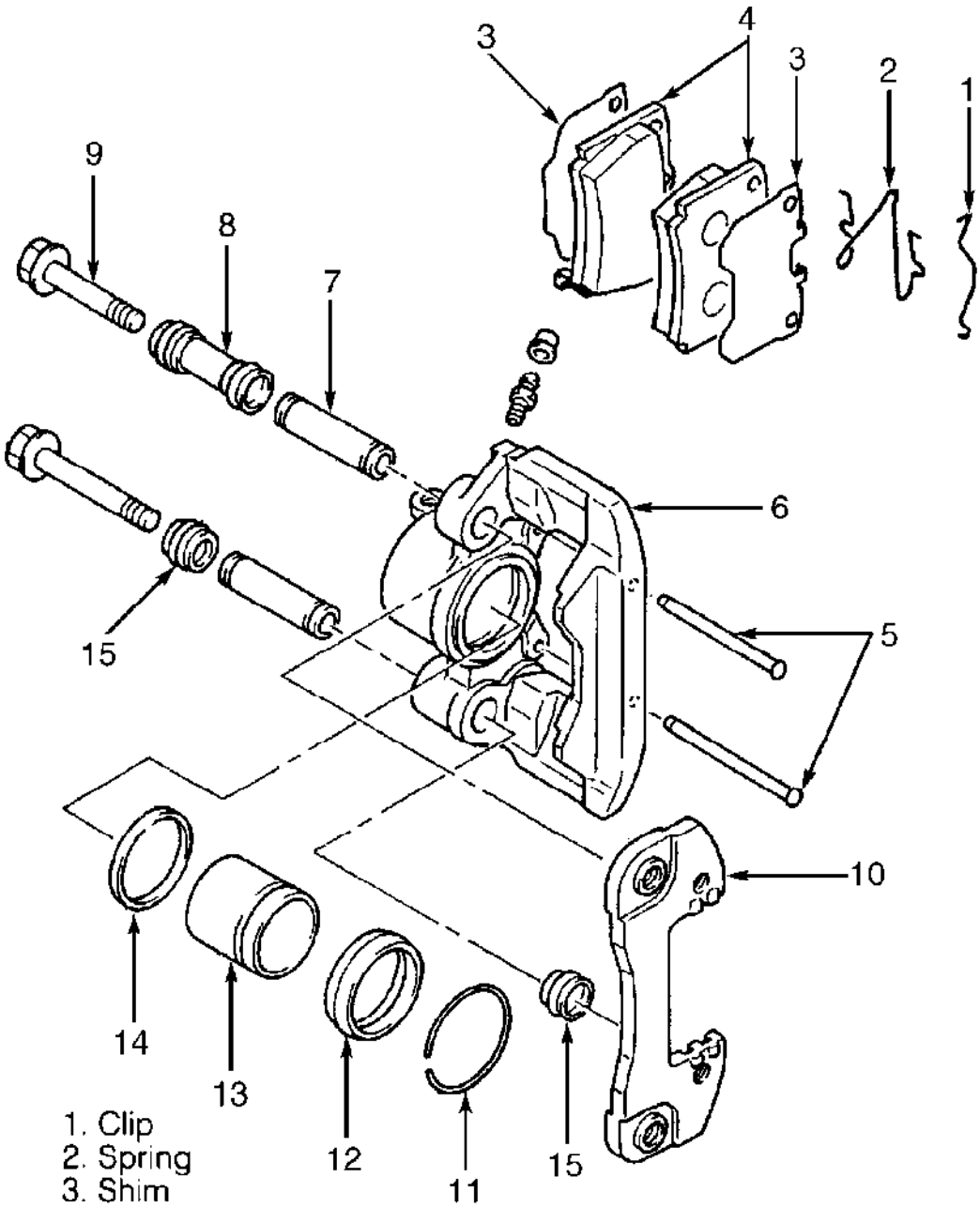


Fig. 14: Exploded View Of Single Piston Caliper Assembly (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America.

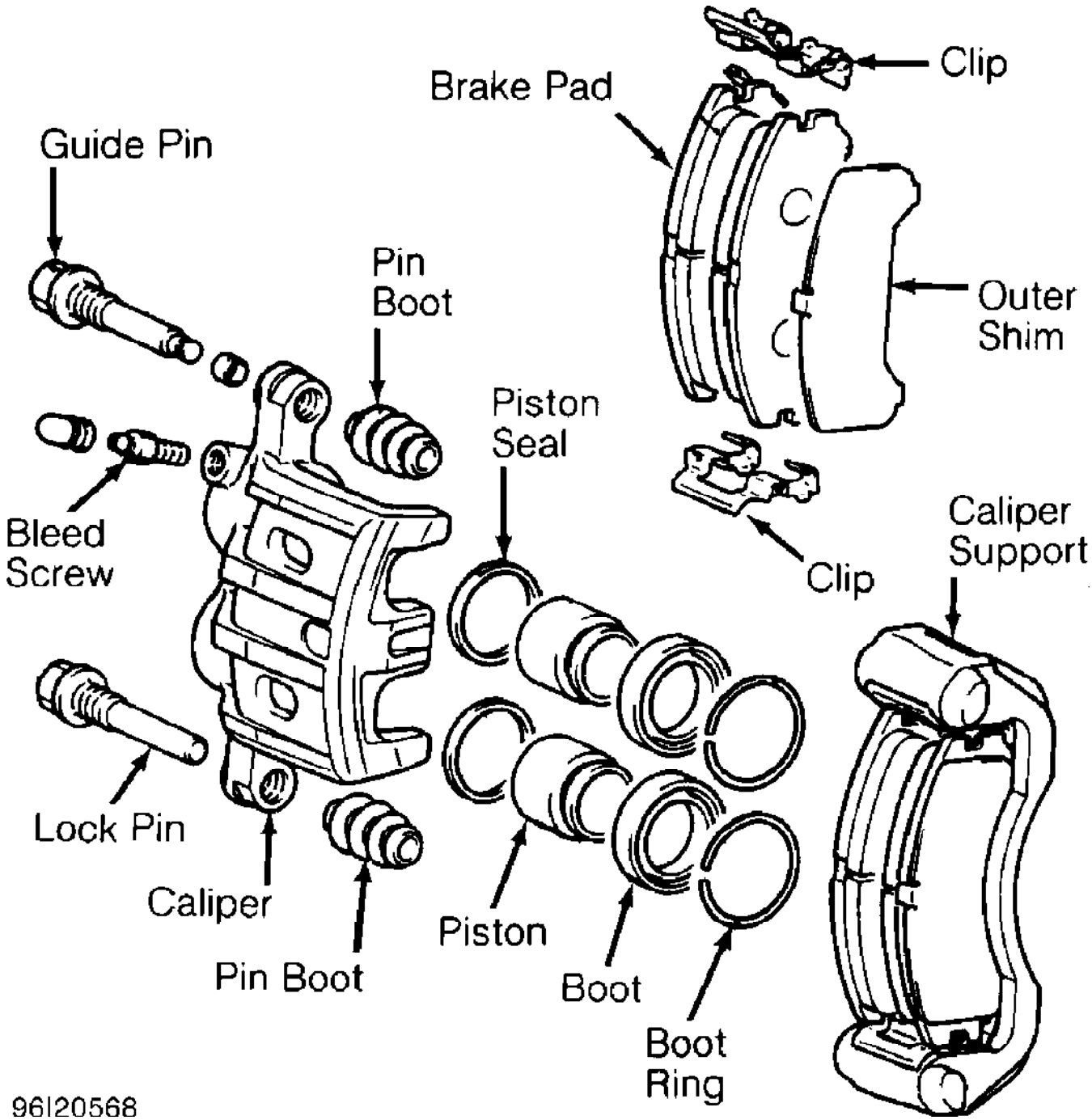


Fig. 15: Exploded View Of Dual Piston Caliper Assembly
Courtesy of Mitsubishi Motor Sales of America.

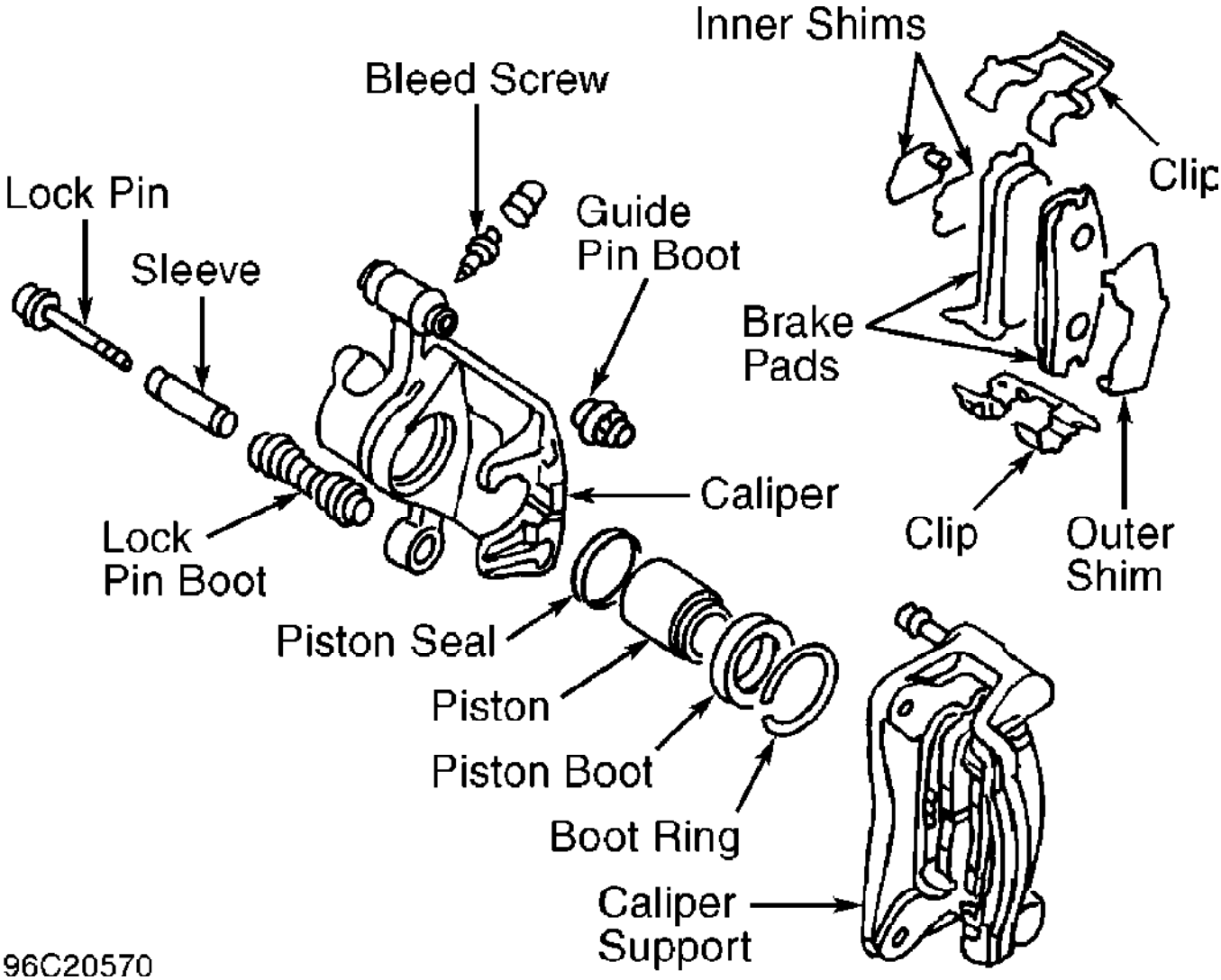


Fig. 16: Exploded View Of 4-Piston Caliper Assembly (Montero)
Courtesy of Mitsubishi Motor Sales of America.

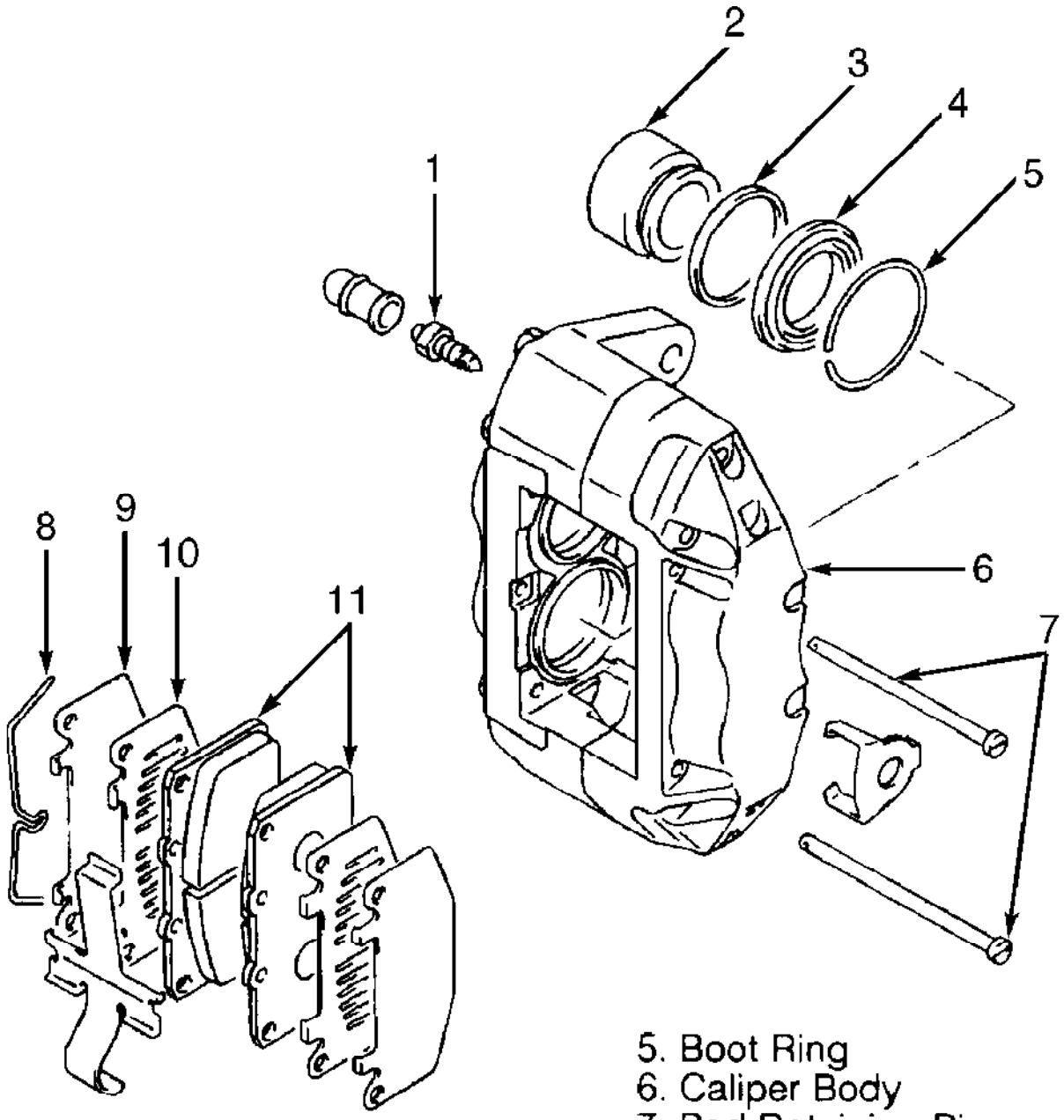


Fig. 17: Exploded View Of 4-Piston Caliper Assembly (3000GT AWD)
Courtesy of Mitsubishi Motor Sales of America.

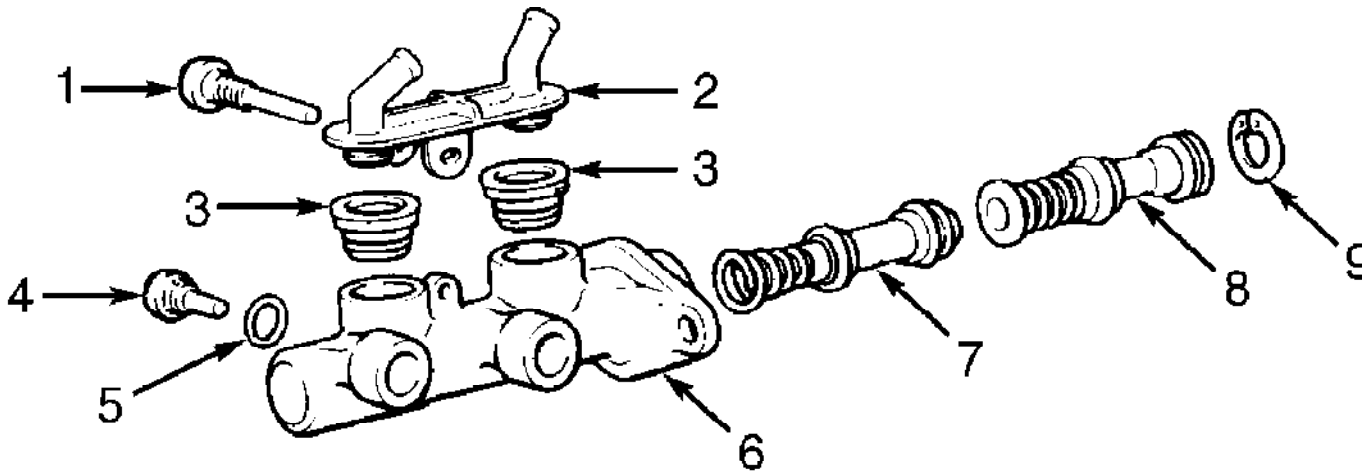


Fig. 18: Exploded View Of Master Cylinder (Typical)
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS (DIAMANTE)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt	
Front	54 (73)
Rear	24 (32)
Caliper Mounting Bolts	
Front	66 (90)
Rear	36-43 (49-59)
Rear Hub-To-Knuckle Bolts	55-65 (74-88)
Wheel Lug Nut	67-81 (90-110)

TORQUE SPECIFICATIONS (ECLIPSE)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt	54 (73)
Caliper Mounting Bolts	66 (90)
Rear Hub-To-Knuckle Nut	60 (81)
Wheel Lug Nut	89-103 (120-140)
	INCH Lbs. (N.m)
Master Cylinder Mounting Nut	115 (13)
Bleeder Screw	71 (8)

Wheel Cylinder Bolt	89 (10)

TORQUE SPECIFICATIONS (GALANT)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt	54 (73)
Caliper Mounting Bolts	66 (90)
Rear Hub-To-Knuckle Nut	60 (81)
Wheel Lug Nut	67-81 (90-110)
	INCH Lbs. (N.m)
Master Cylinder Mounting Booster Nut	115 (13)
Bleeder Screw	71 (8)
Wheel Cylinder Bolt	89 (10)

TORQUE SPECIFICATIONS (MIRAGE)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide Pin Bolt	36 (49)
Caliper Lock Pin Bolt	61-69 (83-93)
Caliper Mounting Bolts	66-81 (90-110)
Rear Wheel Bearing Nut	127 (172)
Wheel Lug Nut	67-81 (90-110)
	INCH Lbs. (N.m)
Master Cylinder Mounting Booster Nut	115 (13)
Bleeder Screw	71 (8)
Wheel Cylinder Bolt	89 (10)

TORQUE SPECIFICATIONS (MONTERO)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt	
Front	54 (73)
Rear	32 (44)
Caliper Mounting Bolt	65 (88)
Wheel Lug Nut	72-87 (98-118)
Rear Axle Bearing Retainer Nut	145-173 (196-235)
	INCH Lbs. (N.m)
Master Cylinder Mounting Nut	115 (13)
Bleeder Screw	71 (8)

TORQUE SPECIFICATIONS (MONTERO SPORT)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt (Front)	54 (73)
Caliper Mounting Bolt	

Front	66 (90)
Rear	94 (127)
Wheel Lug Nut	
15x6" Wheel	87-101 (118-137)
15x7" Wheel	72-86 (98-117)
Rear Axle Bearing Retainer Nut	145-173 (196-235)
	INCH Lbs. (N.m)
Master Cylinder Mounting Nut	115 (13)
Bleeder Screw	71 (8)
Wheel Cylinder Nut	89 (10)

TORQUE SPECIFICATIONS (3000GT)

Application	Ft. Lbs. (N.m)
Brake Line Flare Nuts	11 (15)
Caliper Guide & Lock Pin Bolt (FWD)	
Front	54 (73)
Rear	20 (27)
Caliper Mounting Bolts	
Front	66 (90)
Rear	36-43 (49-59)
Front Axle Shaft Nut	166 (230)
Rear Wheel Bearing Nut	
AWD	192-221 (260-300)
FWD	170 (230)
	INCH Lbs. (N.m)
Master Cylinder Mounting Nut	84 (10)

BRAKE SYSTEM BRAKE SPECIFICATIONS

BRAKE SPECIFICATIONS (DIAMANTE)

Application	In. (mm)
Booster Pushrod Clearance	.016-.024 (.40-.60)
Disc Runout	.003 (.08)
Disc Thickness (Minimum)	
Front	.88 (22.4)
Rear	.33 (8.4)
Hub End Play	.002 (.05)
Master Cylinder Inside Diameter	1.0 (25.4)
Pad Lining Thickness (Minimum)	
Front	1.08 (2.0)
Rear	1.04 (1.0)

BRAKE SPECIFICATIONS (ECLIPSE)

Application	In. (mm)
Booster Pushrod Clearance	.023-.033 (.65-.85)
Disc Runout	.003 (.08)
Disc Diameter	
AWD	9.0 (228)
Except AWD	8.0 (204)

Disc Thickness (Minimum)	
Front	.88 (22.4)
Rear	.33 (8.4)
Drum Inside Diameter (Maximum)	9.1 (231)
Hub End Play	.002 (.05)
Master Cylinder Inside Diameter	
With ABS	1.0 (25.4)
Without ABS	.93 (23.8)
Pad Lining Thickness (Minimum)	.08 (2.0)
Shoe Lining Thickness (Minimum)	.039 (1.0)
Wheel Cylinder Inside Diameter	.750 (19.1)

BRAKE SPECIFICATIONS (GALANT)

Application	In. (mm)
Booster Pushrod Clearance	
Single Booster	.024-.031 (.60-.80)
Tandem Booster	.016-.024 (.40-.60)
Disc Runout	.003 (.08)
Disc Thickness (Minimum)	.88 (22.4)
Drum Inside Diameter (Maximum)	9.1 (231)
Hub End Play	.002 (.05)
Master Cylinder Inside Diameter	1.0 (25.4)
Pad Lining Thickness (Minimum)	.08 (2.0)
Shoe Lining Thickness (Minimum)	.039 (1.0)
Wheel Cylinder Inside Diameter	.750 (19.1)

BRAKE SPECIFICATIONS (MIRAGE)

Application	In. (mm)
Booster Pushrod Clearance	.026-.033 (.65-.85)
Disc Runout	.006 (.0024)
Disc Thickness (Minimum)	.65 (16.4)
Drum Inside Diameter (Maximum)	8.1 (206)
Hub End Play	.002 (.05)
Master Cylinder Inside Diameter	.87 (22.22)
Pad Lining Thickness (Minimum)	.08 (2.0)
Shoe Lining Thickness (Minimum)	.039 (1.0)
Wheel Cylinder Inside Diameter	.750 (19.1)

BRAKE SPECIFICATIONS (MONTERO)

Application	In. (mm)
Booster Pushrod Clearance	.026-.035 (.65-.90)
Disc Runout	
Front	.004 (.10)
Rear	.003 (.08)
Disc Thickness (Minimum)	
Front	1.0 (25.4)
Rear	.65 (16.4)
Hub End Play	.0098 (.25)
Master Cylinder Inside Diameter	.937 (23.8)
Pad Lining Thickness (Minimum)	
Front	1.08 (2.0)
Rear	(1)
Parking Brake Drum Diameter (Maximum)	7.795 (198)

(1) - Information not available from manufacturer.

BRAKE SPECIFICATIONS (MONTERO SPORT)

Application	In. (mm)
Disc Runout	
Front	.002 (.06)
Rear	.003 (.08)
Disc Thickness (Minimum)	
Front	.88 (22.4)
Rear	.65 (16.4)
Drum Diameter (Maximum)	10.71 (272.0)
Hub End Play (Maximum)	.002 (.05)
Master Cylinder Inside Diameter	.937 (23.8)
Pad Lining Thickness (Minimum)	1.08 (2.0)
Shoe Lining Thickness (Minimum)	.039 (1.0)
Wheel Cylinder Inside Diameter	.90 (22.8)

BRAKE SPECIFICATIONS (3000GT)

Application	In. (mm)
Booster Pushrod Clearance	.026-.030 (.65-.75)
Disc Runout	
Front	
AWD	.004 (.10)
FWD	.003 (.07)
Rear	.003 (.08)
Disc Thickness (Minimum)	
Front	
AWD	1.12 (28.4)
FWD	.88 (22.4)
Rear	
AWD	.72 (18.4)
FWD	.65 (16.4)
Hub End Play	.002 (.05)
Master Cylinder Inside Diameter	1.0 (25.4)
Pad Lining Thickness (Minimum)	1.08 (2.0)
Parking Brake Drum Diameter (Maximum)	6.65 (169)

CLUTCH

1997-99 Mitsubishi Montero Sport

1997-99 CLUTCHES
Mitsubishi RWD

Montero, Montero Sport

DESCRIPTION

Clutch system uses diaphragm spring, single-disc type clutches. Clutch is hydraulically operated.

ADJUSTMENTS

CLUTCH PEDAL FREE PLAY

1) Depress clutch pedal by hand until resistance is felt. Measure clutch pedal free play. See CLUTCH PEDAL SPECIFICATIONS table. See Fig. 1.
2) If pedal free play needs to be adjusted, loosen lock nut on clutch master cylinder push rod and rotate push rod to obtain correct free play. Tighten lock nut. See Fig. 1. If depressed free play cannot be adjusted, bleed system and inspect hydraulic and clutch components.

CLUTCH PEDAL HEIGHT

1) Measure distance between face of clutch pedal and floor board. See CLUTCH PEDAL SPECIFICATIONS table. See Fig. 1. To adjust pedal height, disconnect clutch switch connector (if equipped).
2) Loosen master cylinder push rod lock nut. Rotate stopper, clutch switch or clutch master cylinder push rod until correct pedal height is obtained.

CLUTCH PEDAL SPECIFICATIONS

Application	In. (mm)
Montero	
Free Play	.24-.51 (6-13)
Pedal Height	
Pedal Depressed (1)	1.4 (35)
Pedal Released	7.3-7.5 (185-190)
Montero Sport	
Free Play	.24-.51 (6-13)
Pedal Height	
Pedal Depressed (1)	2.2 (56)
Pedal Released	7.0 (178)

(1) - Specification given is minimum distance.

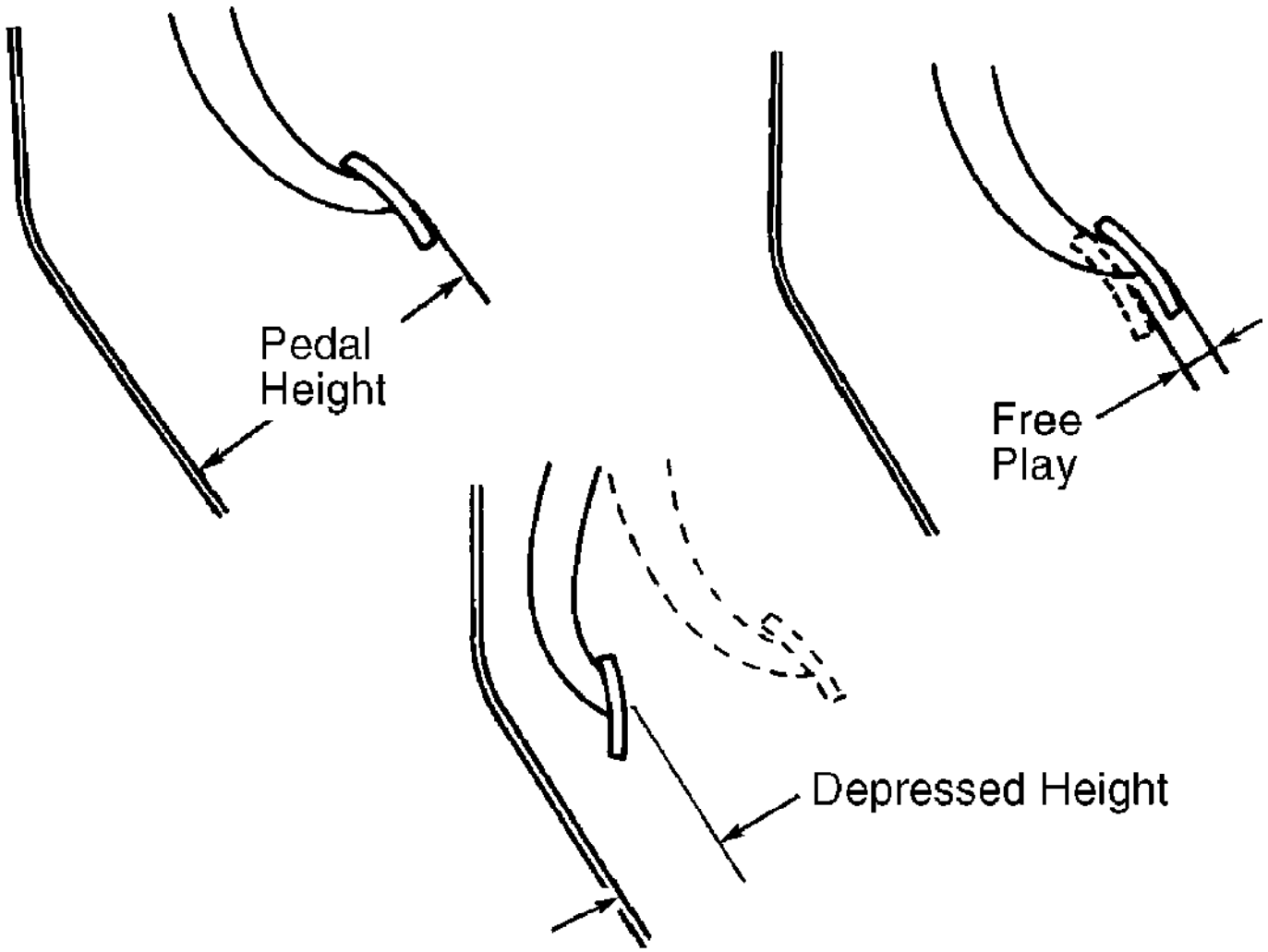


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Fig. 1: Measuring Pedal Free Play & Height (Typical)
Courtesy of Mitsubishi Motor Sales of America.

CLUTCH PEDAL INTERLOCK SWITCH

1) Check and adjust pedal height and free play. See CLUTCH PEDAL HEIGHT and CLUTCH PEDAL FREE PLAY. See Fig. 1. Measure clutch pedal full stroke. Full stroke should be 5.72" (145 mm). If full stroke is out of tolerance, adjust stroke by turning clutch master cylinder push rod. See Fig. 2.

2) Measure clearance "A" with clutch pedal fully depressed (full stroke). See Fig. 2. Clearance "A" should be .177-.217" (4.5-5.5 mm). If clearance is out of tolerance, adjust by loosening interlock switch lock nut and turning interlock switch in appropriate direction. When clearance "A" is correct, tighten lock nut.

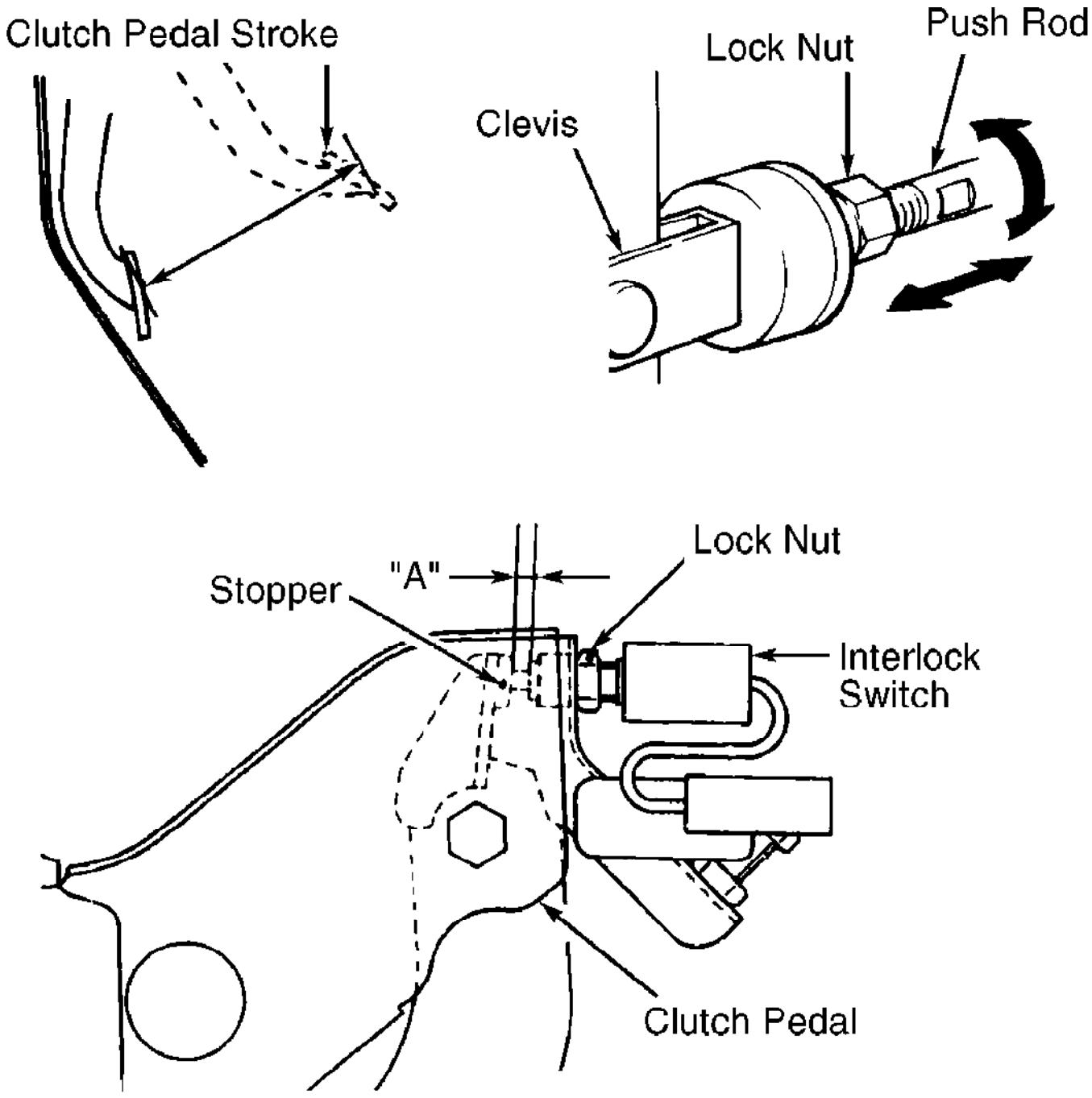


Fig. 2: Adjusting Interlock Switch (Montero Shown)
Courtesy of Mitsubishi Motor Sales of America.

TESTING

CLUTCH PEDAL DEPRESSED HEIGHT

Depress clutch pedal to floor. Measure distance between face of clutch pedal and floor board. If depressed pedal height is not as

specified, bleed system and inspect hydraulic and clutch components. See CLUTCH PEDAL SPECIFICATIONS table.

CLUTCH PEDAL INTERLOCK SWITCH

1) Place transmission in Neutral and apply parking brake. Turn ignition switch to START position with clutch pedal not depressed. Engine should not crank. If engine cranks, adjust or replace interlock switch.

2) Disconnect interlock switch connector. Interlock switch connector is located at clutch pedal. Depress and release interlock switch. Using ohmmeter, check continuity between interlock switch terminals. If continuity exists with interlock switch depressed and does not exist with switch released, switch is okay. Adjust or replace as necessary.

REMOVAL & INSTALLATION

CLUTCH ASSEMBLY

Removal (2WD Models)

1) Disconnect negative battery cable. Remove shift knob, dust cover retaining plate, gaskets, stopper plate and control lever assembly. Raise and support vehicle.

2) Remove front exhaust pipe. Drain transmission fluid. Index mark drive shaft flange and remove drive shaft.

3) Disconnect back-up light switch connector, speedometer cable connection and exhaust pipe mounting bracket. Remove lower bellhousing cover. Disconnect clutch cable from clutch lever.

4) Support transmission with jack. Remove rear engine mount nuts and bolts from transmission. Remove crossmember with rear engine mount. Remove remaining bellhousing bolts, move transmission toward rear and lower from vehicle.

5) If reusing pressure plate, index mark pressure plate to flywheel for installation reference. Install a clutch alignment tool to prevent pressure plate and clutch disc from dropping. Loosen pressure plate bolts gradually in a crisscross pattern to avoid warping pressure plate flange during removal. Remove pressure plate and clutch disc. See Fig. 3.

Inspection

1) Check release bearing and release fork for damage or wear. DO NOT clean release bearing assembly in solvent.

2) Inspect pressure plate surface for wear, cracks, and/or discoloration. Measure diaphragm spring ends for wear and uneven height. Replace assembly if height difference between fingers exceeds .02" (.5 mm).

3) Check facing of clutch disc for loose rivets, uneven contact, deterioration, seizure or oil saturation. Measure distance from clutch disc surface to head of rivet. Replace clutch disc if distance is less than .012" (.30 mm). Replace worn or defective components as necessary. See Fig. 4.

CAUTION: Install clutch disc with manufacturer's stamp mark (located near hub of clutch disc) toward pressure plate.

Installation

1) Using a clutch alignment tool, install pressure plate and clutch disc. If reusing pressure plate, ensure index marks are aligned. Tighten bolts evenly in a crisscross pattern to specification. See TORQUE SPECIFICATIONS. See Fig. 3.

2) Clean release bearing sliding surface. DO NOT clean

release bearing with solvent. Apply a light coat of multipurpose grease to release bearing sliding surface. Apply a very light coating of grease to input shaft splines. DO NOT allow grease or dirt on clutch disc or pressure plate surfaces.

3) To install remaining components, reverse removal procedure. Refill all fluids to proper levels. Adjust all control cables, clutch pedal height and free play. See CLUTCH PEDAL HEIGHT and CLUTCH PEDAL FREE PLAY under ADJUSTMENTS. See Fig. 1.

Removal (4WD Models)

1) Remove switch panel from rear console. Remove suspension control switch or hole cover. Disconnect rear console harness connector. Remove side panel. Remove rear console assembly. Remove shift lever knob(s). Remove floor console harness connector. Remove front console assembly.

2) Move transmission lever to Neutral position and transfer lever to 4H (4WD high range) position. Remove control lever boot retainer and boot. Remove transmission and transfer control lever assemblies. Remove control lever bushing (transmission), gaskets and stopper plates.

3) Raise and support vehicle. Remove skid plate and front exhaust pipe. Drain transmission and transfer case fluid. Index mark front and rear drive shaft flanges. Remove front and rear drive shafts.

4) Remove drive shaft dust seals. Disconnect HI/LO and 2WD/4WD detection switch connectors. Disconnect back-up light switch connector. Disconnect center differential lock detection switch connector. Disconnect center differential lock operation switch connector. Disconnect 4WD operation detection switch.

5) Disconnect speedometer cable. Remove clutch slave cylinder heat shield. Remove clutch slave cylinder (without disconnecting hydraulic line) and wire aside. Remove starter and starter cover. Remove heat shield, both transmission stays and bellhousing lower cover.

6) Support transmission with transmission jack. Remove transfer case roll stopper and bracket. Remove crossmember and engine mounting rear insulator. Remove transfer case protector bracket and mass damper. Remove remaining bellhousing bolts. Pull toward rear of vehicle to free transmission input shaft from clutch. Lower transmission/transfer assembly from vehicle.

7) If reusing pressure plate, mark pressure plate to flywheel for installation reference. Insert a clutch alignment tool to prevent pressure plate and clutch disc from dropping. Loosen pressure plate bolts gradually in a crisscross pattern to avoid warping pressure plate flange during removal. Remove pressure plate and clutch disc. See Fig. 3.

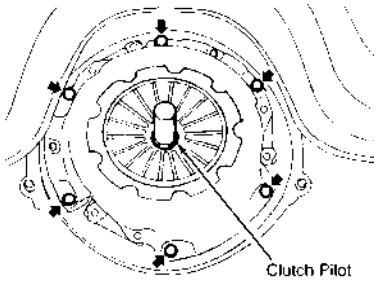


Fig. 3: Removing & Installing Clutch On Flywheel (Typical)
Courtesy of Mitsubishi Motor Sales of America.

Inspection

1) Check release bearing and release fork for damage or wear.

DO NOT clean release bearing assembly in solvent. Inspect hydraulic system components for fluid leakage. Inspect cylinder dust boot for cracks or deterioration.

2) Inspect pressure plate surface for wear, cracks, and/or discoloration. Measure diaphragm spring ends for wear and uneven height. Replace assembly if height difference between fingers exceeds .02" (.5 mm).

3) Check facing of clutch disc for loose rivets, uneven contact, deterioration, seizure or oil saturation. Measure depth from clutch disc surface to head of rivet. Replace clutch disc if measurement is less than .012" (.30 mm). See Fig. 4. Replace worn or defective components as necessary.

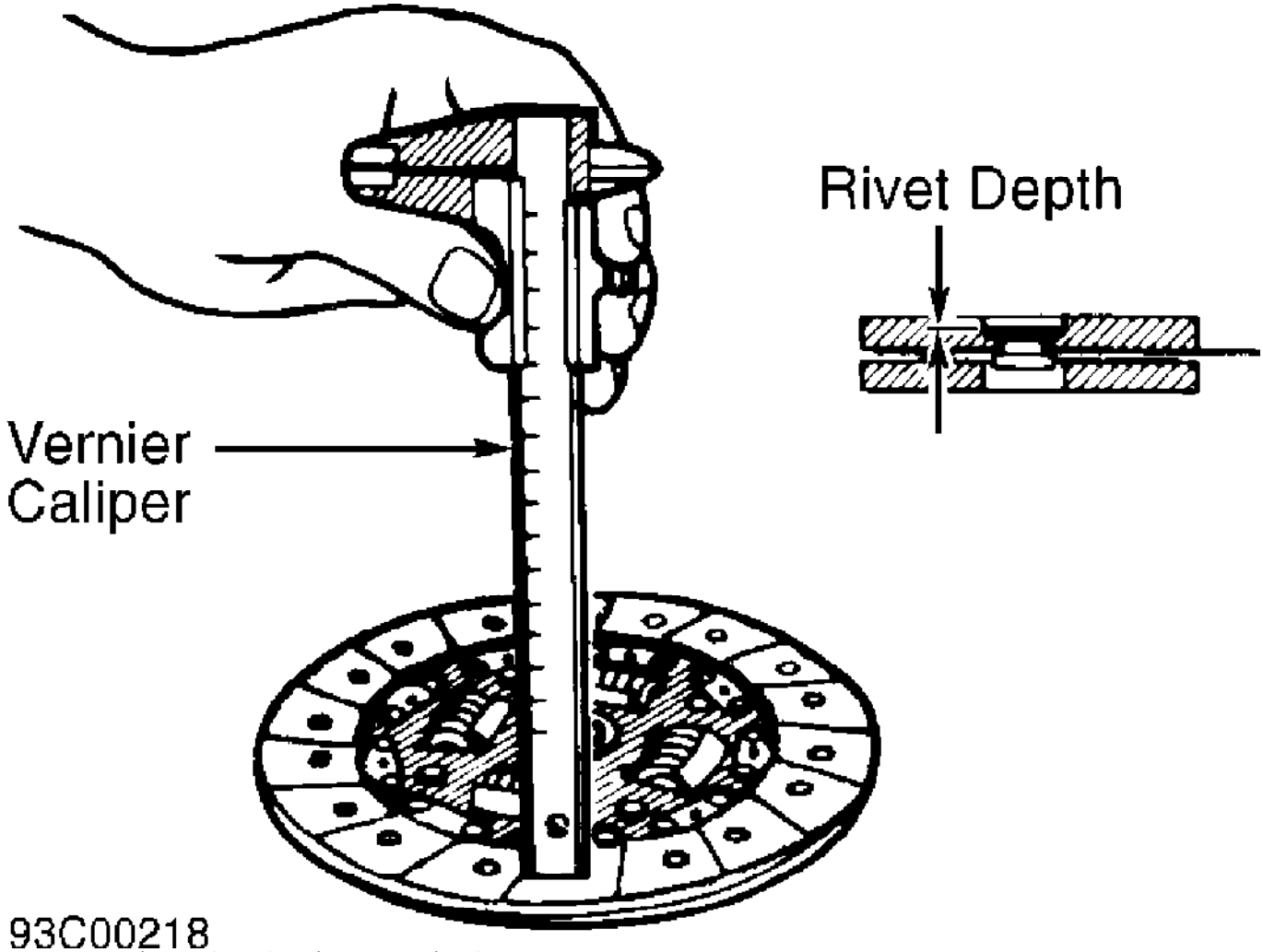


Fig. 4: Measuring Clutch Disc (Typical)
Courtesy of Mitsubishi Motor Sales of America.

CAUTION: Install clutch disc with manufacturer's stamp mark (located near hub of clutch disc) toward pressure plate.

Installation

1) Using a clutch alignment tool, install pressure plate and clutch disc. Tighten bolts evenly in a crisscross pattern to specification. See TORQUE SPECIFICATIONS.

2) Clean release bearing sliding surface. Apply a light coating of multipurpose grease to release bearing sliding surface.

Apply a very light coating of grease to input shaft splines. DO NOT allow grease or dirt on clutch disc or pressure plate surfaces.

3) To install remaining components, reverse removal procedure. Refill all fluids to proper levels. Adjust all control cables, clutch pedal height and free play. See CLUTCH PEDAL HEIGHT and CLUTCH PEDAL FREE PLAY under ADJUSTMENTS. See Fig. 1.

CLUTCH RELEASE BEARING & RELEASE FORK

Removal (2WD Models)

1) Remove transmission. See CLUTCH ASSEMBLY. Remove return clips, release bearing and carrier. Use a punch to remove shift arm spring pin and release lever assembly. Remove shift arm, felt packing and 2 return springs. See Fig. 5.

2) Ensure release bearing turns freely and smoothly under light load. Replace bearing if noise, roughness or dryness is present. DO NOT clean bearing in solvent. Use shop towel or compressed air only.

Installation

1) Insert lever and shaft into left side of transmission case. Place shift arm, felt packing and return springs on shaft assembly. Apply grease to inside of bushing and oil seal lips. Apply oil to felt packing.

2) Align shift arm pin and control shaft pin holes. Drive spring pins into position, with slit area upward. Reverse removal procedure to complete installation. Check pedal height and free play. Adjust if necessary. See CLUTCH PEDAL HEIGHT and CLUTCH PEDAL FREE PLAY under ADJUSTMENTS.

Removal (4WD Models)

1) Remove transmission. See CLUTCH ASSEMBLY. Remove return spring or clips, and remove release bearing.

2) Slide release fork toward outside of transmission and disengage from fulcrum ball. DO NOT slide release fork toward inside of case, or damage to fulcrum ball clip will result. Remove release fork boot.

Installation

To install, reverse removal procedure. Apply grease to fulcrum ball contact area of release fork before installing. Fill groove of release bearing inside diameter with grease before installing. See Fig. 5.

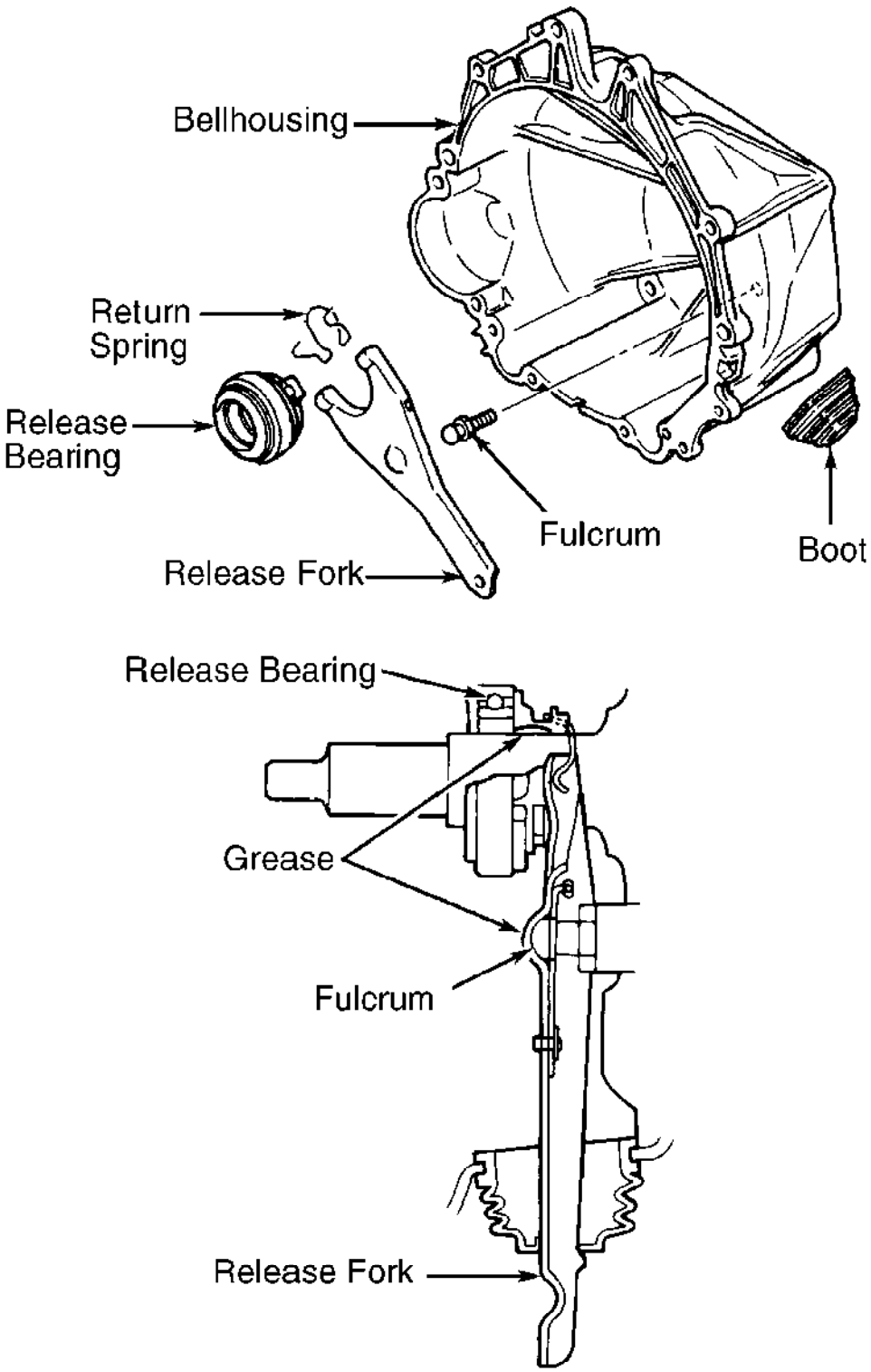


Fig. 5: Exploded View Of Clutch Release Bearing & Shift Arm Assembly
Courtesy of Mitsubishi Motor Sales of America.

CLUTCH MASTER CYLINDER

Removal & Installation

1) Drain master cylinder. Remove cotter pin, washer and clevis pin. Disconnect push rod from clutch pedal. Remove and plug hydraulic line at clutch master cylinder.

2) Remove retaining nuts, clutch master cylinder and gasket. To install, reverse removal procedure. Apply grease to clevis pin before installing. Fill reservoir and bleed clutch system. See BLEEDING CLUTCH HYDRAULIC SYSTEM.

CLUTCH RELEASE CYLINDER

Removal & Installation

Remove and plug hydraulic line at release cylinder. Remove cylinder-to-transmission bolts. Remove clutch release cylinder. To install, reverse removal procedure. Apply grease to push rod-to-release fork contact area. Bleed clutch system. See BLEEDING CLUTCH HYDRAULIC SYSTEM.

BLEEDING CLUTCH HYDRAULIC SYSTEM

Attach hose to bleeder fitting located on clutch release cylinder, next to hydraulic line. Submerge other end of hose in container half full of clean brake fluid. Fill reservoir with brake fluid. Open bleeder fitting. Have assistant press clutch pedal to full release position. Close bleeder fitting. Release clutch pedal. Repeat until air bubbles no longer emerge from hose. Refill reservoir.

OVERHAUL

CLUTCH MASTER CYLINDER

NOTE: DO NOT disassemble piston assembly.

Disassembly

Remove piston stop ring, damper and push rod assembly. See Fig. 6. Remove piston assembly. Note position of reservoir band for reassembly reference. Remove reservoir.

Inspection & Reassembly

Inspect components for corrosion, scoring or damage. Replace if necessary. Apply brake fluid to components during reassembly. On Montero, adjust clutch master cylinder push rod to 5.90" (150 mm). On Montero Sport, push rod adjustment is correct after adjusting clutch pedal free play and pedal height. See CLUTCH PEDAL FREE PLAY and CLUTCH PEDAL HEIGHT under ADJUSTMENTS. To reassemble, reverse disassembly procedure. Ensure piston moves freely in bore.

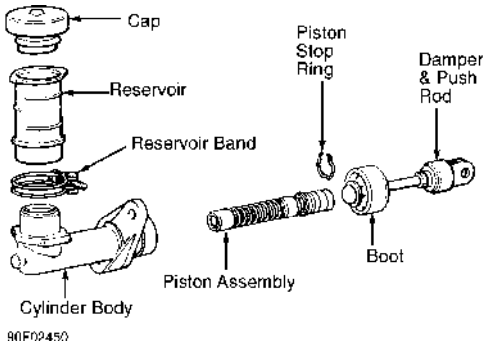


Fig. 6: Exploded View Of Clutch Master Cylinder (Typical)
Courtesy of Mitsubishi Motor Sales of America.

CLUTCH RELEASE CYLINDER

Disassembly

Remove valve plate and spring. See Fig. 7. Remove push rod and boot. Cover piston assembly opening with a rag. Slowly apply air pressure to hydraulic line opening to force piston from body.

Inspection & Reassembly

Inspect components for corrosion, scoring or damage. Replace if necessary. Apply brake fluid to components during reassembly. To reassemble, reverse disassembly procedure. Ensure piston moves freely in bore.

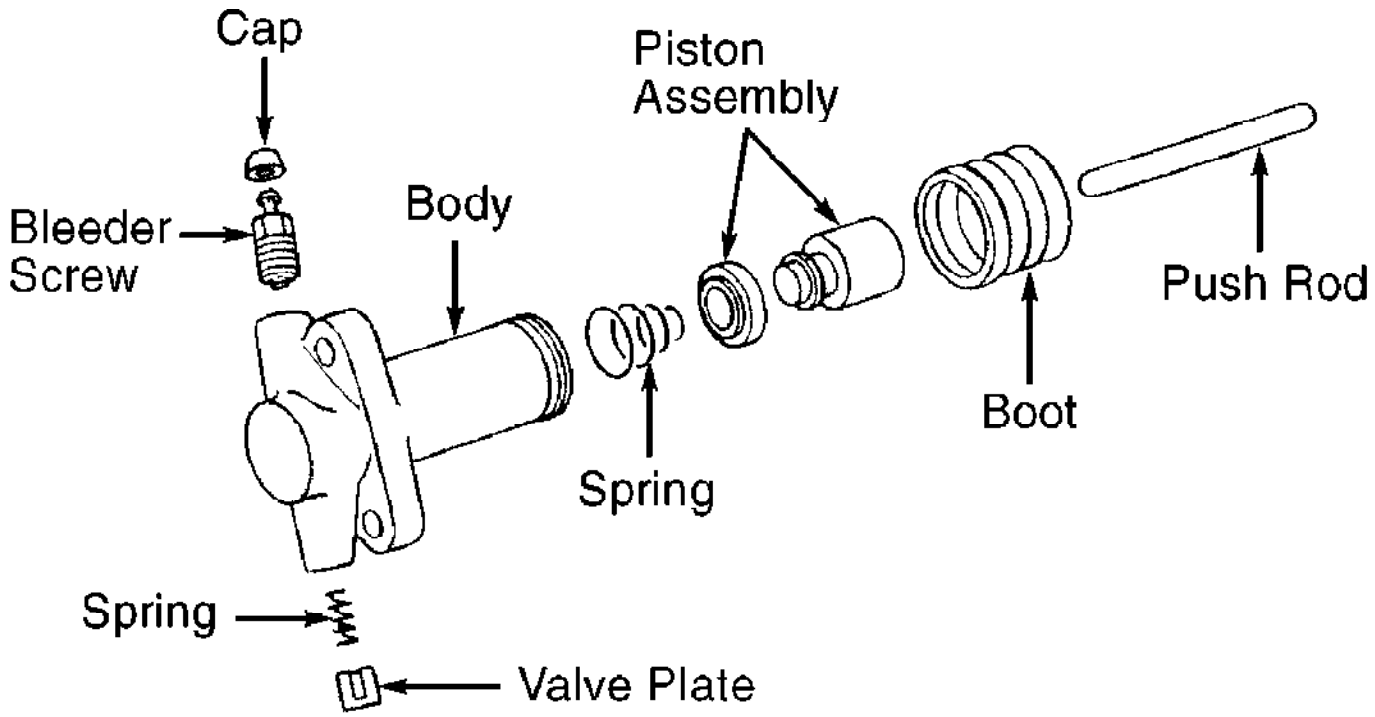


Fig. 7: Exploded View Of Clutch Release Cylinder (Typical)
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Clutch Pedal Position Switch Adjusting Nut Or Bolt	10 (13)
Bellhousing-To-Engine Mounting Bolt	
Montero	
10 x 40 mm	26 (36)
10 x 55 mm	22 (31)
12 x 40 mm	54 (75)
12 x 55 mm	65 (90)
Montero Sport	
2WD	19 (26)
4WD	55 (75)
Clutch Master Cylinder Mounting Nut	10 (13)

Clutch Pedal Mounting Nut	21 (29)
Flywheel Bolt	
Montero	54 (74)
Montero Sport	98 (132)
Fulcrum Ball	26 (35)
Hydraulic Line Flare Nut	11 (15)
Push Rod Jam Nut	10 (13)
Release Cylinder Mounting Bolt	27 (36)
Starter Mounting Bolt	23 (31)
Transfer Case Roll Stopper Bolt	33 (44)
Transmission Crossmember Mounting Bolt	47 (64)
Transmission Support Bolt	
Front (Crossmember)	29 (39)
Rear	26 (35)

COMPUTER RELEARN PROCEDURES

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Computer Relearn Procedures

All Models

* PLEASE READ THIS FIRST *

The following general procedures are to be used if driveability problems are encountered after power loss or battery has been disconnected. These procedures may provide an aid in eliminating these problems.

To reduce the possibility of complaints, after any service which requires battery power to be disconnected, vehicle should be road tested.

COMPUTER RELEARN PROCEDURES

Vehicles equipped with engine or transmission computers may require a relearn procedure after vehicle battery is disconnected. Many vehicle computers memorize and store vehicle operation patterns for optimum driveability and performance. When vehicle battery is disconnected, this memory is lost. The computer will use default data until new data from each key start is stored. As computer memorizes vehicle operation for each new key start, driveability is restored. Vehicle computers may memorize vehicles operation patterns for 40 of more key starts.

Customers often complain of driveability problems during relearn stage because vehicle acts differently then before being serviced. Depending on type and make of vehicle and how it is equipped, the following complaints (driveability problems) may exist:

* Harsh Or Poor Shift Quality
* Rough Or Unstable Idle
* Hesitation Or Stumble
* Rich Or Lean Running
* Poor Fuel Mileage

These symptoms and complaints should disappear after a number of drive cycles have been memorized. To reduce the possibility of complaints, after any service which requires battery power to be disconnected, vehicle should be road tested. If a specific relearn procedure is not available, the following procedure may be used:

Automatic Transmission

* Set parking brake, start engine in "P" or "N" position. Warm-up vehicle to normal operating temperature or until cooling fan cycles.
* Allow vehicle to idle for one minute in "N" position. Select "D" and allow engine to idle for one minute.
* Accelerate at normal throttle position (20-50%) until vehicle shifts into top gear.
* Cruise at light to medium throttle.
* Decelerate to a stop, allowing vehicle to downshift, and use brakes normally.
* Process may be repeated as necessary.

Manual Transmission

* Place transmission in Neutral position.
* Ensure emergency brake has been set and all accessories are turned off.
* Start engine and bring to normal operating temperature.
* Allow vehicle to idle in Neutral for one minute.
* Initial relearn is complete: process will be completed during normal driving.

Some manufacturers identify a specific relearn procedure which will help establish suitable driveability during relearn stage. These procedures are especially important if vehicle is equipped with and electronically controlled automatic transmission or transaxle. Always complete procedure before returning vehicle to customer.

COOLING SYSTEM SPECIFICATIONS & ENGINE COOLING FANS

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE COOLING
Mitsubishi Specifications & Electric Cooling Fans

Diamante, Eclipse, Galant, Mirage, Montero, Montero Sport, 3000GT

SPECIFICATIONS

BELT ADJUSTMENT

NOTE: Use illustration for water pump drive belt routing. See Figs. 1-6. The terms alternator and generator are used interchangeably.

BELT ADJUSTMENT

Application	Deflection (1) In. (mm)
Diamante	(2)
Eclipse & Galant	
2.0L Non-Turbo	(2)
2.0L Turbo & 2.4L	
Generator & Water Pump	0.35-0.45 (9.0-11.4)
Water Pump & Power Steering	0.22-0.32 (5.6-8.1)
Mirage	
1.5L	0.34-0.45 (8.6-11.4)
1.8L	(2)
Montero	
A/C	0.26-0.30 (6.6-7.6)
Generator & Water Pump	(3) 0.22-0.26 (5.6-6.6)
Water Pump & Power Steering	0.54-0.70 (13.7-17.8)
Montero Sport	
2.4L	
A/C	0.24-0.26 (6.1-6.6)
Generator & Water Pump	(4) 0.28-0.35 (7.1-8.9)
Water Pump & Power Steering	0.22-0.30 (5.6-7.6)
3.0L	
A/C	0.22-0.26 (5.6-6.6)
Generator & Water Pump	(3) 0.20-0.27 (5.1-6.8)
Water Pump & Power Steering	0.52-0.68 (13.2-17.3)
3000GT	(3)

(1) - With 22 lbs. (10 kg) pressure applied midway on belt run. Values are for a used belt.
(2) - Water pump is driven by timing belt. Timing belt deflection is controlled by timing belt automatic tensioner.
(3) - Measured between water pump pulley and crankshaft pulley.
(4) - Measured between water pump pulley and generator pulley.

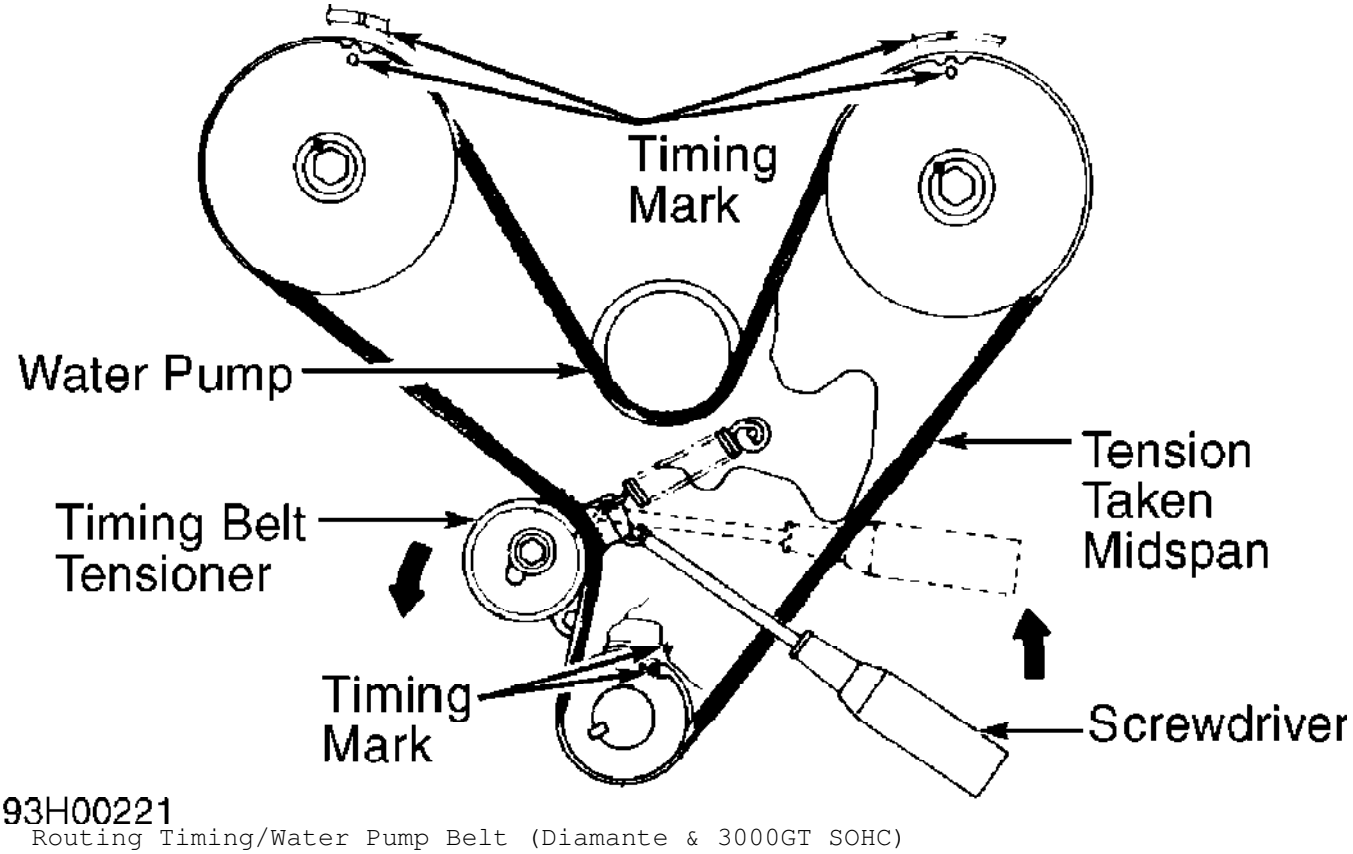


Fig. 1: Routing Timing/Water Pump Belt (Diamante & 3000GT SOHC)
Courtesy of Mitsubishi Motor Sales of America.

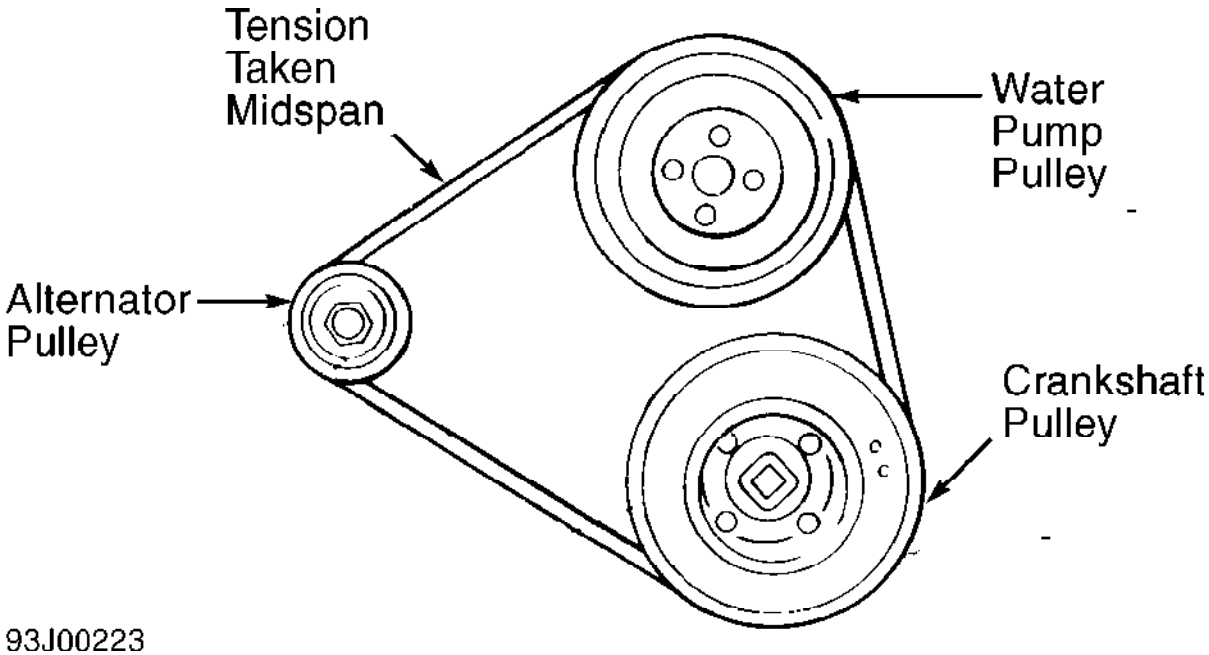


Fig. 2: Routing Alternator & Water Pump Belt (Eclipse - 2.0L Turbo & 2.4L, Galant & Mirage - 1.5L)
Courtesy of Mitsubishi Motor Sales of America.

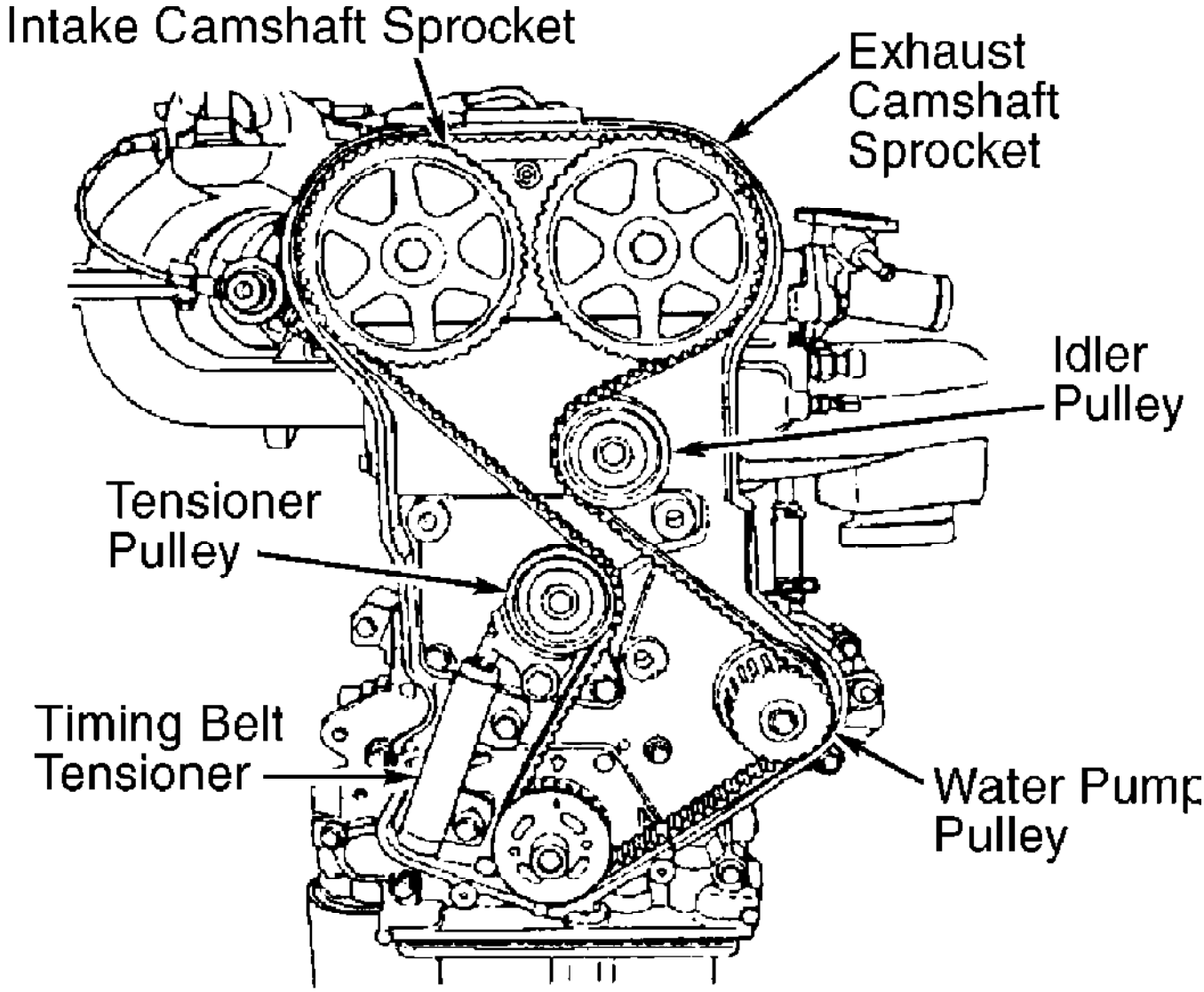


Fig. 3: Routing Timing/Water Pump Belt (Eclipse - 2.0L Non-Turbo)
Courtesy of Mitsubishi Motor Sales of America.

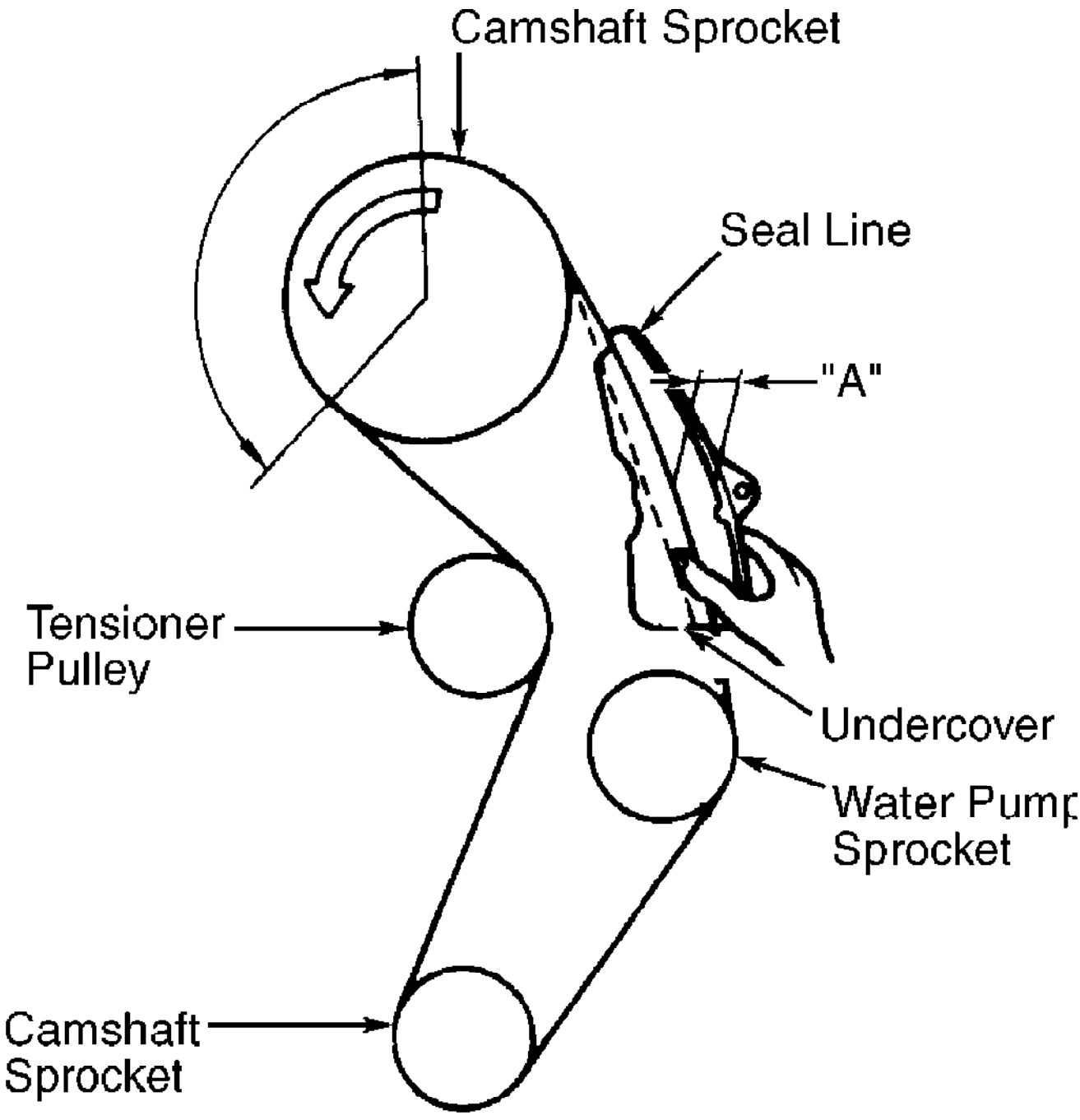


Fig. 4: Routing Timing/Water Pump Belt (Mirage - 1.8L)
Courtesy of Mitsubishi Motor Sales of America.

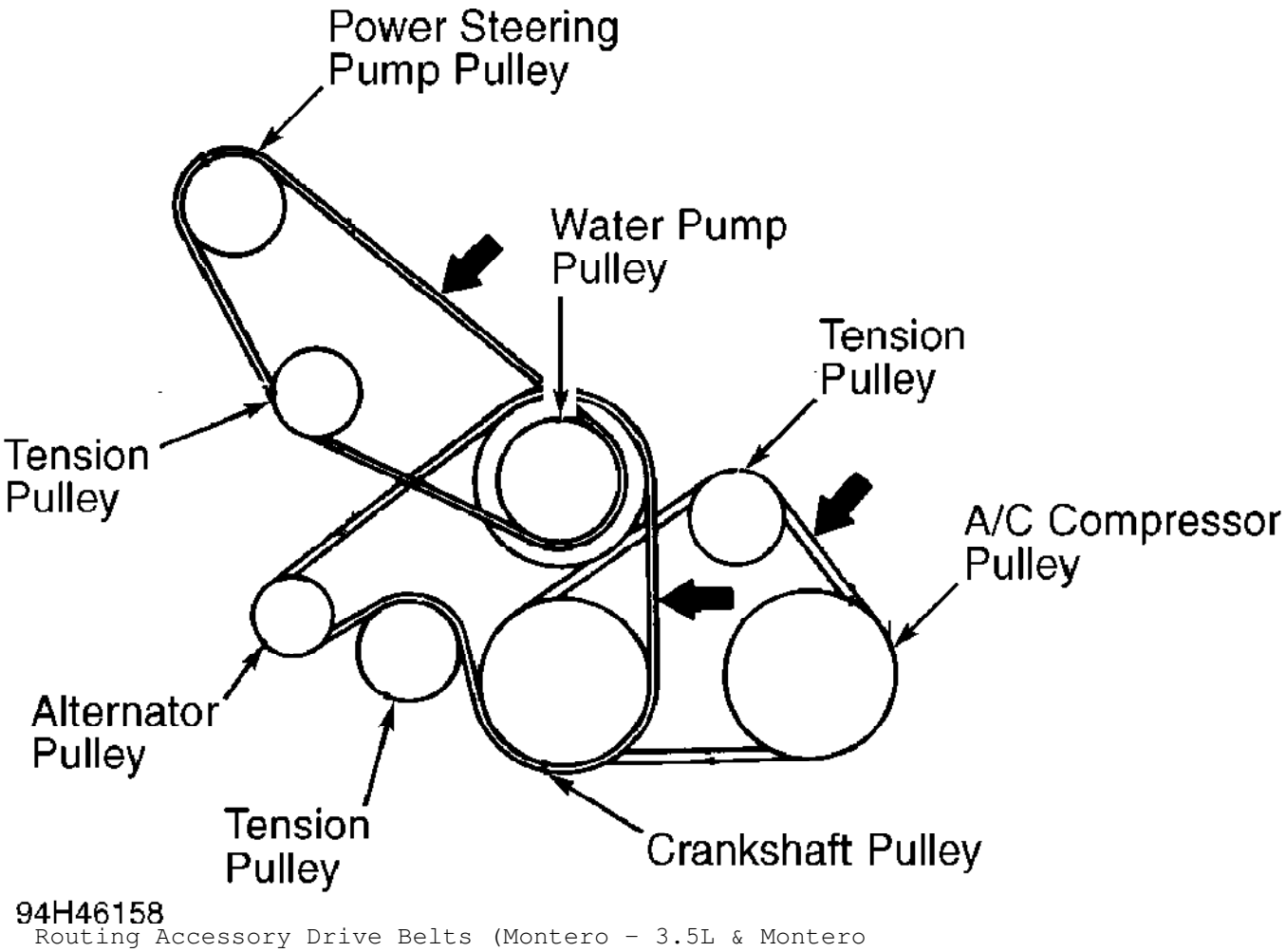
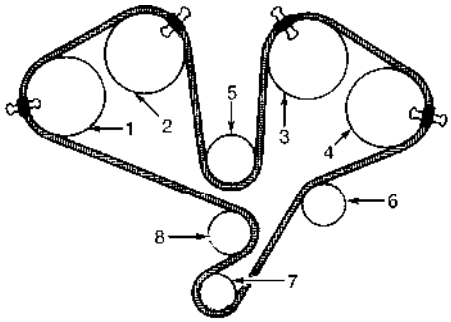


Fig. 5: Routing Accessory Drive Belts (Montero - 3.5L & Montero Sport - 3.0L; Montero Sport - 2.4L Similar)
Courtesy of Mitsubishi Motor Sales of America.



1. Exhaust Camshaft Sprocket (Front Bank)
2. Intake Camshaft Sprocket (Front Bank)
3. Intake Camshaft Sprocket (Rear Bank)
4. Exhaust Camshaft Sprocket (Rear Bank)
5. Water Pump Pulley
6. Idler Pulley
7. Crankshaft Sprocket
8. Tensioner Pulley

Fig. 6: Routing Timing/Water Pump Belt (3000GT - DOHC)
Courtesy of Mitsubishi Motor Sales of America.

COOLING SYSTEM SPECIFICATIONS

COOLING SYSTEM SPECIFICATIONS

Application	Specification
Coolant Replacement Interval	30,000 Miles Or 24 Months
Coolant Capacity (Includes Heater & Reserve Tank)	
Diamante	10.0 Qts. (9.5L)
Eclipse	7.4 Qts. (7.0L)
Galant	7.4 Qts. (7.0L)
Mirage	
1.5L	5.3 Qts. (5.0L)
1.8L	6.3 Qts. (6.0L)
Montero	10.0 Qts. (9.5L)
Montero Sport	
2.4L	
With Rear Heater	9.5 Qts. (9.0L)
Without Rear Heater	8.5 Qts. (8.0L)
3.0L	
With Rear Heater	10.6 Qts. (10.0L)
Without Rear Heater	9.5 Qts. (9.0L)
3000GT	8.5 Qts. (8.0L)
Pressure Cap	
Except Eclipse 2.0L Non-Turbo	11-15 psi
Eclipse 2.0L Non-Turbo	14-18 psi
Thermostat Opens	
Diamante	
1997	
Starts To Open	180°F (82°C)
Fully Open	203°F (95°C)
1998	
Starts To Open	192°F (89°C)
Fully Open	203°F (95°C)
Eclipse	
2.0L Turbo & 2.4L	
Starts To Open	180°F (82°C)
Fully Open	203°F (95°C)
2.0L Non-Turbo	
Starts To Open	195°F (90.5°C)
Fully Open	216°F (102°C)
Galant	
Starts To Open	180°F (82°C)
Fully Open	203°F (95°C)
Mirage	
Starts To Open	177-183°F (80.5-83.9°C)
Fully Open	203°F (95°C)
Montero	
1997	
Starts To Open	180°F (82°C)
Fully Open	203°F (95°C)
1998	
Starts To Open	190°F (88°C)
Fully Open	212°F (100°C)
Montero Sport	
Starts To Open	177-183°F (80.5-83.9°C)
Fully Open	203°F (95°C)
3000GT (SOHC)	
Starts To Open	180°F (82°C)
Fully Open	203°F (95°C)
3000GT (DOHC)	
Starts To Open	170°F (77°C)
Fully Open	194°F (90°C)

ELECTRIC COOLING FAN

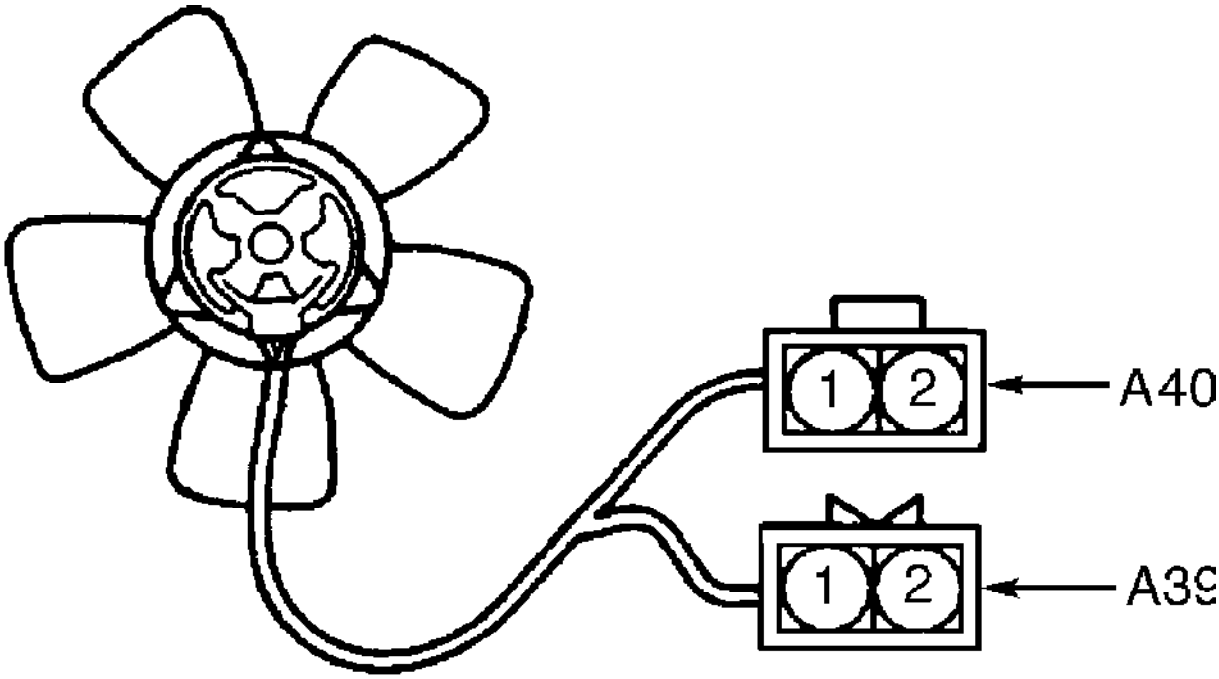
COMPONENT TESTING

Radiator Fan Motor (Diamante)

1) Disconnect radiator fan motor connectors A39 and A40. Ground fan motor connector A39 terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector A39 terminal No. 1 (Blue/Black wire). See Fig. 7. See WIRING DIAGRAMS. Fan motor should operate at low speed with no abnormal noises or interferences. Repair or replace components as necessary.

2) Ground fan motor connector A39 terminal No. 2 (Black wire) and connector A40 terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector A39 terminal No. 1 (Blue/Black wire). See Fig. 7. See WIRING DIAGRAMS. Fan motor should operate at medium speed with no abnormal noises or interferences. Repair or replace components as necessary.

3) Ground fan motor connector A39 terminal No. 2 (Black wire) and connector A40 terminal No. 2 (Black wire). Using 2 fused jumper wires, connect battery voltage to fan motor connector A39 terminal No. 1 (Blue/Black wire) and to connector A40 terminal No. 1 (Green wire). See Fig. 7. See WIRING DIAGRAMS. Fan motor should operate at high speed with no abnormal noises or interferences. Repair or replace components as necessary.



98C11058

Fig. 7: Testing Radiator Fan Motor (Diamante)
Courtesy of Mitsubishi Motor Sales of America.

Radiator Fan Motor (Eclipse)

1) Disconnect radiator fan motor 4-pin connector. Ground fan

motor connector terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector terminal No. 1 (White/Black wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

2) On all models except 1998 2.0L non-turbo, ground fan motor 4-pin connector terminal No. 4 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector terminal No. 3 (White/Blue wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Radiator Fan Motor (Galant)

1) Disconnect radiator fan motor 4-pin connector. Ground fan motor connector terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector terminal No. 1 (Blue wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If no problems exist, go to next step.

2) Ground fan motor 4-pin connector terminal No. 4 (Black wire). Using a fused jumper wire, connect battery voltage to fan motor connector terminal No. 3 (Blue/Black wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Radiator Fan Motor (Mirage)

Disconnect radiator fan motor 2-pin connector. Ground fan motor 2-pin connector terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to 2-pin connector terminal No. 1 (Blue/Black wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Radiator Fan Motor (3000GT)

1) Disconnect radiator fan motor 4-pin connector. Ground fan motor connector terminal No. 4 (Blue/Green wire). Using a fused jumper wire, connect battery voltage to fan motor connector terminal No. 2 (Red/Black wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If radiator fan motor operates as specified, go to next step.

2) Disconnect battery voltage and ground from radiator fan motor 4-pin connector. Using an ohmmeter, measure resistance between radiator fan motor 4-pin connector terminals No. 1 (Black wire) and No. 3 (Yellow/Blue wire). See WIRING DIAGRAMS. Resistance should be 0.29-0.35 ohms. Replace radiator fan motor if resistance is not as specified.

Condenser Fan Motor (Diamante)

1) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 1 (Blue/White wire). Connect ground to connector terminal No. 2 (Black wire). Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If no problems exist, go to next step.

2) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 3 (Yellow wire). When terminal No. 4 (Black wire) is connected to ground, condenser fan should operate faster. Replace condenser fan if operation is not as specified. Ensure there are no abnormal noises or interferences during fan operation.

Condenser Fan Motor (Eclipse)

1) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 1 (Blue wire). Connect ground to connector to terminal No. 4 (Black wire). Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If no problems exist, go to next step.

2) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 3 (Blue/White wire). When terminal No. 2 (Black wire) is connected to ground, condenser fan should operate faster. Replace condenser fan if operation is not as specified. Ensure there are no abnormal noises or interferences during fan operation.

Condenser Fan Motor (Galant)

1) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 1 (Blue wire). Connect ground to connector to terminal No. 2 (Black wire). Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If no problems exist, go to next step.

2) Using a fused jumper wire, connect battery voltage to condenser fan motor 4-pin connector terminal No. 3 (Blue/White wire). When terminal No. 4 (Black wire) is connected to ground, condenser fan should operate faster. Replace condenser fan if operation is not as specified. Ensure there are no abnormal noises or interferences during fan operation.

Condenser Fan Motor (Mirage)

Disconnect radiator fan motor 2-pin connector. Ground fan motor 2-pin connector terminal No. 2 (Black/Blue wire). Using a fused jumper wire, connect battery voltage to 2-pin connector terminal No. 1 (Black/Orange wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Condenser Fan Motor (Montero & Montero Sport)

Disconnect radiator fan motor 2-pin connector. Ground fan motor 2-pin connector terminal No. 1 (Blue/Black wire). Using a fused jumper wire, connect battery voltage to 2-pin connector terminal No. 2 (Blue/White wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Condenser Fan Motor (1997 3000GT)

1) Disconnect both condenser fan motor 2-pin connectors located on driver side of radiator. Ground fan motor 2-pin connector terminal No. 2 (Black wire). Using a fused jumper wire, connect battery voltage to 2-pin connector terminal No. 1 (Blue wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary. If no problems exist, go to next step.

2) Ground fan motor 2-pin connector terminal No. 2 (Blue/Black wire). Using a fused jumper wire, connect battery voltage to 2-pin connector terminal No. 1 (Blue/White wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Condenser Fan Motor (1998 3000GT)

1) Disconnect condenser fan motor 3-pin connector located on driver-side of radiator. Ground fan motor 2-pin connector terminal No. 3 (Black wire). Using a fused jumper wire, connect battery voltage to 3-pin connector terminal No. 1 (Blue/White wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences.

Repair or replace components as necessary. If no problems exist, go to next step.

2) Ground fan motor 3-pin connector terminal No. 3 (Black wire). Using a fused jumper wire, connect battery voltage to 3-pin connector terminal No. 2 (Blue wire). See WIRING DIAGRAMS. Fan motor should operate with no abnormal noises or interferences. Repair or replace components as necessary.

Engine Coolant Temperature (ECT) Sensor

Remove ECT sensor from vehicle. Suspend sensor in water so that sensor does not touch container. Slowly heat water. Using an ohmmeter, check sensor continuity as temperature increases. Replace ECT sensor if resistance is not as specified. See ENGINE COOLANT TEMPERATURE SENSOR RESISTANCE table.

ENGINE COOLANT TEMPERATURE SENSOR RESISTANCE

Temperature °F (°C)	Ohms
Diamante, Eclipse 2.0L Turbo & 2.4L	
32 (0)	5100-6500
68 (20)	2100-2700
104 (40)	900-1300
176 (80)	260-360
Eclipse Non-Turbo	
77 (25)	900-1100
212 (100)	600-800
Galant & Mirage	
68 (20)	2100-2700
176 (80)	260-360
Montero	
68 (20)	2130-2610
176 (80)	258-322
Montero Sport	
68 (20)	2100-2700
176 (80)	260-360
3000GT	
32 (0)	5800
68 (20)	2400
104 (40)	1100
176 (80)	300

Electric Cooling Fan Relay (Diamante, Eclipse, Galant & Mirage)

1) Remove radiator fan motor relay from relay box located at right side of engine compartment. Check for continuity between relay terminals No. 1 and 3. If continuity exists, go to next step. If continuity does not exist, replace cooling fan relay. See Fig. 8.

2) Using a fused jumper wire, connect battery voltage to cooling fan relay terminal No. 1. Using another jumper wire, connect cooling fan relay terminal No. 3 to battery ground. With cooling fan relay energized, there should be continuity between cooling fan relay terminals No. 4 and 5. With cooling fan relay not energized, there should be no continuity between terminals No. 4 and 5. If continuity does not exist as specified, replace cooling fan relay. See Fig. 8.

Electric Cooling Fan Relay (Montero, Montero Sport & 3000GT)

1)Remove relay from relay box in engine compartment relay box. Check for continuity between relay terminals No. 2 and 4. If continuity exists, go to next step. If continuity does not exist, replace cooling fan relay. See Fig. 9.

2) Using a fused jumper wire, connect battery voltage to

cooling fan relay terminal No. 2. Using another jumper wire, connect cooling fan relay terminal No. 4 to battery ground. With cooling fan relay energized, there should be continuity between cooling fan relay terminals No. 1 and 3. With cooling fan relay not energized, there should be no continuity between terminals No. 1 and 3. If continuity does not exist as specified, replace cooling fan relay. See Fig. 9.

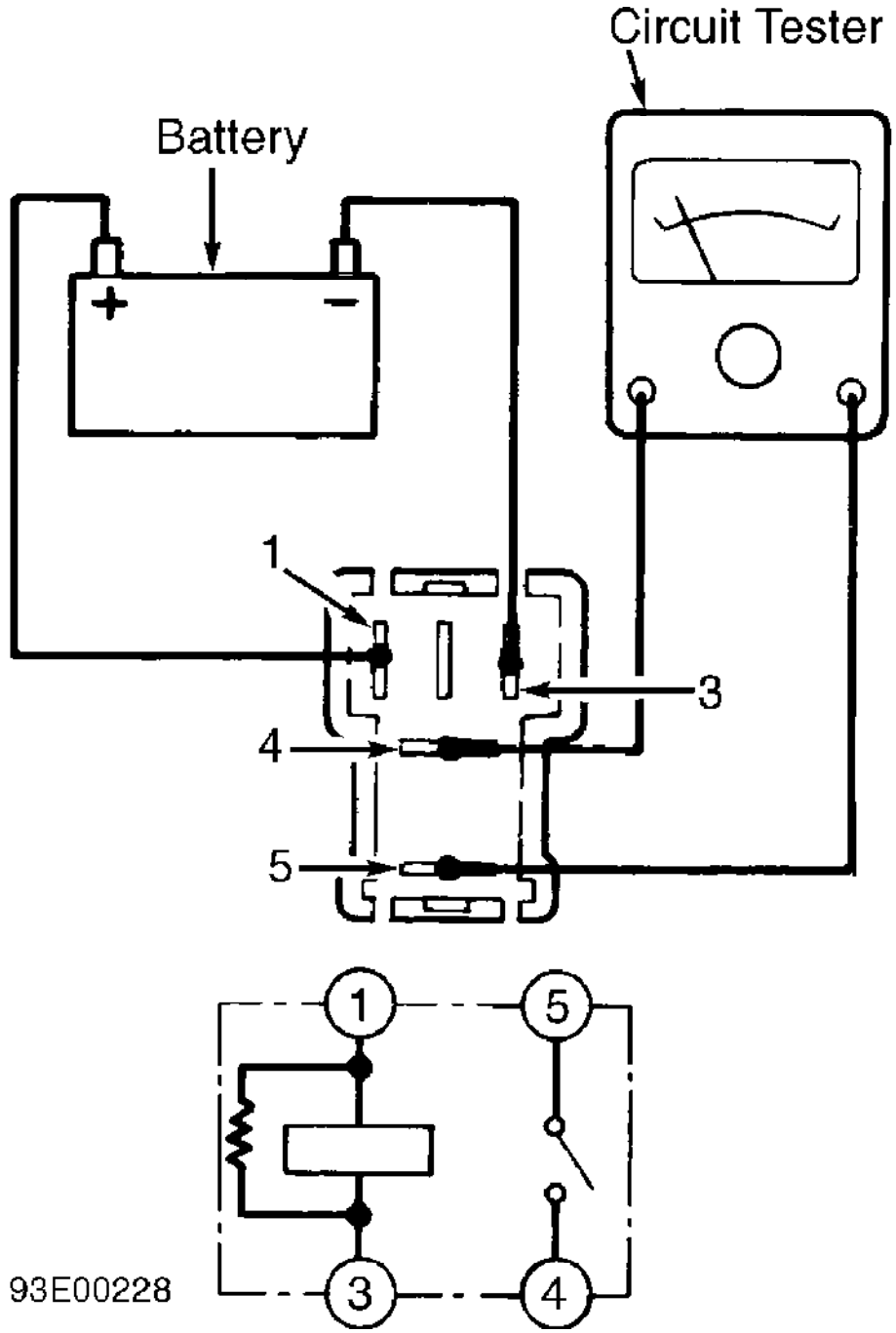


Fig. 8: Testing Electric Cooling Fan Relay (Diamante, Eclipse, Galant & Mirage)
Courtesy of Mitsubishi Motor Sales of America.

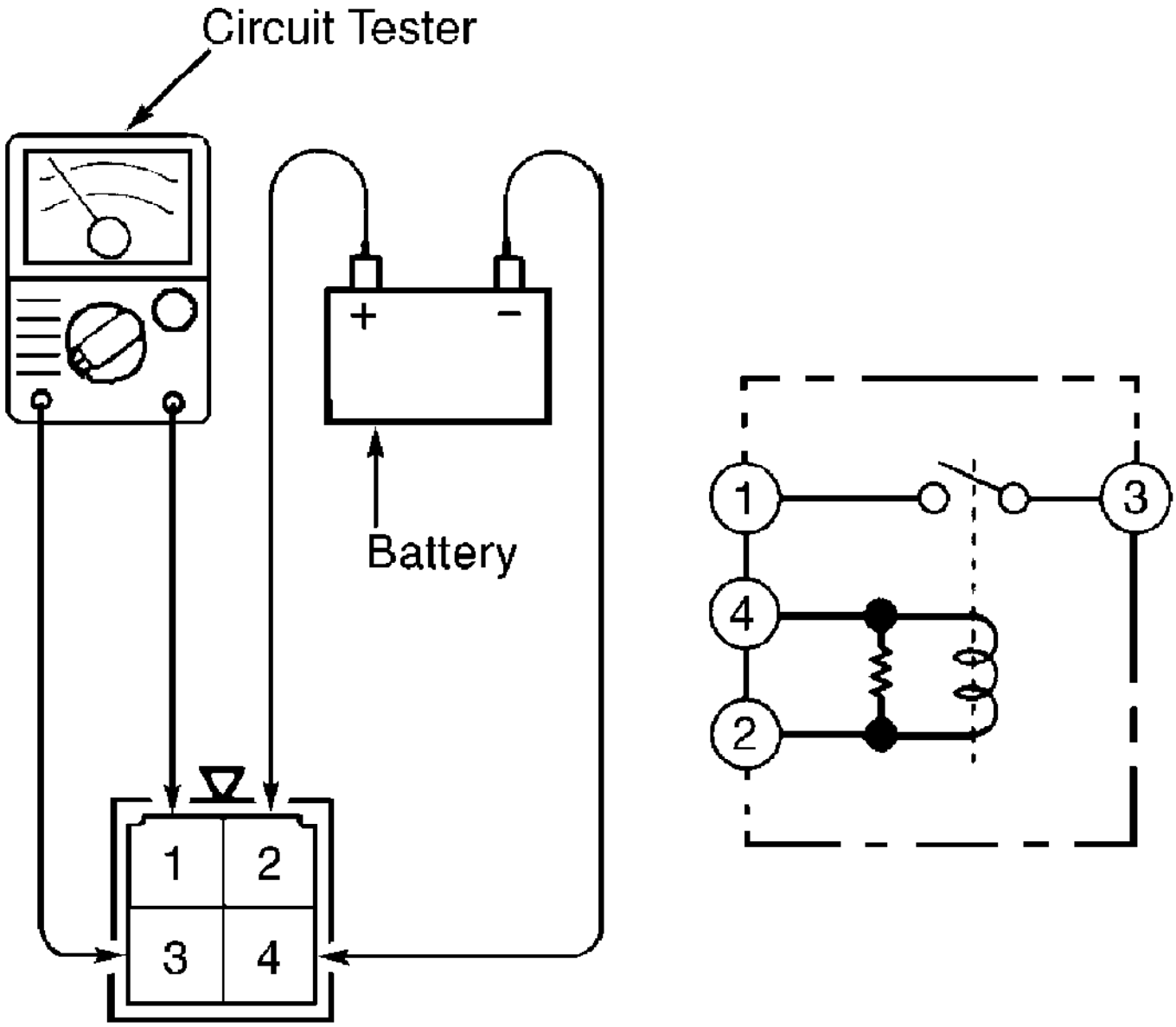


Fig. 9: Testing Electric Cooling Fan Relay (Montero, Montero Sport & 3000GT)
Courtesy of Mitsubishi Motor Sales of America.

SYSTEM TESTING

NOTE: For appropriate wiring diagram, see WIRING DIAGRAMS.

NOTE: Radiator fan on Montero and Montero Sport is mounted to a hydraulic fan clutch which is mounted to the water pump. Replace fan clutch if leaks are detected at case joints and seals, fan can be rotated with very light resistance or the bimetallic strip is damaged.

NOTE: Operation of radiator and condenser fans is controlled by vehicle Powertrain Control Module (PCM). Based on vehicle

speed, coolant temperature and A/C operation request, PCM will command low, medium or high speed fan operation.

Diamante

1) If only the radiator fan does not operate, check fusible link No. 6 located in engine compartment relay box. If only the condenser fan does not operate, check dedicated fuse No. 16 (20-amp) located in engine compartment relay box. See WIRING DIAGRAMS. Repair as necessary.

2) If radiator fan and condenser fan operate in all speeds except low, check appropriate low speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If low speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 1997
* G - TESTS W/CODES - 1998

3) If radiator fan and condenser fan operate in all speeds except high, check appropriate high speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If high speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 1997
* G - TESTS W/CODES - 1998

4) To confirm radiator fan or condenser fan operation, see FAN OPERATING MODE (DIAMANTE) table. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as necessary.

FAN OPERATING MODE (DIAMANTE) (1)

Coolant Temp. °F (°C)	Power Circuit Operating Low/High	Radiator Fan Speed	Condenser Fan Speed
13 MPH (2)			
221 (105) (2)	On/Off	Low	Low
221 (105) (3)	Off/On	Mid	Mid
239 (115) (3)	On/On	High	High
13 MPH (3)			
221 (105) (2)	On/Off	Low	Low
221 (105) (2)	On/On	High	High
30 MPH (2)			
203 (95) (2)	Off/Off	Off	Off
203 (95) (3)	On/Off	Low	Off
221 (105) (3)	Off/On	Mid	Mid
30 MPH (3)			
194 (90) (2)	Off/Off	Off	Off
194 (90) (3)	On/Off	Low	Off
221 (105) (3)	On/On	High	Mid
50 MPH (3)			
221 (105) (2)	Off/Off	Off	Off
221 (105) (3)	On/On	High	Mid

(1) - A/C request switch is turned off.
(2) - Approximate vehicle speed/coolant temperature or less.
(3) - Approximate vehicle speed/coolant temperature or more.

NOTE: Operation of radiator and condenser fans is controlled by vehicle Powertrain Control Module (PCM). Based on vehicle speed, coolant temperature and A/C operation request, PCM

will command low, medium or high speed fan operation.

Eclipse

1) If only the radiator fan does not operate, check fusible link No. 7 (20-amp) located in engine compartment relay box. If only the condenser fan does not operate, check dedicated fuse No. 9 (20-amp) located in engine compartment relay box. See WIRING DIAGRAMS. Repair as necessary.

2) If radiator fan and condenser fan operate in all speeds except low, check appropriate low speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If low speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 2.0L NON-TURBO - 1997
* G - TESTS W/CODES - 2.0L TURBO - 1997
* G - TESTS W/CODES - 2.4L - 1997
* G - TESTS W/CODES - 2.0L NON-TURBO - 1998
* G - TESTS W/CODES - 2.0L TURBO & 2.4L - 1998

3) If radiator fan and condenser fan operate in all speeds except high, check appropriate high speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If high speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 2.0L NON-TURBO - 1997
* G - TESTS W/CODES - 2.0L TURBO - 1997
* G - TESTS W/CODES - 2.4L - 1997
* G - TESTS W/CODES - 2.0L NON-TURBO - 1998
* G - TESTS W/CODES - 2.0L TURBO & 2.4L - 1998

4) To confirm radiator fan or condenser fan operation, see FAN OPERATING MODE (ECLIPSE NON-TURBO) or FAN OPERATING MODE (ECLIPSE 2.0L TURBO & 2.4L) table. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as necessary.

FAN OPERATING MODE (ECLIPSE NON-TURBO)

Coolant Temp. °F (°C)	With A/T Radiator Fan Speed	With M/T Radiator Fan Speed	Condenser Fan Speed
28 MPH (1) (2)			
203 (95) (2)	Off	Off	Off
203-210 (95-99)	Mid	High	Off
210 (99) (3)	High	High	Mid
28-50 MPH (1)			
194 (90) (2)	Off	Off	Off
194-210 (90-99)	Mid	High	Off
210 (99) (3)	High	High	Mid
50 MPH (1) (3)			
210 (99) (2)	Off	Off	Mid
210 (99) (3)	High	High	Off
12 MPH (2) (4)			
210 (99) (2)	Mid	High	Mid
210-242 (99-117)	High	High	High
242 (117) (3)	High	High	High
12-50 MPH (4)			
210 (99) (2)	Mid	High	Mid
210-242 (99-117)	High	High	High
242 (117) (3)	High	High	High
50 MPH (3) (4)			
210 (99) (2)	Mid	High	Mid
210-242 (99-117) (3)	High	High	High

242 (117) (3)	High	High	High

(1) - A/C request switch is turned off.
(2) - Approximate vehicle speed/coolant temperature or less.
(3) - Approximate vehicle speed/coolant temperature or more.
(4) - A/C request switch is turned on.

FAN OPERATING MODE (ECLIPSE 2.0L TURBO & 2.4L)

Coolant Temp. °F (°C)	With A/T Radiator Fan Speed	With M/T Radiator Fan Speed	Condenser Fan Speed
28 MPH (1) (2)			
203 (95) (2)	Off	Off	Off
203-210 (95-99)	Low	Mid	Off
210 (99) (3)	High	High	Mid
28-50 MPH (1)			
194 (90) (2)	Off	Off	Off
194-210 (90-99)	Low	Mid	Off
210 (99) (3)	High	High	Mid
50 MPH (1) (3)			
210 (99) (2)	Off	Off	Off
210 (99) (3)	High	High	Mid
12 MPH (2) (4)			
210 (99) (2)	Low	Mid	Mid
210-242 (99-117)	High	High	High
242 (117) (3)	High	High	High
12-50 MPH (4)			
210 (99) (2)	Low	Mid	Mid
210-242 (99-117)	High	High	High
242 (117) (3)	High	High	High
50 MPH (3) (4)			
210 (99) (2)	Low	Mid	Mid
210-242 (99-117) (3)	High	High	High
242 (117) (3)	High	High	High

(1) - A/C request switch is turned off.
(2) - Approximate vehicle speed/coolant temperature or less.
(3) - Approximate vehicle speed/coolant temperature or more.
(4) - A/C request switch is turned on.

NOTE: Operation of radiator and condenser fans is controlled by vehicle Powertrain Control Module (PCM). Based on vehicle speed, coolant temperature and A/C operation request, PCM will command low, medium or high speed fan operation.

Galant

1) If only the radiator fan does not operate, check fusible link No. 5 (30-amp) located in engine compartment relay box. If only the condenser fan does not operate, check dedicated fuse No. 3 (30-amp) located in engine compartment relay box. See WIRING DIAGRAMS. Repair as necessary.

2) If radiator fan and condenser fan operate in all speeds except low, check appropriate low speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If low speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 1997
* G - TESTS W/CODES - 1998

3) If radiator fan and condenser fan operate in all speeds except high, check appropriate high speed relay. See COMPONENT TESTS. See WIRING DIAGRAMS. If high speed relay is okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 1997
* G - TESTS W/CODES - 1998

4) To confirm radiator fan or condenser fan operation, see appropriate FAN OPERATING MODE (GALANT) table. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as necessary.

FAN OPERATING MODE (GALANT) (1)

Coolant Temp. °F (°C)	Radiator Fan Speed	Condenser Fan Speed
28 MPH (2)		
203 (95) (2)	Off	Off
203-221 (95-105)	Low	Low
221 (105) (3)	High	High
28-50 MPH		
194 (90) (2)	Off	Off
194-221 (90-105)	Low	Low
221 (105) (3)	High	High
50 MPH (3)		
221 (105) (2)	Off	Off
221 (105) (3)	High	High
Any Speed (4)		
221 (105) (2)	Low	Low
221 (105) (3)	High	High

(1) - A/C request switch is turned off.
(2) - Approximate vehicle speed/coolant temperature or less.
(3) - Approximate vehicle speed/coolant temperature or more.
(4) - A/C request switch is turned on.

NOTE: Operation of radiator and condenser fans is controlled by vehicle Powertrain Control Module (PCM). Based on vehicle speed, coolant temperature and A/C operation request, PCM will command low, medium or high speed fan operation.

Mirage

1) If only the radiator fan does not operate, check fusible link No. 5 (30-amp) located in engine compartment relay box. If only the condenser fan does not operate, check fusible link No. 2 (100-amp) and dedicated fuse No. 1 (25-amp) located in engine compartment relay box. See WIRING DIAGRAMS. Repair as necessary.

2) If fusible links and dedicated fuse are okay, check appropriate fan relay and/or fan motor for proper operation. See COMPONENT TESTS. See WIRING DIAGRAMS. If fan relay and motor are okay, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE.

* G - TESTS W/CODES - 1.5L - 1997
* G - TESTS W/CODES - 1.8L - 1997
* G - TESTS W/CODES - 1998

3) To confirm radiator fan or condenser fan operation, see appropriate FAN OPERATING MODE (MIRAGE) table. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as

necessary.

FAN OPERATING MODE (MIRAGE)

Coolant Temp. °F (°C)	Power Circuit Operating RAD/COND	Radiator Fan Speed	Condenser Fan Speed
203 (95) (1) (2)	Off/Off	Off	Off
203-221 (95-105) (1)	On/Off	On	Off
221 (105) (1) (3)	On/On	On	On
All Temp. (4)	On/On	On	On

(1) - A/C request switch is turned off.
(2) - Approximate coolant temperature or less.
(3) - Approximate coolant temperature or more.
(4) - A/C request switch is turned on.

NOTE: Operation of radiator and condenser fans is controlled by vehicle Powertrain Control Module (PCM). Based on vehicle speed, coolant temperature and A/C operation request, PCM will command low, medium or high speed fan operation.

3000GT

1) If neither the radiator fan nor the condenser fan operate, check fusible link No. 5 (40-amp). See WIRING DIAGRAMS. If only the condenser fan does not operate, check dedicated fuse No. 8 (20-amp).

2) If the condenser fan operates in all speeds except low and A/C compressor clutch does not enter the ON state, check for A/C compressor lock controller unit output signal. If the A/C compressor clutch does enter the ON state, check condenser fan low speed relay operation.

3) If the radiator fan and the condenser fan operate in all speeds except high, check PCM. See appropriate G - TESTS W/CODES article in ENGINE PERFORMANCE. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as necessary.

* G - TESTS W/CODES - NON-TURBO - 1997
* G - TESTS W/CODES - TURBO - 1997
* G - TESTS W/CODES - 1998

4) To confirm radiator fan or condenser fan operation, see appropriate FAN OPERATING MODE (3000GT) table. If fan operation is not as specified, check wiring harness for opens or shorts. Repair as necessary.

FAN OPERATING MODE (3000GT)

Coolant Temp. °F (°C)	Power Circuit Operating Low/High	Radiator Fan Speed	Condenser Fan Speed
50 MPH (1) (2)			
203 (95) (2)	Off/Off	Off	Off
203-221 (95-105)	On/Off	Low	Off
221 (105) (3)	On/On	High	High
50 MPH (1) (3)			
221 (105) (2)	Off/Off	Off	Off
221 (105) (3)	On/On	High	High
All Speeds			
221 (105) (2)	On/Off	Low	Low
221 (105) (3)	On/On	High	High

(1) - A/C compressor lock controller output is low (zero volts).
(2) - Approximate vehicle speed/coolant temperature or less.
(3) - Approximate vehicle speed/coolant temperature or more.
(4) - A/C compressor lock controller output is high (12 volts).

WIRING DIAGRAMS

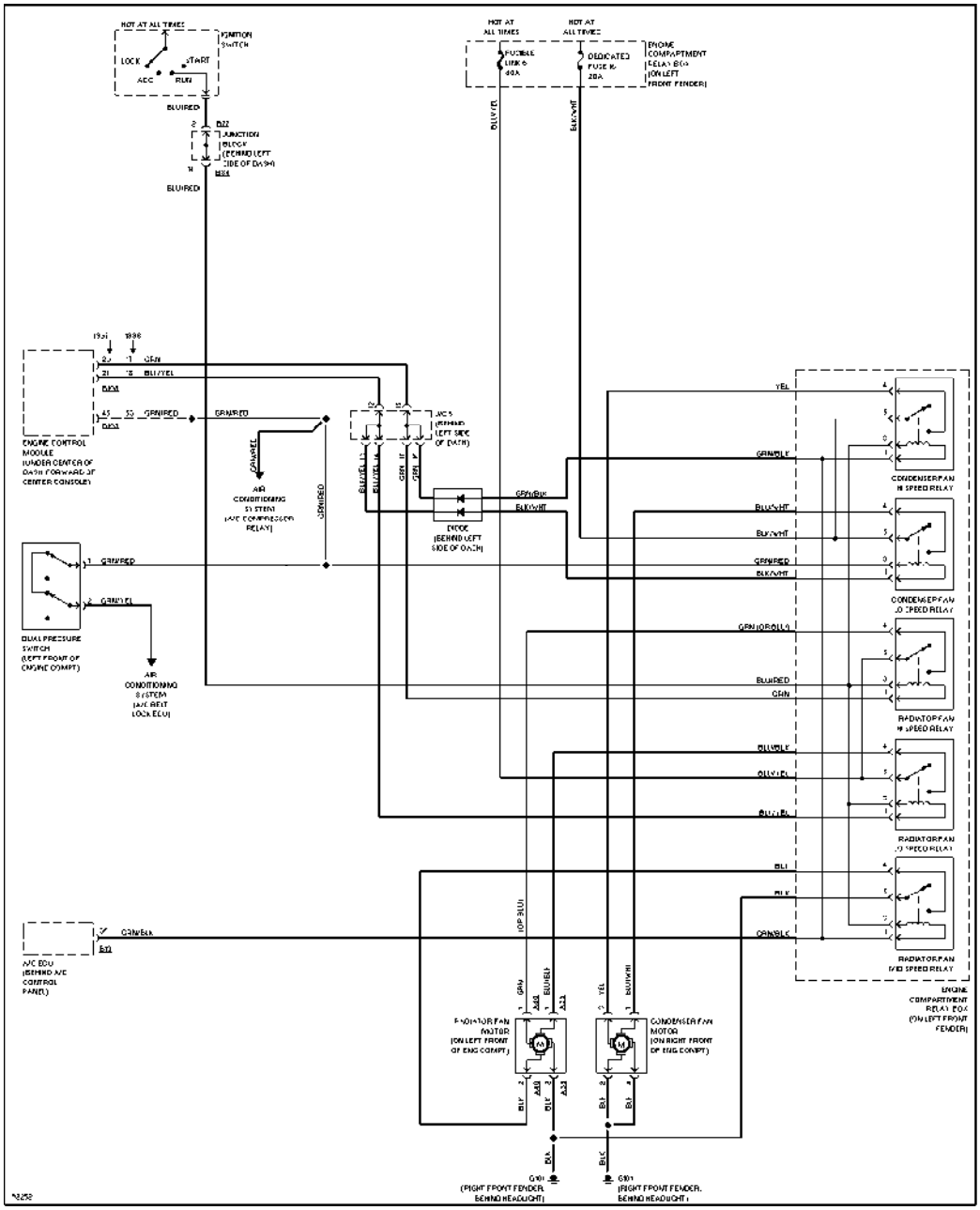


Fig. 10: Wiring Diagram (1997-98 Diamante)

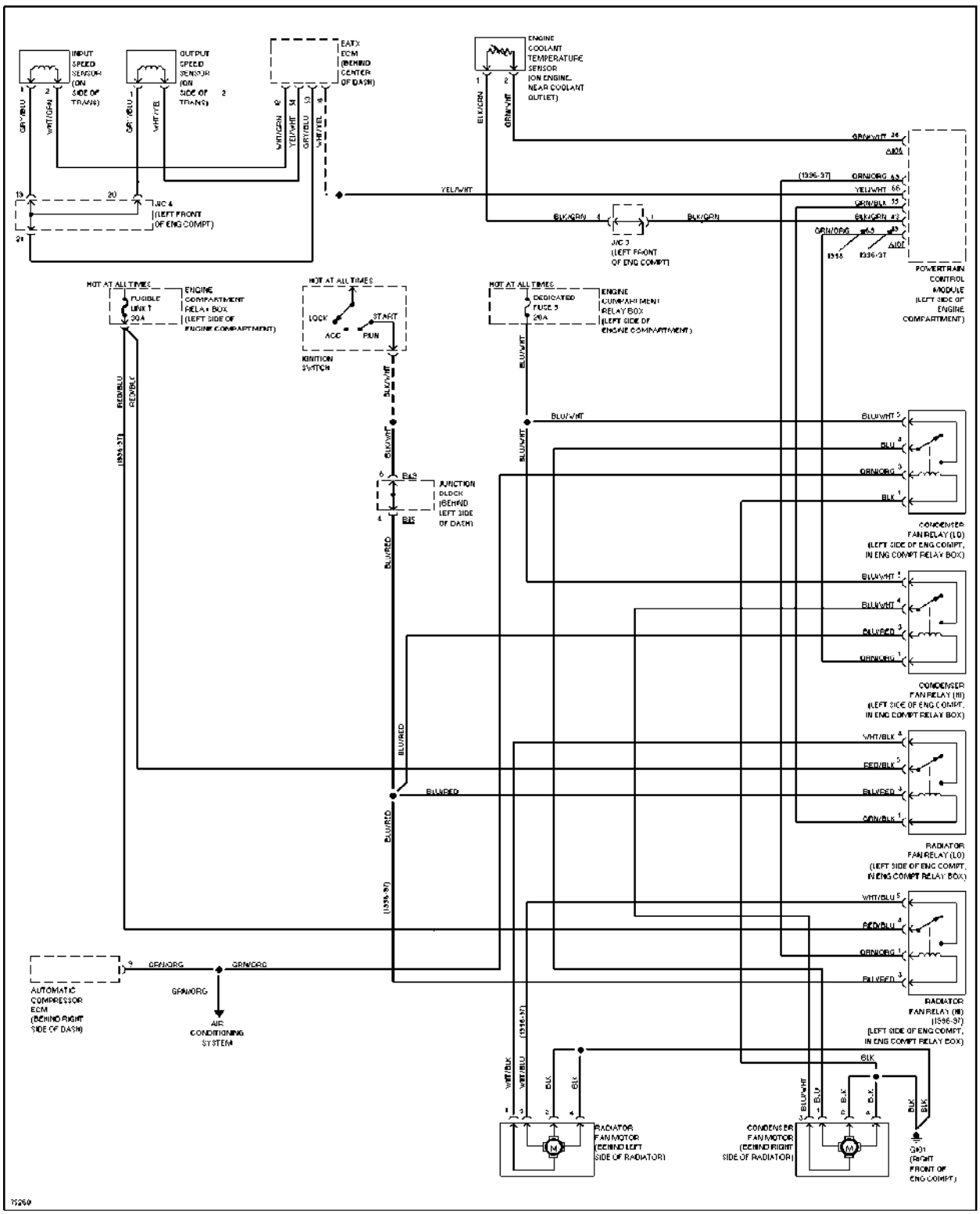


Fig. 11: Wiring Diagram (1997-98 Eclipse - 2.0L A/T)

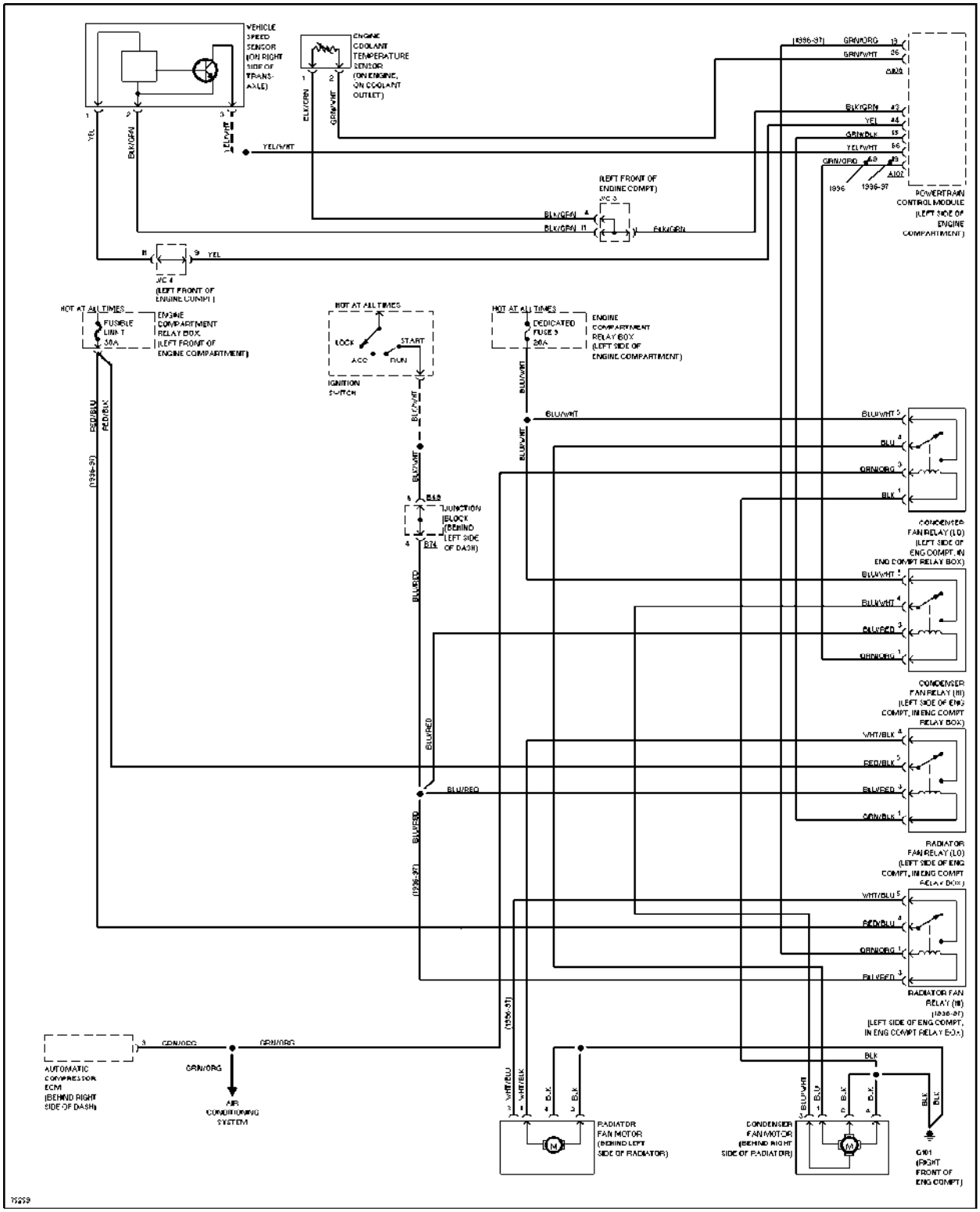


Fig. 12: Wiring Diagram (1997-98 Eclipse - 2.0L M/T)

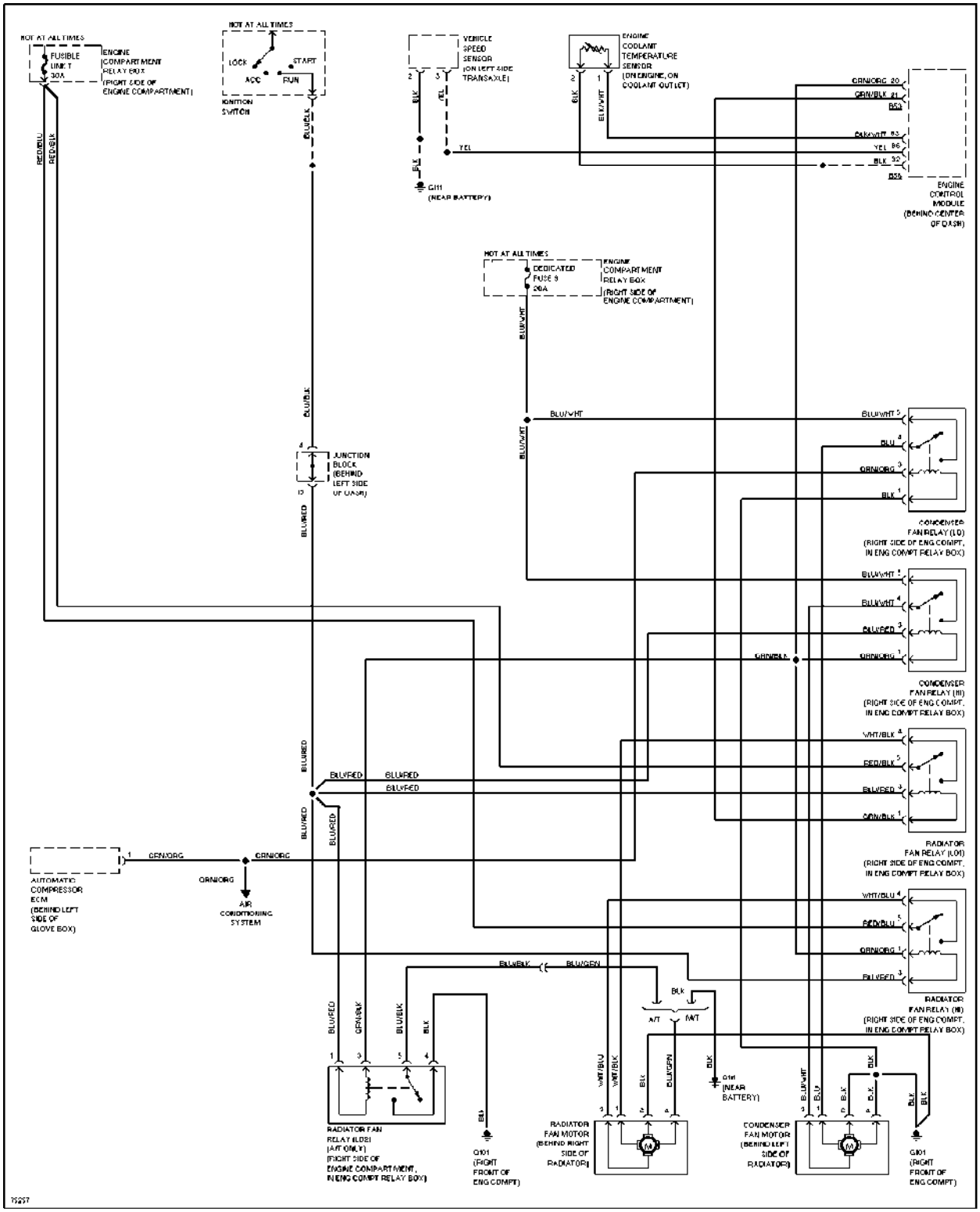


Fig. 13: Wiring Diagram (1997-98 Eclipse - 2.0L Turbo & 2.4L)

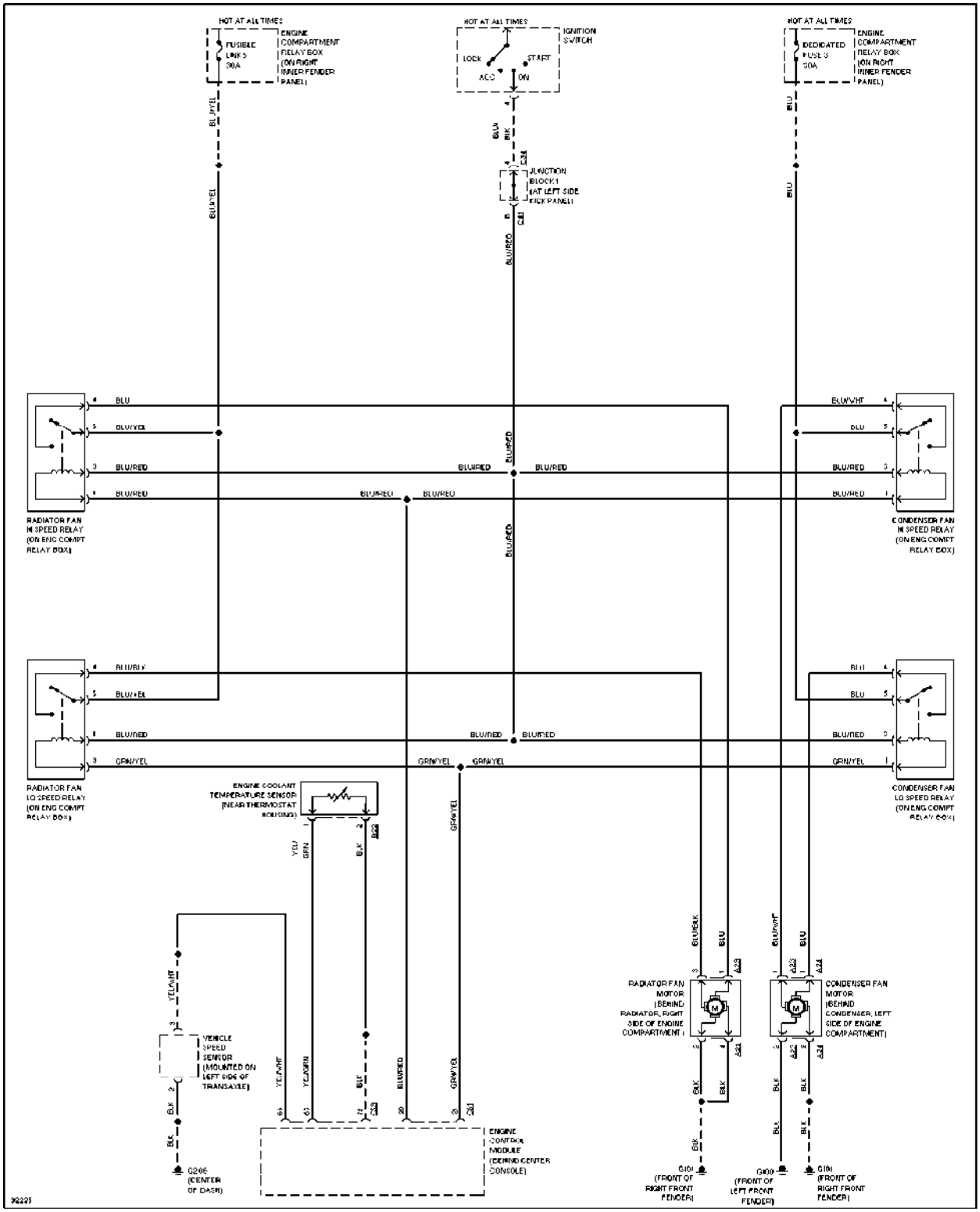


Fig. 14: Wiring Diagram (1997-98 Galant)

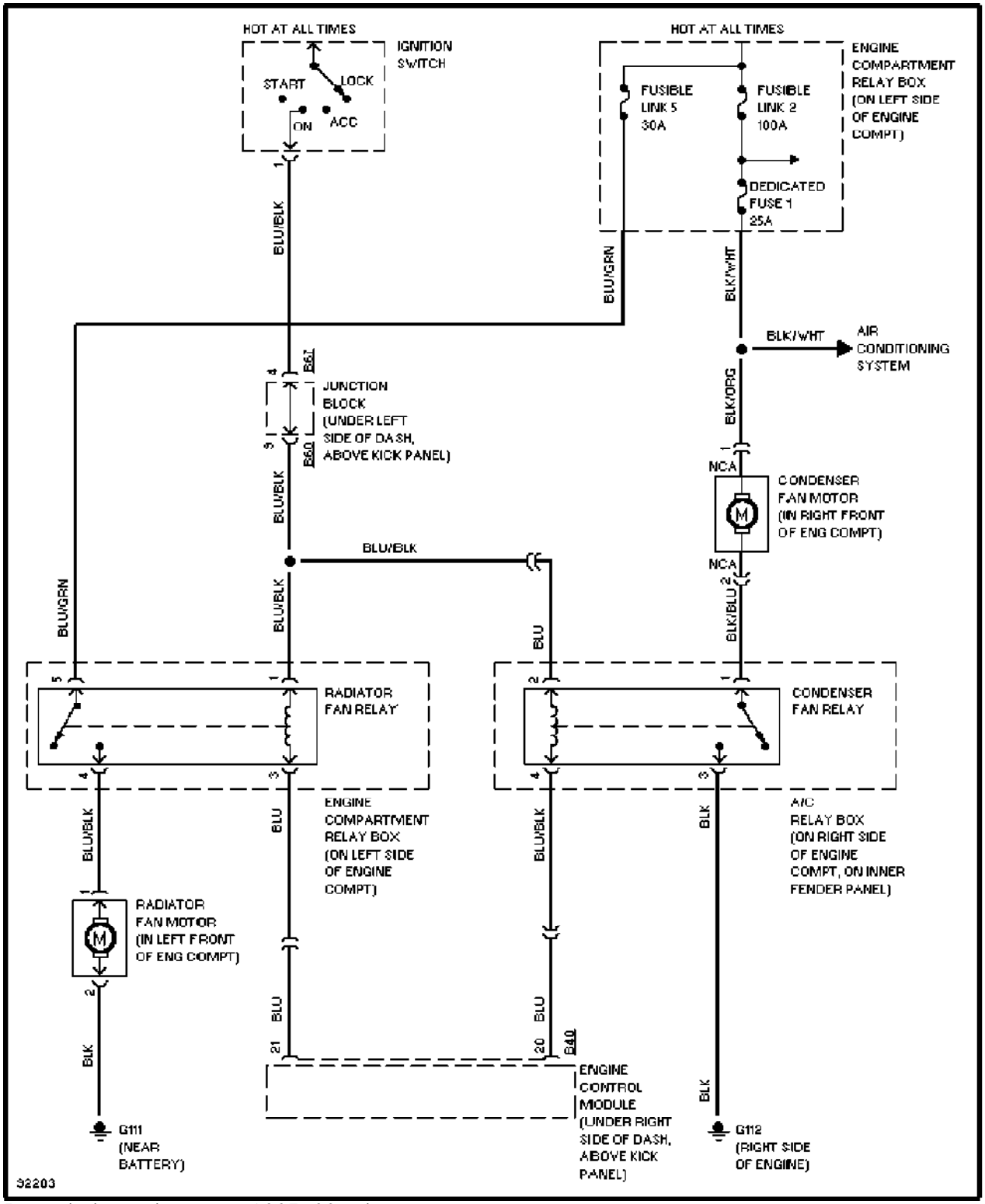


Fig. 15: Wiring Diagram (1997-98 Mirage)

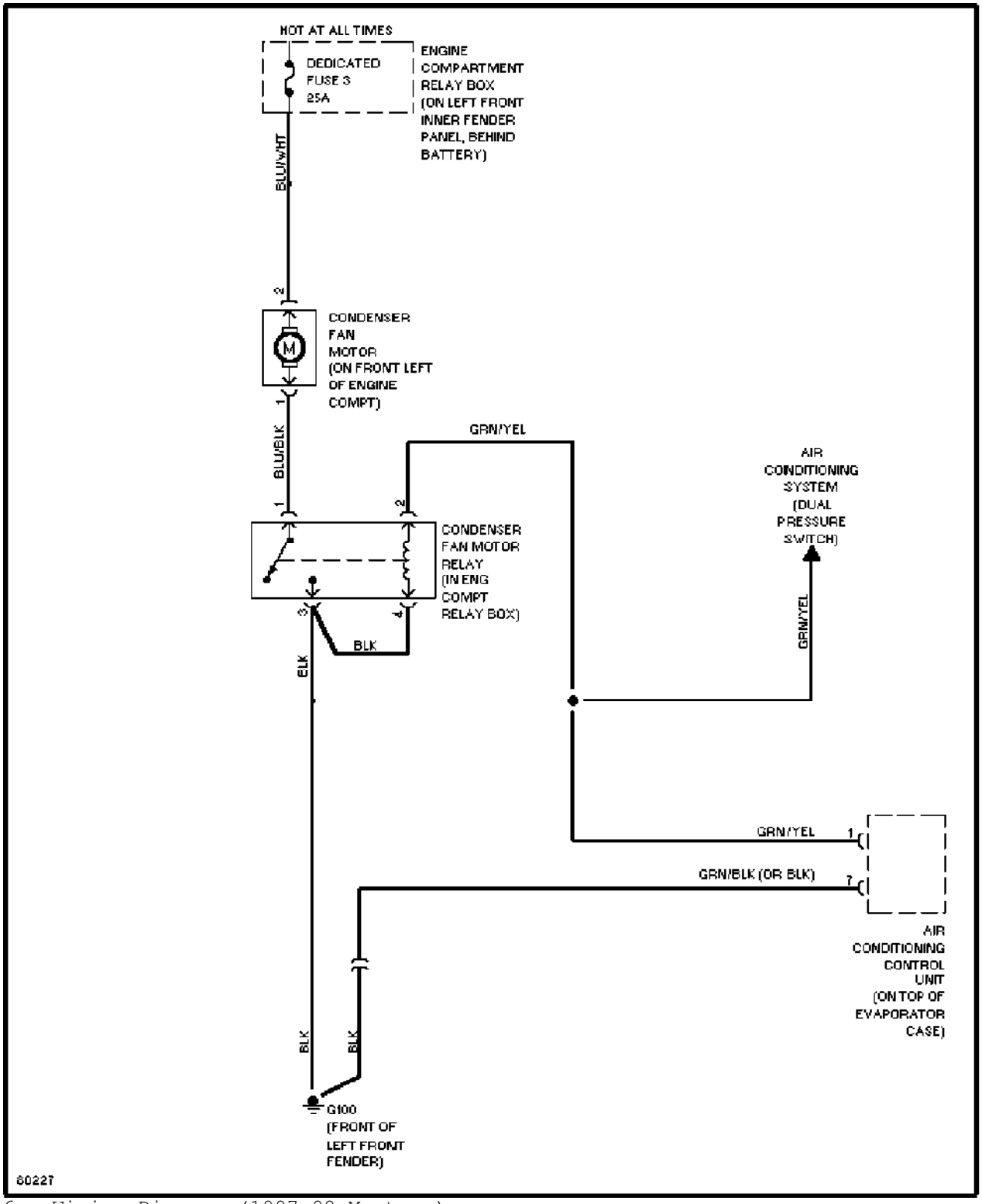


Fig. 16: Wiring Diagram (1997-98 Montero)

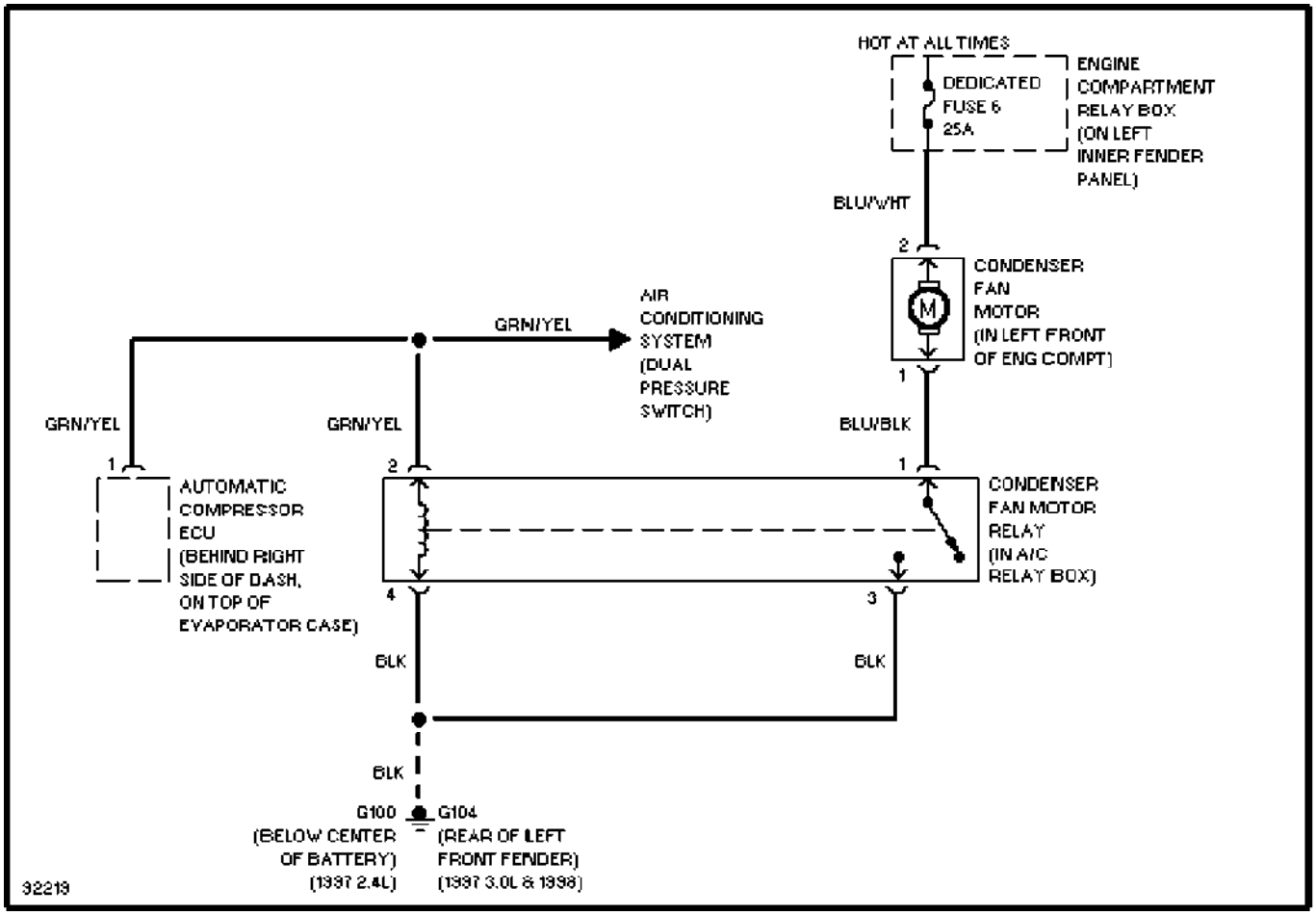


Fig. 17: Wiring Diagram (1997-98 Montero Sport)

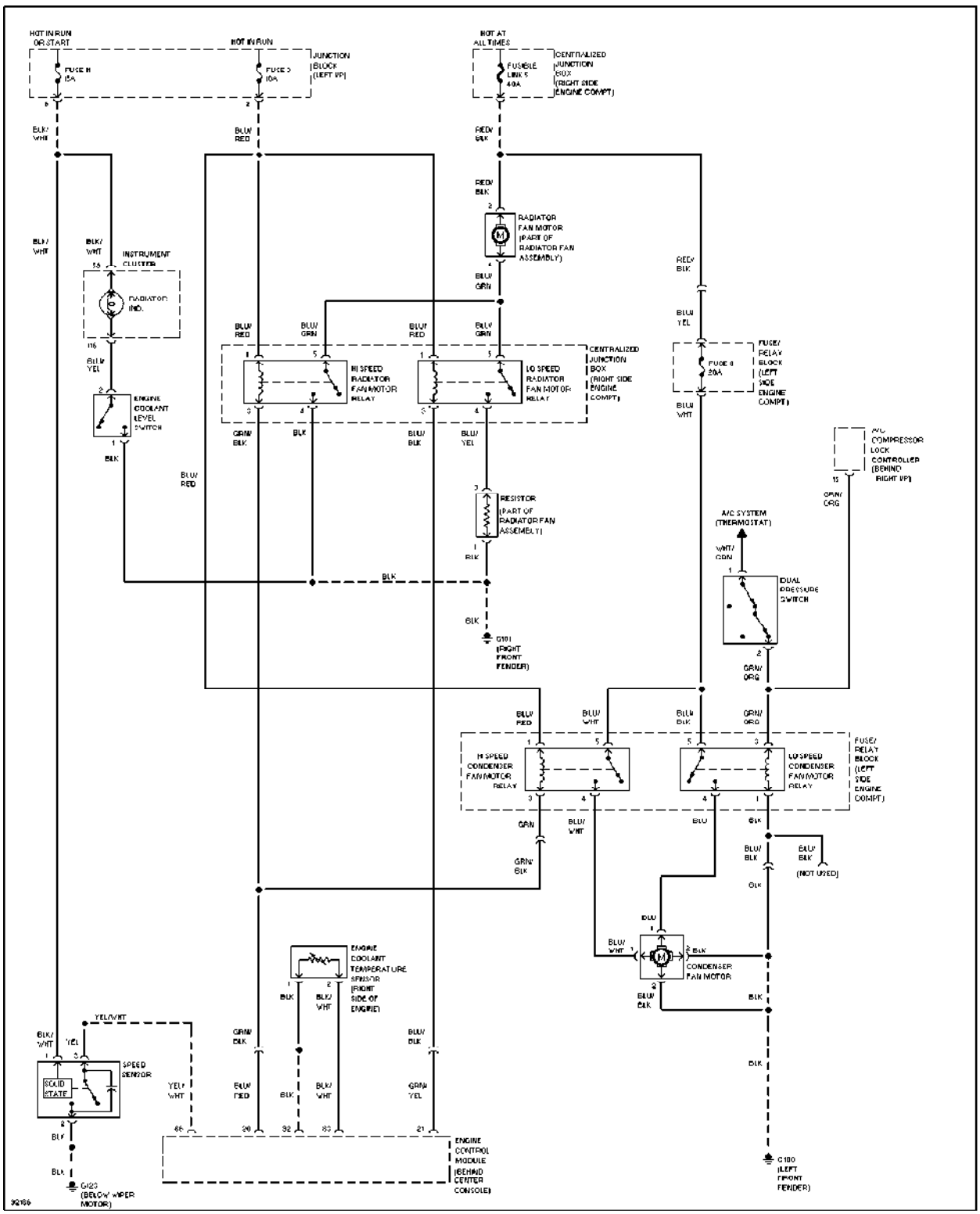


Fig. 18: Wiring Diagram (1997 3000GT)

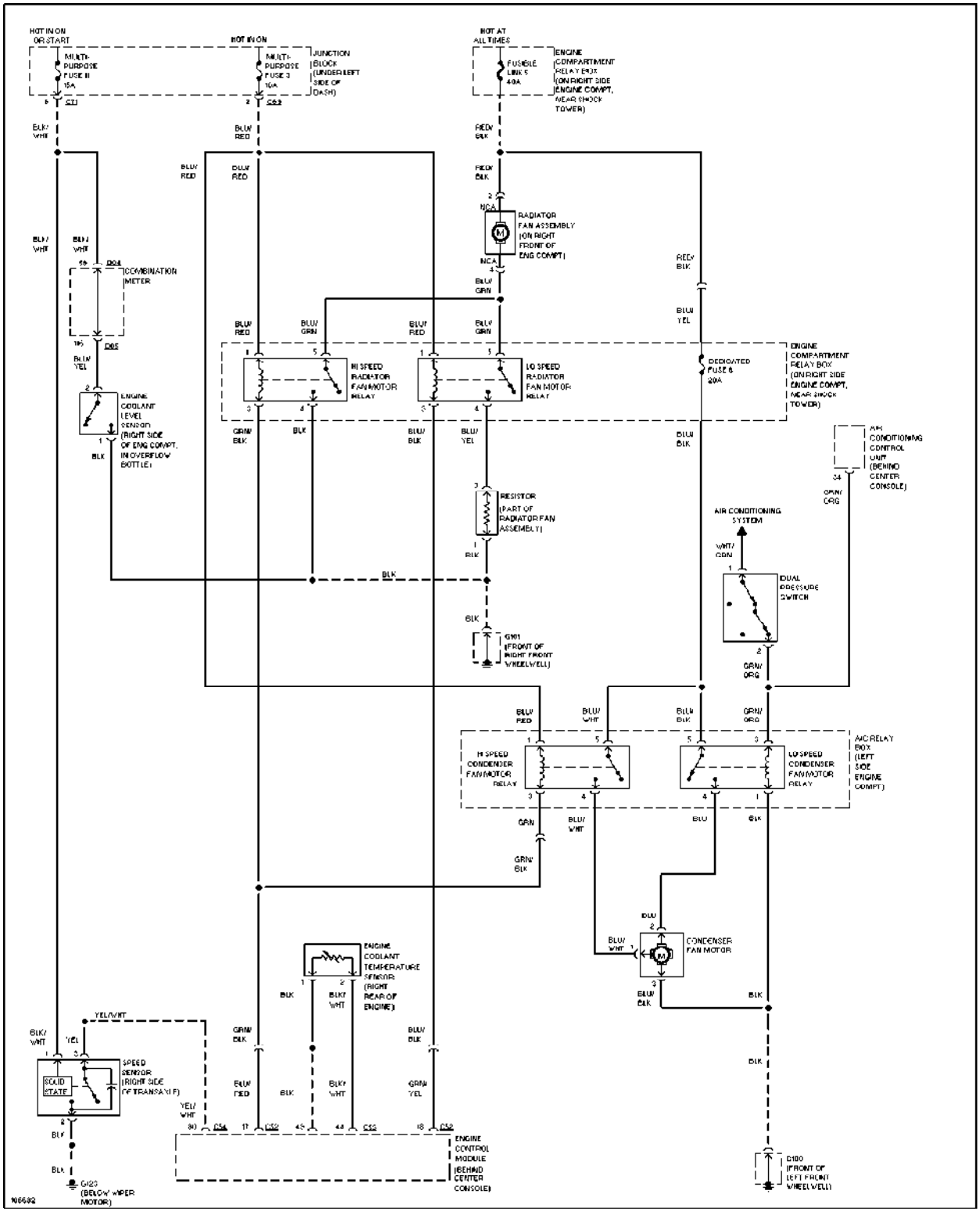


Fig. 19: Wiring Diagram (1998 3000GT)

CRUISE CONTROL SYSTEM

1997-99 Mitsubishi Montero Sport

1997-99 ACCESSORIES & EQUIPMENT
Mitsubishi - Cruise Control System

Montero Sport

DESCRIPTION & OPERATION

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEM article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

The cruise control system is electronically controlled and vacuum actuated. System components include a cruise control Electronic Control Unit (ECU), vacuum pump, actuator, cruise control switch, cruise indicator light, Park/Neutral (P/N) switch (A/T), clutch pedal position switch (M/T), brakelight/stoplight switch, throttle position sensor/closed throttle position switch and vehicle speed sensor.

The system also has self-diagnostic capability. When self-diagnostic mode is activated, each switch and sensor is checked for faults. If cruise control system has been canceled without using a normal cancel method, a trouble code will be set and stored in the cruise control ECU. Trouble codes can be retrieved to help determine which circuit is malfunctioning.

PRELIMINARY INSPECTION

Before performing TROUBLE SHOOTING steps, inspect vacuum pump, linkage assembly, actuator, cables and vacuum hoses. Ensure linkage and cables move smoothly. Ensure cables do not have excessive slack or tension.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Clutch Pedal Position Switch	On Clutch Pedal Bracket
Cruise Control Actuator	On Throttle Body Assembly
Cruise Control ECU	Near Left Kick Panel
Data Link Connector (DLC)	Under Left Side Of Dash, Near Steering Column
Stoplight Switch	On Brake Pedal Bracket
Throttle Position Sensor/Switch	On Throttle Body
Vehicle Speed Sensor	On Transmission Tailshaft
Vacuum Pump	On left Side Of Engine Compartment

ADJUSTMENTS

CRUISE CONTROL CABLE

1) Warm engine to normal operating temperature. Ensure idle speed is correct. See underhood emissions label. Adjust as necessary.
2) Turn engine off. Ensure cable is free of harsh bends or

kinks. Loosen adjusting nut on cruise control cable mounting bracket. Hold linkage "A" so it is touching linkage "B". See Fig. 1 or 2. Adjust play in cruise control cable to .04-.08" (1-2 mm). Tighten adjusting nut.

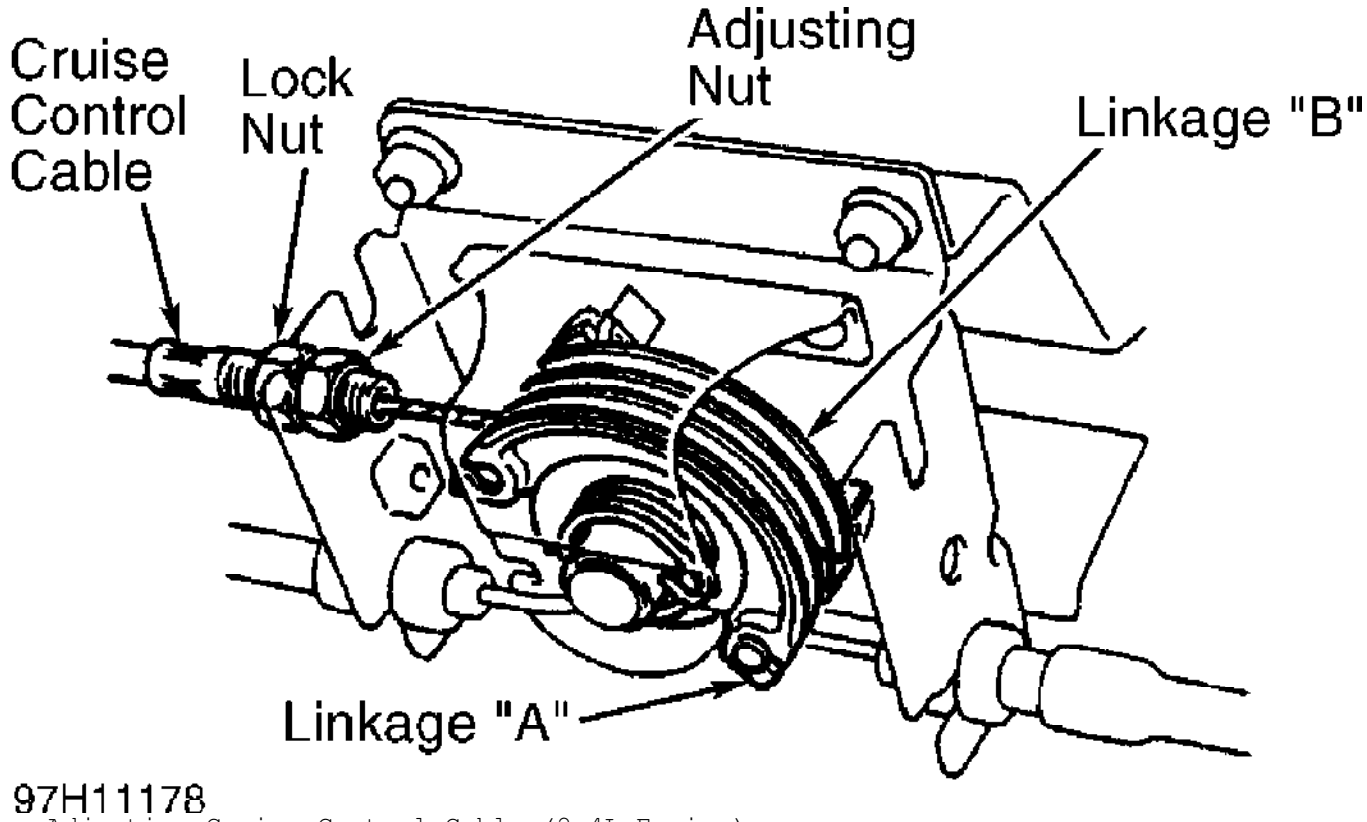


Fig. 1: Adjusting Cruise Control Cable (2.4L Engine)
Courtesy of Mitsubishi Motor Sales of America

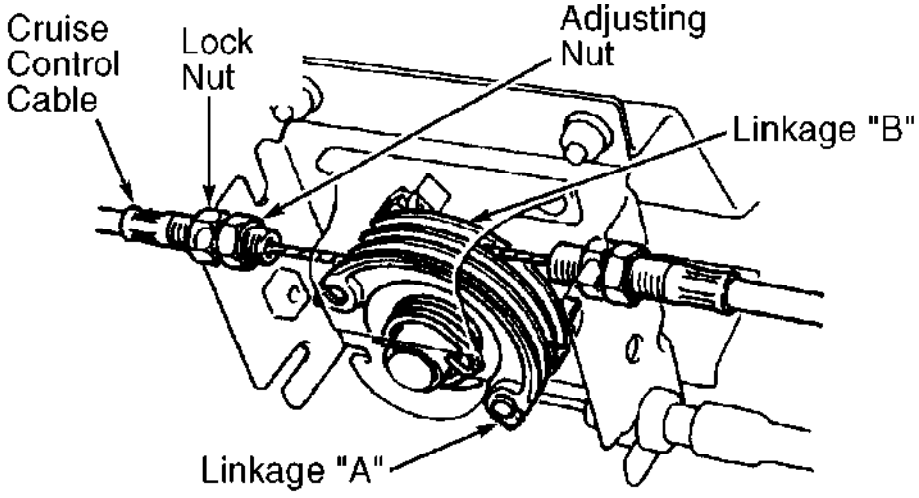


Fig. 2: Adjusting Cruise Control Cable (3.0L Engine)
Courtesy of Mitsubishi Motor Sales of America

TROUBLE SHOOTING

CRUISE CONTROL SWITCH FUNCTION TEST

NOTE: If vehicle speed decreases about 9 MPH less than the set speed, set speed will be canceled. Speed will not set beyond cruise control system speed limit of 124 MPH.

1) Cruise control switch is part of multi-function switch mounted on steering column. To operate cruise control system, turn cruise control main switch to ON position. Ensure indicator light inside switch illuminates.

2) Drive vehicle to about 25 MPH or greater. Move multi-function switch lever down and release to activate COAST/SET mode. Vehicle speed should stay at set speed. Instrument cluster cruise indicator light should illuminate. To increase set speed, move lever up to activate ACC/RES mode and hold until new set speed is reached.

3) To lower set speed, move lever down to activate COAST/SET mode and hold until new set speed is reached. To return to set speed after cancellation, move ACC/RES switch to ON position. Vehicle speed should return to previous setting before cancellation. Set speed should cancel when any of the following occurs:

* Brake pedal is depressed.
* Clutch pedal is depressed.
* Cruise control CANCEL switch is activated.
* Cruise control main switch is turned to OFF position.
* Ignition switch is turned to OFF position.
* Transmission is shifted to Neutral or Park.

SYMPTOM TESTS

NOTE: To diagnose symptom, see Fig. 3 then go to appropriate test under CIRCUIT TESTS.

TROUBLE SYMPTOM		INSPECTION PROCEDURE NO.
COMMUNICATION WITH SCAN TOOL IS NOT POSSIBLE	COMMUNICATION WITH ALL SYSTEMS IS NOT POSSIBLE	1
	COMMUNICATION WITH AUTO-CRUISE CONTROL-ECU ONLY IS NOT POSSIBLE	2
INPUT SWITCH CODE CHECK USING THE SCAN TOOL IS NOT POSSIBLE (HOWEVER, DIAGNOSIS INSPECTION IS POSSIBLE.)		3
AUTO-CRUISE CONTROL IS NOT CANCELLED.	WHEN BRAKE PEDAL IS DEPRESSED	4
	WHEN CLUTCH PEDAL IS DEPRESSED <M/T>	5
	WHEN SELECTOR LEVER IS MOVED TO "N" RANGE <A/T>	6
	WHEN "CANCEL" SWITCH IS TURNED ON	7
THE DIAGNOSTIC RESULT DISPLAYED ON THE SCAN TOOL IS NORMAL EVEN THROUGH AUTO-CRUISE CONTROL CANNOT BE SET.		8
AUTO-CRUISE CONTROL CANNOT BE SET.		9
HUNTING (REPEATED ACCELERATION AND DECELERATION) OCCURS AT THE SET VEHICLE SPEED.		10
WHEN AUTO-CRUISE CONTROL MAIN SWITCH IS ON, SWITCH INDICATOR DOES NOT ILLUMINATE. (HOWEVER, AUTO-CRUISE CONTROL IS NORMAL.)		11
AUTO-CRUISE CONTROL MAIN SWITCH ILLUMINATION LIGHT DOES NOT ILLUMINATE.		12
AUTO-CRUISE CONTROL INDICATOR LIGHT INSIDE COMBINATION METER DOES NOT ILLUMINATE. (HOWEVER, AUTO-CRUISE CONTROL IS NORMAL.)		13

97B11180

Fig. 3: Symptom Chart
Courtesy of Mitsubishi Motor Sales of America

CIRCUIT TESTS

NOTE: To identify circuit connector terminals, see WIRING DIAGRAMS.

Test No. 1 (Communication With Scan Tool Not Possible On All Systems)

1) Check voltage between ground and Data Link Connector (DLC) terminal No. 16 (Red/Black wire). See WIRING DIAGRAMS. See Fig. 5. If battery voltage is present, go to step 3). If battery voltage is not present, go to next step.

2) Check joint connector and junction block between DLC terminal No. 16 and ground. See WIRING DIAGRAMS. If connectors are okay, check circuit between power supply and DLC. Repair as necessary.

3) Check continuity between ground and DLC terminals No. 4 (Black wire) and No. 5 (Black wire). See Fig. 5. If continuity is present, replace scan tool and retest. If continuity is not present, check circuit between ground and DLC. See WIRING DIAGRAMS. Repair as necessary.

Test No. 2 (Communication With Scan Tool Not Possible With Cruise Control ECU)

1) Remove and check cruise control main switch. See COMPONENT TESTS. Replace switch as necessary. If main switch is okay, go to next step.

2) Disconnect cruise control ECU harness connector. Check voltage between ground and cruise control ECU harness-side connector terminal No. 1 (Green/White wire). If battery voltage is present, go to step 4). If battery voltage is not present, go to next step.

3) Check harness connector to fuse/relay block and joint connector between cruise control ECU and junction block. See WIRING DIAGRAMS. Repair as necessary. If harness and joint connectors are okay, go to step 5).

4) Check harness connector to cruise control main switch and cruise control ECU. Repair as necessary. If harness connectors are okay, go to step 6).

5) Check harness connector to cruise control main switch and fuse/relay block. Repair as necessary. If connectors are okay, go to next step.

6) Check circuit between cruise control main switch and ECU. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

7) Check continuity between cruise control ECU harness-side connector terminals No. 9 and 13. If continuity is present, go to step 9). If continuity is not present, go to next step.

8) Check cruise control harness connector. Repair as necessary. If connector is okay, go to step 11).

9) Check harness connectors to cruise control ECU and DLC. Repair as necessary. If connectors are okay, go to next step.

10) Check circuit between cruise control ECU and DLC. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace cruise control ECU.

11) Check circuit between cruise control ECU harness-side connector terminal No. 9 (Black wire) and ground. See WIRING DIAGRAMS. Repair as necessary.

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEM article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

Test No. 3 (Input Switch Inspection With Scan Tool Not Possible; Diagnostic Inspection Is Possible)

1) Check cruise control multi-function switch. See CRUISE CONTROL MULTI-FUNCTION SWITCH under COMPONENT TESTS. Replace switch as necessary. If switch is okay, go to next step.

2) Check clockspring. See appropriate

AIR BAG RESTRAINT SYSTEM article. Replace clockspring as necessary. If clockspring is okay, go to next step.

3) Disconnect clockspring harness connector. Check voltage between ground and harness-side of connector terminal No. 2 (Blue wire). If battery voltage is present, go to next step. If battery voltage is not present, go to step 5).

4) Check harness connector to clockspring and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between clockspring and cruise control ECU. Repair as necessary.

5) Check harness connector to clockspring, junction block connectors to power supply and harness connector between clockspring and power supply. Repair as necessary. If connectors are okay, check circuit between clockspring and power supply. See WIRING DIAGRAMS. Repair as necessary.

Test No. 4 (Cruise Control Does Not Cancel With Brake Pedal Depressed)

1) Check if stoplights illuminate. If stoplights illuminate, go to next step. If stoplights do not illuminate, go to step 3).

2) Check cruise control ECU harness connector. Repair as necessary. If connector is okay, go to step 4).

3) Check stoplight switch. See STOPLIGHT SWITCH under COMPONENT TESTS. Replace stoplight switch if faulty. If switch is okay, go to step 5).

4) Check circuit between stoplight switch and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary.

5) Using a voltmeter, check voltage between ground and stoplight switch harness-side connector terminal No. 2 (White/Red wire). If battery voltage is present, go to next step. If battery voltage is not present, go to step 7).

6) Check harness connectors to cruise control ECU and stoplight switch. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, go to step 9).

7) Check stoplight switch and junction block harness connectors. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, go to next step.

8) Check circuit between stoplight switch and power supply. Repair as necessary.

9) Check circuit between cruise control ECU and stoplight switch. See WIRING DIAGRAMS. Repair as necessary.

Test No. 5 (Cruise Control Does Not Cancel With Clutch Depressed)

1) Check clutch pedal position switch. See CLUTCH PEDAL POSITION SWITCH under COMPONENT TESTS. Replace switch if faulty. If clutch pedal position switch is okay, go to next step.

2) Disconnect clutch pedal position switch harness connector. Check voltage between ground and clutch pedal position switch harness-side connector terminal No. 1 (Black/White wire). If voltage reading is 4.5 volts or greater, go to next step. If voltage reading is not 4.5 volts or greater, go to step 4).

3) Check harness connectors to clutch pedal position switch and ground circuit. Repair as necessary. If connectors are okay, check circuit between clutch pedal position switch and ground. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace cruise control ECU.

4) Check cruise control harness connector. Repair as necessary. If connector is okay, check circuit between clutch pedal position switch and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary.

Test No. 6 (Cruise Control Does Not Cancel With A/T Select

Lever In "N")

1) Check Park/Neutral (P/N) switch. See PARK/NEUTRAL SWITCH under COMPONENT TESTS. Replace as necessary. If switch is okay, go to next step.

2) Check starter relay. See STARTER RELAY under COMPONENT TESTS. Replace relay as necessary. If relay is okay, go to next step.

3) Check circuit and harness connectors between P/N position switch and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary. If circuit and connectors are okay, replace cruise control ECU.

Test No. 7 (Cruise Control Does Not Cancel Using CANCEL Switch)

Replace multi-function switch. See MULTI-FUNCTION SWITCH under REMOVAL & INSTALLATION.

Test No. 8 (Scan Tool Diagnostic Result Is Normal But Cruise Control Cannot Be Set)

1) Disconnect cruise control ECU harness connector. Check voltage between ground and cruise control ECU harness connector terminal No. 6 (Red/Black wire). If battery voltage is present, go to next step. If battery voltage is not present, go to step 3).

2) Check cruise control ECU harness connector. Repair as necessary. If connector is okay, go to next step.

3) Check joint connector between power supply and cruise control ECU and main switch. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between cruise control ECU and power supply. Repair as necessary.

Test No. 9 (Cruise Control Cannot Be Set)

1) Check if scan tool can communicate with cruise control system. If communication is not possible, go to TEST NO. 2. If communication is possible, go to next step.

2) Check if input switch inspection is possible using scan tool. See RETRIEVING INPUT SWITCH CODES under SELF-DIAGNOSTIC SYSTEM. If input switch inspection is possible, go to next step. If input switch inspection is not possible, go to TEST NO. 8.

3) Check if DTC 11, 12, 14, 15, 16 or 17 is present. If DTC(s) are present, diagnose using appropriate trouble code diagnosis. See SELF-DIAGNOSTIC SYSTEM. If DTC(s) are not present, go to next step.

4) Check if input switch inspection is possible using scan tool. If input switch inspection is not possible, go to TEST NO. 3. If input switch inspection is possible, and check result Code 23 or 26 is present, go to next step. See RETRIEVING INPUT SWITCH CODES under SELF-DIAGNOSTIC SYSTEM. If code(s) are not present, replace cruise control ECU.

5) If check result Code 23 (stoplight switch input circuit) is present, go to TEST NO. 14. If Code 26 (clutch pedal position switch or P/N switch circuit) is present, go to TEST NO. 15.

Test No. 10 (Hunting Occurs At Set Vehicle Speed)

1) Check vehicle speed sensor. See VEHICLE SPEED SENSOR TEST under COMPONENT TESTS. Replace as necessary. If sensor is okay, go to next step.

2) Check cruise control vacuum pump. See VACUUM PUMP under COMPONENT TESTS. Replace as necessary. If cruise control pump is okay, go to next step.

3) Check vacuum actuator. See COMPONENT TESTS. Replace as necessary. If actuator is okay, replace cruise control ECU.

Test No. 11 (Cruise Control Indicator On Instrument Panel Does Not Illuminate; Cruise Control Is Normal)

Replace cruise control main switch. See MAIN SWITCH under REMOVAL & INSTALLATION.

Test No. 12 (Cruise Control Main Switch Indicator Light Does Not Illuminate)

1) Check cruise control main switch. See CRUISE CONTROL MAIN SWITCH under COMPONENT TESTS. Replace as necessary. If switch is okay, go to next step.

2) Check voltage between ground and harness-side of cruise control main switch connector terminal No. 2 (Green/White wire). If battery voltage is present, go to next step. If battery voltage is not present, go to step 4).

3) Check harness connectors to power supply. See WIRING DIAGRAM. Repair as necessary. If connectors are okay, check circuit between cruise control main switch and power supply. Repair as necessary.

4) Check circuit and harness connector to cruise control main switch and power supply. See WIRING DIAGRAMS. Repair as necessary.

Test No. 13 (Cruise Control Indicator In Combination Meter Does Not Illuminate; Cruise Control Is Normal)

1) Remove combination meter (instrument cluster). See COMBINATION METER/INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Check indicator light bulb. Replace as necessary. If light bulb is okay, go to next step.

2) Check voltage between ground and cruise control harness-side connector terminal No. 17 (Lt. Green/Red wire). If battery voltage is present, replace cruise control ECU. If battery voltage is not present, go to next step.

3) Check harness connector to cruise control ECU and fuse/relay block. Repair as necessary. If connectors are okay, go to next step.

4) Check circuit between cruise control ECU and fuse/relay block. See WIRING DIAGRAMS. Repair as necessary.

Test No. 14 (Stoplight Input Circuit Check)

1) Check stoplight switch. See STOPLIGHT SWITCH under COMPONENT TESTS. Replace as necessary. If stoplight is okay, go to next step.

2) Check harness connector to cruise control ECU and power supply. Repair as necessary. If connectors are okay, check circuit between fusible link and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary.

Test No. 15 (Clutch Pedal Position Switch Or P/N Switch)

1) For M/T models, check clutch pedal position switch. See CLUTCH PEDAL POSITION SWITCH under COMPONENT TESTS. Replace as necessary. If switch is okay, check circuit between clutch pedal position switch and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary.

2) For A/T models, check Park/Neutral switch. See PARK/NEUTRAL switch under COMPONENT TESTS. Replace as necessary. If switch is okay, check circuit between cruise control ECU and power supply. See WIRING DIAGRAMS. Repair as necessary.

COMPONENT TESTS

ACTUATOR

Disconnect vacuum hose to actuator. Apply vacuum to actuator. Actuator linkage should operate or move throttle lever. Actuator diaphragm should hold vacuum.

CLUTCH PEDAL POSITION SWITCH

Disconnect clutch pedal position switch connector. Continuity should be present between clutch switch terminals when clutch pedal is depressed. If continuity is not present, replace clutch switch.

MAIN SWITCH

Disconnect cruise control main switch harness connector. Remove main switch from instrument panel. Apply battery voltage to specified switch terminals. Check continuity between specified switch terminals. See MAIN SWITCH TEST table. Replace as necessary.

MAIN SWITCH TEST TABLE

Position & Terminal No.	Condition
OFF (1)	
2 & 7	Continuity
NEUTRAL (1)	
2 & 7	Continuity
4 & 5	Continuity
ON (1)	
1 & 4	Continuity
1 & 5	Continuity
2 & 7	Continuity

(1) - Battery voltage applied to switch term. Nos. 1 and 4.

CRUISE CONTROL MULTI-FUNCTION SWITCH

Disconnect cruise control multi-function switch harness connector. Check continuity or resistance between switch terminals No. 1 and 2. See MULTI-FUNCTION SWITCH TEST table. Replace as necessary.

MULTI-FUNCTION SWITCH TEST TABLE

Switch Position	(1) Condition
OFF	No Continuity
CANCEL (Switch ON)	Zero Ohms
RESUME (Switch ON)	820 Ohms
SET (Switch ON)	2700 Ohms

(1) - With ohmmeter leads connected between multi-function switch terminals No. 1 and 2.

PARK/NEUTRAL SWITCH

Disconnect Park/Neutral (P/N) position switch harness connector. Continuity should exist between specified switch terminals. See PARK/NEUTRAL SWITCH TEST table. If continuity is not as specified, replace switch.

PARK/NEUTRAL SWITCH TEST TABLE

Position & Terminal No.	Condition

"P"		
1 & 10	.....	Continuity
5 & 7	.....	Continuity
"R"		
1 & 9	.....	Continuity
"N"		
1 & 7	.....	Continuity
5 & 6	.....	Continuity
"D"		
1 & 8	.....	Continuity
"2"		
1 & 3	.....	Continuity
"L"		
1 & 2	.....	Continuity

STARTER RELAY

1) Remove starter relay. Relay is located in engine compartment relay block. Using jumper wires, connect battery positive to relay terminal No. 3 and battery negative to relay terminal No. 1.
2) Using ohmmeter, check continuity between relay terminals No. 2 and 5. If continuity is not present, replace starter relay.

STOPLIGHT SWITCH

Disconnect switch harness connector. When brake pedal is depressed, continuity should exist between switch terminals No. 2 and 3. See WIRING DIAGRAMS. When brake pedal is released, continuity should exist between terminals No. 1 and 4. If continuity is not correct, replace stoplight switch.

THROTTLE POSITION SENSOR/ CLOSED THROTTLE POSITION SWITCH

1) Disconnect throttle position sensor/switch harness connector. Connect an ohmmeter between throttle position sensor/switch terminals No. 1 and 2 (ground). Insert a .026" (.65 mm) feeler gauge between throttle lever and idle set screw.
2) Loosen throttle position sensor/switch mounting screws. Turn sensor/switch fully counterclockwise. Throttle position sensor/switch should be ON. Slowly turn sensor/switch clockwise until switch is OFF. Tighten throttle position sensor/switch mounting screws.

VACUUM PUMP

1) Disconnect vacuum hose from vacuum pump. Connect a vacuum gauge to vacuum pump. Disconnect vacuum pump harness connector.
2) Using jumper wires, connect battery voltage to vacuum pump harness connector terminal No. 1 and connect terminals No. 2, 3 and 4 to ground. Vacuum pump should start and vacuum gauge should read about 15.7 in. Hg or greater.
3) Disconnect jumper wire from vacuum pump terminal No. 2. Vacuum gauge should read 6 in. Hg or less. If vacuum pump does not operate or vacuum readings are not as specified, replace vacuum pump.

VEHICLE SPEED SENSOR TEST

1) Remove vehicle speed sensor from transaxle. Jumper a 3000-10,000 ohm resistor between sensor terminals No. 1 and 3. Connect battery positive to sensor terminal No. 1 and battery negative to

sensor terminal No. 2. See Fig. 4.

2) Connect a voltmeter between sensor terminals No. 2 and 3. Manually turn speed sensor shaft. Voltage should pulse 4 times each revolution. Replace vehicle speed sensor if operation is not correct.

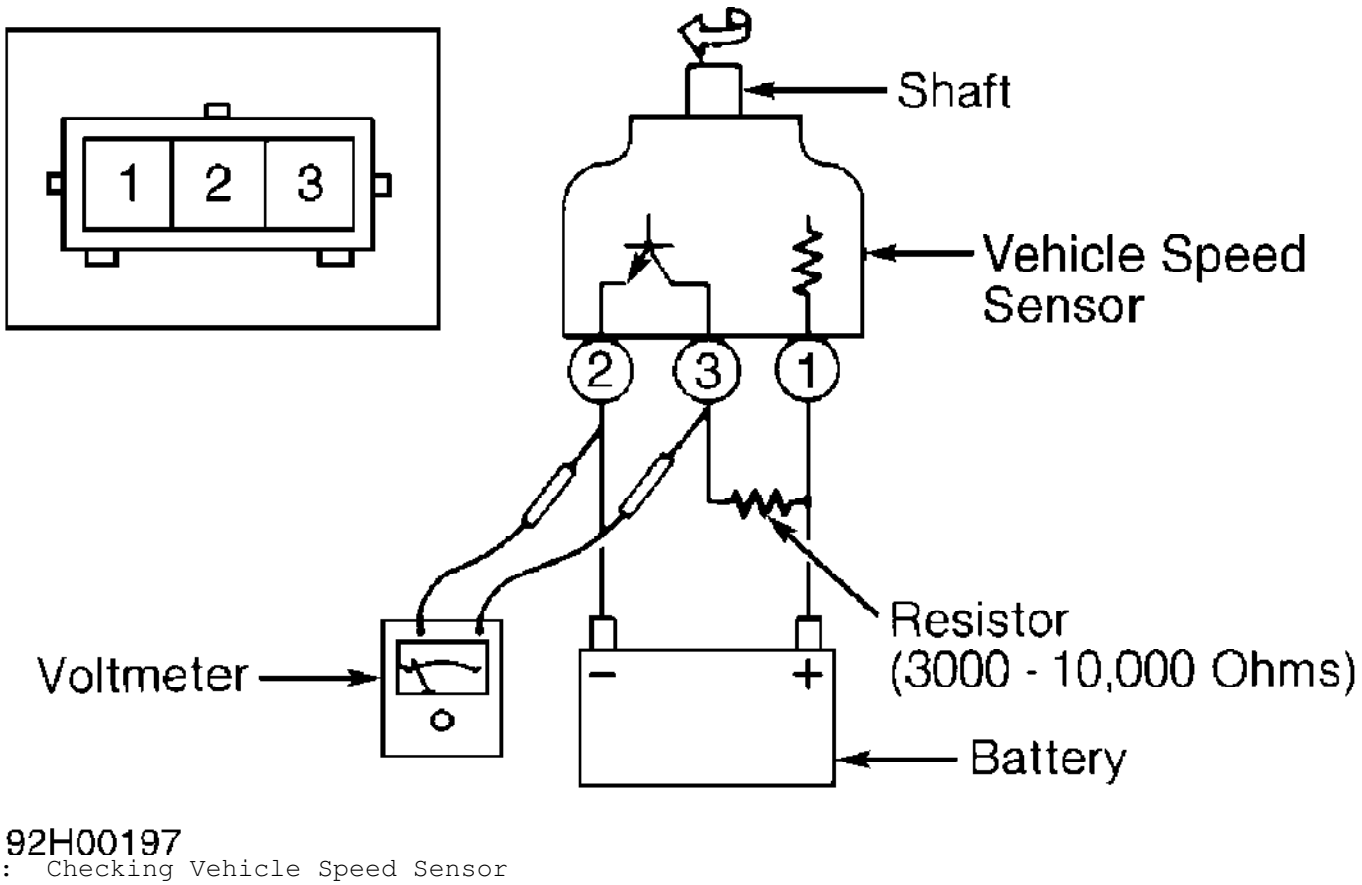


Fig. 4: Checking Vehicle Speed Sensor
Courtesy of Mitsubishi Motor Sales of America

SELF-DIAGNOSTIC SYSTEM

NOTE: Self-diagnostics should be performed when cruise control cancels without driver using normal cancel modes.

RETRIEVING TROUBLE CODES

1) Use Scan Tool (MB991554) or an analog voltmeter for code retrieval. Turn ignition off. Install scan tool. Turn ignition and cruise control main switch ON. Read trouble codes. See DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION table. To diagnose trouble code(s), go to appropriate test under DIAGNOSTIC TESTS.

2) If using an analog voltmeter, connect DTC Check Harness (MB991529) to DLC terminal No. 4 or 5 (ground) and No. 13 (diagnostic output). Connect voltmeter to DTC check harness leads. See Fig. 5. Read voltmeter needle sweeps to determine trouble code. Once trouble codes have been displayed, see TROUBLE CODE IDENTIFICATION table. To diagnose affected circuit, go to appropriate test under DIAGNOSTIC TESTS.

DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION TABLE

Code	Probable Cause
11	Vacuum Pump Drive System
12	Vehicle Speed Signal System
14	Vacuum Pump Power Supply
15	Cruise Control Switch
16	Cruise Control ECU
17	Throttle Position Sensor

RETRIEVING INPUT SWITCH CODES

NOTE: System input switch test should be performed only if no trouble codes are stored when performing SELF-DIAGNOSTICS. System input test cycles each cruise control switch and sensor.

1) Use Scan Tool (MB991554) or an analog voltmeter for code retrieval. Turn ignition off. Install scan tool. Turn ignition and cruise control SET switch ON. Turn on cruise control main switch and within one second turn on RESUME switch.

2) Operate each switch listed in CHECK RESULTS CODE IDENTIFICATION table and read input switch codes on scan tool or voltmeter. Repair or replace components as necessary.

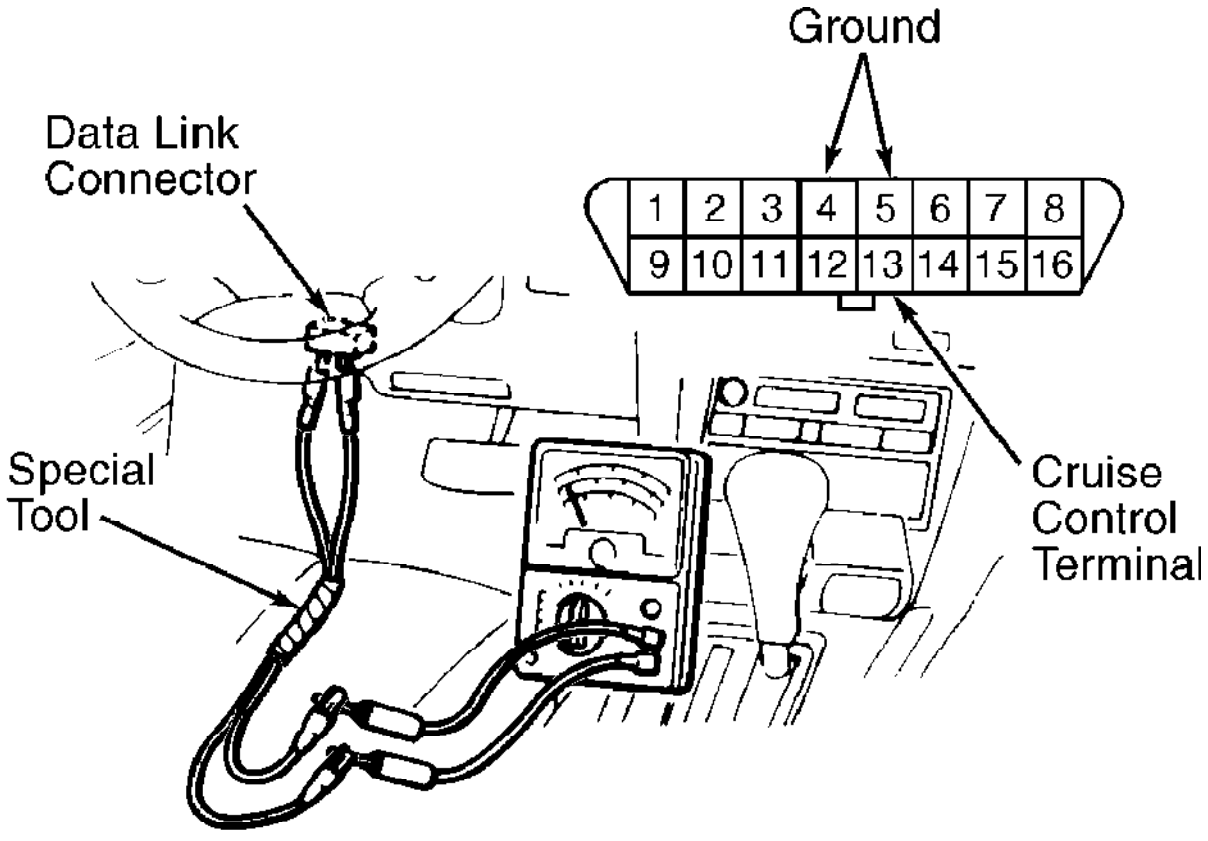


Fig. 5: Identifying Data Link Connector (DLC) Terminal
Courtesy of Mitsubishi Motor Sales of America

CHECK RESULTS CODE IDENTIFICATION TABLE

Code	Input Operation
21	SET Switch ON
22	RESUME Switch ON
23	Stoplight Switch ON (Brake Pedal Depressed)
24	(1) Vehicle Speed Signal
25	(2) Vehicle Speed Signal
26	(3) P/N Switch ON With Lever "N" Range (A/T) Or (3) Clutch Pedal Position Switch (M/T)
27	CANCEL Switch ON
28	(4) Throttle Position (TP) Sensor Signal
29	(5) Closed Throttle Position Switch

(1) - ECU determines that vehicle speed is 25 MPH or greater.
(2) - ECU determines that vehicle speed is less than 25 MPH.
(3) - ECU determines that P/N or clutch pos. switch is ON.
(4) - ECU determines that TP sensor voltage is 1.5 volts or greater.
(5) - ECU determines that closed throttle pos. switch is OFF.

CLEARING TROUBLE CODES

1) To clear trouble codes, disconnect negative battery cable for about 10 seconds or turn ignition on and then turn on cruise control SET switch. Turn cruise main switch on and within one second turn RES switch on.
2) Depress brake pedal and hold cruise control SET switch in ON position for 5 seconds or more. Verify codes are cleared.

DIAGNOSTIC TESTS

CODE 11: CRUISE CONTROL VACUUM PUMP SYSTEM

1) Check cruise control vacuum pump. See VACUUM PUMP under COMPONENT TESTS. Replace as necessary. If vacuum pump is okay, go to next step.
2) Check harness connector to cruise control vacuum pump. Repair as necessary. If connector is okay, check circuit between cruise control vacuum pump and cruise control ECU. See WIRING DIAGRAMS . Repair as necessary. If circuit is okay, replace cruise control ECU.

CODE 12: VEHICLE SPEED SIGNAL

1) Ensure speedometer is operating properly. Repair as necessary. If speedometer is operating properly, check vehicle speed sensor. See VEHICLE SPEED SENSOR TEST under COMPONENT TESTS. Replace sensor as necessary. If sensor is okay, go to next step.
2) Disconnect cruise control ECU harness connector. Check voltage between ground and ECU harness-side connector terminal No. 11 (Yellow/White wire). See WIRING DIAGRAMS. If voltage reading is 4.5 volts or greater, go to next step. If voltage reading is not 4.5 volts or greater, check cruise control harness connector. Repair as necessary. If connector is okay, replace cruise control ECU.
3) Check circuit between cruise control ECU and vehicle speed sensor. See WIRING DIAGRAMS. Repair as necessary.

CODE 14: VACUUM PUMP POWER SUPPLY

1) Disconnect vacuum pump harness connector. Check voltage between ground and cruise control vacuum pump harness-side connector

terminal No. 1 (Brown wire). If battery voltage is present, go to next step. If battery voltage is not present, go to step 5).

2) Check cruise control vacuum pump. See VACUUM PUMP under COMPONENT TESTS. Replace as necessary. If vacuum pump is okay, go to next step.

3) Disconnect cruise control ECU harness connector. Check voltage between ground and cruise control ECU harness-side connector terminals No. 7 (Blue/Yellow wire), No. 8 (Blue/Black wire) and No. 18 (Orange wire). If battery voltage is present on each of the terminals, go to next step. If battery voltage is not present, check circuit between vacuum pump and cruise control ECU. Repair as necessary.

4) Check cruise control ECU harness connector. Repair as necessary. If connector is okay, replace cruise control ECU.

5) Check stoplight switch. See STOPLIGHT SWITCH under COMPONENT TESTS. Replace switch as necessary. If switch is okay, check circuit between cruise control vacuum pump and ECU. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace cruise control ECU.

CODE 15: CRUISE CONTROL SWITCH

This code sets if cruise control RESUME, CANCEL or SET switch remains on. Check cruise control multi-function switch. See CRUISE CONTROL MULTI-FUNCTION SWITCH under COMPONENT TESTS. Replace cruise control multi-function switch as necessary.

CODE 16: CRUISE CONTROL ECU

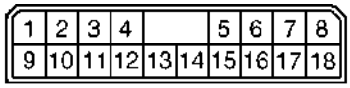
This code sets if there is an abnormality in the CANCEL hold switch or in microprocessor monitor circuit in cruise control ECU. Replace cruise control ECU.

CODE 17: THROTTLE POSITION SENSOR

1) Check if PCM DTC 14 (engine performance code) is also present. If DTC 14 is present, diagnose using appropriate G - TESTS W/CODES - 3.0L article under ENGINE PERFORMANCE. If DTC 14 is not present, go to next step.

2) Check harness connector to cruise control ECU. Repair as necessary. If connector is okay, check circuit between throttle position sensor and cruise control ECU. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace cruise control ECU.

PIN VOLTAGE TESTS



TERMINAL NO.	CHECK ITEM	CHECKING REQUIREMENTS		NORMAL CONDITION
1	THROTTLE POSITION SENSOR INPUT	WHEN ACCELERATOR PEDAL IS FULLY DEPRESSED		4.6 – 5.5 V
		WHEN ACCELERATOR PEDAL IS RELEASED		0.3 – 1.0 V
2	CLOSED THROTTLE POSITION SWITCH OUTPUT	WHEN ACCELERATOR PEDAL IS DEPRESSED	WHEN CLOSED THROTTLE POSITION SWITCH IS OFF	4.5 – 5.5 V
		WHEN ACCELERATOR PEDAL IS NOT DEPRESSED	WHEN CLOSED THROTTLE POSITION SWITCH IS ON	0 V
3	"ACC" POWER SUPPLY	WHEN IGNITION SWITCH IS IN "ACC" POSITION		BATTERY POSITIVE VOLTAGE
4	STOPLIGHT SWITCH INPUT	WHEN BRAKE PEDAL IS DEPRESSED	WHEN STOPLIGHT SWITCH IS ON	BATTERY POSITIVE VOLTAGE
		WHEN BRAKE PEDAL IS NOT DEPRESSED	WHEN STOPLIGHT SWITCH IS OFF	0 V
5	DIAGNOSIS CONTROL INPUT	WHEN IGNITION SWITCH IS "ON"		4 V OR MORE
6	ECU BACKUP POWER SUPPLY	ALWAYS		BATTERY POSITIVE VOLTAGE
7	AUTO-CRUISE VACUUM PUMP RELEASE VALVE AND CONTROL VALVE INPUT	WHEN DECELERATING WITH THE "SET" SWITCH WHILE DRIVING AT CONSTANT SPEED	CONTROL VALVE OPEN	BATTERY POSITIVE VOLTAGE
8			RELEASE VALVE CLOSED	0 V
7		WHEN CANCELLING AUTO-CRUISE CONTROL BY THE "CANCEL" SWITCH	CONTROL VALVE OPEN	BATTERY POSITIVE VOLTAGE
8			RELEASE VALVE OPEN	BATTERY POSITIVE VOLTAGE
9	GROUND	ALWAYS		CONTINUITY

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Fig. 6: Pin Voltage Chart (1 Of 3)
Courtesy of Mitsubishi Motor Sales of America

TERMINAL NO.	CHECK ITEM	CHECKING REQUIREMENTS		NORMAL CONDITION
10	A/T CONTROL OUTPUT	OD SWITCH ON		BATTERY POSITIVE VOLTAGE
		OD SWITCH OFF		0 V
11	VEHICLE SPEED SENSOR INPUT	WHEN THE VEHICLE MOVES FORWARD AND REVERSES, THE VEHICLE SPEED SENSOR TURNS ON AND OFF REPEATEDLY	WHEN THE SENSOR IS ON	0 V
			WHEN THE SENSOR IS OFF	4.5 V OR MORE
12	AUTO-CRUISE CONTROL SWITCH INPUT	WHEN THE AUTO-CRUISE CONTROL SWITCH HAS NOT BEEN OPERATED	WHEN ALL SWITCHES ARE "OFF"	0 V
		WHEN THE AUTO-CRUISE CONTROL SWITCH IS PUSHED DOWN	WHEN "SET" SWITCH IS "ON"	3 V
		WHEN THE AUTO-CRUISE CONTROL SWITCH IS PUSHED UP	WHEN "RESUME" SWITCH IS "ON"	6 V
		WHEN THE AUTO-CRUISE CONTROL SWITCH IS PULLED FORWARD	WHEN "CANCEL" SWITCH IS "ON"	BATTERY POSITIVE VOLTAGE
13	GROUND	ALWAYS		CONTINUITY
14	CLUTCH PEDAL POSITION SWITCH INPUT <M/T>	WHEN PEDAL IS NOT DEPRESSED	WHEN THE CLUTCH PEDAL POSITION SWITCH IS "OFF"	4.5 V OR MORE
		WHEN THE CLUTCH PEDAL IS DEPRESSED	WHEN THE CLUTCH PEDAL POSITION SWITCH IS "ON"	0 V
	PARK/NEUTRAL POSITION SWITCH INPUT <A/T>	WHEN THE SELECTOR LEVER IS IN A POSITION OTHER THAN "N" OR "P" RANGE	WHEN THE PARK/NEUTRAL POSITION SWITCH IS "OFF"	BATTERY POSITIVE VOLTAGE
		WHEN THE SELECTOR LEVER IS IN "N" OR "P" RANGE	WHEN THE PARK/NEUTRAL POSITION SWITCH IS "ON"	0 V

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Fig. 7: Pin Voltage Chart (2 Of 3)
Courtesy of Mitsubishi Motor Sales of America

TERMINAL NO.	CHECK ITEM	CHECKING REQUIREMENTS		NORMAL CONDITION
15	PUMP POWER SUPPLY	IGNITION SWITCH "ON" MAIN SWITCH "ON" STOPLIGHT SWITCH: "ON"		BATTERY POSITIVE VOLTAGE
16	ECU POWER SUPPLY	IGNITION SWITCH: "ON" MAIN SWITCH: "ON"		BATTERY POSITIVE VOLTAGE
17	INDICATOR INPUT (INSIDE COMBINATION METER)	WHEN DRIVING AT CONSTANT SPEED	WHEN INDICATOR IS ILLUMINATED	0 V
		WHEN CONSTANT SPEED DRIVING IS CANCELLED	WHEN INDICATOR IS SWITCHED OFF	BATTERY POSITIVE VOLTAGE
18	AUTO-CRUISE VACUUM PUMP MOTOR INPUT	WHEN DRIVING AT CONSTANT SPEED USING THE "SET" SWITCH	MOTOR STOPPED/ RUNNING	BATTERY POSITIVE VOLTAGE/0 V
		WHEN ACCELERATING WITH THE "RESUME" SWITCH WHILE DRIVING AT CONSTANT SPEED	MOTOR STOPPED/ RUNNING	BATTERY POSITIVE VOLTAGE/0 V
		WHEN DECELERATING WITH "SET" SWITCH WHILE DRIVING AT CONSTANT SPEED	MOTOR STOPPED	BATTERY POSITIVE VOLTAGE
		WHEN CANCELLING CONSTANT SPEED DRIVING WITH THE "CANCEL" SWITCH	MOTOR STOPPED	BATTERY POSITIVE VOLTAGE

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Fig. 8: Pin Voltage Chart (3 Of 3)
Courtesy of Mitsubishi Motor Sales of America

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEM article. Do not apply electrical power to any component on steering column

without first deactivating air bag system. Air bag may deploy.

AIR BAG MODULE

Removal & Installation

1) Remove air bag module mounting nuts from back of steering wheel. When disconnecting clockspring connector, press connector toward the outer side to spread it open.

2) Disconnect clockspring connector from air bag module. DO NOT apply excessive force to connector. Lay air bag with pad cover face up. To install, reverse removal procedure.

ACTUATOR

Removal & Installation

Remove linkage protector. Remove cruise control cable. Remove accelerator and throttle cables. Disconnect vacuum hoses and electrical connectors. Remove linkage assembly. Remove vacuum pump and bracket. Remove actuator and bracket. To install, reverse removal procedure.

CRUISE CONTROL ECU

Removal & Installation

Cruise control ECU is located near left kick panel. Remove kick panel and cruise control ECU. To install, reverse removal procedure.

CRUISE CONTROL MAIN SWITCH

Removal & Installation

Using a flat bladed screwdriver wrapped with shop towel, pry out cruise control main switch from instrument panel. Disconnect harness connector from switch. Remove cruise control main switch. To install, reverse removal procedure.

INDICATOR LIGHT

Removal & Installation

Indicator light is located in instrument cluster. Remove combination meter (instrument cluster). See COMBINATION METER/INSTRUMENT CLUSTER. To install, reverse removal procedure.

COMBINATION METER/INSTRUMENT CLUSTER

Removal & Installation

1) Disconnect negative battery cable. Remove cluster cover. Remove cluster mounting screws. Disconnect all necessary electrical connectors. Remove combination meter/instrument cluster.

2) Disconnect speedometer cable at transaxle end. Pull speedometer cable slightly toward vehicle interior. Release adapter by turning left or right, and remove adapter. To install, reverse removal procedure.

MULTI-FUNCTION SWITCH

* PLEASE READ THIS FIRST *

WARNING: DO NOT hammer steering wheel. Collapsible steering column mechanism may be damaged.

Removal & Installation

Remove knee protector and lower panel. Remove column covers. Remove air bag module and bracket. See AIR BAG MODULE. Remove clip and column switch. To install, reverse removal procedure.

VEHICLE SPEED SENSOR

Removal & Installation

Vehicle speed sensor is located on top of transaxle. Remove hold-down bolt and then remove sensor. To install, reverse removal procedure. Install NEW "O" ring.

WIRING DIAGRAMS

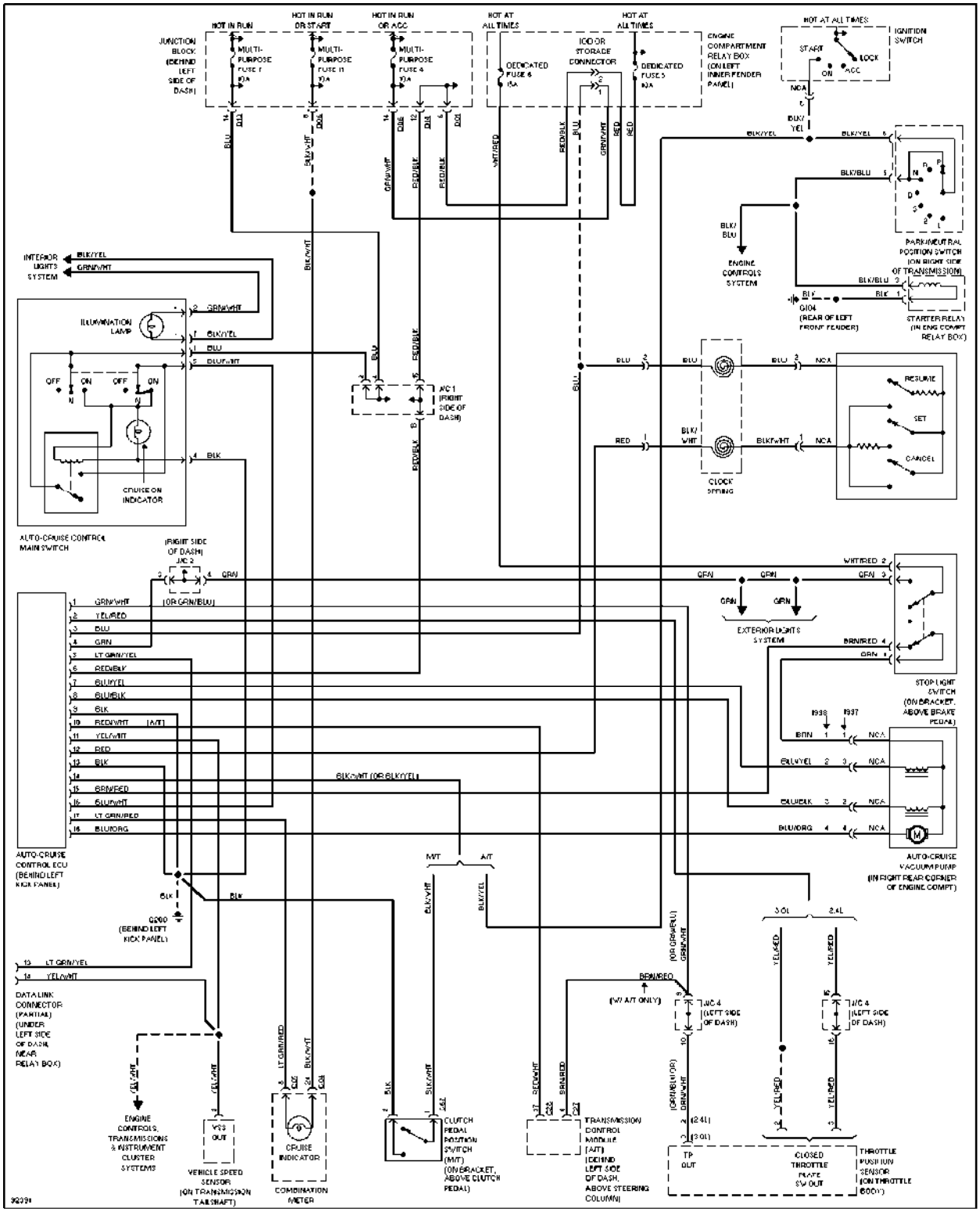


Fig. 9: Cruise Control System Wiring Diagram

DEFOGGER - REAR WINDOW

1997-99 Mitsubishi Montero Sport

1997-99 ACCESSORIES & EQUIPMENT
Mitsubishi - Rear Window Defogger

Montero Sport

DESCRIPTION & OPERATION

The rear window defogger is a heating filament grid bonded to inside of window. Rear window defogger is controlled by defogger switch on instrument panel and a defogger relay.

A timer relay controls defogger operation for 9-11 minutes, then turns defogger off. Timer will operate defogger for 11 minutes then turn off, even with defogger switch in ON position and indicator light illuminated.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Data Link Connector (DLC)	Under Left Side Of Dash, Near Steering Column
Defogger Relay	Under Left Side Of Glove Compartment
Defogger Timer	On Passenger Compartment Fuse and Relay Block
ETACS-ECU	Above Left Kick Panel, On Junction Block

TROUBLE SHOOTING

DEFOGGER DOES NOT WORK

Check for blown fuse, poor contact, defective defogger switch, poor connection or open wire.

DEFOGGER TIMER INOPERATIVE

Check defogger switch or defogger timer. See WIRING DIAGRAMS.

INDICATOR LIGHT DOES NOT WORK

Check for burned out bulb, open circuit or poor connection.

INDICATOR LIGHT IS DIM

Check rheostat or indicator bulb.

COMPONENT TESTS

DEFOGGER RELAY TEST

1) Remove defogger relay. See COMPONENT LOCATIONS table. Ground relay terminal No. 1, and apply battery voltage to terminal No. 3. Check relay continuity using ohmmeter.

2) Continuity should exist between terminals No. 2 and 5.

With voltage disconnected, continuity should not exist between terminals No. 2and 5. Ensure continuity exists between terminals No. 1 and 3. See Fig. 1. Replace relay if it does not test as specified.

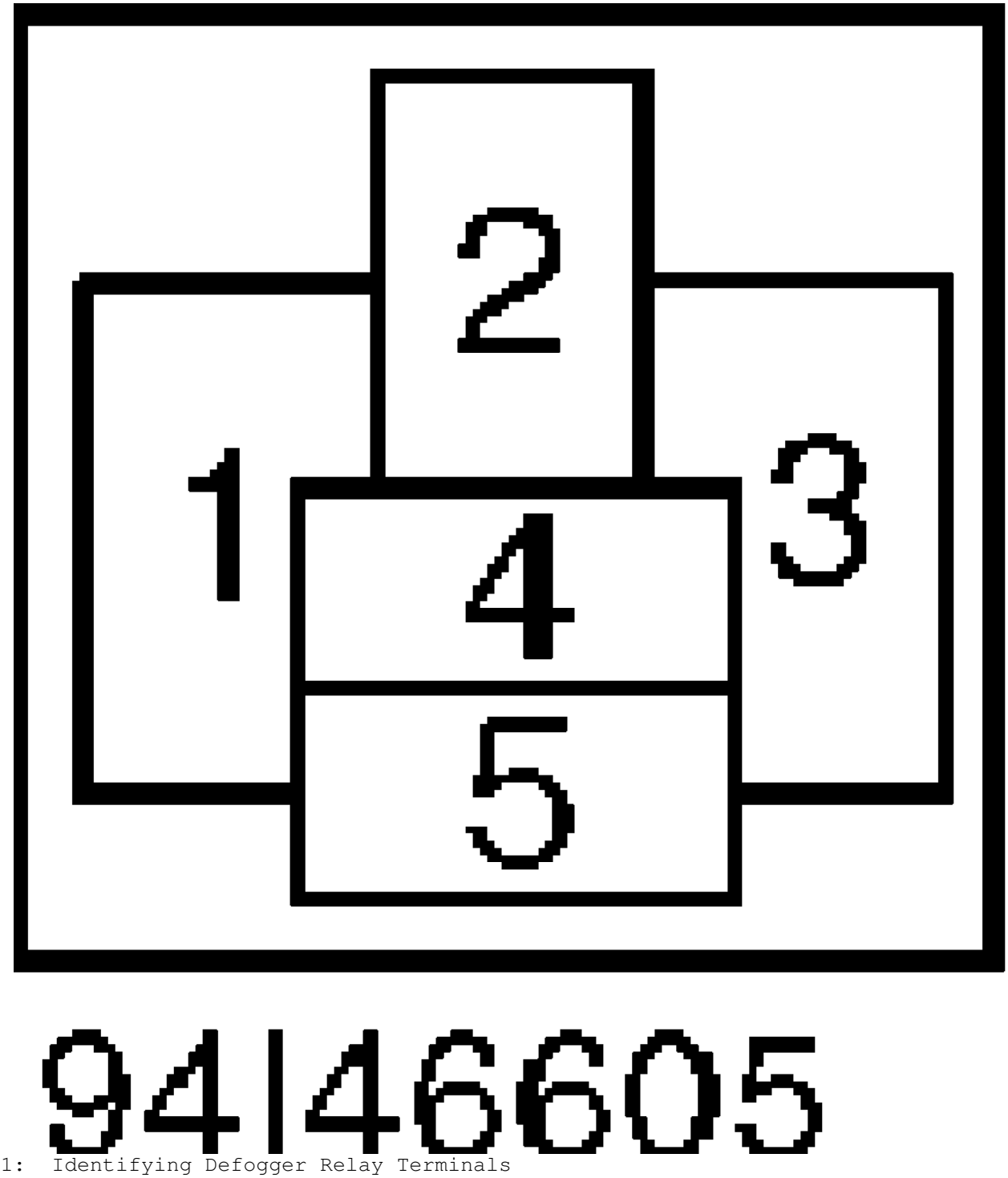


Fig. 1: Identifying Defogger Relay Terminals
Courtesy of Mitsubishi Motor Sales of America.

DEFOGGER SWITCH TEST

Turn defogger switch to OFF position. Using ohmmeter, check switch continuity. Continuity should be present between terminals No. 1 and 5, and terminals No. 2 and 6. Turn defogger switch to ON position. Continuity should be present between terminals No. 3 and 4, 1 and 5, and between terminals No. 2 and 6. See Fig. 2. Replace switch if it does not test as specified.

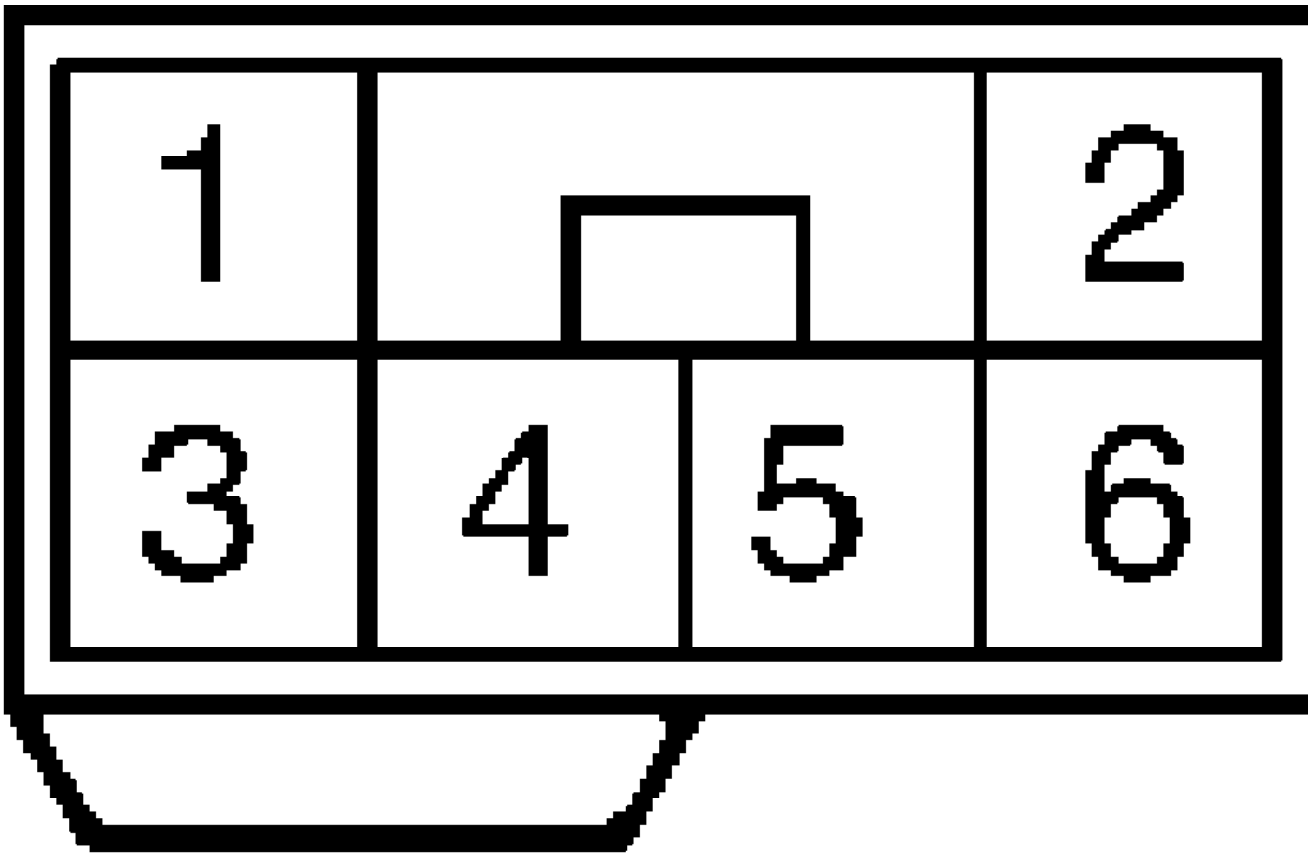


Fig. 2: Identifying Defogger Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

GRID TEST

1) Start and run engine at 2000 RPM. Ensure battery is fully charged. Turn defogger switch to ON position. Using a voltmeter, check voltage at center section of each grid filament and run engine at 2000 RPM. Ensure battery is fully charged. Turn defogger switch to ON position. Using a voltmeter, check voltage at center section of each grid filament.

2) If voltage is about 6 volts, grid filament is okay. If voltage is about 12 volts, an open is present in negative circuit. Move probe slowly toward negative terminal to determine location of open circuit.

3) If voltage is zero volts, an open is present in positive circuit. Move probe slowly toward positive terminal to determine

location of open circuit. Repair grid as necessary. See Fig. 3.

ON-VEHICLE SERVICE

GRID FILAMENT REPAIR

Clean broken wire tips thoroughly. Place masking tape along both sides of broken wire. See Fig. 3. Apply Repair Paste (DuPont 4817) to broken section of grid. Remove masking tape after paste has dried. Wait 24 hours before using defogger.

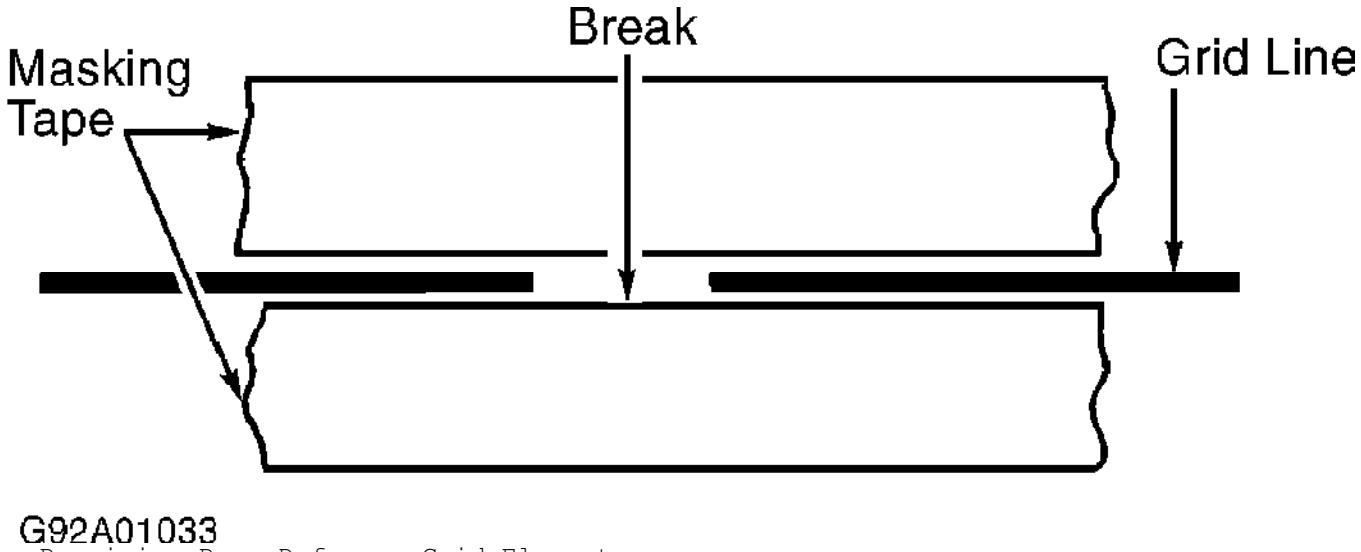


Fig. 3: Repairing Rear Defogger Grid Element

REMOVAL & INSTALLATION

DEFOGGER SWITCH

Removal & Installation

Remove instrument cluster bezel. Bezel is held in by metal clips. Disconnect wiring harness from defogger switch. Remove switch from behind bezel. To install, reverse removal procedure.

WIRING DIAGRAMS

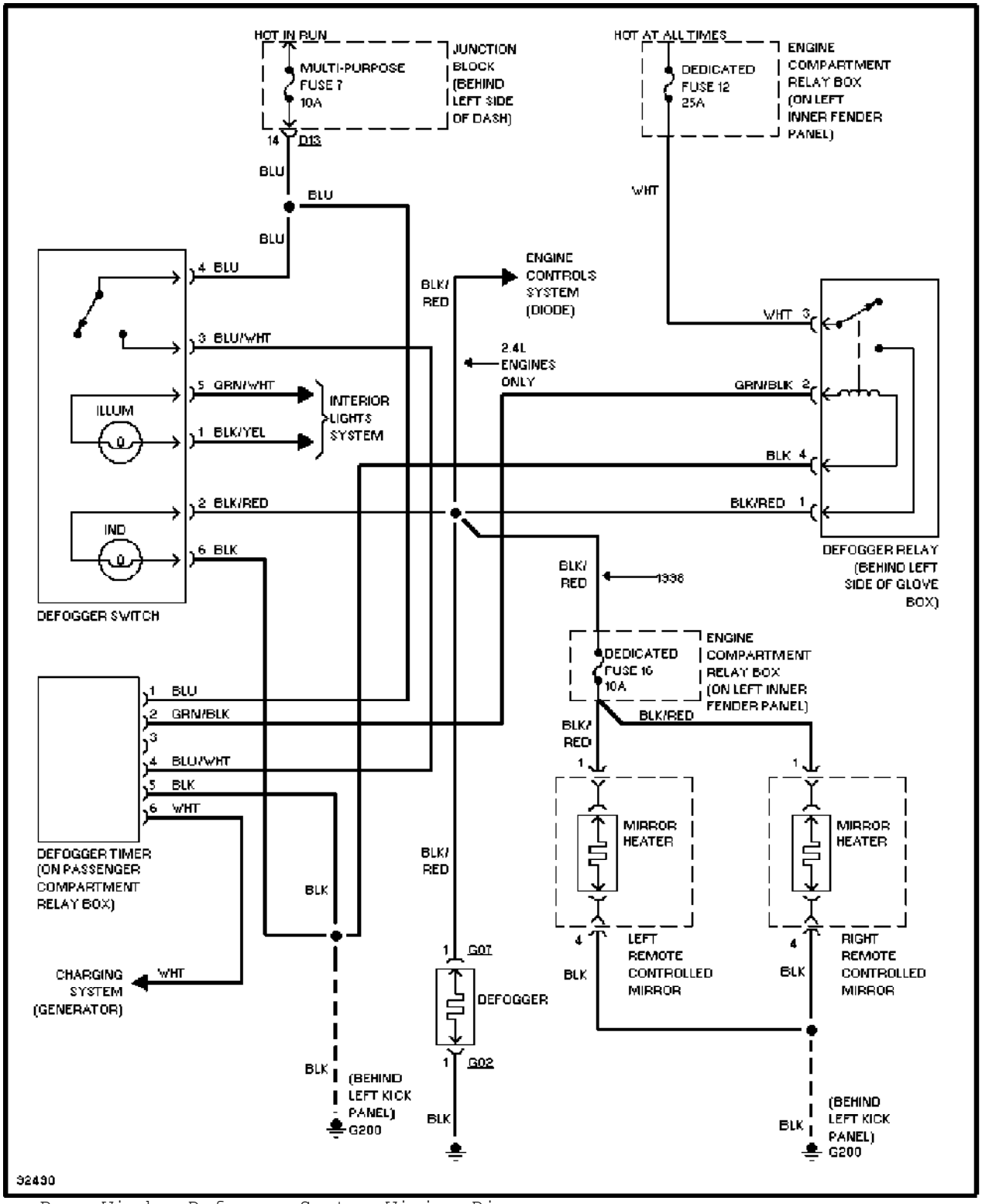


Fig. 4: Rear Window Defogger System Wiring Diagram

DIFFERENTIAL & AXLE SHAFTS - FRONT

1997-99 Mitsubishi Montero Sport

1997-99 DRIVE AXLES
Mitsubishi Differentials & Axle Shafts - Front

Montero, Montero Sport

DESCRIPTION & OPERATION

Front axle assembly consists of a differential carrier, housing tube, inner shaft and drive axles. See Figs. 1 and 2. A full-floating axle design is used. Drive axles are flexible assemblies made up of a shaft and an inner Birfield Joint (BJ) and an outer Double Offset Joint (DOJ).

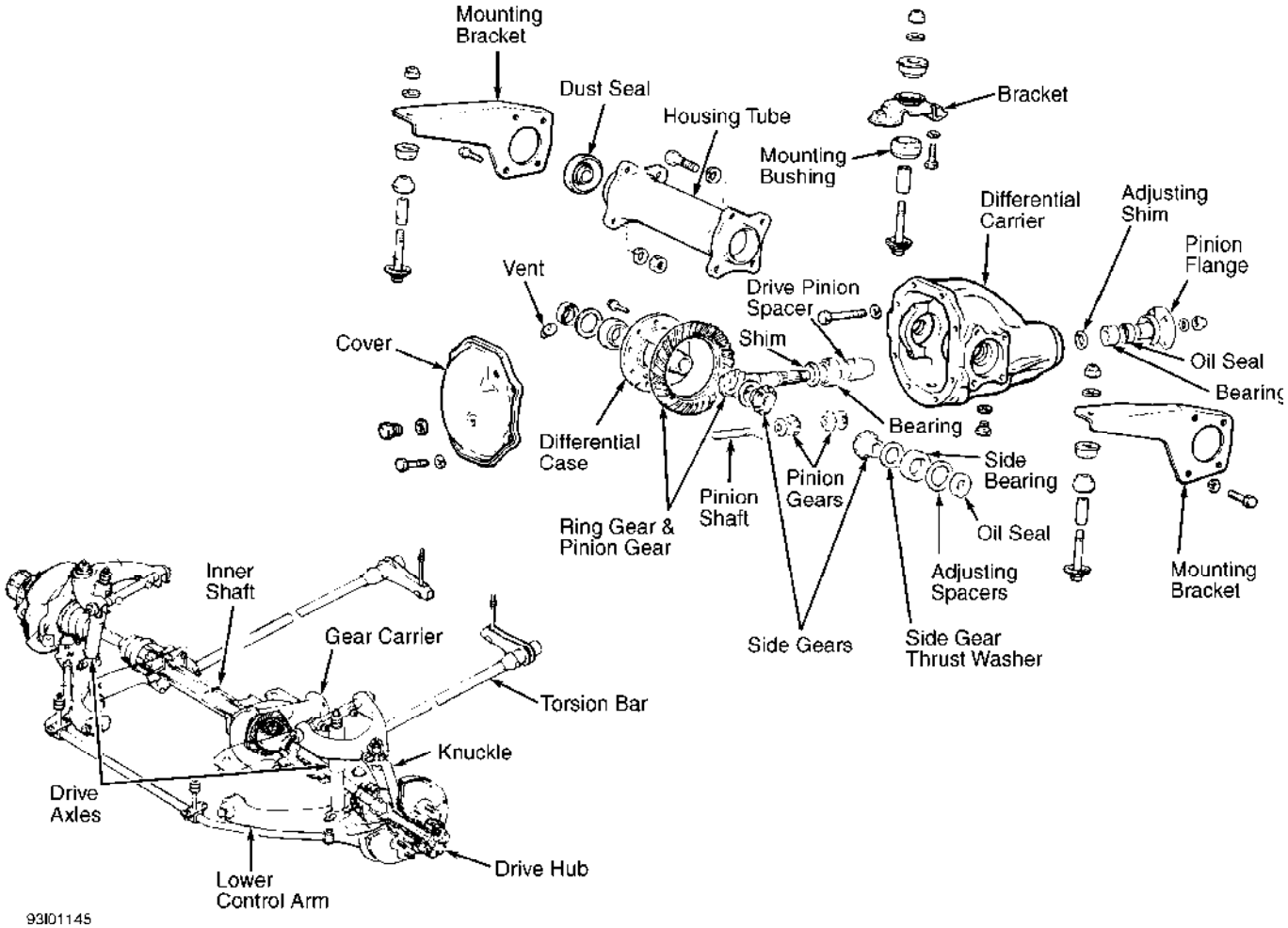
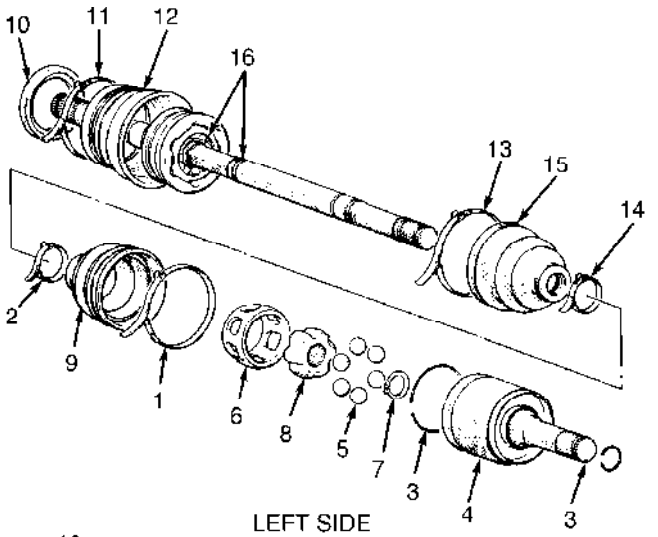
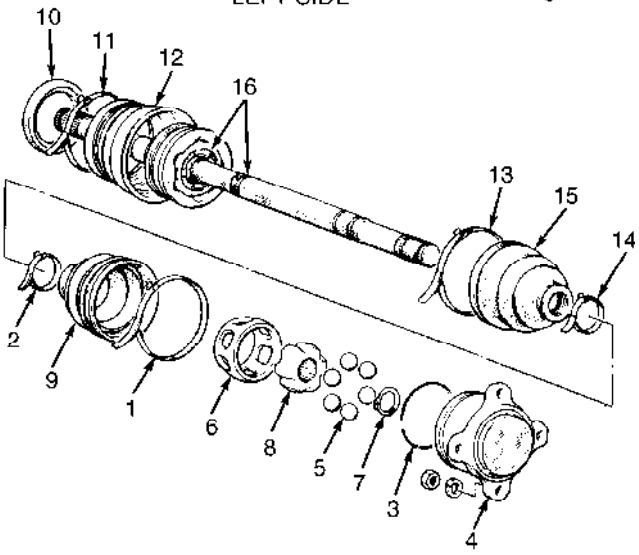
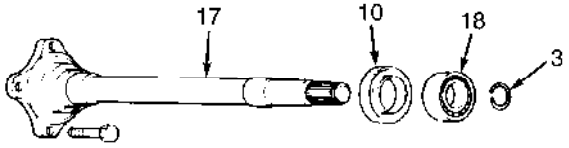


Fig. 1: Exploded View Of Front Differential Assembly & Suspension Components (Typical)
Courtesy of Mitsubishi Motor Sales of America.



LEFT SIDE





RIGHT SIDE

1. Boot Band	10. Dust Cover
2. Boot Band	11. Boot Protector Band
3. Circlip	12. Boot Protector
4. DOJ Outer Race	13. Boot Band
5. Balls	14. Boot Band
6. DOJ Cage	15. BJ Boot
7. Snap Ring	16. Drive Shaft & BJ Assembly
8. DOJ Inner Race	17. Inner Shaft
9. DOJ Boot	18. Bearing

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Fig. 2: Exploded View Of Drive Axles (Typical)
Courtesy of Mitsubishi Motor Sales of America.

AXLE RATIO & IDENTIFICATION

AXLE RATIO SPECIFICATIONS

Application	Ratio
Montero	4.27:1
Montero Sport	(1)

(1) - On vehicles equipped with wide fender, ratio is 4.64:1. On vehicles with narrow fender, ratio is 4.27:1.

LUBRICATION

CAPACITY

DIFFERENTIAL FLUID CAPACITY

Application	Specification
Montero & Montero Sport	2.4 Pts. (1.1L)

FLUID TYPE

All models use fluid type SAE 80W-90/API GL-5.

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING - BASIC PROCEDURES article in the GENERAL TROUBLE SHOOTING section.

REMOVAL & INSTALLATION

AXLE SHAFTS R & I

Removal

1) Raise and support vehicle. Remove wheels and undercover. Ensure hub is in free-wheeling position. Place transfer case in 2H position. Remove drive hub cover, snap ring and shim from axle shaft. See Fig. 3. Remove brake calipers and support aside.

2) Disconnect tie rod assembly. Support lower control arm with jack. Separate ball joints from knuckle. Remove knuckle and front hub assembly. Using flat-blade pry bar, carefully remove left axle shaft from differential carrier. DO NOT damage oil seal. On right axle shaft, remove axle shaft-to-inner shaft flange retaining bolts. Remove right axle shaft.

CAUTION: Replace circlips on BJ/DOJ splined shaft end.

Installation

1) Install right axle shaft on inner shaft flange. Install new circlip on DOJ side of left axle shaft. Carefully install left axle shaft into differential. DO NOT damage oil seal.

2) Reinstall knuckle with front hub assembly. To complete installation, reverse removal procedure. Install shim and snap ring. Check axle end play. See Fig. 4. End play should be .016-.028" (.4-.7 mm). If end play is not within specification, install correct shim.

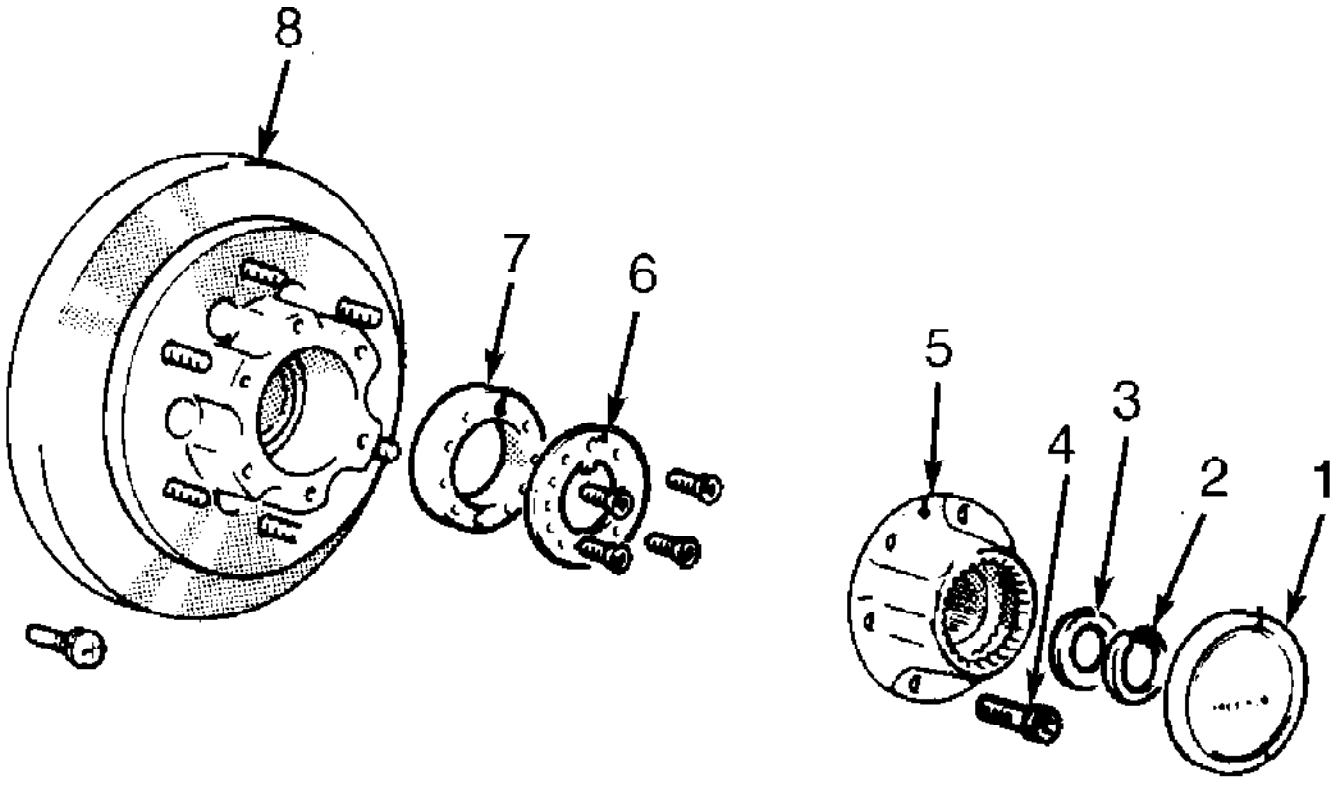

Fig. 3: Exploded View Of Auto-Locking Hub Assembly (Typical)
Courtesy of Mitsubishi Motor Sales of America.

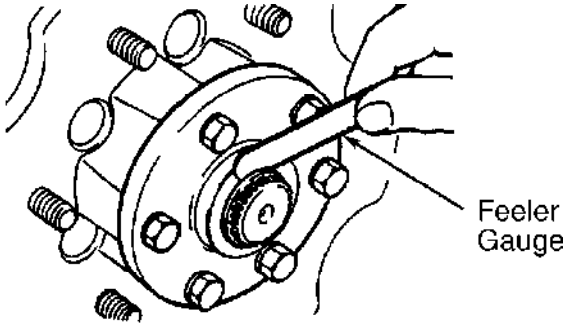

Fig. 4: Measuring Axle Shaft End Play
Courtesy of Mitsubishi Motor Sales of America.

DIFFERENTIAL CARRIER ASSEMBLY

Removal

1) Raise and support vehicle. Drain gear oil. Support differential carrier. Remove axle shafts and inner shaft. See AXLE SHAFTS R & I and INNER SHAFT & BEARING. Place alignment mark on drive shaft and pinion companion flange for reassembly reference.

2) Remove drive shaft. Remove differential mounting brackets at differential and frame. See Fig. 1. Disconnect front crossmember from frame. Remove differential carrier assembly and front crossmember. Remove differential carrier from front crossmember.

Installation

To install, reverse removal procedure. Align marks on drive shaft and pinion companion flange.

INNER SHAFT & BEARING

Removal

Remove right axle shaft. See AXLE SHAFTS R & I. Using slide hammer, remove inner shaft from differential carrier. See Fig. 1. If dust seal replacement is required, pry dust seal from housing tube assembly using a screwdriver. To remove bearing, bend outer area of dust cover inward on inner shaft. Press shaft out of bearing. Remove dust cover from shaft.

Inspection

Inspect inner shaft for damaged splines or threads. Inspect bearing for roughness or damage.

Installation

1) Install housing tube. Using Seal Installer (MB990955) and Handle (C-4171), install NEW dust seal in housing tube. Dust seal must be even with housing tube. Coat seal lip with grease.

2) Using a pipe with O.D. of 2.00" (75.0 mm), wall thickness of .16" (4.0 mm) and overall length of 2.00" (50.0 mm), install dust cover on shaft. Coat inside of dust cover with grease. Press bearing on shaft. Install new circlip on inner shaft. Carefully drive inner shaft into differential. DO NOT damage oil seal. To complete installation, reverse removal procedure.

OVERHAUL

AXLE SHAFTS & BEARINGS

NOTE: References to BJ and DOJ refer to Birfield Joint and Double Offset Joint, respectively.

Disassembly

1) Remove boot bands. Remove circlip from DOJ outer race. Separate axle shaft from DOJ outer race. Remove balls from DOJ cage. Remove DOJ cage from DOJ inner race in direction of BJ. See Fig. 2.

2) Remove snap ring from axle shaft shaft. Remove DOJ inner race from shaft. Remove circlip from shaft. Wrap tape around splines of shaft to prevent boot damage during removal. Remove DOJ boot. Note size of boot. Remove dust cover from shaft. Move boot protector toward BJ side of shaft and remove. Remove BJ boot.

CAUTION: Axle shaft and BJ are serviced as a unit. DO NOT attempt to disassemble BJ and axle shaft.

Reassembly

1) Coat shaft with light coat of grease. Wrap splines with

tape. Install BJ boot, bands and DOJ boot on shaft. Ensure correct size boot is installed in proper location.

2) Pack proper amount of grease in BJ and BJ boot. See CV JOINT GREASE CAPACITY table. Boot bands must be installed so lever is pulled toward rear of vehicle when band is tightened.

3) Place DOJ cage on shaft with smaller diameter installed first. Install circlip, DOJ inner race and snap ring on shaft. Apply grease to DOJ inner race and cage. Install balls into cage. Apply proper amount of grease to outer DOJ race. See CV JOINT GREASE CAPACITY table. Install shaft into DOJ outer race. Install circlip.

4) Place DOJ boot over DOJ outer race. Install boot bands so lever is pulled toward rear of vehicle when band is tightened. Adjust DOJ boot bands to have proper distance between center line of boot bands. Distance should be 3.03-3.27" (76.9-83.0 mm). This distance is necessary to control air in DOJ boot. Tighten boot bands. Install boot protector and band. Install dust cover on shaft.

CV JOINT GREASE CAPACITY

Application	(1) Ozs. (g)
BJ Boot & Joint	
Montero	4.6 (130)
Montero Sport	4.2 (120)
DOJ Boot & Joint	
Montero	3.5 (100)
Montero Sport	4.9 (140)

(1) - Apply 1/2 of the amount of grease specified to joint, the other half to inside of CV boot.

DIFFERENTIAL ASSEMBLY

Disassembly

1) Remove differential carrier from vehicle. See DIFFERENTIAL CARRIER ASSEMBLY under REMOVAL & INSTALLATION. Remove cover. Mark bearing caps for reassembly reference. Remove bearing caps. Remove differential case assembly from carrier.

CAUTION: Ensure adjusting spacers, bearing caps, gears and side bearings are marked for reassembly reference. Components must be installed in original location.

2) Using bearing puller, remove differential case side bearings. Loosen ring gear retaining bolts in diagonal sequence. Remove ring gear. Remove drive pinion shaft lock pin from ring gear side. Remove pinion shaft and pinion gears. Remove side gears and thrust spacers.

Drive Pinion Removal

Remove pinion flange nut. Scribe alignment mark on pinion companion flange and drive pinion. Remove flange. Using soft-faced hammer, drive out pinion. Remove rear bearing and oil seal from carrier. Remove rear adjusting shim from pinion. See Fig. 1. Press front bearing from pinion. Remove front adjusting shim and spacer from pinion.

Cleaning & Inspection

Use cleaning solvent to rinse gears and components. Check bearings for wear or discoloration. Check gear carrier for cracks or damage. Check pinion, side gear and flange splines for excessive wear.

Check ring gear, pinion and side gears for wear or damage. Replace components as necessary.

Reassembly & Adjustments

1) Place side gear thrust spacers behind side gears, in original position. Assemble side gears in differential case. Install pinion gears and washers. Rotate pinion gears to mesh with side gears.

2) Install pinion shaft without lock pin. Check pinion and side gear backlash. Install wooden wedge to lock side gears. Using dial indicator, measure gear backlash. See Fig. 5.

3) Backlash must be within specification. See PINION & SIDE GEAR BACKLASH SPECIFICATIONS table. Adjust backlash by using different side gear spacers. Ensure both sides are equally shimmed. If backlash cannot be adjusted within specifications, replace side and pinion gears as matched set.

4) Install pinion shaft lock pin. Using a punch, securely stake lock pin in 2 places. Ensure adhesive is removed from ring gear mounting bolts and gear mounting surface. Clean internal threads with tap.

5) Install ring gear on differential case. Ensure alignment marks on differential case and ring gear are aligned. Apply Loctite 271 to bolts and install bolts. Tighten bolts alternately in diagonal sequence to specification. See TORQUE SPECIFICATIONS.

PINION & SIDE GEAR BACKLASH SPECIFICATIONS

Application	In. (mm)
Standard	.003 (.08)
Wear Limit	.008 (.20)

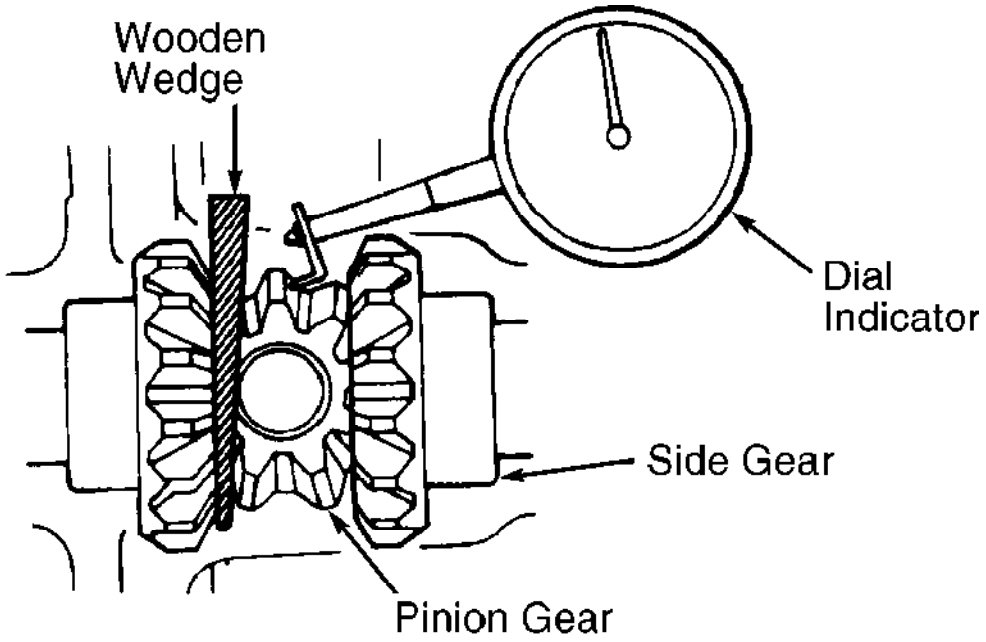

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Fig. 5: Checking Pinion & Side Gear Backlash
Courtesy of Mitsubishi Motor Sales of America.

Drive Pinion Depth

1) Install pinion bearing races in carrier housing. Ensure

races are fully seated. Install Pinion Height Gauge (MB990901-01) with pinion bearings. See Fig. 6. DO NOT install oil seal.

2) Using INCH-lb. torque wrench, measure pinion rotating torque. Gradually tighten pinion height gauge to increase rotating torque to proper specification. See PINION ROTATING TORQUE SPECIFICATIONS table. Install Cylinder Gauge (MB990903-01). Ensure flat areas are aligned and that gauge contacts carrier bearing bores firmly. See Fig. 6.

3) Select adjusting shim with same thickness as gap between cylinder gauge and pinion height gauge. Use minimum amount of adjusting shims. Install selected adjusting shims between drive pinion gear and rear drive pinion bearing. Using Bearing Installer (MB990802-01), install rear pinion bearing.

PINION ROTATING TORQUE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Oil Seal Not Installed	
With Lubrication	1.3-2.2 (.15-.25)
Without Lubrication	2.6-4.3 (.30-.50)
Oil Seal Installed	
With Lubrication	3.1-3.9 (.35-.45)
Without Lubrication	4.3-6.1 (.50-.70)

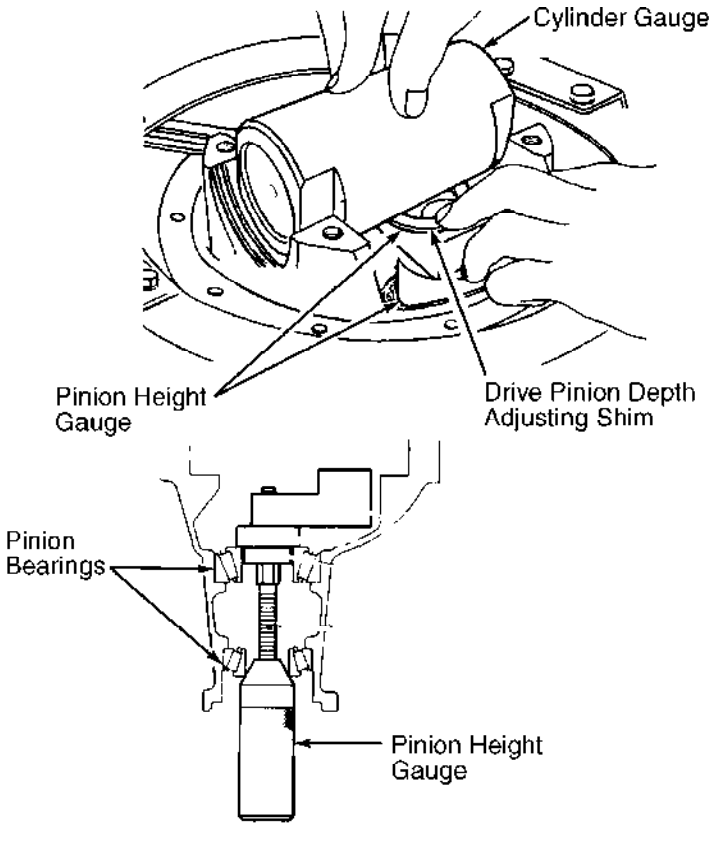


Fig. 6: Setting Drive Pinion Depth
Courtesy of Mitsubishi Motor Sales of America.

Drive Pinion Preload

1) Install drive pinion in differential carrier. Install

spacer, pinion front shim(s) and front pinion bearing. DO NOT install oil seal at this time. Install pinion companion flange, washer and retaining nut. Tighten nut to 137 ft. lbs. (190 N.m).

2) Using INCH-lb. torque wrench, check pinion rotating torque without pinion oil seal. See PINION ROTATING TORQUE SPECIFICATIONS table. Adjust rotating torque by replacing drive pinion front shims or spacer. Once correct rotating torque is obtained, install oil seal. Coat seal lip with grease.

3) Install pinion flange so alignment marks are correct. Apply light coat of grease to flange washer contact area. Install NEW retaining nut. Check pinion rotating torque with pinion oil seal installed. Rotating torque must be within specification. See PINION ROTATING TORQUE SPECIFICATIONS table.

Side Bearing Installation

1) Using Bearing Installer (MB990802-01), install bearings on differential case. Select 2 side bearing adjusting shims thinner than those removed. Shims must be equal in thickness on both sides. Install shims on each side of case assembly. Install case assembly in differential carrier housing.

2) Push case assembly fully to one side of carrier. Using 2 feeler gauges (feeler gauges 180 degrees opposed), measure clearance between carrier and side bearing. Remove shims from one side of differential carrier.

3) Measure thickness of shims removed. Add .002" (.05 mm) to 50% of measured clearance and then add thickness measurement of removed shim. This is thickness of new shim that should be installed on each side of case. Install equal thickness shims on each side of case assembly.

NOTE: Ensure zero clearance exists between gear carrier and adjusting shim.

4) Install side bearing shims and differential case assembly in differential carrier. Using brass drift, tap shims to fit them to side bearing outer race. Install bearing caps. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Check ring gear backlash.

Ring Gear Backlash

1) Lock drive pinion in place. Using dial indicator, check ring gear backlash at heel of ring gear tooth. Measure at 4 locations of ring gear. Gear backlash should be .004-.006" (.10-.15 mm).

2) If backlash is not within specification, change side bearing adjusting shims and recheck backlash. See GEAR TOOTH CONTACT PATTERNS article in GENERAL INFORMATION. Check gear tooth contact using Prussian Blue.

CAUTION: When changing shims, total thickness of all shims must remain constant to ensure correct bearing preload.

Ring Gear Runout

Using dial indicator, measure runout at back side of ring gear. Runout should not exceed .002" (.05 mm). If runout is excessive, change ring gear-to-differential case mounting position. Ensure ring gear mounting bolts are tightened to correct specification. Recheck runout. Install cover and gasket.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)

Brake Caliper Bolt	65 (88)
Carrier-To-Housing Tube Bolt	
Montero	(1)
Montero Sport	58-72 (79-98)
Differential	
Cover Bolt	14 (19)
Drain Plug	
Montero	43-51 (58-69)
Montero Sport	(1)
Fill Plug	
Montero	39 (53)
Montero Sport	36 (49)
Drive Shaft Flange Bolt	36-43 (49-58)
Front Crossmember Bolt	72-87 (98-118)
Hub Cover Bolt	13-25 (18-34)
Knuckle-To-Ball Joint Nut	
Upper	
Montero	54 (73)
Montero Sport	44-65 (60-88)
Lower	
Montero	108 (146)
Montero Sport	87-130 (118-176)
Mounting Bracket-To-Frame Bolt	58-80 (79-108)
Mounting Bracket-To-Housing Tube Bolt	58-72 (79-98)
Pinion Flange Nut	
Montero	
A/T	137 (186)
M/T	159 (216)
Montero Sport	159 (216)
Right Drive Axle-To-Inner Shaft Bolt	36-43 (49-58)
Ring Gear-To-Case Bolt	58-65 (79-88)
Side Bearing Cap Bolt	40-47 (54-64)
Tie Rod-To-Knuckle Nut	
Montero	33 (45)
Montero Sport	32 (43)
Wheel Lug Nuts	
Montero	72-87 (98-118)
Montero Sport	
Aluminum Wheel	73-86 (99-117)
Steel Wheel	87-101 (118-137)

	INCH Lbs. (N.m)
Undercover-To-Frame Bolts (Montero)	84-108 (9.5-12.2)

(1) - Information is not available from manufacturer.

DIFFERENTIAL & AXLE SHAFTS REAR

1997-99 Mitsubishi Montero Sport

1997-99 DRIVE AXLES
Mitsubishi Differentials & Axle Shafts - Rear Non-Integral

Montero, Montero Sport

DESCRIPTION

Rear axle features a rigid banjo-type housing with semi-floating axle shafts. Differential consists of hypoid reduction gears and straight bevel differential gears. Limited Slip Differential (LSD) is available on some models. Locking rear differential is available on 1997-98 Montero and 1998 Montero Sport. See DIFFERENTIAL LOCK - REAR article.

AXLE RATIO & IDENTIFICATION

Ratio is determined by dividing number of ring gear teeth by number of drive pinion teeth.

AXLE RATIO SPECIFICATIONS

Application	Ratio
Montero	4.27:1
Montero Sport	
With Wide Fender	
2WD	4.22:1
4WD	4.27:1
Without Wide Fender	4.64:1

LUBRICATION

CAPACITY

REAR AXLE GEAR OIL CAPACITY

Application	Pts. (L)
Montero	6.8 (3.2)
Montero Sport	
Conventional & Locking	3.2 (1.5)
Limited Slip	5.5 (2.6)

FLUID TYPE

Conventional differentials use SAE 80W or SAE 90W API GL-5. Limited slip differentials use Mitsubishi Gear Oil (8149630 EX), or Mopar Gear Oil (4318058) and Mopar Friction Modifier (4318060).

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING - BASIC PROCEDURES article in the GENERAL TROUBLE SHOOTING section.

TESTING & INSPECTION

AXLE SHAFT END PLAY

Montero & Montero Sport

Using dial indicator, check axle shaft end play. End play should be .010" (.25 mm). If end play is not within specification, replace axle bearing. See AXLE SHAFT OVERHAUL under OVERHAUL.

AXLE TOTAL BACKLASH

1) Raise and support rear axle. Place transmission in Neutral. Apply parking brake. Rotate drive shaft clockwise. Place reference marks on pinion dust cover and differential housing.

2) Rotate drive shaft counterclockwise, and measure distance between reference marks. Differential must be removed and backlash adjusted if distance exceeds 0.2" (5 mm). See RING GEAR BACK-LASH procedure under DIFFERENTIAL ASSEMBLY (LIMITED SLIP) under OVERHAUL.

LIMITED SLIP DIFFERENTIAL PRELOAD

1) Place transmission in Neutral. Block front wheels. Raise one rear wheel off ground and remove wheel. Release parking brake.

2) Using torque wrench and axle puller adapter, measure starting torque while rotating wheel in forward direction. See Fig. 1. Differential must be repaired if torque is less than 18 ft. lbs. (25 N.m).

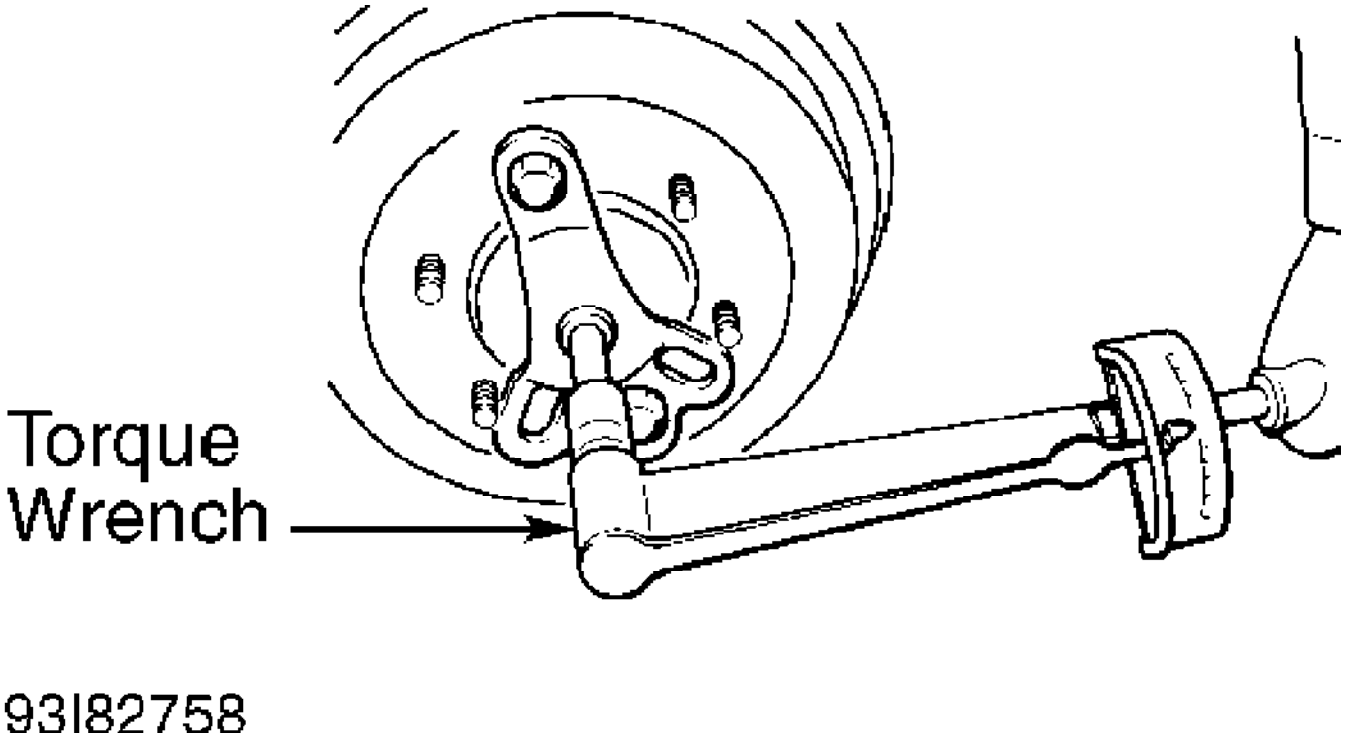


Fig. 1: Testing Limited Slip Differential Preload
Courtesy of Mitsubishi Motor Sales of America.

LOCKING DIFFERENTIAL (MONTERO)

Air Pump

Connect air pressure gauge in-line to air hose from air pump. Air pump is located in right storage area, under rear seat. Connect battery voltage to air pump (positive lead to Red wire). The air pump is operating correctly when the following sequences occur;

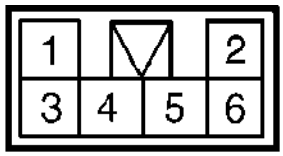
* Pump should operate for no more than 5 seconds.
* Pressure should be 4-6 psi (.28-.41 kg/cm^2) within 10-20 seconds after pump has stopped.
* After air pump has stopped operating, it should not restart operating for 5 minutes.

Center Differential Lock Operation Switch
See ANTI-LOCK BRAKE SYSTEM article in BRAKES.

Differential Lock Switch
Remove switch from center console. To test switch operation, see Fig. 2. Replace switch as needed.

Differential Lock Control Unit
See ANTI-LOCK BRAKE SYSTEM article in BRAKES.

Lock Detection Switch
1) Raise and support vehicle. Disconnect air hose connection near rear differential. Connect air source with pressure regulator and pressure gauge. Apply 4 psi (.28 kg/cm^2) pressure. Disconnect lock detection switch harness connector.
2) Using ohmmeter, check if continuity exists with air pressure applied. Continuity should exist with air pressure applied. If continuity exists, ensure axle is locked by attempting to turn rear wheels separately of each other.
3) If continuity does not exist, go to step 4). If continuity does exist but axles are not locked, see CARRIER ASSEMBLY under REMOVAL & INSTALLATION and inspect locking assembly.
4) Remove detection switch from housing. Using ohmmeter, check continuity of switch. Continuity should exist with switch plunger extended. With plunger in neutral position, continuity should not exist. Replace switch as needed.



Terminal / Switch Position	5	3	2	6	1
ON	○		○	○	○
OFF		○	○		

NOTE: ○—○ Indicates continuity between terminals.

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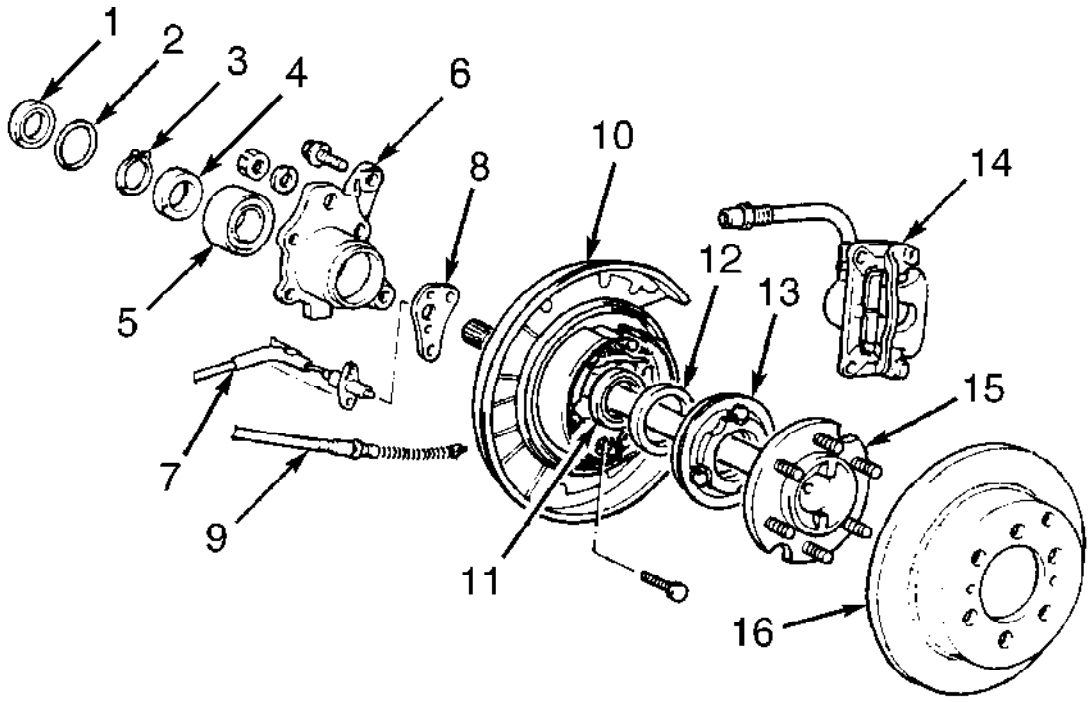
Fig. 2: Checking Differential Lock Switch Continuity
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

AXLE SHAFT R & I

Removal (Montero & Montero Sport)
Block front wheels. Raise and support rear axle housing. Remove brake caliper and rotor. See Fig. 3. Remove parking brake cable attaching bolts. Remove connection for parking brake cable end from rear brake assembly. Remove ABS speed sensor (if equipped). Unbolt backing plate with bearing housing from rear axle housing. Using Puller (MB990241) and Slide Hammer (MB990211), remove axle assembly. DO NOT damage oil seal. Remove "O" ring. Replace if necessary.

Installation
Install NEW oil seal in axle housing as needed. To install axle assembly, reverse removal procedure.



1. Oil Seal
2. "O" Ring
3. Snap Ring
4. Retainer
5. Bearing
6. Bearing Case
7. ABS Speed Sensor
8. Speed Sensor Bracket
9. Parking Brake Cable
10. Dust Shield
11. Parking Brake Assembly
12. Oil Seal
13. ABS Sensor Rotor
14. Brake Caliper
15. Axle
16. Brake Rotor

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Fig. 3: Exploded View Of Typical Axle Shaft
Courtesy of Mitsubishi Motor Sales of America.

Installation
1) Insert new "O" ring and shim of .04" (1.0 mm) thickness

into left side axle housing. Install left axle shaft assembly into axle housing, and tighten nuts to specification. See TORQUE SPECIFICATIONS.

2) Install right axle shaft assembly into axle housing without shim or "O" ring. Temporarily tighten nuts in diagonal sequence to 51.6 INCH lbs. (5.8 N.m) in 2 stages. Measure clearance between bearing case of right axle and rear axle housing end with feeler gauge.

3) Select shims equal to sum of measured clearance plus .002-.008" (.05-.20 mm). Remove right axle shaft, and install selected shim(s) and "O" ring into right axle housing end. Install right axle shaft assembly into rear axle housing. Tighten nuts in diagonal sequence to specification. See TORQUE SPECIFICATIONS.

4) Using dial indicator, check end play of axle shaft. End play should be .002-.008" (.05-.20 mm). If end play is not within specification, change shim(s) to obtain correct end play. Reverse removal procedure to install remaining components. Adjust parking brake, and bleed brake system.

CARRIER ASSEMBLY

Removal

Raise and support vehicle. Drain gear oil. Mark drive shaft flange-to-pinion flange position. Remove drive shaft. Remove axle shafts. See AXLE SHAFT R & I. Support differential carrier with jack. Remove differential carrier retaining nuts. Remove differential carrier.

Inspection

Check for leaks at vent plug, differential carrier companion flange and where carrier joins axle housing.

Installation

Apply sealant to axle housing surface. To install, reverse removal procedure. Align marks on drive shaft and pinion flange.

DRIVE SHAFT

Removal

Make match marks on drive shaft yoke flange and pinion flange. Remove bolts and drive shaft from vehicle.

Installation

To install, reverse removal procedure. Ensure match marks are aligned. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

OVERHAUL

AXLE SHAFT OVERHAUL

Removal

1) Secure axle shaft assembly in a vise, and remove one retainer bolt from backing plate. Push bearing case completely to side of dust cover. Place adhesive tape around edge of bearing case at retainer bolt hole to prevent damage.

CAUTION: DO NOT damage bearing case or axle shaft when grinding or chiseling retainer ring.

2) Secure axle shaft, and grind retainer ring until retainer ring wall thickness is .04-.06" (1.0-1.5 mm) on axle shaft side and .08" (2.0 mm) on bearing side. See Fig. 4.

3) Change angle of grind, and remove remaining .08" (2.0 mm) of retainer ring wall on bearing side. Using a chisel, cut retainer ring. Remove ring. DO NOT damage axle shaft.

4) Install Puller (MB990787-01) to remove bearing case from axle shaft. See Fig. 5. Rotate nuts with equal force to remove wheel bearing. Remove bearing outer race using a hammer and drift. Remove oil seal from axle housing using a slide hammer and hook.

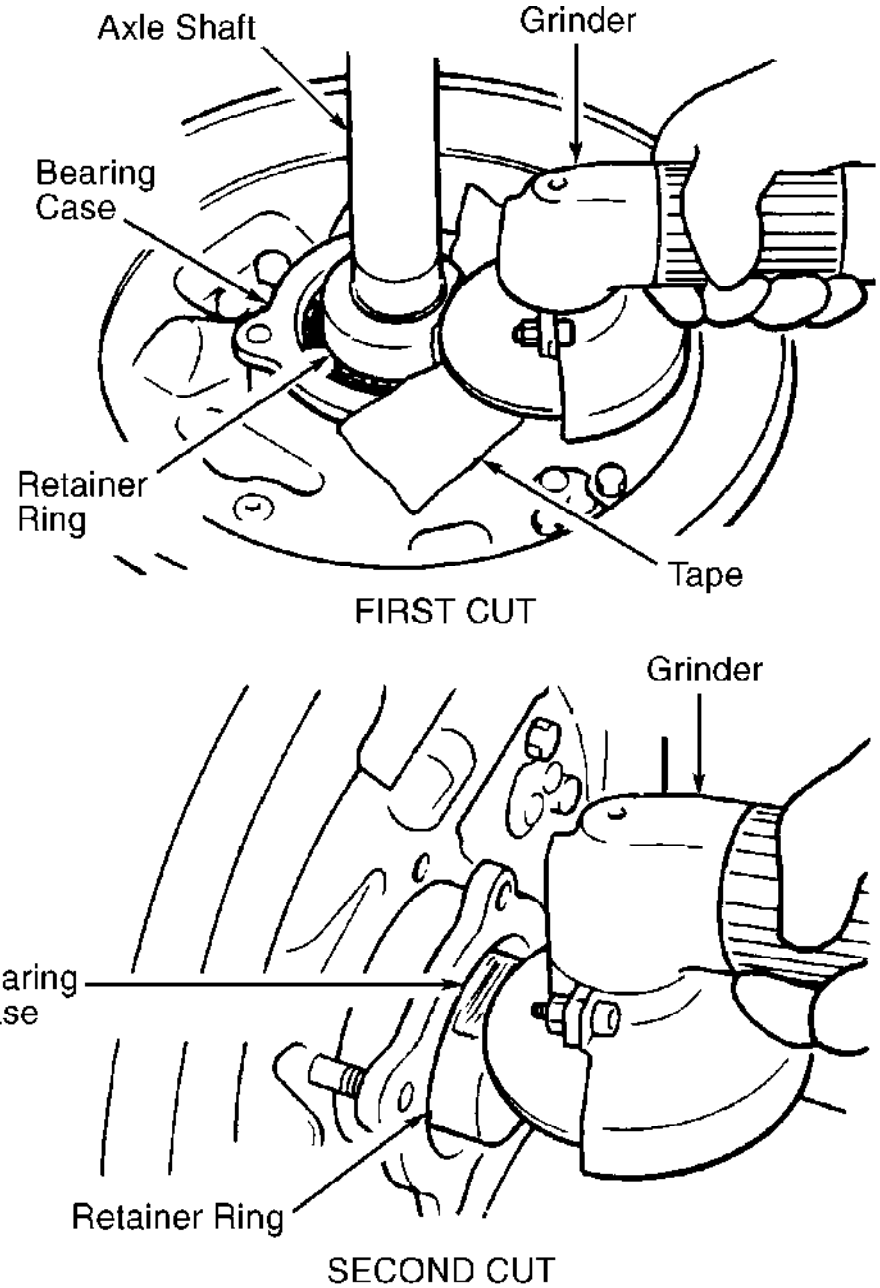

Fig. 4: Grinding Bearing Retainer Ring
Courtesy of Mitsubishi Motor Sales of America.

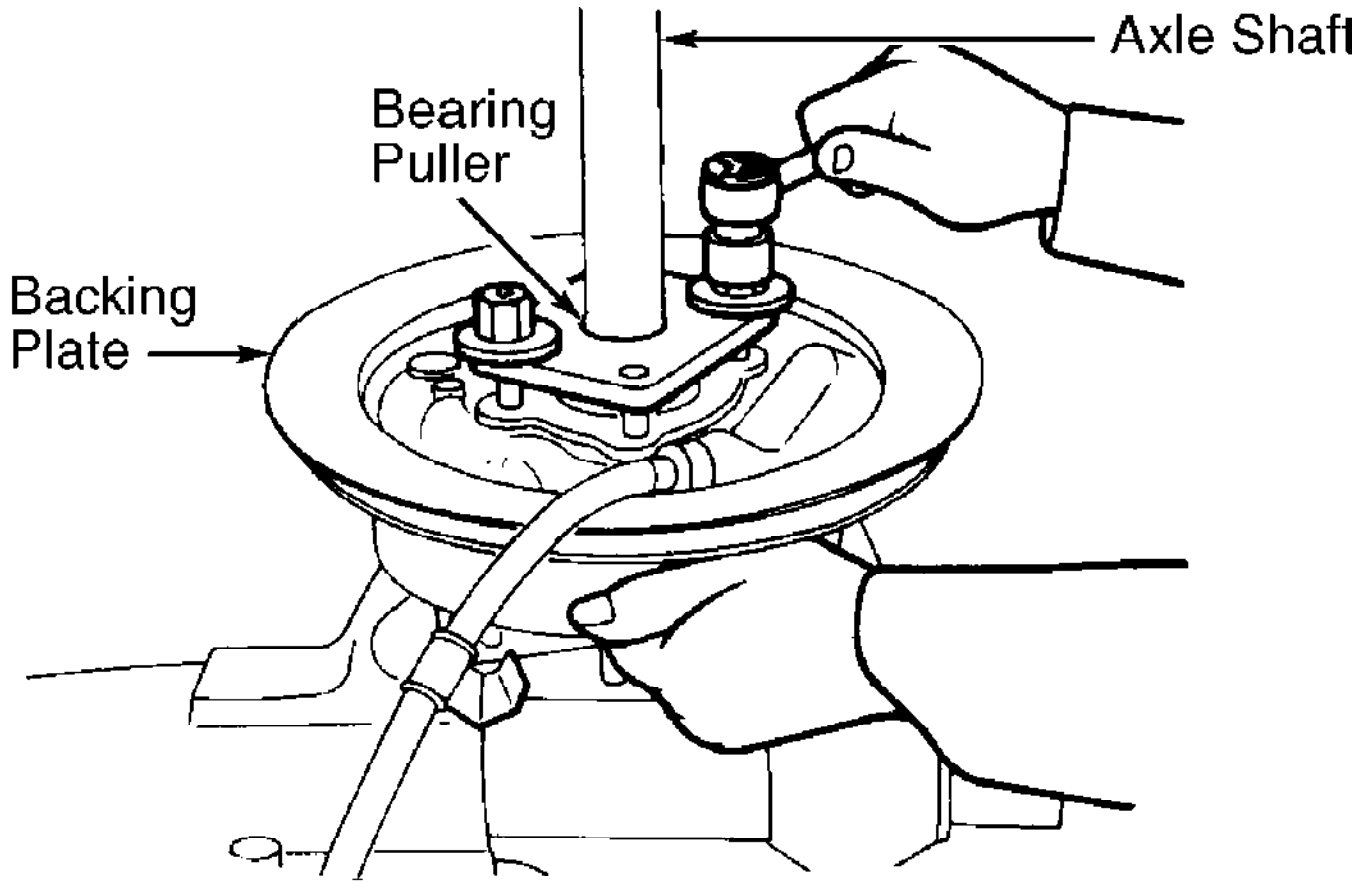

Fig. 5: Removing Bearing Case From Axle Shaft
Courtesy of Mitsubishi Motor Sales of America.

Inspection

Inspect bearings for roughness, pitting or damage. Inspect axle shaft for damaged splines or flange. Inspect bearing case for cracks or damage.

Installation

1) Apply Multipurpose Grease (SAE J310) to oil seal, oil seal cavity and contact surfaces. Install oil seal using seal driver. Press new oil seal into bearing case until it is flush with face of bearing case. Install backing plate and bearing case.

2) Apply grease to external surfaces of bearing outer race. Press bearing outer race into bearing case. Install bearing on axle shaft. Install rear brake assembly with bearing case onto axle. Install inner bearing on axle. Install NEW retainer ring. Do not exceed 22,046 lbs. (100,00 N) when pressing on retainer ring. Install NEW snap ring.

3) Using a feeler gauge, measure clearance between snap ring and NEW retainer ring. Clearance should be less than .007" (.17 mm). If clearance exceeds specification, install correct snap ring. See SNAP RING THICKNESS SPECIFICATION table.

SNAP RING THICKNESS SPECIFICATION

Thickness: In. (mm)	Color

.060 (1.52)	Red
.067 (1.70)	Purple
.073 (1.85)	Blue
.079 (2.01)	Yellow
.085 (2.16)	Neutral

DIFFERENTIAL ASSEMBLY (CONVENTIONAL)

Pre-Disassembly Inspection

1) Secure differential assembly in appropriate holder. Secure drive pinion from turning. Mount dial indicator on case and check ring gear backlash at 4 positions. See Fig. 6. Backlash should be .005-.007" (.13-.18 mm).

2) Remount dial indicator and measure ring gear runout. See Fig. 7. On all models, runout should not exceed .002" (.05 mm). Remount dial indicator and measure pinion gear backlash on models without limited slip differential. See Fig. 8. Secure side gear from turning with wedge. Backlash should be 0-.003" (0-.08 mm). Pinion gear backlash service limit is .008" (.20 mm).

3) Check gear tooth contact pattern between ring gear and drive pinion gear. Apply Prussian Blue to both surfaces of ring gear teeth. Insert brass rod between differential housing and carrier assembly to provide resistance while turning drive pinion.

4) Turning resistance of drive pinion should be 28-33 INCH lbs. (2.5-3.0 N.m). Rotate drive pinion until ring gear completes one revolution. Reverse direction of rotation and return to original starting point. Check wear pattern. See GEAR TOOTH CONTACT PATTERNS article in GENERAL INFORMATION.

5) On Montero models with differential lock, connect air supply hose with pressure gauge and regulator to actuator air pipe. Apply 4 psi (.28 kg/cm^2) of pressure. Using Adapter Shaft (MB990992), turn side gear on one side of carrier assembly only. Locking mechanism should engage. To disengage, release air pressure and turn side gear 1/4-1/2 turn.

6) With lock mechanism engaged, measure turning torque of drive pinion. Turning torque should not be less than 36 ft. lbs. (50 N.m). With lock mechanism disengaged, turning torque should not be more than 36 ft. lbs. (50 N.m).

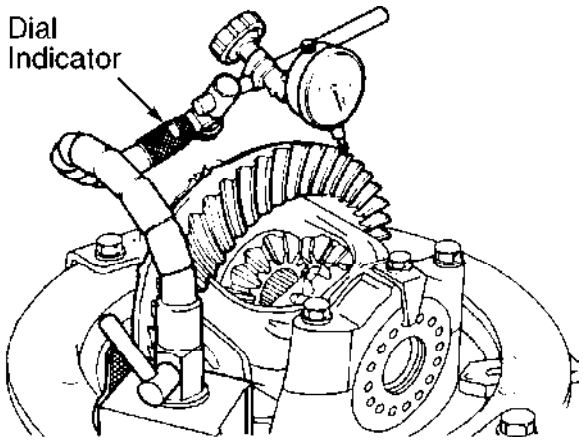

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Fig. 6: Measuring Ring Gear Backlash
Courtesy of Mitsubishi Motor Sales of America.

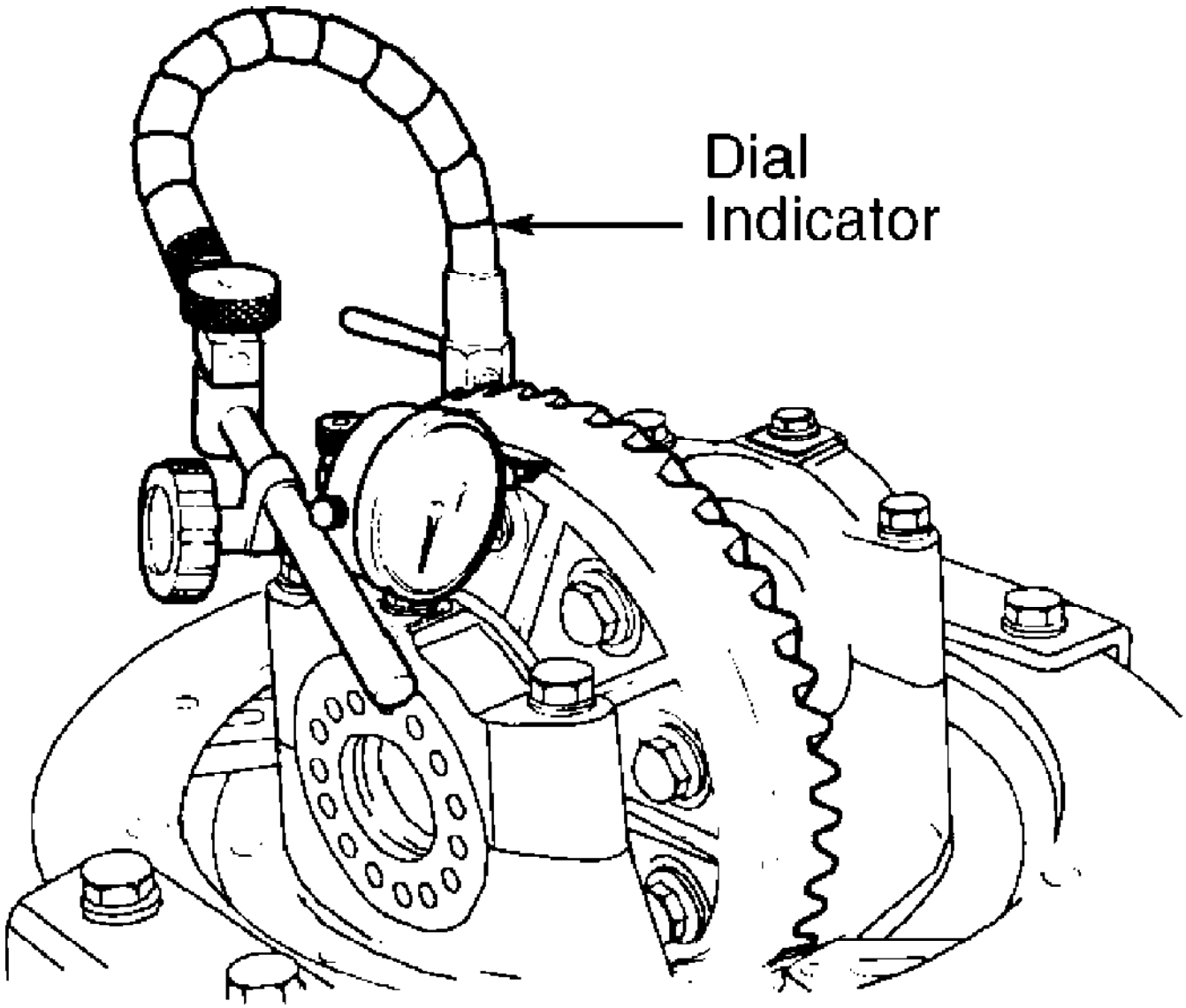

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Fig. 7: Measuring Ring Gear Runout
Courtesy of Mitsubishi Motor Sales of America.

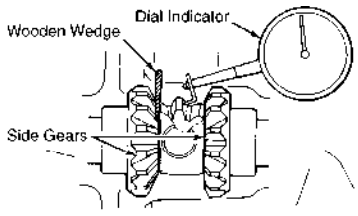


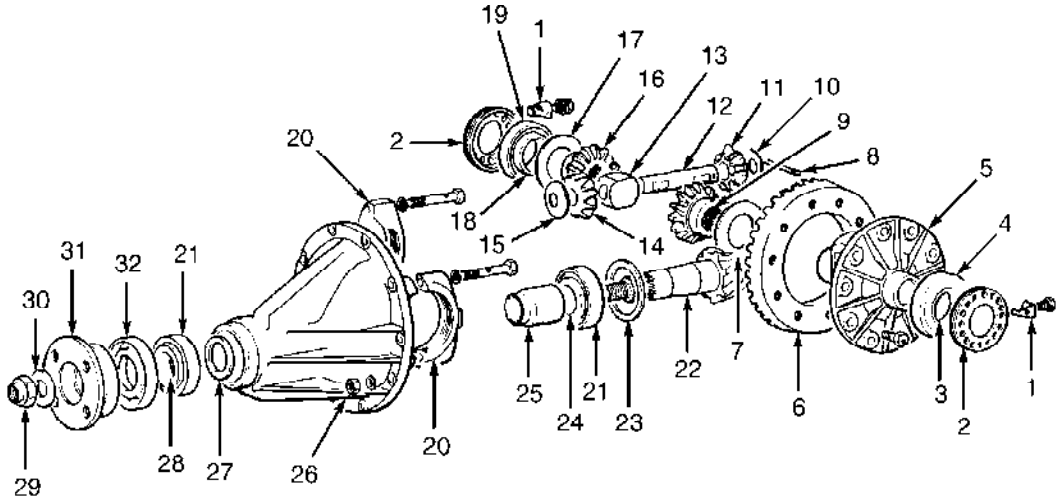
Fig. 8: Checking Pinion & Side Gear Backlash
Courtesy of Mitsubishi Motor Sales of America.

NOTE: See DIFFERENTIAL ASSEMBLY (LIMITED SLIP) for carrier

assembly and drive pinion installation.

Carrier Assembly & Drive Pinion Removal

1) Remove differential carrier from axle housing. Remove lock plates. Mark location of side bearing nuts for reassembly. Remove side bearing nuts. See Fig. 9. Mark location of bearing caps for reassembly. Remove bearing caps. Remove differential carrier assembly from differential housing.



1. Lock Plate
2. Side Bearing Nut
3. Bearing
4. Bearing Race
5. Differential Case
6. Ring Gear
7. Thrust Spacer
8. Lock Pin
9. Side Gear
10. Pinion Washer
11. Pinion Gear
12. Pinion Shaft
13. Thrust Block (Some Models)
14. Pinion Gear
15. Pinion Washer
16. Side Gear
17. Thrust Spacer
18. Bearing
19. Bearing Race
20. Bearing Cap
21. Bearing Race
22. Pinion
23. Pinion Rear Shim
24. Bearing
25. Spacer
26. Differential Carrier
27. Pinion Front Shim
28. Bearing
29. Lock Nut
30. Washer
31. Pinion Flange
32. Oil Seal

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Fig. 9: Exploded View Of Conventional Rear Differential (Typical) Courtesy of Mitsubishi Motor Sales of America.

2) Secure drive pinion companion flange from turning. Remove companion flange retaining nut. Scribe alignment marks on drive pinion and companion flange for reassembly. Using soft-face hammer, drive pinion out of housing. Remove front adjusting shim and spacer from pinion.

3) Using bearing splitter and press, remove rear bearing from pinion. Remove rear adjusting shim from drive pinion. Remove oil seal and bearing races from differential housing.

Disassembly (Carrier Assembly)

1) Using bearing splitter and press, remove differential case side bearings. Place alignment marks on ring gear and differential case for reassembly. Loosen ring gear bolts in diagonal sequence. Remove ring gear.

2) Remove pinion shaft lock pin from differential carrier. Remove differential pinion shaft and thrust block (if equipped). Remove pinion gears and washers. Remove side gears and thrust spacers. Mark components for reassembly reference.

Inspection

Wash parts in clean solvent and dry with compressed air. Inspect bearings for discoloration and/or flaking. Check all gears for irregular wear or damage. Ring gear and drive pinion must be replaced

as matched set. Side gears and pinion gears must be replaced as matched set.

Reassembly & Adjustment

1) Install thrust spacers, side gears, pinion washers and pinion gears in differential case. DO NOT install thrust block (if equipped) at this time.

2) Install pinion shaft without lock pin. Check pinion and side gear backlash. Install wooden wedge to lock side gears. See Fig. 8. Using dial indicator, measure gear backlash. Backlash should be .0004-.0030" (.010-.080 mm). Service limit is .008" (.20 mm).

3) Adjust backlash by using different side gear spacers. Ensure both sides are equally shimmed. Install thrust block (if equipped) once correct backlash is obtained. Install pinion shaft lock pin from ring gear side of carrier housing. Securely stake pin in 2 places. Ensure adhesive is removed from ring gear mounting bolts and gear mounting surface. Clean internal threads with tap.

4) Ensure alignment marks on differential case and ring gear align. Apply Loctite 271 to bolts, and install ring gear on differential case. Tighten bolts in diagonal sequence to specification. See TORQUE SPECIFICATIONS. Using appropriate adapter, press on carrier side bearings.

DIFFERENTIAL ASSEMBLY (LIMITED SLIP)

NOTE: Manufacturer does not provide disassembly or reassembly procedures for locking type differential. Use illustrations for exploded views of assembly. See Figs. 11 and 12.

NOTE: See PRE-DISASSEMBLY INSPECTION under DIFFERENTIAL ASSEMBLY (CONVENTIONAL) before disassembling carrier assembly. For carrier assembly and drive pinion removal, see DIFFERENTIAL ASSEMBLY (CONVENTIONAL).

Disassembly

1) Once ring gear is removed, loosen carrier housing screws in diagonal pattern. Separate cases and remove components. See Fig. 10 . Maintain parts in order of disassembly. Clean all parts in new solvent.

2) Inspect condition of friction and spring plates and friction discs. Replace disc and/or plates if worn or heat damaged. Distortion of discs will cause incorrect clutch pressure. Scratches, nicks or burrs on components can be repaired with an oil stone.

3) Discs must be flat and free of distortion. Check discs on surface plate with dial indicator. Maximum warpage of friction plate or disc is .003" (.08 mm). Inspect thickness of discs and plates. Thickness limit between discs and plates is .004" (.10 mm).

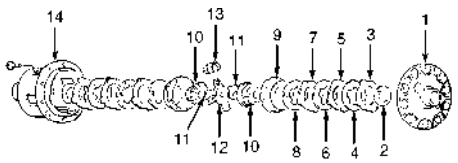
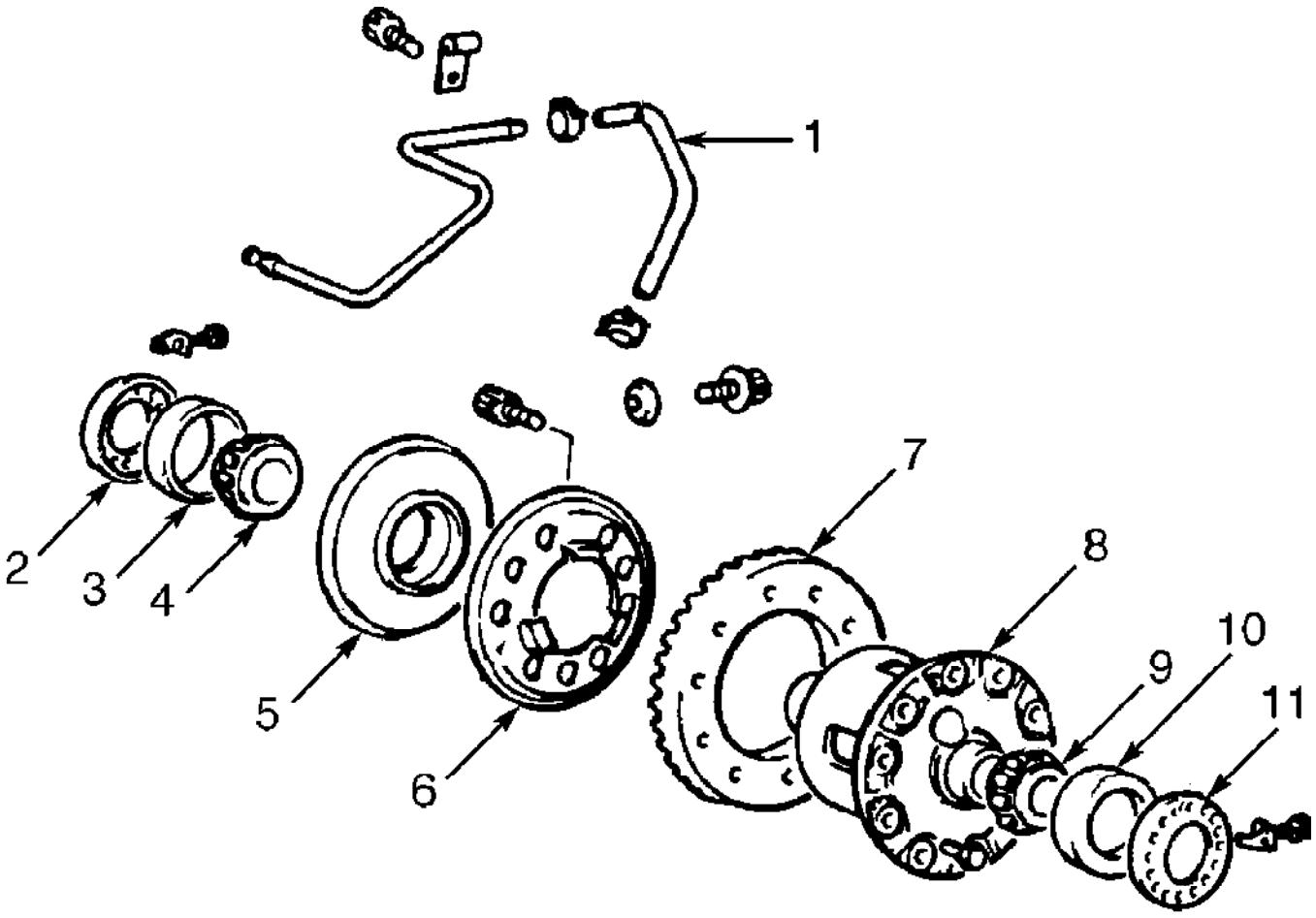


Fig. 10: Exploded View Of Limited Slip Differential
Courtesy of Mitsubishi Motor Sales of America.



1. Air Pipe
2. Side Bearing Nut
3. Bearing Race
4. Bearing
5. Actuator Assembly
6. Pressure Plate
7. Ring Gear
8. Differential Case
9. Bearing
10. Race
11. Side Bearing Nut

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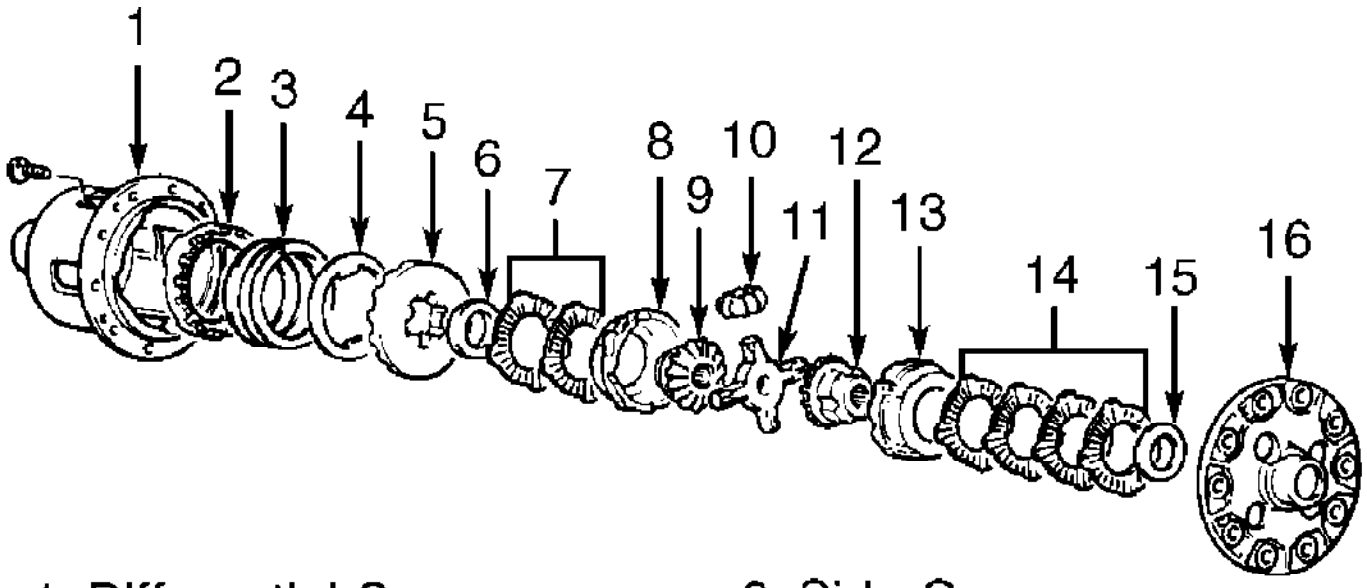
Fig. 11: Exploded View Of Locking Differential Actuator Assembly
Courtesy of Mitsubishi Motor Sales of America.



1. Differential Case
2. Drive Cam
3. Spring
4. Spring Washer
5. Driven Cam
6. Thrust Washer
7. Friction Plate
8. Pressure Ring
9. Side Gear
10. Pinion Gear
11. Pinion Shaft
12. Side Gear
13. Pressure Ring
14. Friction Plate
15. Thrust Washer
16. Differential Case Cover

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Fig. 12: Exploded View Of Locking Differential
Courtesy of Mitsubishi Motor Sales of America.

Reassembly

1) Arrange friction plates and discs of each side of differential. Measure each assembly thickness. Assembled discs and plates should not exceed a difference of .002" (.05 mm). Replace discs or plates as needed.

2) Assemble one spring plate and one spring disc on each side. Measure assembly thickness. Assemble disc and plates to obtain minimum difference in thickness between each assembly.

3) Assemble clutch assemblies, pressure rings, pinion gears, side gears and pinion shaft. Measure overall width of assembly plus spring plates and spring discs (dimension "C"). See Fig. 13.

4) Determine depth of differential case (dimension "D"). On 2.4L, dimension "D" = "E" + "F" - "G"; on 3.0L, dimension "D" = "E" + "H"

See Fig. 14. Subtract "C" from "D" to determine spring plate-to-case clearance. Adjust spring disc thickness to obtain proper spring plate-to-case clearance. Correct clearance is .0024-.0079" (.060-.200 mm).

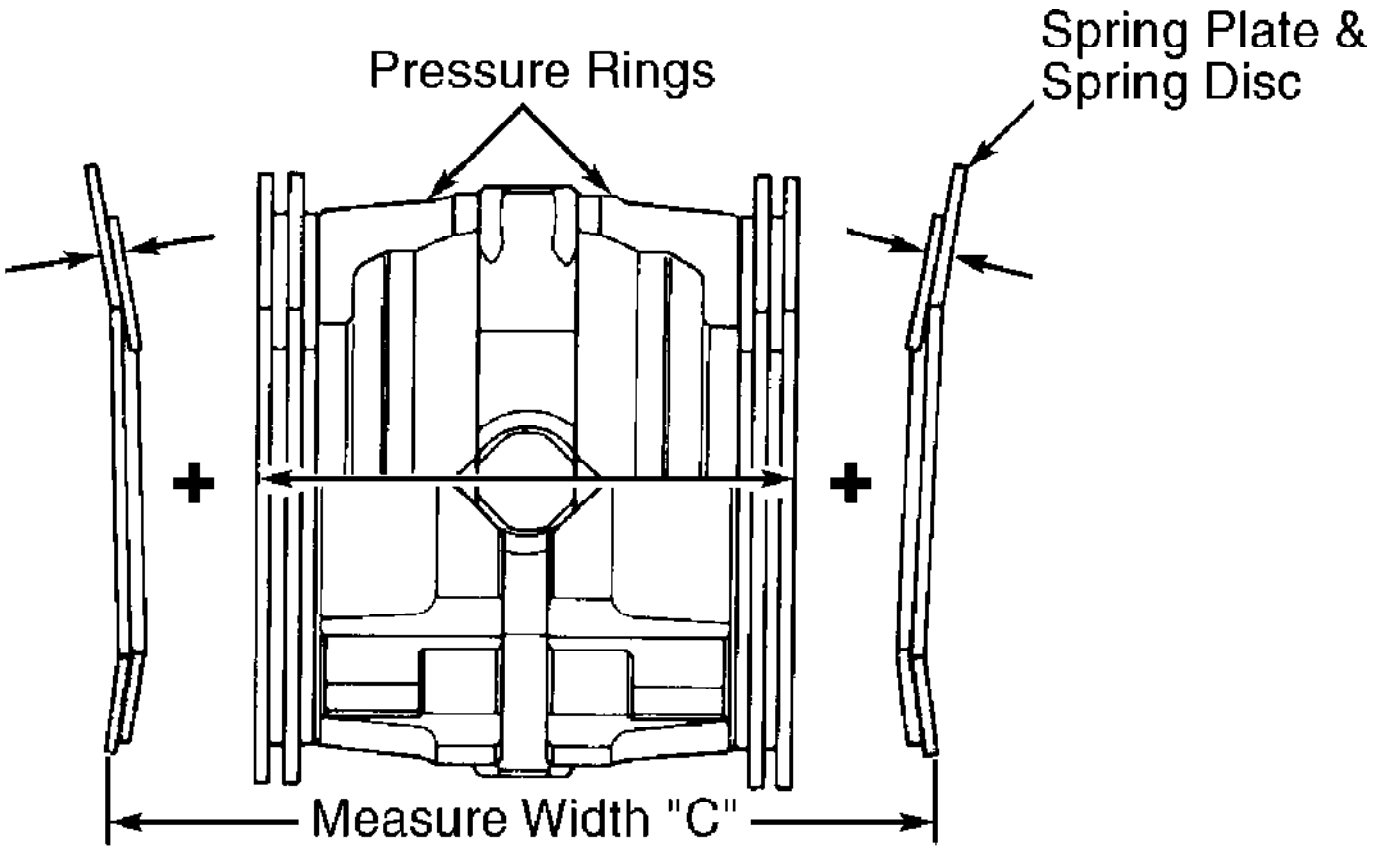


Fig. 13: Measuring Clutch Assembly Width
Courtesy of Mitsubishi Motor Sales of America.

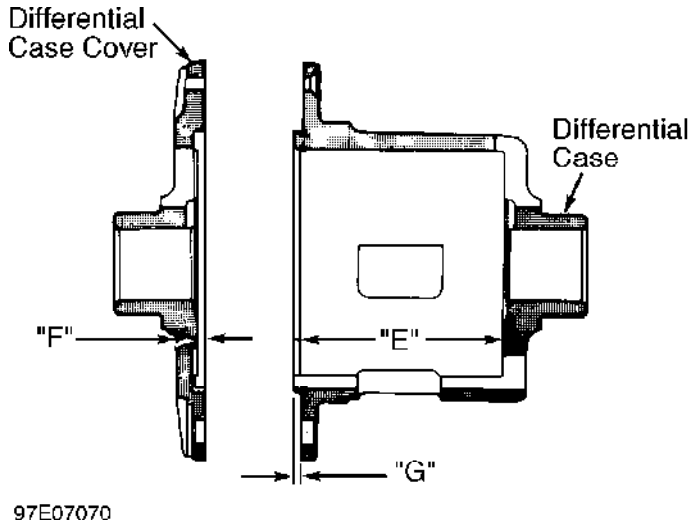


Fig. 14: Measuring Limited Slip Case Depth
Courtesy of Mitsubishi Motor Sales of America.

5) Remove spring plates, spring discs, friction plates and friction disc from pressure rings. Mark components for location.

Install thrust washers on each end of pressure rings. See Fig. 15.

6) Measure clearance from end of thrust washer to rear face of pressure ring. Clearance should be .002" (.05 mm) or less. If clearance is not as specified, select proper thickness thrust washers to obtain correct clearance.

7) Once correct thrust washers are determined, install thrust washers on pressure rings. Squeeze pressure rings together, and measure width (dimension "H") from end of thrust washer to remaining thrust washer.

8) Determine distance between thrust washer surfaces when differential case is assembled (dimension "I"). Dimension "I" = "J" + "K" + "L". Dimension "J" is the same as dimension "D" in step 4).

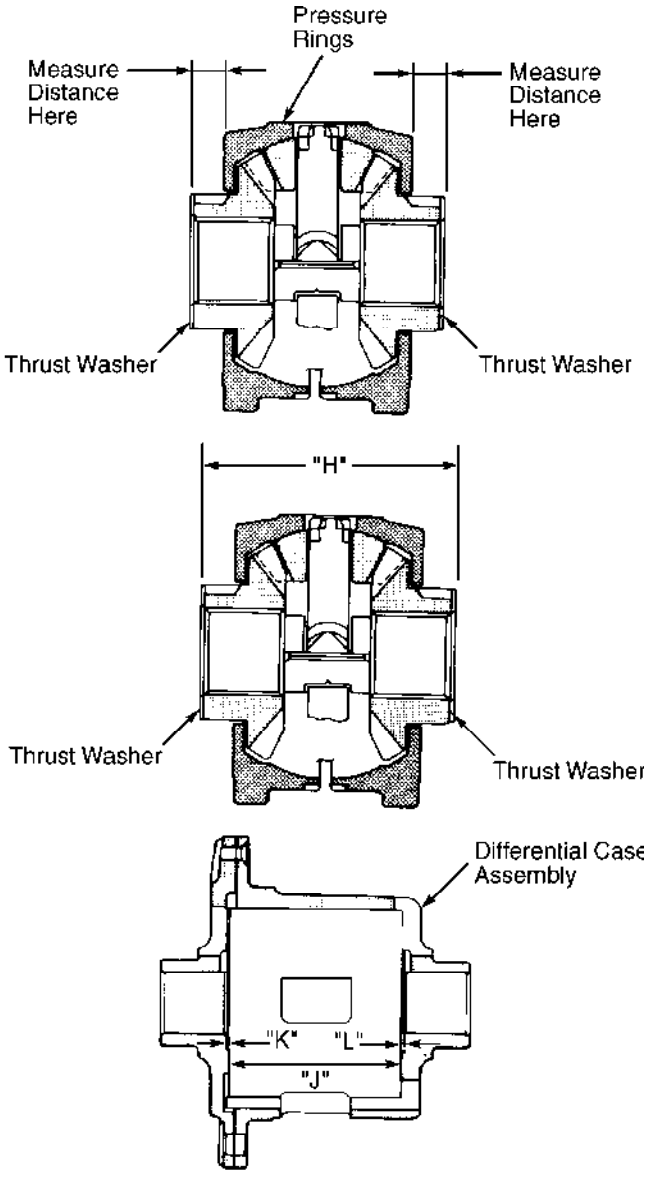


Fig. 15: Measuring Thrust Washer Clearance
Courtesy of Mitsubishi Motor Sales of America.

9) Subtract "H" from "I". This is the clearance between thrust washer and differential case. Correct clearance is .002-.008"

(.05-.20 mm). If clearance is not within specification, change thrust washer to obtain correct clearance.

10) Apply gear oil and friction modifier to all components. Install components in differential case. Ensure assembly order and direction of clutch components are correct. See Fig. 16.

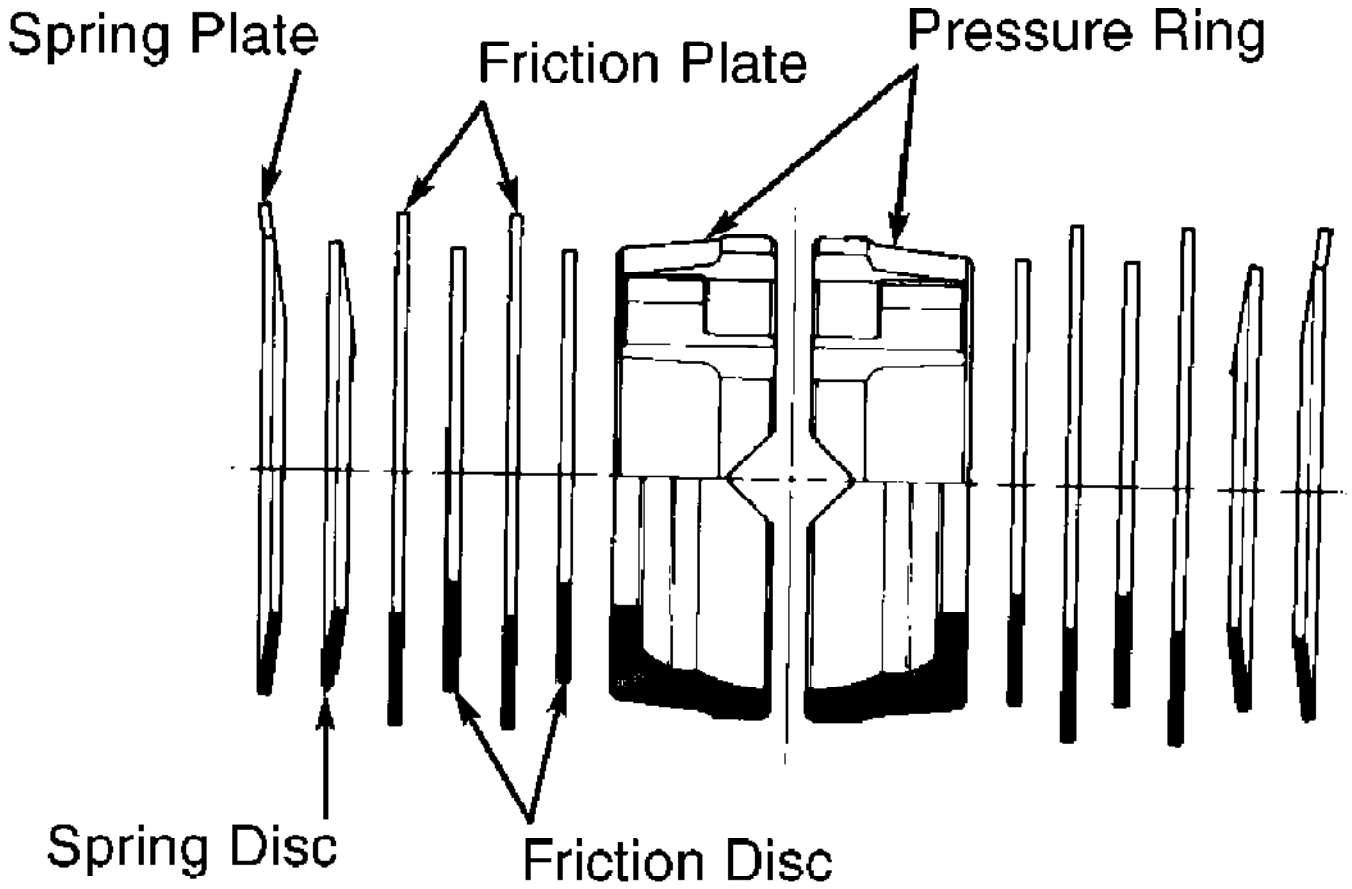


Fig. 16: Limited Slip Differential Assembly
Courtesy of Mitsubishi Motor Sales of America.

11) Install differential case cover with reference marks aligned. Tighten screws to specification in several steps. See TORQUE SPECIFICATIONS. Ensure cases contact each other completely when fully assembled. Check for incorrect clutch assembly if gap exists.

12) Using Clutch Plate Preload Tool (MB990988), Shaft (MB990989) and torque wrench, measure starting torque. See Fig. 17. Rotate unit slightly before measuring starting torque.

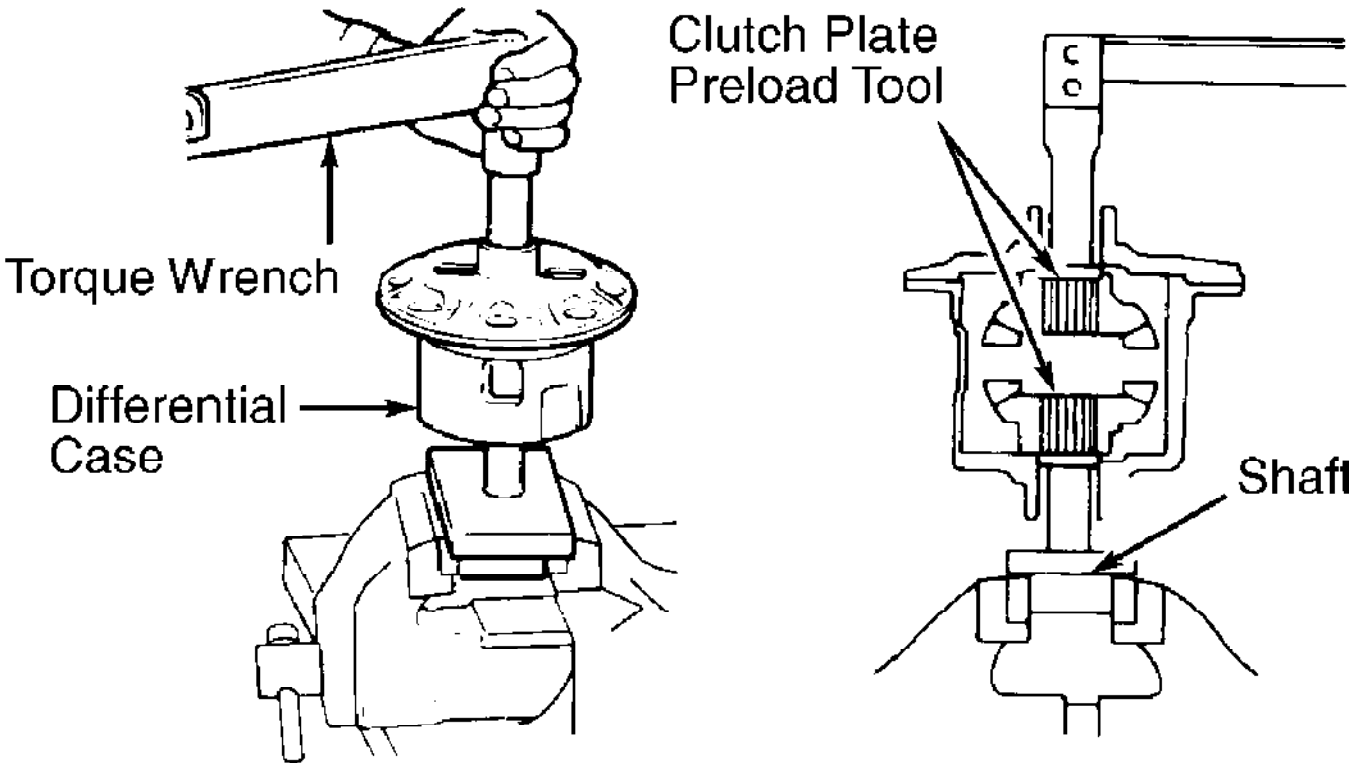


Fig. 17: Checking Differential Starting Torque
Courtesy of Mitsubishi Motor Sales of America.

13) Ensure starting torque is within specification. See STARTING TORQUE table. Ensure adhesive is removed from ring gear mounting bolts and gear mounting surface. Clean internal threads with tap.

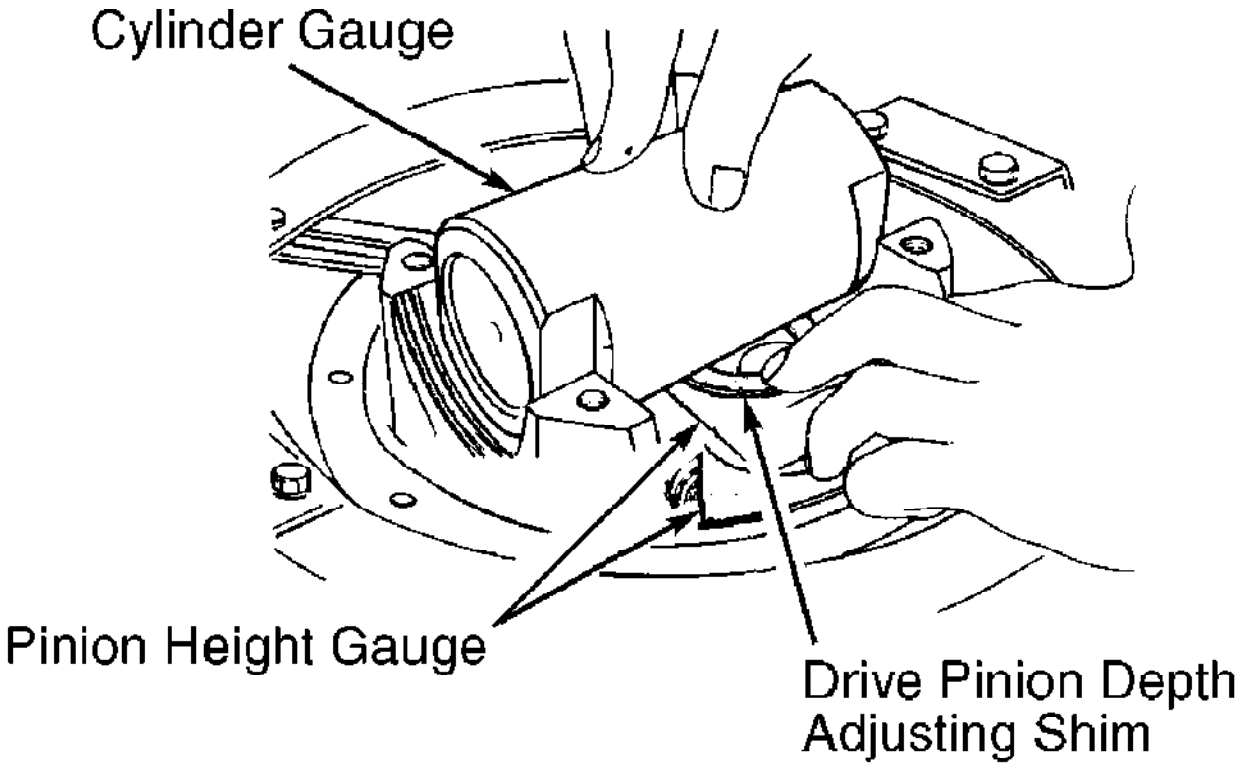
14) Ensure alignment marks on differential case and ring gear align. Apply Loctite 271 to bolts, and install ring gear on differential case. Tighten bolts in diagonal sequence to specification. See TORQUE SPECIFICATIONS.

STARTING TORQUE

Application	Ft. Lbs. (N.m)
Used Clutch Plates	29-54 (40-75)
New Clutch Plates	18-54 (25-75)

Carrier Assembly & Drive Pinion Installation

1) Install pinion bearing races in differential housing. Ensure races are fully seated. Install Pinion Height Gauge (MB990901) and pinion bearings. See Fig. 18. DO NOT install oil seal.



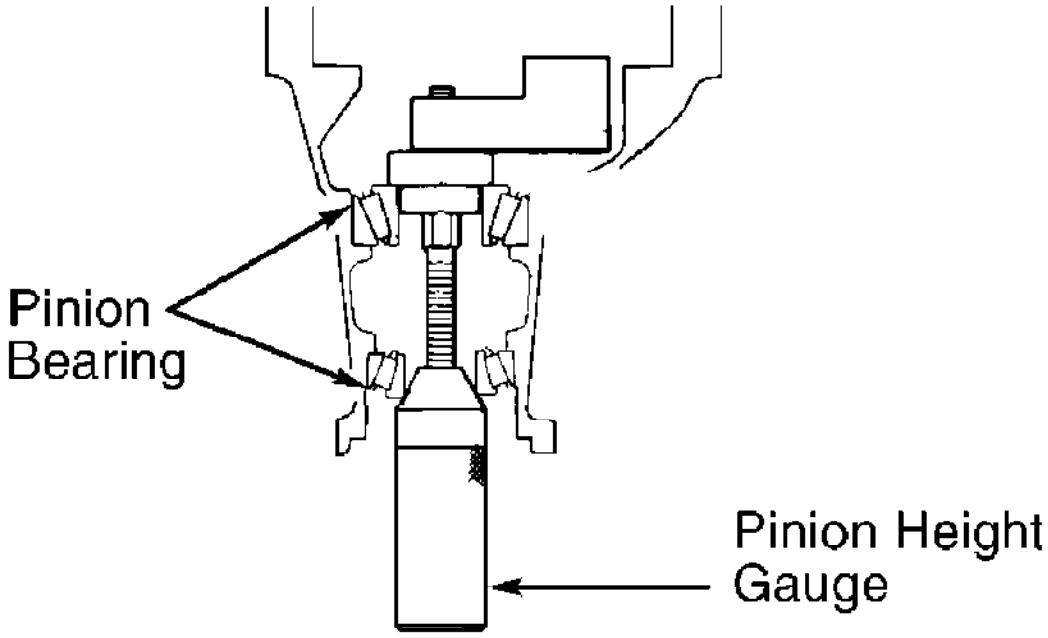


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Fig. 18: Setting Pinion Height
Courtesy of Mitsubishi Motor Sales of America.

2) Using torque wrench, measure pinion rotating torque. Gradually tighten pinion height gauge to increase rotating torque. See

PINION ROTATING TORQUE SPECIFICATIONS table.

PINION ROTATING TORQUE SPECIFICATIONS

Application	INCH Lbs. (N.m)
Oil Seal Not Installed	
With Lubrication	3.5-4.3 (.4-.5)
Without Lubrication	5.2-7.8 (.6-.9)
Oil Seal Installed	
With Lubrication	5.6-6.5 (.65-.75)
Without Lubrication	7.4-10.0 (.85-1.15)

3) Install cylinder gauge in side bearing seats. Ensure flat areas align, and gauge contacts side bearing seat firmly. Select adjusting shim with same thickness as gap between cylinder gauge and pinion height gauge.

4) Use minimum amount of adjusting shims. Install selected adjusting shims between drive pinion gear and rear pinion bearing. Using bearing installer and press, install rear pinion bearing.

5) Install drive pinion in differential housing. Install spacer, pinion front shim(s) and front pinion bearing. DO NOT install oil seal. Install pinion companion flange, washer and retaining nut. Tighten nut to specification. See TORQUE SPECIFICATIONS.

6) Check pinion rotating torque. See PINION ROTATING TORQUE SPECIFICATIONS table. Adjust rotating torque by replacing drive pinion front shims or spacer. Once correct rotating torque is obtained, install oil seal. Coat seal lip with grease. Install pinion companion flange so alignment marks are correct. Apply light coat of grease to contact area of pinion flange washer.

7) Install NEW retaining nut. Recheck pinion rotating torque. Ensure rotating torque is within specification. Press side bearings onto differential case. Install outer races. Install differential carrier into differential housing. Align bearing cap index marks, and snug carrier cap bolts. Ensure outer races and bearing caps are installed in original location.

8) Install side bearing nuts. Tighten bearing cap bolts to specification. See TORQUE SPECIFICATIONS. Tighten bearing nuts until bearing outer races are seated against bearings. Adjust ring gear backlash.

Ring Gear Backlash

1) Secure drive pinion in place. Using dial indicator, check ring gear backlash at heel of ring gear tooth. See Fig. 6. Measure at 4 locations of ring gear. Gear backlash must be within specification. Backlash should be .005-.007" (.13-.18 mm).

2) If backlash is less than specification, loosen side bearing nut at back of ring gear, and tighten side bearing nut on tooth side of ring gear by same amount. If backlash exceeds specification, loosen side bearing nut at tooth side of ring gear, and tighten side bearing nut at back of ring gear by same amount.

3) After adjusting backlash, tighten both side bearing nuts half the distance between 2 adjacent holes on side bearing nut. Recheck backlash. Ensure bearing cap bolts are tightened to specification. See TORQUE SPECIFICATIONS.

4) Lock plates are of 2 designs for hole location of side bearing nuts. Install proper type lock plate. Tighten lock plate bolt to specification. See TORQUE SPECIFICATIONS. Check gear tooth contact pattern. See GEAR TOOTH CONTACT PATTERNS article in GENERAL INFORMATION.

Ring Gear Runout

Using dial indicator, measure runout at back side of ring gear. See Fig. 7. Runout must be within .002" (.05 mm). If runout is excessive, change ring gear-to-differential case mounting position. Recheck runout.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Bearing Cap Bolt	
Montero	40-47 (54-64)
Montero Sport	37-48 (51-65)
Bearing Case-To-Axle Housing Bolt	
Montero	35 (47)
Montero Sport	40-47 (54-64)
Brake Tube Flare Nut	11 (15)
Differential Carrier-To-Axle Housing Nut	
Montero	35 (47)
Montero Sport	
2.4L	18-21 (24-28)
3.0L	35 (47)
Drain Plug (Montero Sport)	44 (60)
Drive Shaft-To-Flange Bolt	36-43 (49-58)
Lock Plate Bolt	11-16 (15-22)
Pinion Flange Nut	159 (216)
Ring Gear Bolt	58-65 (79-88)
Side Bearing Lock Plate Bolts	11-16 (15-22)
Wheel Lug Nut	
Montero	72-87 (98-118)
Montero Sport	
Aluminum Wheel	73-86 (99-117)
Steel Wheel	87-101 (118-137)

DIFFERENTIAL LOCK - REAR

1997-99 Mitsubishi Montero Sport

1997-99 DRIVE AXLES
Mitsubishi Rear Differential Lock

Montero, Montero Sport

DESCRIPTION & OPERATION

The rear differential lock system is designed to be used only when low-speed wheel spin occurs in a ditch, or on a slippery or uneven surface. The indicator light will blink when switch is turned on as system completes locking operation. After the differential is locked, the light will stop blinking and remain on.

The rear differential lock system will not lock with vehicle in 4H or 2H position, and if vehicle speed is greater than 7 MPH. Vehicle speed should be maintained at less than 12 MPH during rear differential lock operation.

NOTE: The Anti-lock Brake System (ABS) does not operate when the rear differential is locked. It is normal for the ABS warning light to be on at this time.

COMPONENT LOCATIONS

Rear Differential Lock Air Pump
Air pump is located under left side of rear seat.

Rear Differential Lock Control Unit
Control unit is located under left side lower quarter trim panel in rear compartment.

Rear Differential Lock Switch
Lock switch is located on lower center of instrument panel, below radio.

Rear Differential Lock Detection Switch
Lock detection switch is located on rear differential carrier.

TROUBLE SHOOTING

INDICATOR LIGHT FLASHES WHEN LOCK SWITCH IS TURNED ON

If vehicle speed is greater than 7 MPH, reduce speed to less than 3 MPH. If vehicle speed is less than 7 MPH, rotate steering wheel to right and left to reset light.

INDICATOR LIGHT FLASHES WHEN LOCK SWITCH IS TURNED OFF

If indicator flashes after lock switch is turned off, depress and release accelerator several times while driving straight ahead to reset light.

TESTING

REAR DIFFERENTIAL LOCK AIR PUMP

1) Connect pressure gauge with "T" joint to air pump discharge outlet nozzle. See Fig. 1. Install air hose to differential. Apply battery voltage to air pump connector. Note amount of time between when air pump starts operating to when air pump stops operating. If air pump stops within 5 seconds, internal pressure switch is operating properly.

2) Measure pressure 10-20 seconds after air pump has stopped. Pressure should be 4-6 psi (.28-.42 kg/cm^2). If pressure is as specified, internal release valve is operating properly. Ensure air pump does not begin operating for 5 minutes after it has stopped.

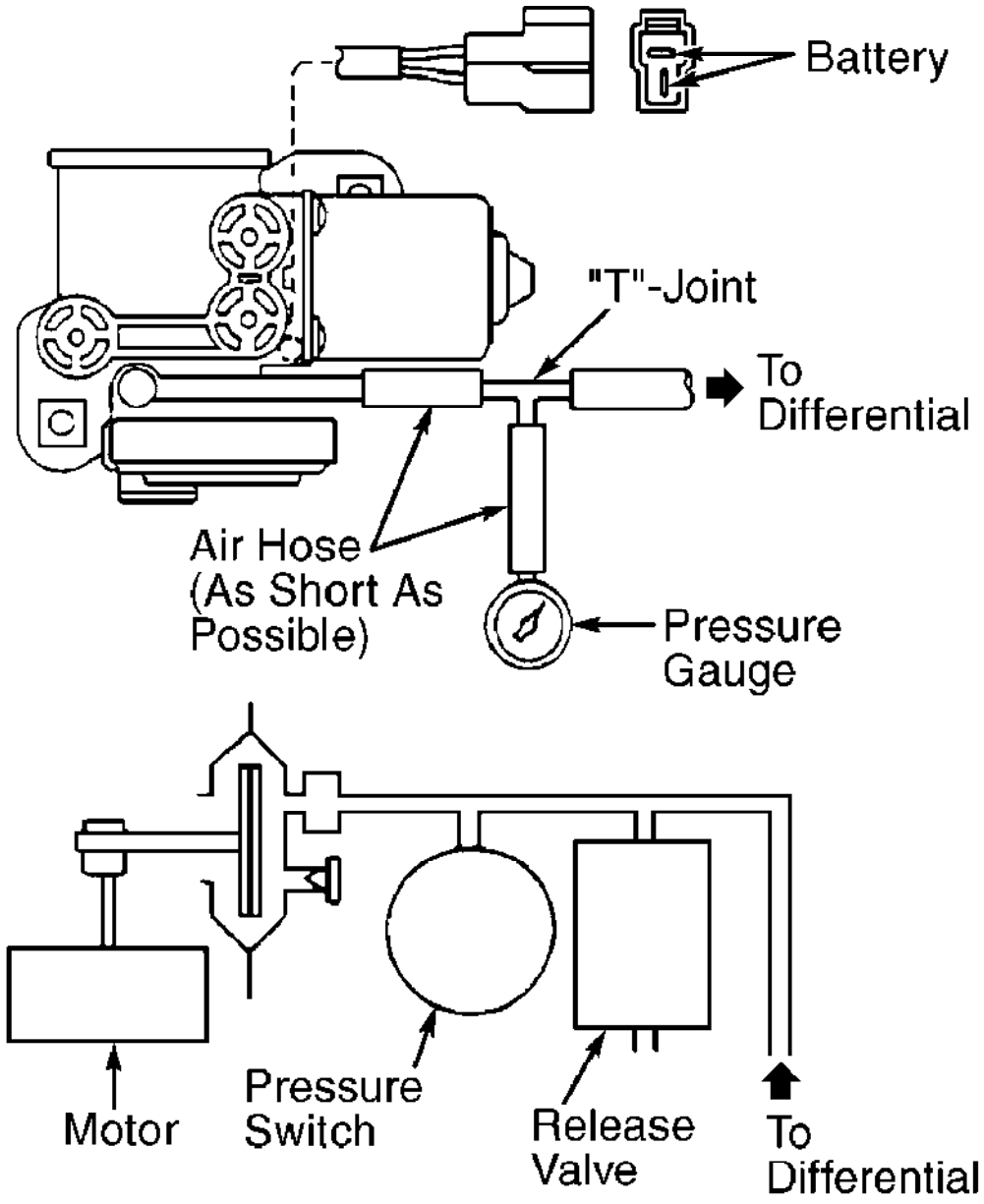

Fig. 1: Testing Rear Differential Lock Air Pump
Courtesy of Mitsubishi Motor Sales of America.

REAR DIFFERENTIAL LOCK CONTROL UNIT

Using voltmeter, backprobe rear differential lock control unit connector between terminal No. 6 (ground) and specified terminal under specified conditions. See WIRING DIAGRAMS. See REAR DIFFERENTIAL LOCK CONTROL UNIT VOLTAGE table. If voltage is not as specified, replace control unit.

REAR DIFFERENTIAL LOCK CONTROL UNIT VOLTAGE

Terminal No.	Circuit	Voltage
3	Ignition Switch (IG1)	(1) Zero
3	Ignition Switch (IG1)	(2) Battery
9 (ON side)	Rear Lock Switch	(2)(3) Zero
1 (OFF side)	Rear Lock Switch	(2)(4) Battery
10	Indicator Light	(2)(5) Zero
10	Indicator Light	(2)(6) Battery
2	Vehicle Speed Reed Switch	(7) 5
8	Rear Lock Detection Switch	(2)(5) Zero
8	Rear Lock Detection Switch	(2)(6) Battery
4	Rear Lock Air Pump	(2)(8) Battery
4	Rear Lock Air Pump	(2)(9) Zero
5	Center Lock Operation	(2)(10) Battery
5	Detection Switch	(2)(10) Battery
5	Detection Switch	(2)(11) Zero

(1) - Ignition off.
(2) - Ignition on.
(3) - ON side or OFF side.
(4) - In Neutral.
(5) - Rear differential locked.
(6) - Rear differential free.
(7) - Select Drive or 1st gear and drive forward slowly.
(8) - When filing or holding.
(9) - When releasing.
(10) - Center differential free.
(11) - Center differential locked.

REAR DIFFERENTIAL LOCK DETECTION SWITCH

NOTE: DO NOT apply more pressure than required to bring pressure gauge reading to about 4 psi (.28 kg/cm^2).

1) Raise and support vehicle. Remove air pipe and air hose connections. Connect a pressure gauge and air regulator (for adjusting compressed air pressure) to air hose. See Fig. 2. Using air regulator, adjust compressed air pressure until pressure gauge indicates about 4 psi (.28 kg/cm^2).

2) While an assistant holds one wheel on one side of vehicle stationary, slowly turn wheel on other side of vehicle. Using ohmmeter, check for continuity between rear differential lock detection switch connector terminals.

3) With air supplied, continuity should exist. With air released, continuity should not exist. If continuity is not as specified, replace lock detection switch.

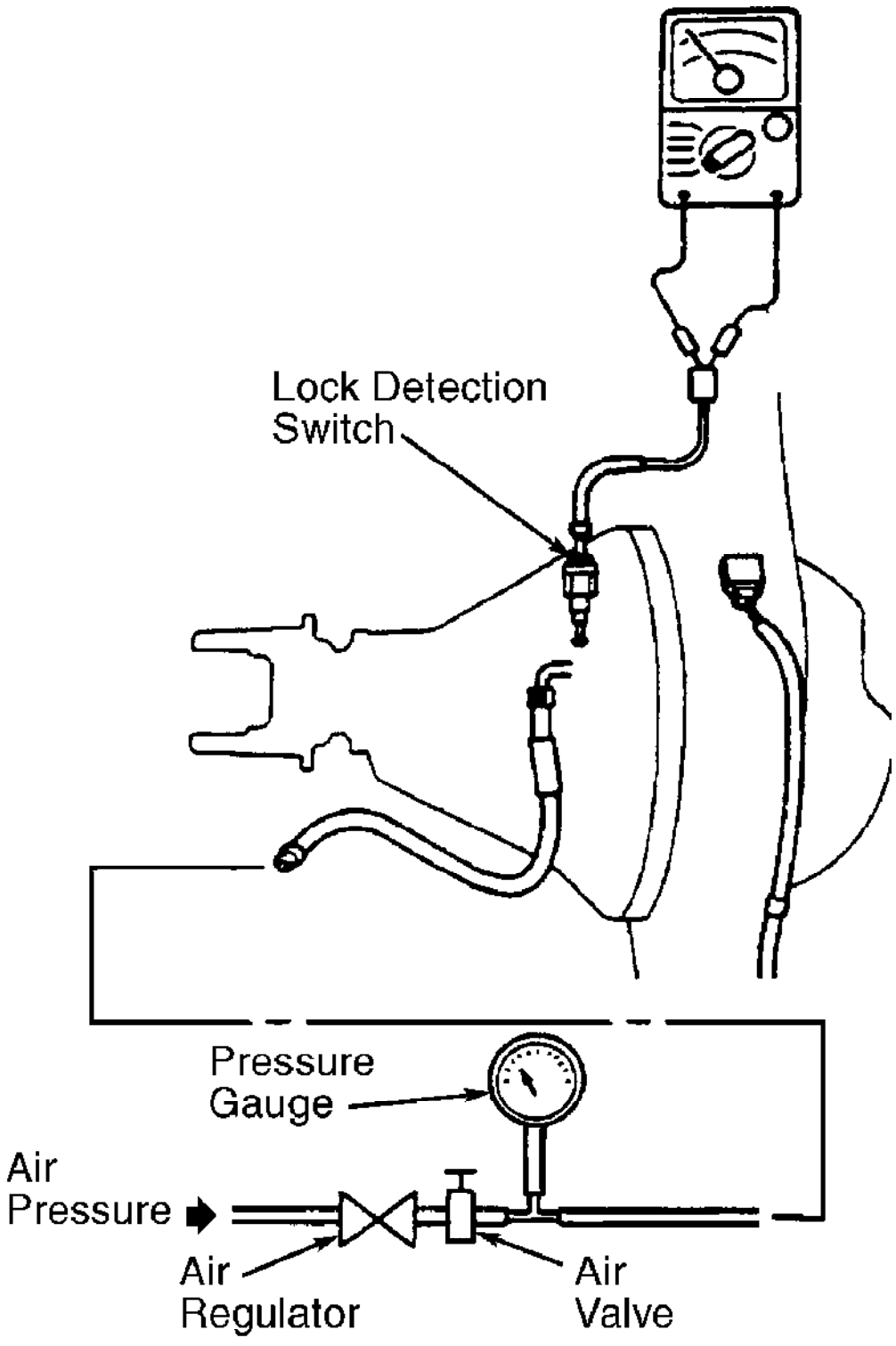

Fig. 2: Testing Rear Differential Lock Detection Switch
Courtesy of Mitsubishi Motor Sales of America.

REAR DIFFERENTIAL LOCK SWITCH

1) Using ohmmeter, check for continuity between specified rear differential lock switch terminals with switch in specified positions. See WIRING DIAGRAMS.

2) With lock switch in ON position, continuity should exist between terminals No. 2 and 5. With lock switch in OFF position, continuity should exist between terminals No. 2 and 3.

3) Continuity should also exist between terminals No. 1 and 6 with lock switch in ON or OFF position. If continuity is not as specified, replace lock switch.

REAR DIFFERENTIAL LOCK SYSTEM AIR LEAKAGE CHECK

NOTE: DO NOT apply more pressure than required to bring pressure gauge reading to about 5 psi (.35 kg/cm^2).

1) Remove rear differential lock air pump and remove air hose from air pump. Connect a pressure gauge and air regulator (for adjusting compressed air pressure) to air hose. Using air regulator, adjust compressed air pressure until pressure gauge indicates about 5 psi (.35 kg/cm^2).

2) Shut off air valve. Wait about 10 minutes and check if air pressure has dropped. If air pressure has dropped, air hose is not leaking.

REMOVAL & INSTALLATION

REAR DIFFERENTIAL LOCK AIR PUMP

Removal & Installation

Remove rear seat. Remove bracket from rear differential lock air pump and remove air pump. Disconnect air hoses from air pump. Disconnect electrical connector from air pump. To install, reverse removal procedure.

REAR DIFFERENTIAL LOCK CONTROL UNIT

Removal & Installation

Remove left side lower quarter trim panel in rear compartment. Remove rear differential lock control unit. Disconnect electrical connector from control unit. To install, reverse removal procedure.

WIRING DIAGRAMS

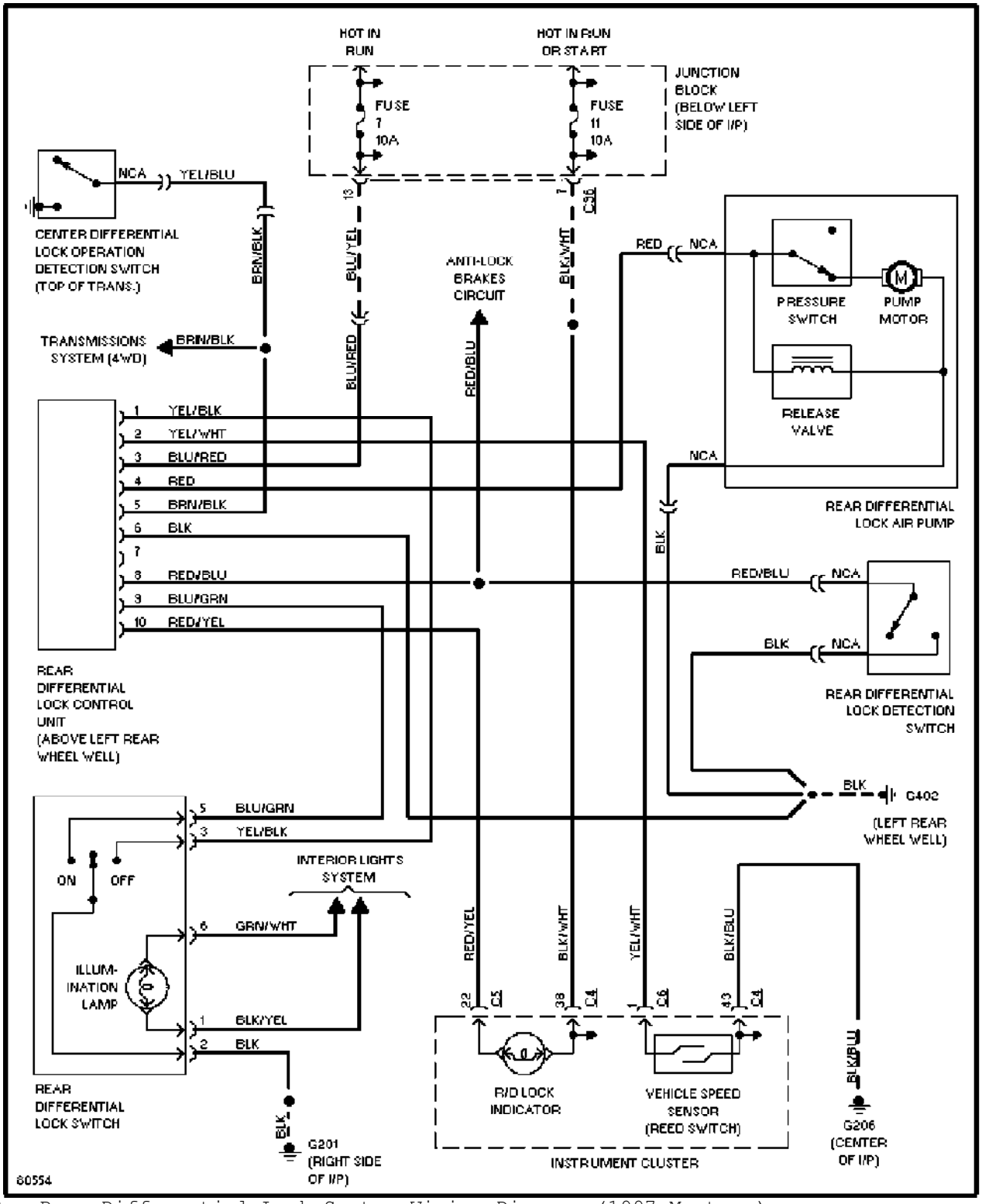

Fig. 3: Rear Differential Lock System Wiring Diagram (1997 Montero)

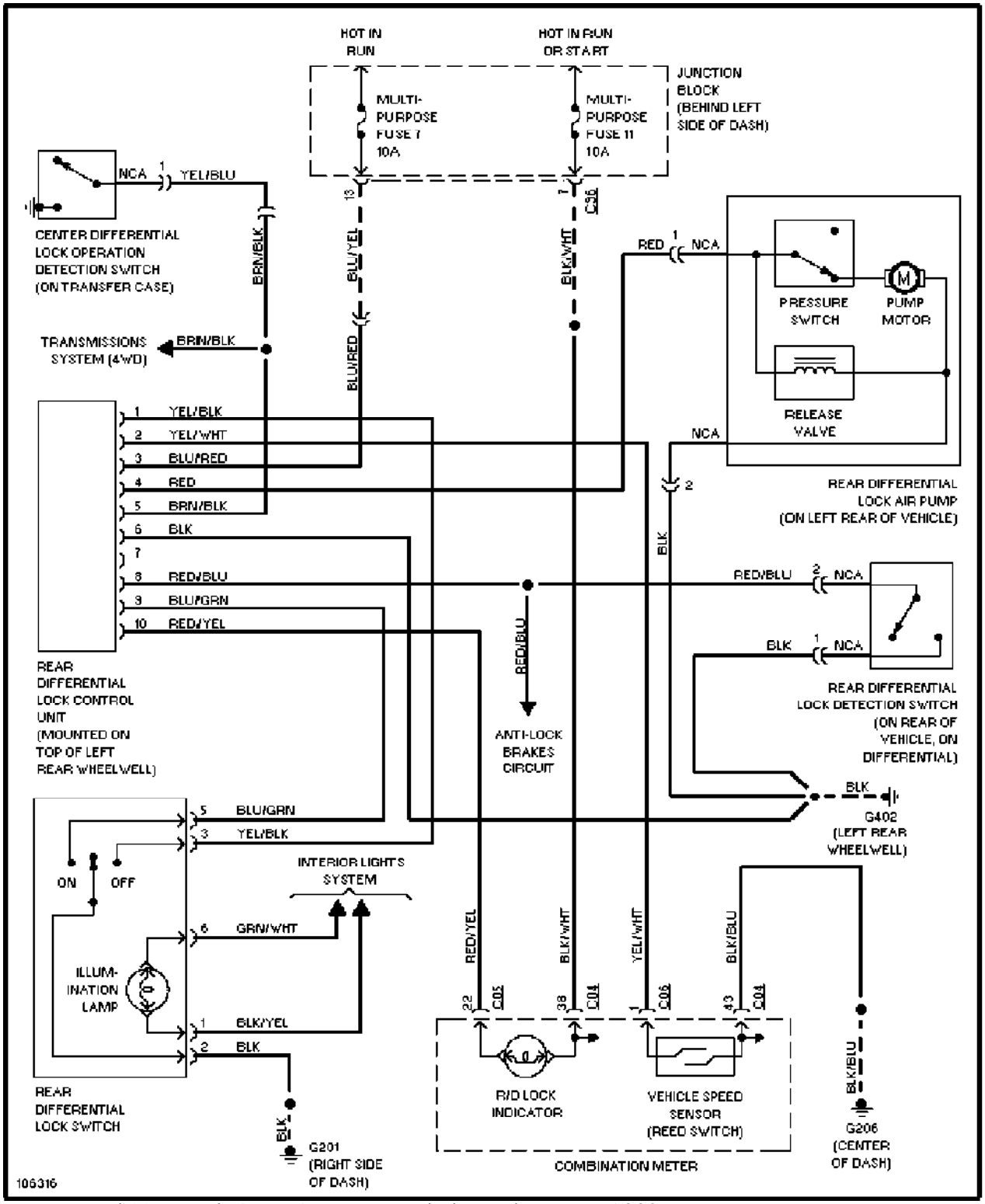

Fig. 4: Rear Differential Lock System Wiring Diagram (1998 Montero)

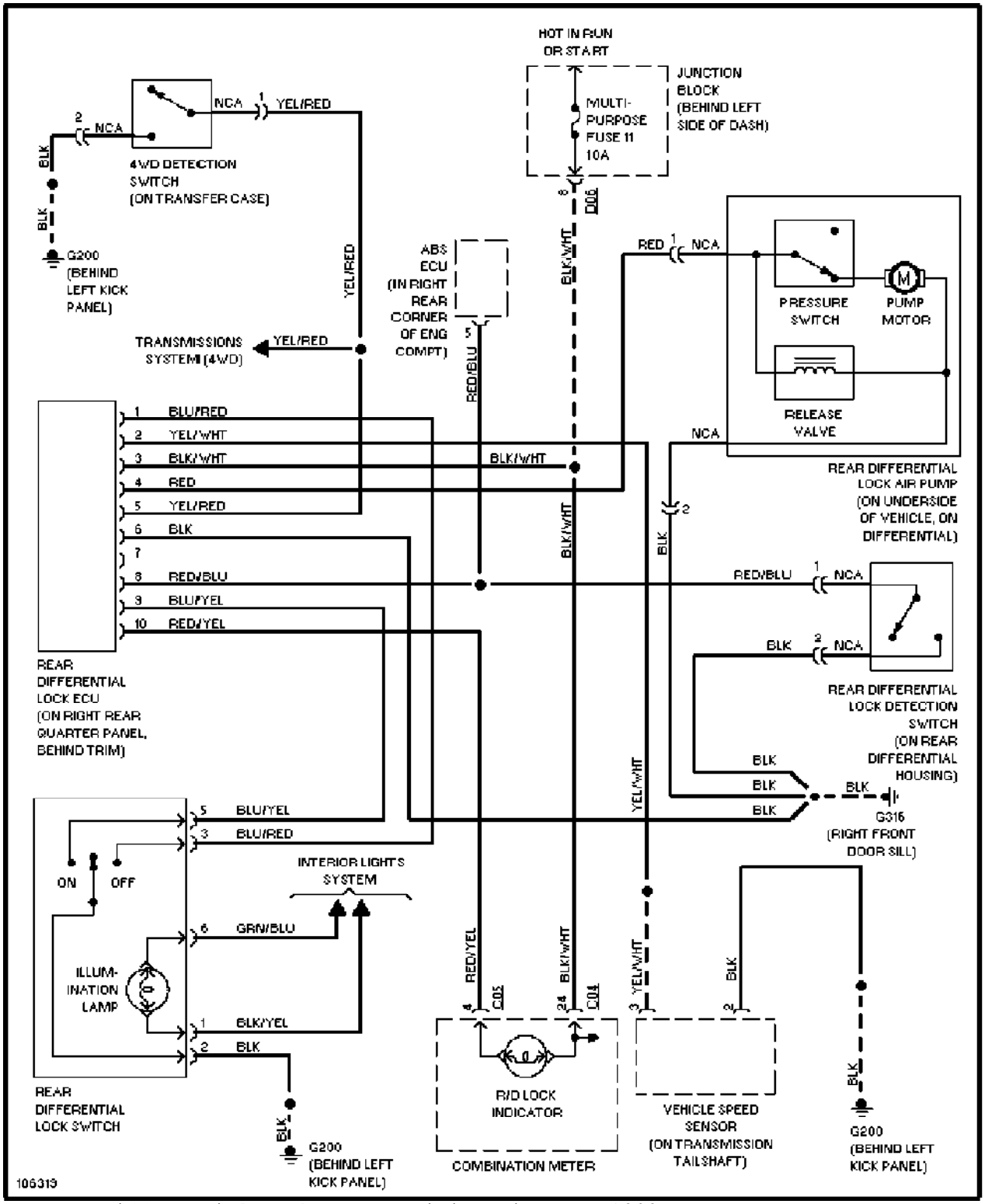

Fig. 5: Rear Differential Lock System Wiring Diagram (1998 Montero Sport)

DOOR LOCKS - POWER

1997-99 Mitsubishi Montero Sport

1997-99 ACCESSORIES & EQUIPMENT
Mitsubishi - Door Locks - Power

Montero Sport

DESCRIPTION & OPERATION

Power door locks are controlled by driver or passenger switches which send signals to Electronic Timer Alarm Control System (ETACS) ECU. The ETACS-ECU sends appropriate signals to individual door lock actuators through individual relays.

The following features are incorporated in power door lock systems that have an ETACS-ECU:

* Once locked door is closed, system will unlock door if key remains in ignition switch.
* Continuous switching between lock and unlock of door will disable system for about one minute.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
ETACS-ECU	Mounted Behind Fuse/Relay Block, Behind Left Side Of Dash
Data Link Connector (DLC)	Under Left Side Of Dash, Below Steering Column
Door Lock Actuator	Behind Each Door
Door Lock Key Cylinder Switch	In Each Key Cylinder

TROUBLE SHOOTING

INPUT SIGNAL

NOTE: Ensure ignition is off when connecting or disconnecting scan tool.

Scan Tool Method

Connect Scan Tool (MB991502) to DLC. Turn ignition on. If can ETACS-ECU buzzer sounds when each switch is operated (i.e., door lock switch), ETACS-ECU input signal for the switch circuit is normal. If switch or related component is not functioning, check related circuit and/or component.

Voltmeter Method

1) Connect Diagnostic Trouble Code Check Harness (MB991529) to Data Link Connector (DLC) terminal No. 9 and terminal No. 4 or 5 (ground). Connect voltmeter to DTC check harness.

2) Turn ignition on. Voltmeter needle should sweep when each switch is operated (i.e., door lock switch). If switch or related component is not functioning, voltmeter needle will not move when switch is activated. Check related circuit and/or component.

POWER DOOR LOCK INOPERATIVE

Operate door lock(s) with ignition switch in OFF position. If door lock(s) do not operate, check for following possible causes:

* Burned fuse, circuit breaker or fusible link caused by short-to-body ground.
* Wire connector, or pin inside connector, disengaged at any connector or component in system.
* Defective ETACS-ECU (if equipped).
* Defective door lock switch, relay or actuator.
* Subfreezing weather conditions, mechanical failure, or corroded or misaligned assemblies.

KEY REMINDER SYSTEM INOPERATIVE (ETACS-ECU CONTROLLED SYSTEM)

With key inserted in ignition switch, lock driver's or passenger's door and close door. If door locks do not unlock, check for following possible causes:

* Defective key reminder switch or no input signal to ETACS-ECU.
* Defective front door switch or no input signal to ETACS-ECU.
* Defective vehicle speed sensor or no input signal to ETACS-ECU.

SYMPTOM TESTS

NOTE: To diagnose symptom see Fig. 1, then go to appropriate test under CIRCUIT TESTS.

Trouble Symptom	Circuit Test No.
None of the door lock functions operate.	1
The other door(s) does not lock or unlock by the door lock switch or the front passenger's side door lock key cylinder. (However, they can be operated by the driver's inside door lock knob.)	2
The other door(s) does not lock or unlock by the driver's inside door lock knob or driver's side door lock key cylinder.	3
Some doors do not lock or unlock.	4

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Fig. 1: Symptom Chart
Courtesy of Mitsubishi Motor Sales of America.

CIRCUIT TESTS

Test No. 1

1) Disconnect ETACS-ECU from junction block. Check voltage between ground and junction block ETACS-ECU terminals No. 1 and 2. See WIRING DIAGRAMS. If battery voltage is present on both terminals, go to step 3). If battery voltage is not present on both terminals, go to next step.

2) Check connector terminals and circuit between fusible link No. 6 and junction block. See WIRING DIAGRAMS. Repair as necessary.

3) Check connector and circuit between junction block and

ground. See WIRING DIAGRAMS. Repair as necessary. If connector and circuit are okay, replace ETACS-ECU.

Test No. 2

1) Disconnect left door lock switch harness connector. Check voltage between ground and door lock switch harness-side connector terminals No. 5 and 10. See WIRING DIAGRAMS. If battery voltage is present, go to step 3). If battery voltage is not present, go to step 4).

2) Disconnect right door lock switch harness connector. Check voltage between ground and door lock switch harness-side connector terminals No. 1 and 3. See WIRING DIAGRAMS. If battery voltage is present, go to next step. If battery voltage is not present, go to step 4).

3) Check connector and circuit between ETACS-ECU and left or right front doors. See WIRING DIAGRAMS. Repair as necessary. If connector and circuit are okay, go to next step.

4) Disconnect right side door lock cylinder switch harness connector. Check voltage between ground and door lock key cylinder switch harness-side connector terminals No. 1 and 3. See WIRING DIAGRAMS. If battery voltage is present, go to step 6). If battery voltage is not present, go to next step.

5) Check circuit between ETACS-ECU and right side door key cylinder switch. See WIRING DIAGRAMS. Repair as necessary.

6) Check door lock switch. See DOOR LOCK SWITCH under COMPONENT TESTS. Replace as necessary. If switch is okay, go to next step.

7) Check right side door lock key cylinder switch. Refer to DOOR LOCK KEY CYLINDER SWITCH under COMPONENT TESTS. Replace as necessary. If door lock key cylinder switch is okay, go to next step.

8) Check connectors and circuit between right and left side door lock key cylinder switch connector. See WIRING DIAGRAMS. Repair as necessary. If connectors and circuit are okay, replace ETACS-ECU.

Test No. 3

1) Check input signal. If using a voltmeter, go to next step. If using a Scan Tool (MB991502), install scan tool to DLC. Operate left door lock actuator or key cylinder switch. If ETACS-ECU buzzer sounds once when switch is moved from LOCK to UNLOCK position, input signal for that switch circuit is normal. If buzzer does not sound, replace ETACS-ECU.

2) Install Diagnostic Trouble Code Check Harness (MB991529) between DLC terminal No. 9 (ground) and terminal No. 4 or 5. Connect voltmeter to check harness. Operate left door lock actuator or key cylinder switch to LOCK or UNLOCK position. If voltmeter needle deflects once when a switch is operated, ETACS-ECU input signal for that switch circuit is normal. If actuator is faulty, go to next step. If key cylinder switch is faulty, go to step 4). If both switches are okay, replace ETACS-ECU.

3) Check left door lock actuator. See DOOR LOCK ACTUATOR TEST under COMPONENT TESTS. Replace as necessary.

4) Check left door lock key cylinder switch. See DOOR LOCK KEY CYLINDER SWITCH under COMPONENT TESTS. Replace as necessary. If door lock key cylinder switch is okay, go to next step.

5) Check circuit between ETACS-ECU and left door lock actuator, and left door lock key cylinder switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

6) Check circuit between ground and left door actuator, and left door lock key cylinder switch. See WIRING DIAGRAMS. Repair as necessary.

Test No. 4

1) Check front, rear and liftgate actuators. See

DOOR LOCK ACTUATOR TEST under COMPONENT TESTS. Replace as necessary. If actuator(s) are okay, go to next step.

2) Check circuit between ETACS-ECU and affected door lock actuators. See WIRING DIAGRAMS. Repair as necessary.

COMPONENT TESTS

NOTE: If after all testing procedures are completed, system is not functioning properly, substitute with a known-good ETACS-ECU and retest.

DOOR LOCK ACTUATOR TEST

Left Front Door

1) Access left front door lock actuator. See LOCK ACTUATOR under REMOVAL & INSTALLATION. Disconnect harness connector. Set actuator in LOCK position. Connect positive lead of 12-volt power source to terminal No. 4 (Blue/Red wire) of actuator. See WIRING DIAGRAMS. Actuator should move to UNLOCK position when terminal No. 6 (Blue/Black wire) is connected to battery negative terminal.

2) With actuator set in UNLOCK position, connect positive lead of 12-volt power source to terminal No. 6 (Blue/Black wire) of actuator. See WIRING DIAGRAMS. Actuator should move to LOCK position when terminal No. 4 (Blue/Red wire) is connected to negative lead.

3) Set actuator to LOCK position. Continuity should be present between actuator terminals No. 1 (Black wire) and No. 3. Set actuator to UNLOCK position. Continuity should be present between actuator terminals No. 1 (Black wire) and No. 2 (Blue/White wire). If actuator does not test as indicated, replace door lock actuator.

Right Front Door

1) Access right front door lock actuator. See LOCK ACTUATOR under REMOVAL & INSTALLATION. Disconnect harness connector. Set actuator in LOCK position. Connect positive lead of 12-volt power source to terminal No. 6 (Blue/Red wire) of actuator. Actuator should move to UNLOCK position when terminal No. 4 (Blue/Black wire) is connected to negative lead.

2) With actuator set in UNLOCK position, connect positive lead of 12-volt power source to terminal No. 4 (Blue/Black wire) of actuator. Actuator should move to LOCK position when terminal No. 6 (Blue/Red wire) is connected to negative lead. Replace door lock actuator as necessary.

Rear Doors

1) Access left or right rear door lock actuator. See LOCK ACTUATOR under REMOVAL & INSTALLATION. Disconnect harness connector. Set actuator in LOCK position. Connect positive lead of 12-volt power source to terminal No. 1 of actuator. See WIRING DIAGRAMS. Actuator should move to UNLOCK position when terminal No. 2 is connected to negative lead.

2) With actuator set in UNLOCK position, connect positive lead of 12-volt power source to terminal No. 2 of actuator. See WIRING DIAGRAMS. Actuator should move to LOCK position when terminal No. 1 is connected to negative lead. Replace door lock actuator as necessary.

Liftgate

1) Access liftgate door lock actuator. Disconnect harness connector. Set actuator in LOCK position. Connect positive lead of 12-volt power source to terminal No. 1 of actuator. See WIRING DIAGRAMS. Actuator should move to UNLOCK position when terminal No. 2 is connected to negative lead.

2) With actuator set in UNLOCK position, connect positive lead of 12-volt power source to terminal No. 2 of actuator. See WIRING DIAGRAMS. Actuator should move to LOCK position when terminal No. 1 is connected to negative lead. Replace door lock actuator as necessary.

DOOR LOCK KEY CYLINDER SWITCH

1) Access left or right door lock key cylinder switch. Disconnect harness connector. Set actuator in LOCK position. Continuity should be present between key cylinder switch terminals No. 2 and 3. See WIRING DIAGRAMS.
2) With actuator set in UNLOCK position, continuity should be present between key cylinder switch terminals No. 1 and 2. See WIRING DIAGRAMS. Set lock key cylinder switch in neutral position. Continuity should not be present in any of the terminals. Replace door lock key cylinder switch.

DOOR LOCK SWITCH

Left Doors
1) Remove left door lock switch. Disconnect harness connector. Set door lock switch in LOCK position. Continuity should be present between door lock switch terminals No. 10 (Black/Blue wire) and No. 12 (Black wire).
2) Set door lock switch in UNLOCK position. Continuity should be present between door lock switch terminals No. 5 (Black/Red wire) and No. 12 (Black wire). Set door lock switch in neutral position. Continuity should not be present in any of the terminals. Replace door lock switch as necessary.

Right Doors
1) Remove right door lock switch. Disconnect harness connector. Set door lock switch in LOCK position. Continuity should be present between door lock switch terminals No. 1 (Black/Red wire) and No. 2 (Black wire).
2) Set door lock switch in UNLOCK position. Continuity should be present between door lock switch terminals No. 2 (Black wire) and No. 3 (Black/Blue wire). Set door lock switch in neutral position. Continuity should not be present in any of the terminals. Replace door lock switch as necessary.

REMOVAL & INSTALLATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

LOCK ACTUATOR

Removal & Installation (Except Rear Or Hatch)
Remove inner door panel. Remove delta cover (access to mirror mounting). Remove door light, switch panel and armrest. Remove mounting screws, and slide panel up to remove. Remove waterproof film. Remove actuator. To install, reverse removal procedure.

Removal & Installation (Rear Hatch)
Remove door pull handle. Remove window trim. Remove door release handle trim. Remove tool kit (if equipped). Remove door panel and waterproof film. Remove actuator solenoid. To install, reverse removal procedure.

WIRING DIAGRAMS

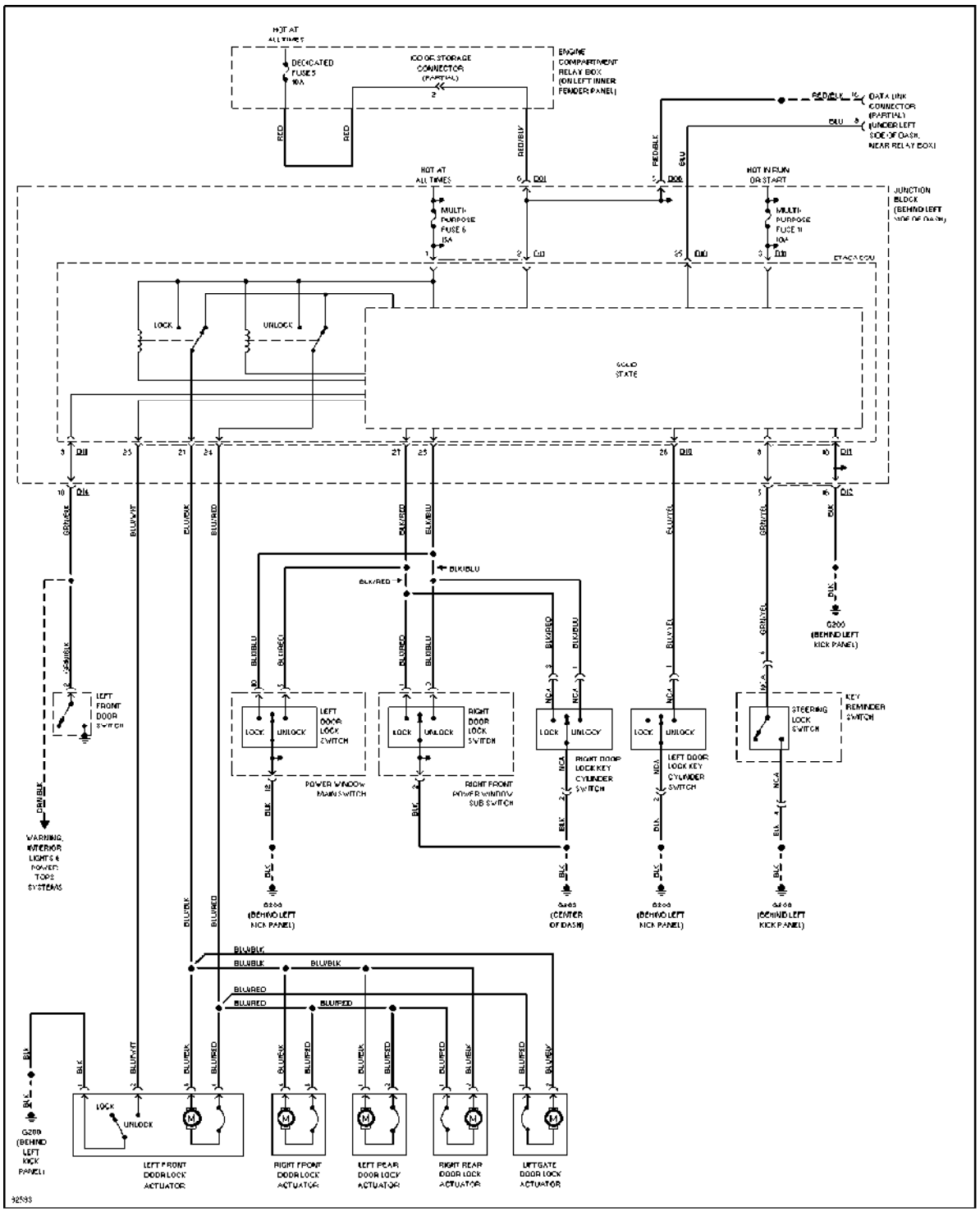

Fig. 2: Power Door Locks Wiring Diagram

* DRIVETRAIN SYSTEMS UNIFORM INSPECTION GUIDELINES *

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Drivetrain/Transmission Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection were recently published. Further, revisions to all of these inspection communication standards are continually republished. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method

has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A - Part no longer performs intended purpose
B - Part does not meet a design specification (regardless of performance)
C - Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

DRIVE/POWER TRAIN ASSEMBLIES

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

NOTE: Whenever transmission or drivetrain service is performed that affects the suspension alignment, for example, removing the engine cradle, it is required that the alignment be checked and corrected if necessary.

AUTOMATIC TRANSMISSION/TRANSAXLE ASSEMBLIES

AUTOMATIC TRANSMISSION/TRANSAXLE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	(2) Require repair or replacement of the automatic transmission/transaxle assembly.

(1) - It is Required that the torque converter and all other failure related components be inspected for cause and condition.
(2) - For components not requiring removal of the assembly, refer to the component listing in this document.

DIFFERENTIAL AND FINAL DRIVE ASSEMBLIES

NOTE: Does not include half shafts.

DIFFERENTIAL AND FINAL DRIVE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A ...	Require repair or replacement of the differential assembly.

(1) - For components not requiring removal of the assembly, refer to the component listing in this document.

MANUAL TRANSMISSION/TRANSAXLE ASSEMBLIES

MANUAL TRANSMISSION/TRANSAXLE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A ...	Require repair or replacement of the manual transmission/transaxle assembly.

(1) - For components not requiring removal of the assembly,

refer to the component listing in this document.

TRANSFER CASE ASSEMBLIES

TRANSFER CASE ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure that requires removal of the assembly from the vehicle for service. (1)	A	Require repair or replacement of the transfer case differential assembly.

(1) - For components not requiring removal of the assembly, refer to the component listing in this document.

DRIVE TRAIN/COMPONENTS

The conditions listed for the components included in this section assume that the problem has been isolated to the specific component through proper testing.

ACTUATORS (ELECTRICAL)

ACTUATOR (ELECTRICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	1	(1) Suggest repair or

		replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	1	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

ACTUATORS (VACUUM)

ACTUATOR (VACUUM) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted, affecting performance	A	(1) Require repair or replacement.
Connector melted, not affecting performance	2	(1) Suggest repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking (vacuum)	A	Require repair or replacement.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.

Linkage missing	C	....	Require replacement.
Linkage noisy	2	..	Suggest repair or replacement.
Missing	C	....	Require replacement.
Noisy	2	..	Suggest repair or replacement.
Out of adjustment	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AXLES

AXLE INSPECTION

Condition	Code		Procedure
Bent	A	....	Require replacement.
Broken	A	....	Require replacement.
End play exceeds specifications	B	..	Require repair or replacement.
Flange bent	A	....	Require replacement.
Flange threads stripped	A	..	Require repair or replacement.
Twisted	A	....	Require replacement.
Worn, affecting performance	A	....	Require replacement.

BEARINGS AND RACES

NOTE: When replacing or repacking bearings, grease seal replacement is required. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

BEARING AND RACE INSPECTION

Condition	Code		Procedure
Bearing end-play exceeds specifications	B	..	Require adjustment of bearing, if possible. If proper adjustment cannot be obtained, require replacement of bearing assembly.
Bearing rollers, balls or races are worn, pitted, or			

feel rough when rotated as an assembly	B ..	Require replacement of bearing assembly.

BELL CRANKS

BELL CRANK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Bent	A ..	Require repair or replacement.
Broken	A ..	Require repair or replacement.
Cracked	A ..	Require repair or replacement.
Missing	C	Require replacement.
Worn, affecting performance	A ..	Require repair or replacement.

BELL HOUSINGS

See HOUSINGS (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY).

BUSHINGS (EXTERNAL)

BUSHING (EXTERNAL) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B ...	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A ...	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity ...	A .	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A ...	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C ..	Require replacement of missing part if available; otherwise, replace bushing.

Condition	Code	Procedure
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads if available; otherwise, replace bushing.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace bushing.
Binding	A	Require repair or replacement.
Contaminated	1	Suggest replacement.
Deteriorated, affecting performance	A	Require repair or replacement.
Distorted, affecting performance	A	Require repair or replacement.
Missing	A	Require replacement.
Noisy	2	(1) Further inspection required.
Rubber separating from internal metal sleeve on bonded bushing	A	Require replacement.
Seized	A	Require replacement.
Shifted (out of position)	B	Require repair or replacement.
Split	A	Require replacement.
Surface cracking (weather-checked)	..	No service suggested or required.
Worn, affecting performance	A	Require repair or replacement.
Worn close to the end of its useful life	1	Suggest replacement.

(1) - If noise isolated to bushing, suggest repair or replacement.

CAUTION: Use only approved lubricant on rubber bushings. Petroleum-based lubricants may damage rubber bushings.

CABLES (SPEEDOMETER)

CABLE (SPEEDOMETER) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Binding	A	Require repair or replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or

			required.
Bracket broken, affecting performance	A	.....	Require replacement.
Bracket broken, not affecting performance	..	.....	No service suggested or required.
Bracket corroded, affecting performance	A	..	Require repair or replacement.
Bracket corroded, not affecting performance	2	..	Suggest repair or replacement.
Bracket cracked, affecting performance	A	..	Require repair or replacement.
Bracket cracked, not affecting performance	1	..	Suggest repair or replacement.
Bracket loose, affecting performance	A	..	Require repair or replacement.
Bracket loose, not affecting performance	1	..	Suggest repair or replacement.
Bracket missing	C	.....	Require replacement.
Broken	A	.....	Require replacement.
Cracked	A	..	Require repair or replacement.
Disconnected	A	..	Require repair or replacement.
Kinked	A	..	Require repair or replacement.
Melted	A	.....	(1) Require repair or replacement.
Missing	C	.....	Require replacement.
Noisy	2	..	Suggest repair or replacement.
Routed incorrectly	2	.....	Suggest repair.
Seized	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

CABLES (TV, DETENT AND SHIFT)

CABLE (TV, DETENT AND SHIFT) INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Bent	A	..	Require repair or replacement.
Binding	A	..	Require repair or replacement.
Bracket bent, affecting performance	A	..	Require repair or replacement.
Bracket bent, not affecting performance	..	.....	No service suggested or required.
Bracket broken, affecting performance	A	.....	Require replacement.
Bracket broken, not affecting performance	..	.....	No service suggested or required.
Bracket corroded, affecting performance	A	..	Require repair or replacement.

Condition	Code	Procedure
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Frayed	A	Require replacement.
Kinked	A	Require repair or replacement.
Melted	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(2) Require repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.
Self-adjuster inoperative	A	Require repair or replacement of self-adjuster.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Cable replacement is required if it cannot be adjusted within specifications.

CARRIER BEARINGS

See INTERMEDIATE SHAFT SUPPORT BEARINGS.

CLUTCH CABLES AND CABLE HOUSINGS

CLUTCH CABLE AND CABLE HOUSING INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Cable bent	A	Require replacement.
Cable binding	A	Require repair or replacement.
Cable mounting loose	B	Require repair or replacement.
Cable out of adjustment	B	Require repair or replacement.
Frayed	B	Require replacement.
Housing heat-damaged	1	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH DISCS (MANUAL TRANSMISSION)

CLUTCH DISC (MANUAL TRANSMISSION) INSPECTION

Condition	Code	Procedure
Backing plate cracked	A	Require replacement.
Broken	A	Require replacement.
Contaminated with oil	A	Require replacement.
Damper cushion broken	A	Require replacement.
Damper cushion collapsed	A	Require replacement.
Damper spring collapsed	A	Require replacement.
Damper spring missing	C	(1) Require replacement.
Friction material cracked through	B	Require replacement.
Friction material flaking or chunking	B	Require replacement.
Friction material surface cracking	B	No service suggested or required.
Grooved	B	No service suggested or required unless the pressure plate or flywheel is being resurfaced or replaced. In this case, replacement of clutch disc is required.
Ridged	B	No service suggested or required unless the pressure plate or flywheel is being resurfaced or replaced. In this case, replacement of clutch disc is required.
Splines worn, affecting performance	A	Require replacement.
Warped	A	Require replacement.
Wear exceeds specifications (where applicable)	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

(1) - Not all clutch discs have springs in all spring chambers on the disc.

CLUTCH FORKS

CLUTCH FORK INSPECTION

Condition	Code	Procedure
Bent	B	Require replacement.
Broken	A	Require repair or replacement.
Cracked	B	Require repair or replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH LINKAGES (MECHANICAL)

See LINKAGES (EXTERNAL).

CLUTCH MASTER CYLINDERS

CLUTCH MASTER CYLINDER INSPECTION

Condition	Code	Procedure
Cover gasket distorted	A	Require replacement of cover gasket.
Cover gasket gummy	A	Require replacement of cover gasket.
Cylinder leaking fluid from rear of bore	A	Require repair or replacement.
Cylinder leaking fluid internally	A	Require replacement.
Dust boot missing	C	Require replacement of dust boot.
Dust boot punctured	A	Require replacement of dust boot.
Dust boot torn	A	Require replacement of dust boot.
Fluid level incorrect	B	Require fluid level adjustment.
Housing damaged, affecting performance	A	Require repair or replacement.
Master cylinder has residue in reservoir (make parallel w/brakes when they are done)	2	(1) Further inspection required.
Threads damaged	A	Require repair replacement
Threads stripped (threads missing)	A	Require replacement.

(1) - DO NOT replace master cylinder unless it exhibits conditions listed for replacement. You may suggest fluid change according to OEM service intervals.

CLUTCH PEDALS

CLUTCH PEDAL INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Pedal pad missing	C	Require replacement of pedal pad.
Pivot bushings worn, affecting performance	A	Require replacement of pivot bushings.

CLUTCH PIVOTS

CLUTCH PIVOT INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	Require repair or replacement.
Cracked	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH PRESSURE PLATES

See PRESSURE PLATES.

CLUTCH RELEASE BEARINGS

CLUTCH RELEASE BEARING INSPECTION

Condition	Code	Procedure
Collar broken	A	Require replacement.
Cracked	A	Require replacement.
Rough when rotated as an assembly	B	Require replacement.
Seized	A	Require replacement.
Wear exceeds specifications	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH SLAVE CYLINDERS (CONCENTRIC)

CLUTCH SLAVE CYLINDER (CONCENTRIC) INSPECTION

Condition	Code	Procedure
Bearing rough when rotated as an assembly	B	Require replacement.
Bearing seized	A	Require replacement.
Bleeder pipe leaks	A	Require repair or replacement.
Carrier assembly worn, affecting performance	A	Require replacement.
Collar broken	A	Require replacement.
Cracked	A	Require replacement.
Housing leaks	A	Require replacement.
Inoperative	A	Require replacement.
Release binding	A	Require replacement.
Spring broken	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

CLUTCH SLAVE CYLINDERS (CONVENTIONAL OR EXTERNAL)

CLUTCH SLAVE CYLINDER (CONVENTIONAL OR EXTERNAL) INSPECTION

Condition	Code	Procedure
Binding	A	Require repair or replacement.
Bleeder port damaged (not repairable)	A	(1) Require replacement.
Bleeder port damaged (repairable)	A	(1) Require repair.
Bleeder screw broken off in slave cylinder	A	(1) Require replacement.
Bleeder screw seized	A	(2) Require replacement.
Bore corroded (pitted)	B	Require replacement.
Bore grooved	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Only required if the hydraulic system must be opened.
(2) - Seized is defined as a bleeder screw that cannot be removed after a practical attempt at removing it has been made.

COMPANION FLANGES

See YOKES AND SLIP YOKES.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

COOLER BYPASS VALVES

COOLER BYPASS VALVE INSPECTION

Condition	Code	Procedure
Inoperative	A	Require replacement.
Installed incorrectly	A	Require repair.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.

COOLER LINES

COOLER LINE INSPECTION

Condition	Code	Procedure
Abrasion damage, affecting structural integrity	A	Require repair or replacement.
Abrasion damage, not affecting structural integrity		No service suggested or required.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Clamp corroded, not reusable	1	Suggest replacement.
Connected incorrectly	A	Require repair.
Corroded, affecting structural integrity	A	Require replacement.
Corroded, not affecting structural integrity	..	No service suggested or required.
Cracked	A	Require repair or replacement.
Fitting type incorrect (such as compression fitting)	B	Require replacement.
Flange leaking	A	Require repair or replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Melted	1	Suggest repair or replacement.
Missing	C	Require replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement.
Protective sleeves damaged	2	Suggest replacement of sleeves.
Protective sleeves missing	C	Require replacement of sleeves.
Restricted, affecting performance	A	Require repair or replacement.
Routed incorrectly	2	Require repair.
Swollen	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Type incorrect	1	Suggest repair or replacement.

COOLERS

See TRANSMISSION COOLERS.

CV JOINTS

CV JOINT INSPECTION

Condition	Code	Procedure
Bearing, bushing or seal surface worn, affecting performance	A	Require repair or replacement.
Boot clamp broken	A	Require repair or replacement of clamp.
Boot clamp loose	A	Require repair or replacement of clamp.
Boot clamp missing	C	Require repair or replacement of clamp.
Boot leaking	A	Require replacement of CV boot.
Boot surface cracked,		

not leaking	2	. Suggest replacement of CV boot.
Cage broken	A	... Require repair or replacement of CV joint.
Housing damaged to the extent that it no longer performs its intended function	A	..... (1) Require repair or replacement of CV joint.
Housing worn to the extent that it no longer performs its intended function ..	A	..... (1) Require repair or replacement of CV joint.
Holes elongated	A	..... Require replacement.
Internal parts binding ..	A	.. Require repair or replacement.
Internal parts worn	A	.. Require repair or replacement.
Lubricant missing	C	... Require cleaning, inspection, and repacking of CV joint.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - Housing assembly may appear blue in color from normal manufacturing process of heat-treating the housing.

DIP STICK TUBES

DIP STICK TUBE INSPECTION

Condition	Code	Procedure
Broken	A	.. Require repair or replacement.
Checkball missing	C	.. Suggest repair or replacement.
Cracked	A	.. Require repair or replacement.
Hold down bracket broken	A	.. Require repair or replacement.
Hold down bracket missing	C	..... Require replacement.
Leaking	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

DIP STICKS (FLUID LEVEL INDICATORS)

DIP STICK (FLUID LEVEL INDICATOR) INSPECTION

Condition	Code	Procedure
Application incorrect ...	B	..... Require replacement.
Broken	A	..... Require replacement.
Compressed	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Modified	A	..... Require replacement.
Stretched	A	.. Require repair or replacement.

DOWEL PINS, GUIDES AND PILOT HOLES

DOWEL PIN, GUIDE AND PILOT HOLE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Cracked	A	Require repair or replacement.
Distorted	A	Require repair or replacement.
Missing	C	Require replacement.
Positioned incorrectly	B	Require repair or replacement.
Stepped	A	Require repair or replacement.
Worn to the extent that it no longer performs its intended function	A	Require repair or replacement.

DRIVE SHAFT FLANGES

See COMPANION FLANGES.

DRIVE SHAFTS AND HALF SHAFTS

DRIVE SHAFT AND HALF SHAFT INSPECTION

Condition	Code	Procedure
Balance weight missing	C	Require repair or replacement.
Bearing cap bore distorted	A	Require repair or replacement.
Bent	A	Require replacement.
Bolt holes elongated	A	Require repair or replacement.
Bushing or seal surface worn, affecting performance	A	Require repair or replacement.
Leaking through soft yoke plug	A	Require repair or replacement of soft yoke plug.
Out of balance	A	Require repair or replacement.
Retainer strap bent	A	Require replacement of retainer strap.
Slip yoke broken	A	Require replacement.
Splines worn, affecting performance	A	Require replacement.
Splines worn close to the end of their useful life	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
U-bolt damaged, affecting performance	A	Require replacement of U-bolts.
Yoke damaged, affecting performance	A	Require repair or replacement.

DUST BOOTS

NOTE: Does not include CV boots.

DUST BOOT INSPECTION

Condition	Code	Procedure
Cracked, not leaking	1	Suggest replacement.
Missing	C	Require replacement.
Leaking	A	Require repair or replacement.

Torn	A	.....	Require replacement.

ENGINE MOUNTS

See MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION).

EXCITER RINGS

See TOOTHED RINGS (TONE WHEELS).

FILLER TUBES

See DIP STICK TUBES.

FILTERS AND SCREENS

FILTER AND SCREEN INSPECTION

Condition	Code		Procedure
At service interval	3	.....	Suggest replacement.
Bent	A	..	Require repair or replacement.
Exceeding service interval	3	.....	Suggest replacement.
Missing	C	.....	Require replacement.
Near service interval	3	.....	Suggest replacement.
Restricted	A	.....	(1) Require repair or replacement.
Torn	A	.....	Require replacement.
Worn, affecting performance (metal or nylon screen type)	A	..	Require repair or replacement.

(1) - Further inspection may be required to determine the source of restriction or contamination.

FLANGES

See COMPANION FLANGES.

FLEX PLATES

FLEX PLATE INSPECTION

Condition	Code		Procedure
Bent, affecting performance	A	.....	Require replacement.
Bent, not affecting performance	..	.....	No service suggested or required.
Bolt or stud holes elongated	B	.....	Require replacement.
Broken	A	.....	Require replacement.
Cracked	A	.....	Require replacement.
Ring gear worn close to the end of its useful life	1	.....	Suggest replacement.
Ring gear worn to the extent that it no longer			

performs its intended function	A	Require replacement.
Weights missing	A	Require replacement.

FLUID LEVEL INDICATORS

See DIP STICKS (FLUID LEVEL INDICATORS).

FLUIDS AND LUBRICANTS

FLUID AND LUBRICANT INSPECTION

Condition	Code	Procedure
Application incorrect	B	(1) Require replacement.
At service interval	3	Suggest replacement.
Beyond service interval	3	Suggest replacement.
Burned	..	(2) Further inspection required.
Contaminated, for example, fluid other than hydraulic fluid present	A or B	(3)(4) Require service.
Exceeding service interval	3	Suggest replacement.
Hydraulic fluid incorrect	B	(5) Require service.
Level incorrect	B	Require correction of fluid level.
Near service interval	3	Suggest replacement.
Rubber master cylinder cover gasket distorted and gummy	A	(3) Require service.
Varnished	..	(6) Further inspection required.

(1) - Determine and correct cause.
(2) - Fluid that is burned indicates a serious problem. Determine and correct the cause.
(3) - If a fluid other than hydraulic fluid is present in the hydraulic system which DOES affect the rubber parts, the required service is to: 1) remove all components having rubber parts from the system, 2) flush lines with denatured alcohol or hydraulic cleaner, 3) repair or replace all components having rubber parts, and 4) bleed and flush with correct hydraulic fluid. (Code A)
(4) - If a fluid other than hydraulic fluid is present in the hydraulic system which DOES NOT affect the rubber parts, the required service is to flush and fill with the correct hydraulic fluid. (Code B)
(5) - If a fluid other than specification hydraulic fluid is present in the hydraulic system, the required service is to flush and fill with the correct hydraulic fluid.
(6) - Fluid that is varnished may indicate a serious problem. Determine and correct the cause.

FLYWHEELS

NOTE: Clutch disc replacement does not necessitate flywheel reconditioning, unless other conditions justify the reason to do so.

FLYWHEEL INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked (other than mounting area)	A	(1) Require resurfacing or replacement.
Cracks in mounting area	B	Require replacement.
Hard spots	B	Require repair or replacement.
Ring gear broken	A	Require replacement of ring gear.
Ring gear teeth worn, affecting performance	A	Require replacement of ring gear.
Runout exceeds specifications	B	Require repair or replacement.
Scored	B	Require repair or replacement.
Surface cracks after resurfacing to manufacturer's minimum specifications	B	Require replacement.
Wear exceeds specifications	B	Require replacement.
Worn close to the end of its useful life	1	Suggest replacement.
Worn, affecting performance	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Some manufacturers allow slight surface cracking in the friction surface.

FORCE MOTORS

See ACTUATORS (ELECTRICAL).

GUIDES

See DOWEL PINS, GUIDES AND PILOT HOLES.

HALF SHAFTS

See DRIVE SHAFTS AND HALF SHAFTS.

HOSES, LINES AND TUBES

HOSE, LINE AND TUBE INSPECTION

Condition	Code	Procedure

Application incorrect	B	Require replacement.
Connected incorrectly	A	Require repair.
Corroded, not reusable	1	Suggest replacement.
Cracked	A	Require replacement.
Dry-rotted	1	Suggest repair or replacement.
Hard	1	Suggest repair or replacement.
Inner fabric (webbing) damaged	A	Require replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Maintenance intervals	3	Suggest replacement.
Melted	1	Suggest repair or replacement.
Missing	C	Require replacement.
Outer covering damaged	1	Suggest replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement.
Protective sleeves damaged	2	Suggest replacement of sleeves.
Protective sleeves missing	2	Suggest replacement of sleeves.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	2	Suggest repair or replacement.
Routed incorrectly	2	Suggest replacement.
Safety clip missing	C	Require replacement.
Spongy	1	Suggest repair or replacement.
Stripped	A	Require replacement.
Swollen	B	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Type incorrect	1	Suggest repair or replacement.

HOUSINGS (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY)

HOUSING (BELL, CASE, TAIL (EXTENSION) AND AUXILIARY) INSPECTION

Condition	Code	Procedure
Bearing race loose in bore	A	Require repair or replacement.
Broken, affecting performance	A	Require repair or replacement.
Cracked	A	Require repair or replacement.
Dowel pin holes worn, affecting performance	A	(1) Require repair or replacement.
Machined surfaces damaged, affecting performance	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require repair or replacement.

(1) - See DOWEL PINS, GUIDES AND PILOT HOLES.

INTERMEDIATE SHAFT SUPPORT BEARINGS

INTERMEDIATE SHAFT SUPPORT BEARING INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing rollers, balls or races are worn, pitted, noisy, or feel rough when rotated as an assembly	A	Require replacement of bearing assembly.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance		No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance		No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performances)		No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Cracked		Require replacement.
Rough (brinelling, spalling)	A	Require replacement.
Rubber deteriorated, affecting performance	A	Require replacement.
Seized	A	Require replacement.

KEY INTERLOCK SYSTEMS

See SHIFT INTERLOCK SYSTEMS (SELECTOR AND KEY INTERLOCK SYSTEMS).

LIMITED SLIPS

See DIFFERENTIAL AND FINAL DRIVE ASSEMBLIES.

LINES

See HOSES, LINES AND TUBES.

LINKAGES (EXTERNAL)

LINKAGE (EXTERNAL) INSPECTION

Condition	Code	Procedure
Components missing	C	Require replacement of missing components.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage missing	C	Require replacement.
Linkage noisy	2	Suggest repair or replacement.
Out of adjustment	B	Require repair or replacement.
Worn to the extent that it no longer performs its intended function	A	Require repair or replacement.

LOCKING HUB ASSEMBLIES

LOCKING HUB ASSEMBLY INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.
Loose	A	Require repair or replacement.
Seized in any position	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation.

LOCKING HUB CONTROL KNOBS

LOCKING HUB CONTROL KNOB INSPECTION

Condition	Code	Procedure

Damaged, affecting performance	A	.....	Require replacement.
Missing	C	.....	Require replacement.
Worn, affecting performance	A	.....	Require replacement.

LUBRICANTS

See FLUIDS AND LUBRICANTS.

METAL-CLAD SEALS

See SEALS.

METALASTIC JOINTS

See RUBBER JOINTS (METALASTIC).

MODULATOR PINS

MODULATOR PIN INSPECTION

Condition	Code	Procedure
Application incorrect ...	B	..... Require replacement.
Missing	C	..... Require replacement.

MODULATORS

MODULATOR INSPECTION

Condition	Code	Procedure
Bent, affecting performance	A	..... Require replacement.
Contaminated (water, fuel, etc.)	A	..... (1) Require replacement.
Housing cracked	A	..... Require replacement.
Inoperative	A	..... (2) Require replacement.
Leaking fluid externally	A	.. Require repair or replacement.
Leaking fluid internally	A	..... Require replacement.
Leaking vacuum	A	..... Require replacement.
Nipple broken	A	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - Further inspection is required to determine the cause of the contamination.
(2) - Inoperative includes intermittent operation or out of OEM specification.

MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION)

MOUNT (ENGINE, TRANSAXLE AND TRANSMISSION) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require replacement.
Leaking (hydraulic mount)	A	Require replacement.
Mounting hole worn, affecting performance	A	Require replacement.
Mounting hole worn, not affecting performance		No service suggested or required.
Rubber deteriorated, affecting performance	A	Require replacement.
Rubber deteriorated, not affecting performance		No service suggested or required.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

ODOMETER DRIVES (MECHANICAL)

See SPEEDOMETER/ODOMETER DRIVES (MECHANICAL).

ODOMETER HEADS (MECHANICAL)

See SPEEDOMETER/ODOMETER HEADS (MECHANICAL).

OIL PANS

See TRANSMISSION PANS.

PANS

See TRANSMISSION PANS.

PILOT HOLES

See DOWEL PINS, GUIDES AND PILOT HOLES.

PRESSURE PLATES

PRESSURE PLATE INSPECTION

Condition	Code	Procedure
Balance weight missing	C	Require replacement.
Broken	A	Require replacement.
Contact surface distorted	B	Require replacement.
Cracks	B	Require replacement.
Fingers bent	A	Require replacement.
Hard spots	B	Require replacement.

Scored	B	.....	Require replacement.
Spring rate less than specifications	B	.....	Require replacement.
Worn, affecting performance	A	.....	Require replacement.
Worn beyond specifications	B	.....	Require replacement.
Worn close to the end of its useful life	1	.....	Suggest replacement.

PRESSURE SWITCHES

See SWITCHES.

RACES

See BEARINGS AND RACES.

RUBBER JOINTS (METALASTIC)

These joints may be found on half and/or drive shafts. They are usually found on European vehicles featuring a three-lug drive flange. They may be equipped with a centering ball or pin.

RUBBER JOINT (METALASTIC) INSPECTION

Condition	Code		Procedure
Drive flange bent	A	.....	Require repair or replacement.
Drive flange damaged, affecting performance	A	.....	Require replacement.
Rubber drive joint cracked	2	.....	Suggest replacement.
Rubber drive joint damaged, affecting performance	A	.....	Require replacement.
Rubber drive joint split between mounting holes	A	.....	Require replacement.
Rubber drive joint torn at mounting holes	A	.....	Require replacement.
Rubber drive joint weather-cracked	..	.....	No service suggested or required.

SCREENS

See FILTERS AND SCREENS.

SEALS

SEAL INSPECTION

Condition	Code		Procedure
Leaking	A	.....	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary. Check vent. A plugged

vent may force fluid past the seal.

SEALS (METAL-CLAD)

See SEALS.

SELECTOR INTERLOCK SYSTEMS

See SHIFT INTERLOCK SYSTEMS (SELECTOR AND KEY INTERLOCK SYSTEMS).

SERVOS

See ACTUATORS (VACUUM).

SHIFT INTERLOCK SYSTEMS (SELECTOR AND KEY INTERLOCK SYSTEMS)

See:
ACTUATORS (ELECTRICAL)
CABLES
LINKAGES (EXTERNAL)
SWITCHES

SENSORS

SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Leaking (vacuum/fluid/air)	A	Require replacement.
Out of adjustment	B	(3) Further inspection required.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting		

performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of specification.
(3) - Follow OEM recommended adjustment procedures. Repair or replace if out of specification.

SIDE COVERS

See TRANSMISSION PANS.

SLIP YOKES

See YOKES AND SLIP YOKES.

SOLENOIDS

See:
ACTUATORS (ELECTRICAL)
ACTUATORS (VACUUM)

SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE)

SPEED SENSOR (ELECTRONIC WHEEL AND VEHICLE) INSPECTION

Condition	Code		Procedure
Air gap incorrect	B	.....	(1) Require adjustment or replacement.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware threads damaged	A	...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(2) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(3) Require repair or replacement.
Inoperative	B	.....	(4) Require repair or replacement. Further inspection required.
Leaking	A	..	Require repair or replacement.
Loose	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Resistance out of			

specification	B	Require repair or replacement.
Sensor housing cracked	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead misrouted	B	Require re-routing according to vehicle manufacturer's specifications.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - If a sensor is not adjustable, further inspection is required to identify and correct cause.
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as metal particles or water. Require repair or replacement.
(4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

SPEEDOMETER-DRIVEN GEAR HOUSINGS

See SPEEDOMETER/ODOMETER DRIVES (MECHANICAL).

SPEEDOMETER/ODOMETER DRIVES (MECHANICAL)

SPEEDOMETER/ODOMETER DRIVE (MECHANICAL) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Teeth broken	A	Require repair or replacement.

Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Worn close to the end of its useful life	1	.....	Suggest replacement.
Worn, affecting performance	A	.....	Require replacement.

(1) - Inoperative includes intermittent operation.

SPEEDOMETER/ODOMETER HEADS (MECHANICAL)

SPEEDOMETER/ODOMETER HEAD (MECHANICAL) INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Lens broken	A	.....	(1) Require repair or replacement.
Lens cloudy	2	.....	(1) Suggest repair or replacement.
Lens missing	C	.....	(1) Require repair or replacement.
Malfunctioning	A	.....	(2) Require repair or replacement.
Noisy	2	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

(1) - If lens is available as a separate part, require replacement of lens only.
(2) - Includes inoperative, intermittent operation, failure to perform all functions, out of OEM specification, or out of range.

SPEEDOMETERS AND ODOMETERS (ELECTRONIC)

SPEEDOMETER AND ODOMETER (ELECTRONIC) INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack			

type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Leaking	A	.....	Require replacement.
Lens broken	A	.....	(2) Require repair or replacement.
Lens cloudy	2	.....	(2) Suggest repair or replacement.
Lens missing	C	.....	(2) Require repair or replacement.
Malfunctioning	A	.....	(3) Require repair or replacement.
Mechanical head noisy ...	2	..	Suggest repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	..	Require repair or replacement.
Terminal corroded, not affecting performance ..	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance ..	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - If lens is available as a separate part, require replacement of lens only.
(3) - Includes inoperative, intermittent operation, failure to perform all functions, out of OEM specification, or out of range.

SWITCHES

SWITCH INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Binding, affecting performance	A	..	Require repair or replacement.
Binding, not affecting performance	2	..	Suggest repair or replacement.
Broken	A	..	Require repair or replacement.
Burned, affecting performance	A	.....	(1) Require repair or replacement.
Burned, not affecting performance	2	.....	(1) Suggest repair or

			replacement.
Cracked, affecting performance	A	..	Require repair or replacement.
Cracked, not affecting performance	1	..	Suggest repair or replacement.
Leaking	A	..	Require repair or replacement.
Malfunctioning	A	.....	(2) Require repair or replacement.
Melted, affecting performance	A	.....	(1) Require repair or replacement.
Melted, not affecting performance	2	.....	(1) Suggest repair or replacement.
Missing	C	.....	Require replacement.
Out of adjustment	B	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Won't return	A	..	Require repair or replacement.
Worn	1	.....	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

TONE WHEELS

See TOOTHED RINGS (TONE WHEELS).

TOOTHED RINGS (TONE WHEELS)

If the toothed ring requires replacement and cannot be replaced as a separate component, replace the assembly of which the ring is a part.

TOOTHED RING (TONE WHEEL) INSPECTION

Condition	Code		Procedure
Alignment incorrect	B	..	Require repair or replacement.
Bent	B	.....	Require replacement.
Contaminated, affecting performance	A	....	Require repair. Identify and correct cause.
Cracked	B	.....	Require replacement.
Loose	A	.....	Require replacement of worn parts.
Missing	C	.....	Require replacement.
Number of teeth			

incorrect	B		Require replacement.
Teeth broken	A		Require replacement.
Teeth damaged, affecting performance	A		Require replacement.

TORQUE CONVERTERS

TORQUE CONVERTER INSPECTION

Condition	Code	Procedure
Converter clutch lock-up operation is faulty	A	Require replacement.
Cover shell damaged, affecting performance	A	Require replacement.
Does not meet stall speed specification	B	Require replacement.
End play exceeds specifications	B	Require replacement.
Hub broken	A	Require replacement.
Hub cracked	A	Require replacement.
Internal component failure	A	Require replacement.
Leaking	A	Require repair or replacement.
Pilot broken	A	Require replacement.
Pilot worn, affecting performance	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Weights missing	C	Require replacement.

TRANSAXLE MOUNTS

See MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION).

TRANSDUCERS (TRANSMISSION)

See SENSORS.

TRANSMISSION COOLERS

TRANSMISSION COOLER INSPECTION

Condition	Code	Procedure
Air flow obstruction	A	Require repair.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connection leaking	A	Require repair or replacement.
Contaminated	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Fins damaged, affecting		

performance	A	..	Require repair or replacement.
Fins damaged, not affecting performance			No service suggested or required.
Internal restrictions ...	B	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	..	Require repair or replacement.
Tubes damaged, affecting performance	A	..	Require repair or replacement.
Tubes damaged, not affecting performance			No service suggested or required.

TRANSMISSION MOUNTS

See MOUNTS (ENGINE, TRANSAXLE AND TRANSMISSION).

TRANSMISSION PANS

TRANSMISSION PAN INSPECTION

Condition	Code		Procedure
Bent, interfering with filter or other internal components	A	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.

TRANSMISSION RANGE INDICATORS (PRNDL)

TRANSMISSION RANGE INDICATOR (PRNDL) INSPECTION

Condition	Code		Procedure
Binding	A	..	Require repair or replacement.
Broken	A	..	Require repair or replacement.
Components missing	C	..	Require replacement of missing components.
Loose, affecting performance	A	..	Require repair or replacement.
Out of adjustment	A	.....	Require repair.
Worn, affecting performance	A	..	Require repair or replacement.

TUBES

See HOSES, LINES AND TUBES.

UNIVERSAL JOINTS (CARDON OR CROSS TYPE)

UNIVERSAL JOINT (CARDON OR CROSS TYPE) INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing cap distorted	B	Require replacement.
Binding	A	Require replacement.
Cross (trunion) worn, affecting performance	A	Require replacement.
Double cardon centering ball damaged	A	Require replacement.
Double cardon centering ball worn, affecting performance	A	Require replacement.
Double cardon centering spring broken	A	Require replacement.
Double cardon centering spring missing	C	Require replacement.
Double cardon centering spring weak	A	Require replacement.
End cap seal cracked	2	Suggest replacement.
End cap seal missing	C	Require replacement of seal.
Grease fitting broken	A	(1) Require replacement of grease fitting.
Grease fitting missing	C	(2) Require replacement of grease fitting.
Rust-colored powder around end cap seals	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Worn, affecting performance	A	Require replacement.

(1) - A broken grease fitting does not require replacement of the U-Joint.
(2) - A missing grease fitting does not require replacement of the U-Joint.

VACUUM CONTROLS

See ACTUATORS (VACUUM).

VACUUM HOSES

See HOSES, LINES AND TUBES.

VACUUM MOTORS

See ACTUATORS (VACUUM).

VACUUM-OPERATED SWITCHES

See SWITCHES.

VEHICLE SPEED SENSORS

See SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE).

VENTS

VENT INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Plugged	A	(1) Require repair or replacement.

(1) - A plugged vent may force fluid past the seal.

VIBRATION DAMPERS

VIBRATION DAMPER INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Out of position	B	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

WHEEL ATTACHMENT HARDWARE

NOTE: For conditions noted below, also check conditions of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHMENT HARDWARE INSPECTION

Condition	Code	Procedure
Bent	A	Require replacement.
Broken	A	(1) Require replacement.
Loose	B	Require repair or replacement of affected component.
Lug nut installed backward	B	Require repair or replacement.
Lug nut mating surface dished	A	Require replacement of nut.
Lug nut mating type incorrect	B	Require replacement of nut.
Lug nut rounded	A	(2) Require replacement of nut.
Lug nut seized	A	(2) Require replacement of nut.
Stud incorrect	B	Require replacement of stud.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.
(2) - Only required if removing wheel.

WHEEL SPEED SENSORS

See SPEED SENSORS (ELECTRONIC WHEEL AND VEHICLE).

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Transmission connector leaking		See TRANSMISSION ASSEMBLY.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

YOKES AND SLIP YOKES

YOKE AND SLIP YOKE INSPECTION

Condition	Code	Procedure
Bearing cap bore distorted	A	Require repair or replacement.
Bent	A	Require replacement.
Bolt holes elongated	A	Require repair or replacement.
Bushing or seal surface worn, affecting performance	A	Require repair or replacement.
Leaking through soft yoke plug	A	Require repair or replacement of soft yoke plug.
Retainer strap bent	A	Require replacement of retainer strap.
Slip yoke broken	A	Require replacement.
Splines worn, affecting performance	A	Require replacement.
Splines worn close to the end of their useful life	1	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
U-bolt damaged, affecting performance	A	Require replacement of U-bolts.
Yoke damaged, affecting performance	A	Require repair or replacement.

ELECTRICAL COMPONENT LOCATOR - 2.4L 4-CYL

1997-99 Mitsubishi Montero Sport

1997-99 ELECTRICAL COMPONENT LOCATION
Mitsubishi Electrical Components - 2.4L 4-Cyl.

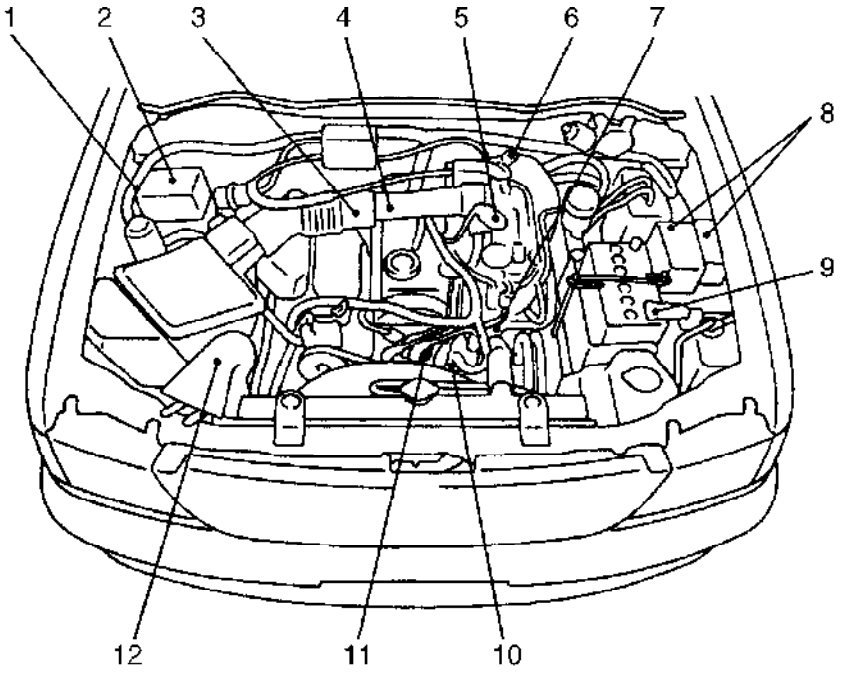
Mitsubishi; Montero Sport

SAFETY PRECAUTION

WARNING: When working on vehicles equipped with Supplemental Restraint System (SRS), never apply electrical voltage to the system. This could cause the SRS (air bag) to be deployed.

BUZZERS, RELAYS & TIMERS

Component	Component Location

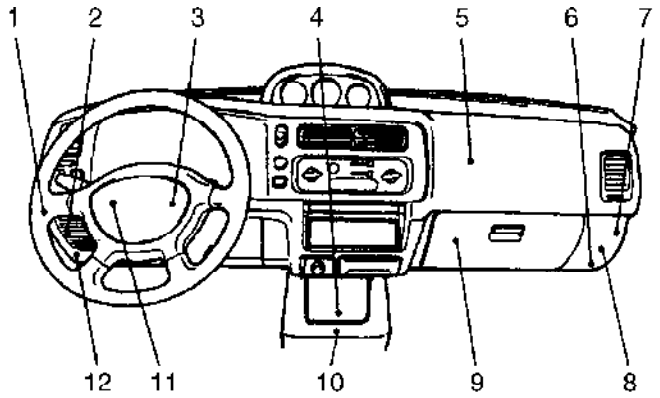


2.4L

1. ABS Relay & Horn Relay
2. ABS ECU
3. Volume Air Flow Sensor
4. Heated Oxygen Sensor (Front) (Calif.)
5. Throttle Position Sensor
6. Manifold Differential Pressure Sensor
7. Engine Coolant Temperature Sensor
8. Fuse/Relay Block (Engine Compartment)
9. Fusible Link No. 9
10. Crankshaft Position Sensor
11. Camshaft Position Sensor
12. Front Impact Sensor (Right)

97H00379

ABS Relay	On right rear side of engine compartment.



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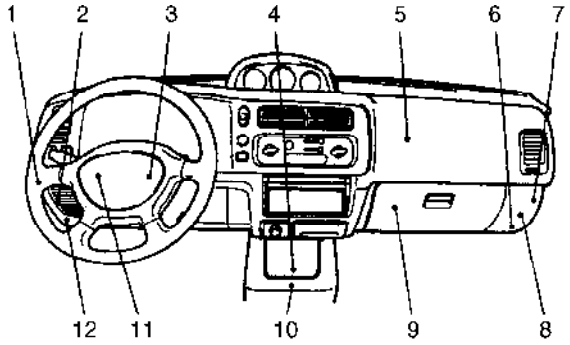
2. ETACS ECU & Tone Alarm ECU
3. Transmission Control Module
4. SRS ECU
5. Automatic Compressor ECU
6. 4WD Indicator ECU & Fuel Pump Control Module
7. Engine Control Module (ECM)
8. Fuel Pump Relay & Multiport Fuel Injection Relay
9. Defogger Relay
10. G Sensor (4WD & ABS)
11. Fuse/Relay Block (Passenger Compartment) Accessory Socket Relay, Defogger Timer, Power Window Relay, Rear Heater Relay & Intermittent Wiper Relay (Rear)
12. Auto-Cruise Control ECU

97B00381

Accessory Socket Relay	On passenger compartment fuse/relay block.
A/C Compressor Clutch Relay	In engine compartment fuse/relay block.
Blower Motor Relay	In engine compartment fuse/relay block.
Condenser Fan Motor Relay	In engine compartment fuse/relay block.



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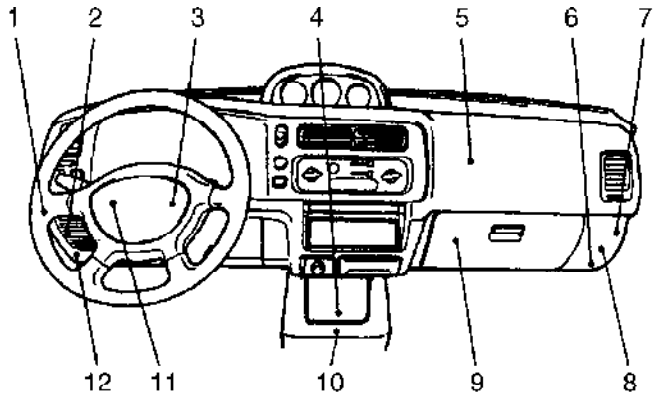
97B00381

Defogger Relay	Behind left side of glove box.



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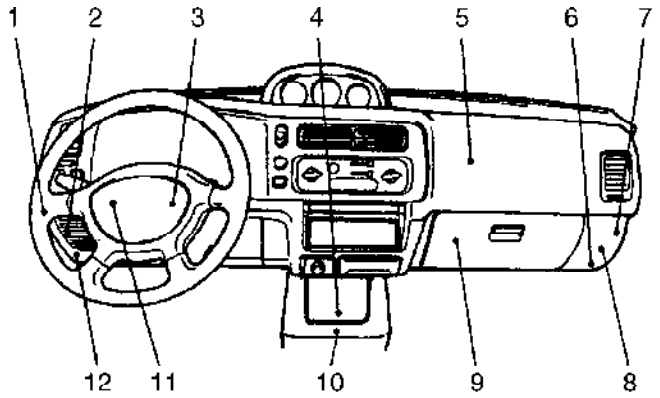
97B00381

Defogger Timer	On passenger compartment fuse/relay block.



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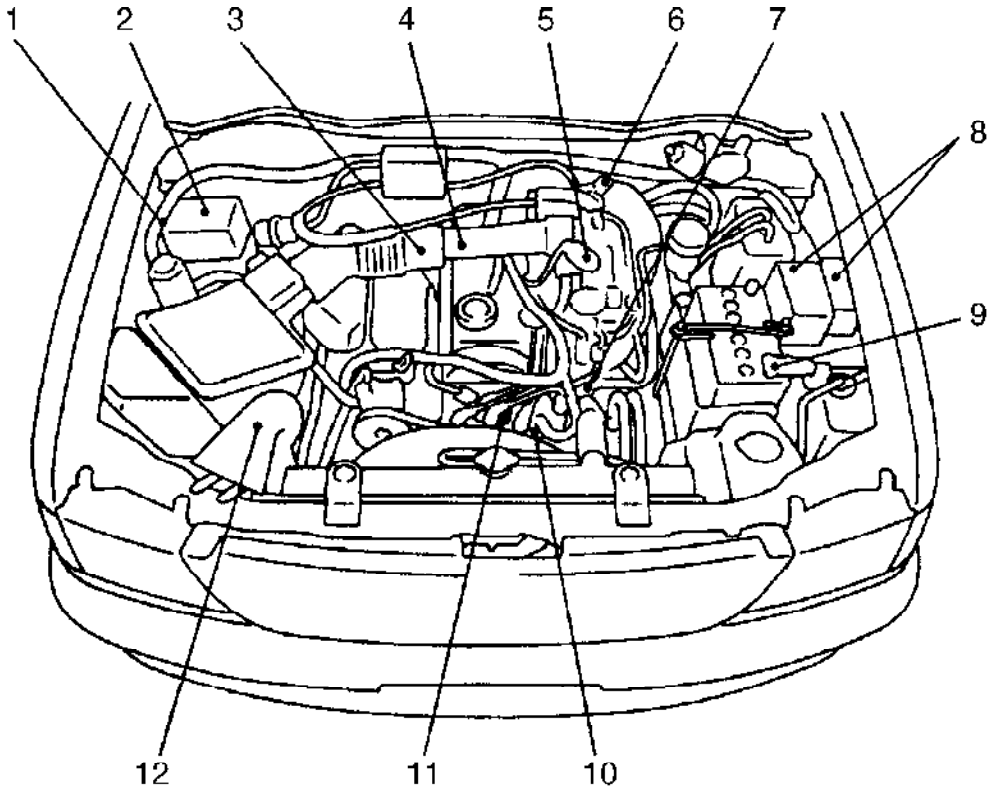
12. Auto-Cruise Control ECU

97B00381

Fuel Pump Relay	Behind right kick panel.
Generator Relay	In engine compartment fuse/relay block.
Headlamp Relay	In engine compartment fuse/relay block.



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5. Throttle Position Sensor
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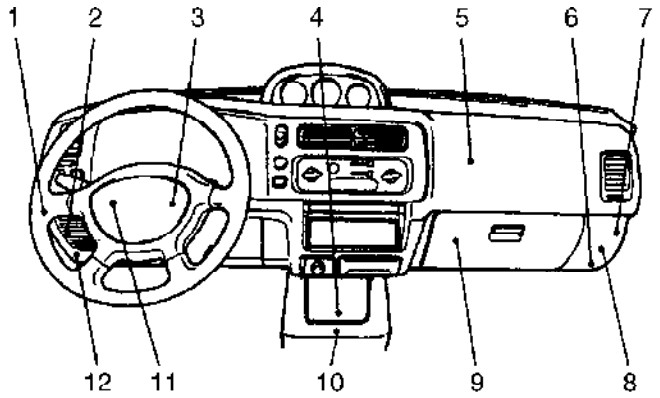
7. Engine Coolant Temperature Sensor
8. Fuse/Relay Block (Engine Compartment)
9. Fusible Link No. 9
10. Crankshaft Position Sensor
11. Camshaft Position Sensor
12. Front Impact Sensor (Right)

97H00379

Horn Relay	On right rear side of engine compartment.
Intermittent Wiper Relay (Front)	Built-in steering column switch.



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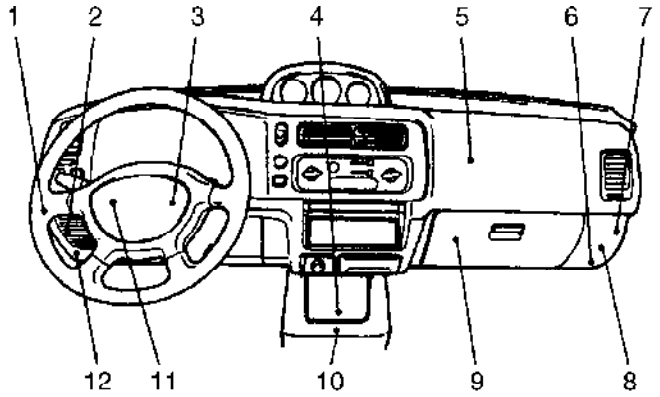
12. Auto-Cruise Control ECU

97B00381

Intermittent Wiper Relay (Rear)

On passenger compartment fuse/relay block.



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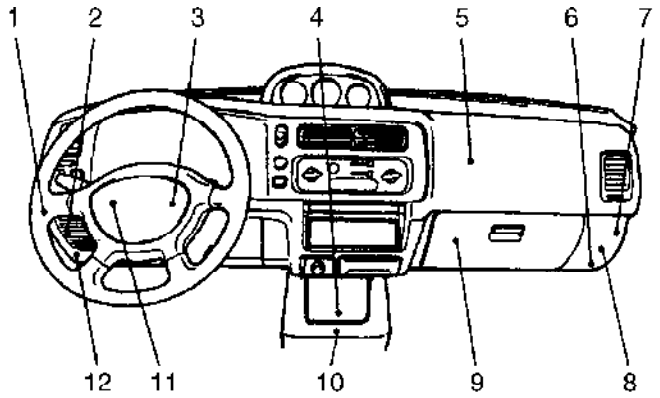
97B00381

Multiport Fuel Injection Relay

Behind right kick panel.



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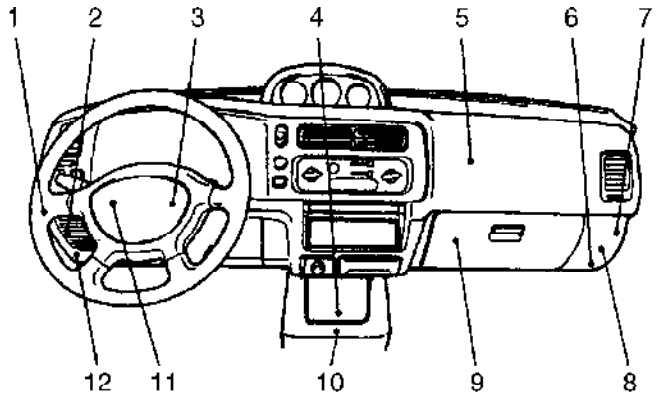
97B00381

Power Window Relay	On passenger compartment fuse/relay block.



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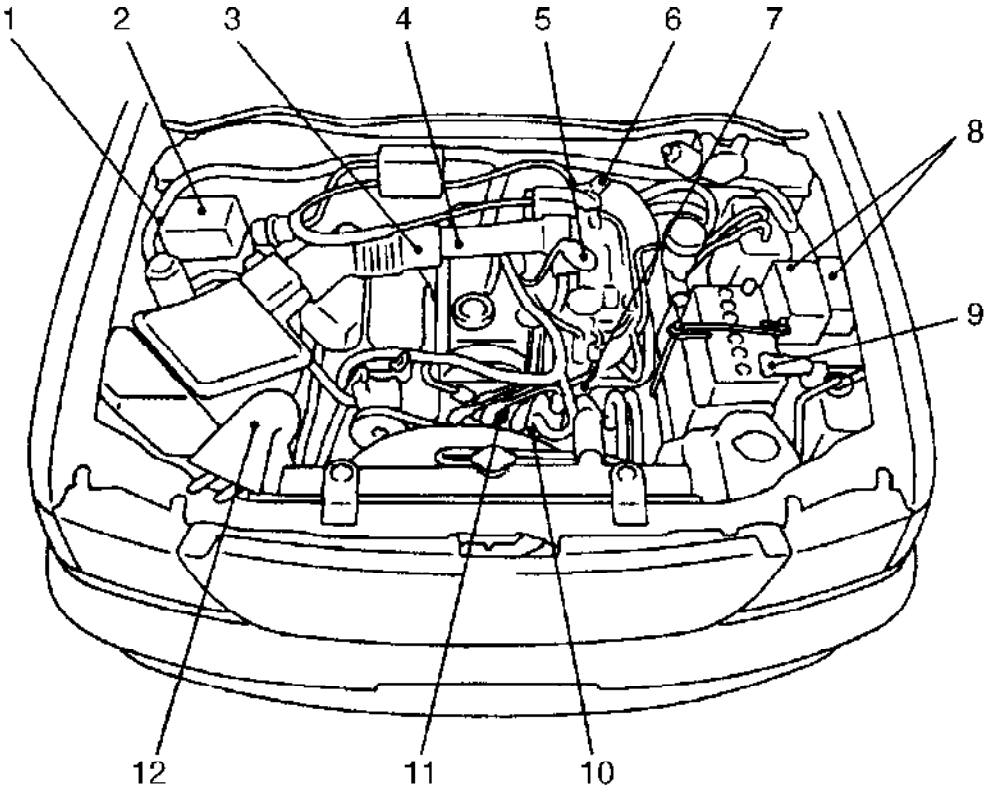
12. Auto-Cruise Control ECU

97B00381

Rear Heater Relay	On passenger compartment fuse/relay block.
Starter Relay	In engine compartment fuse/relay block.
Turn Signal & Hazard Warning Flasher Unit	Under left side of dash.

CIRCUIT PROTECTION DEVICES

Component	Component Location

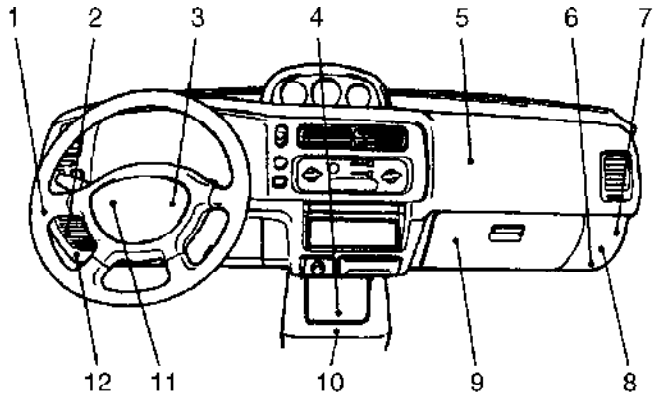


2.4L

1. ABS Relay & Horn Relay
2. ABS ECU
3. Volume Air Flow Sensor
4. Heated Oxygen Sensor (Front) (Calif.)
5. Throttle Position Sensor
6. Manifold Differential Pressure Sensor
7. Engine Coolant Temperature Sensor
8. Fuse/Relay Block (Engine Compartment)
9. Fusible Link No. 9
10. Crankshaft Position Sensor
11. Camshaft Position Sensor
12. Front Impact Sensor (Right)

97H00379

Fuse/Relay Block (Engine Compartment)	On left inner fender panel.



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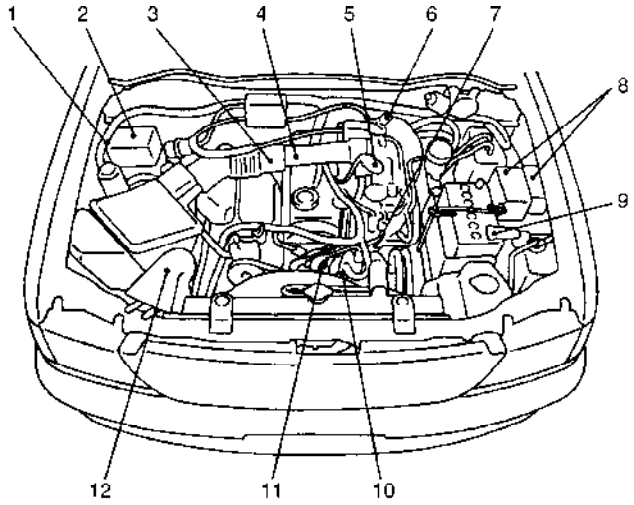
12. Auto-Cruise Control ECU

97B00381

Fuse/Relay Block (Passenger Compartment)	Behind left side of dash.
Fusible Links No. 1-8	In engine compartment fuse/relay block.



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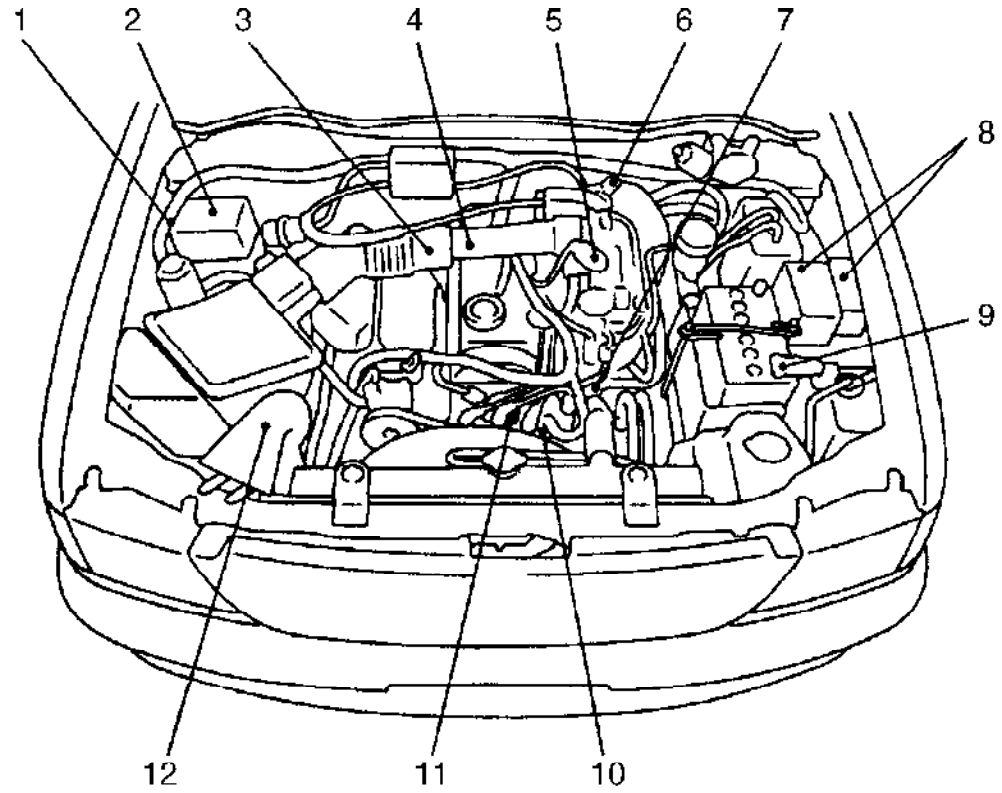
12. Front Impact Sensor (Right)

97H00379

Fusible Link No. 9	On positive battery terminal.

CONTROL UNITS

Component	Component Location



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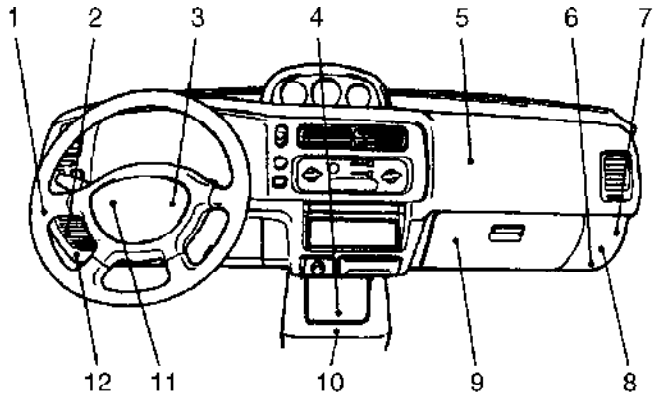
97H00379

ABS ECU	In right rear corner of engine compartment.



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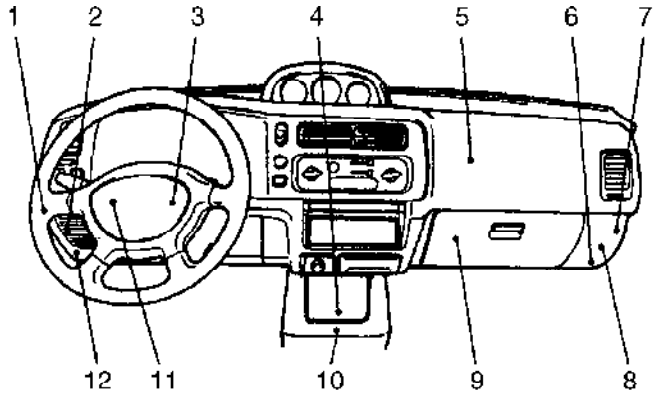
12. Auto-Cruise Control ECU

97B00381

Antenna Motor ECU — Under left side of dash.



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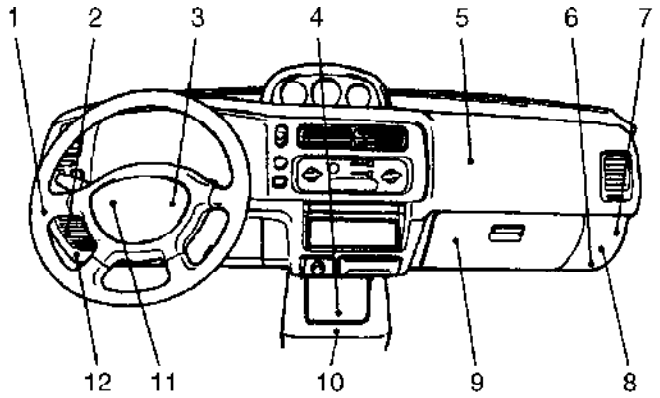
12. Auto-Cruise Control ECU

97B00381

Auto Cruise Control ECU — Behind left kick panel.



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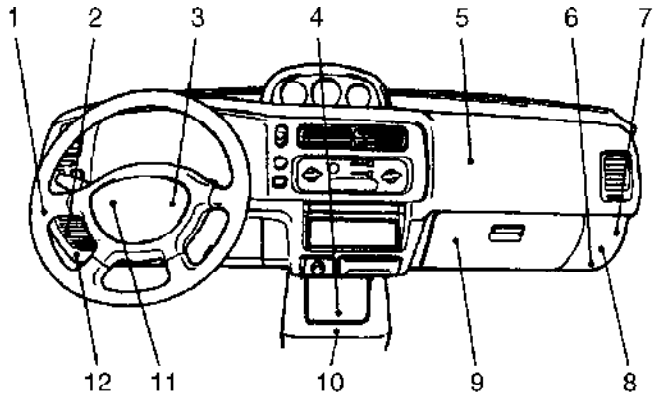
12. Auto-Cruise Control ECU

97B00381

Automatic Compressor ECU — Behind right side of dash, on top of evaporator case.



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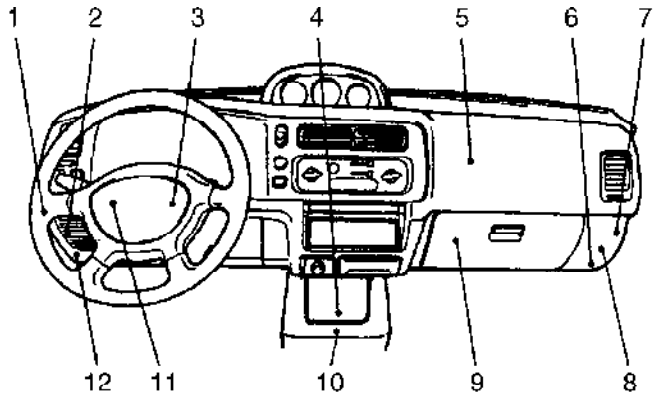
12. Auto-Cruise Control ECU

97B00381

Engine Control Module (ECM) — Behind right side of dash.



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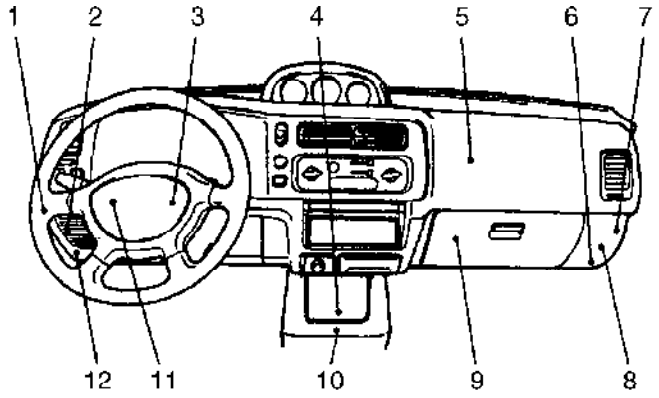
12. Auto-Cruise Control ECU

97B00381

ETACS ECU — Under left side of dash.



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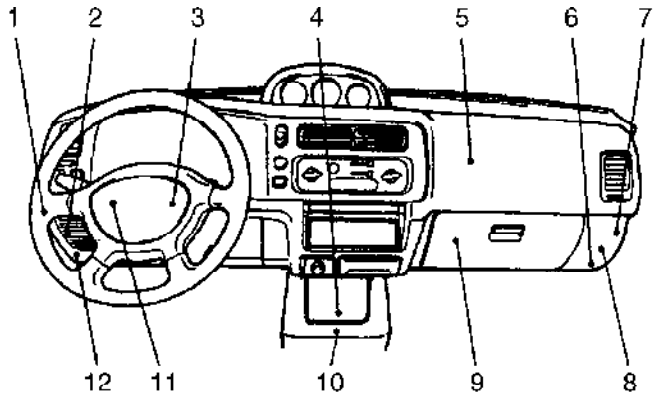
12. Auto-Cruise Control ECU

97B00381

Fuel Pump Control Module — Behind right kick panel.



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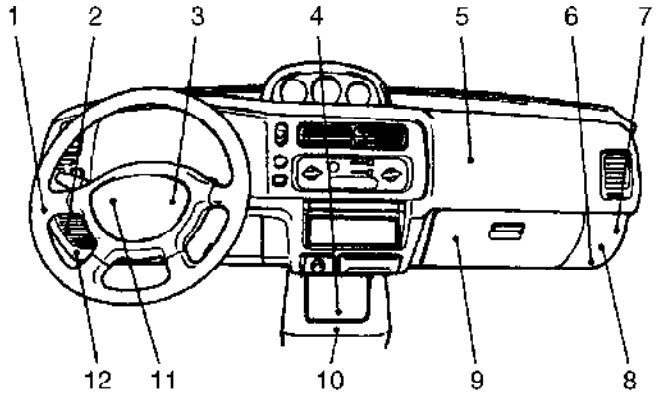
12. Auto-Cruise Control ECU

97B00381

SRS ECU — Behind center console.

Sunroof ECU — Under headliner, on right side of sunroof control panel.



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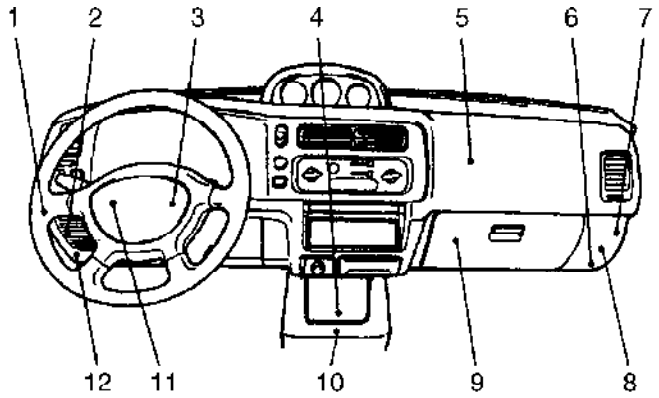
97B00381

Tone Alarm ECU — Under left side of dash.



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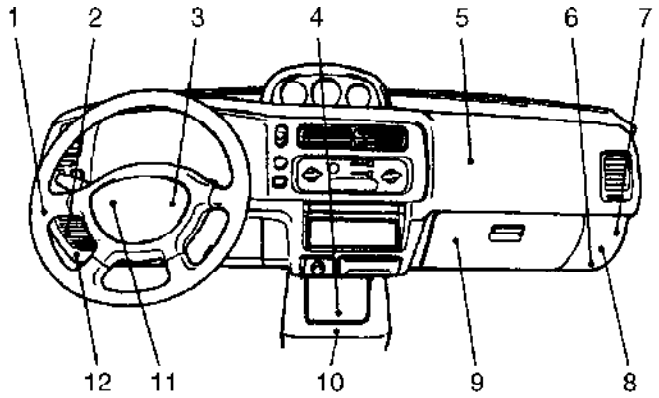
97B00381

Transmission Control Module	Behind left side of dash, above steering column.



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12. Auto-Cruise Control ECU

97B00381

4WD Indicator ECU	Behind right kick panel.

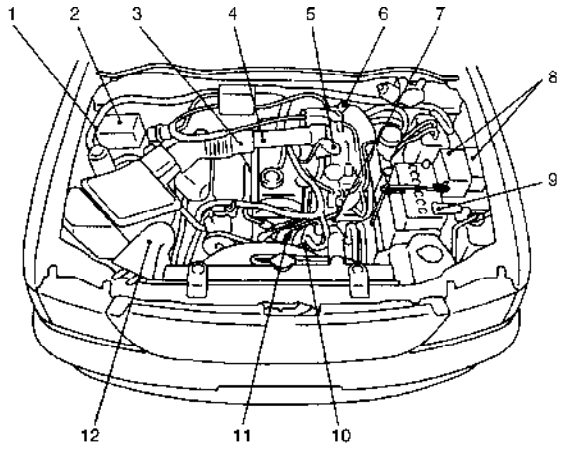
MOTORS

Component	Component Location
Auto-Cruise Vacuum Pump	In right rear corner of engine compartment

Blower Motor	Behind right side of dash.
Condenser Fan Motor	In left front of engine compartment.
Idle Air Control Motor	On throttle body.
Motor Antenna	Rear of right front wheelwell.
Rear Fan Motor Assembly	In rear of center console.
Rear Washer Motor	In right rear of vehicle.
Rear Wiper Motor	On center of tailgate.
Sunroof Motor	Behind headliner, in front of sunroof.
Windshield Washer Motor	Bottom of windshield washer reservoir.
Windshield Wiper Motor	On left side of firewall.

SENDING UNITS & SENSORS

Component	Component Location
A/T Fluid Temperature Sensor	On top of transmission.



2.4L

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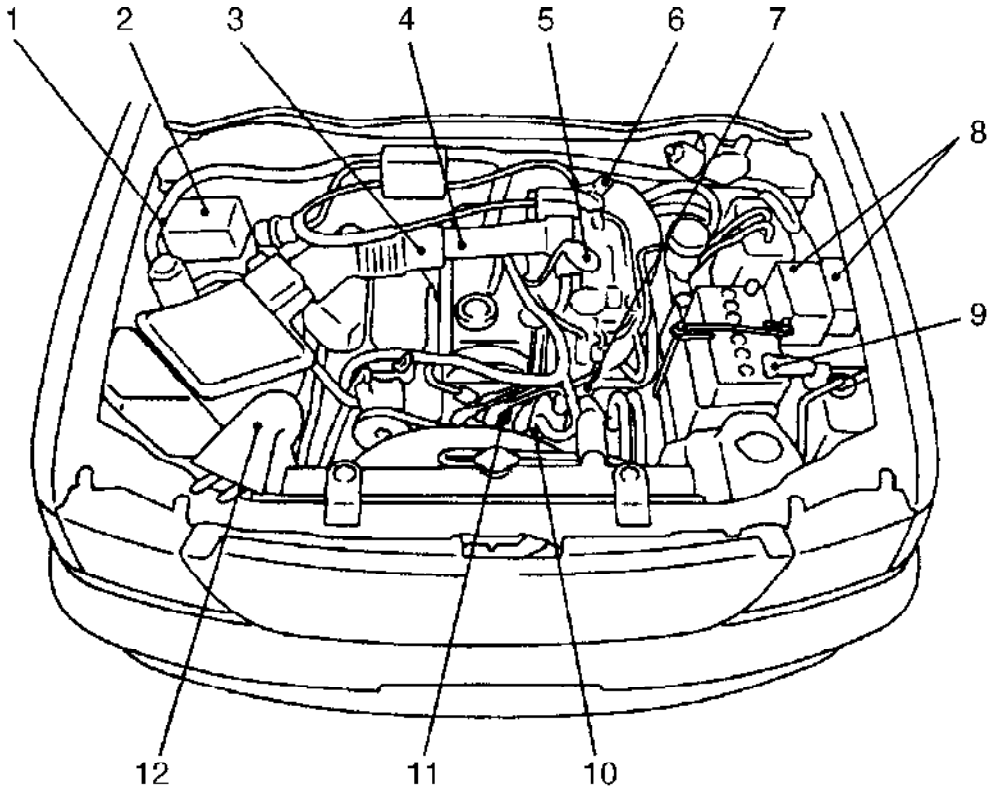
11. Camshaft Position Sensor
12. Front Impact Sensor (Right)

97H00379

Camshaft Position Sensor (Built-In Distributor)	On front of engine.



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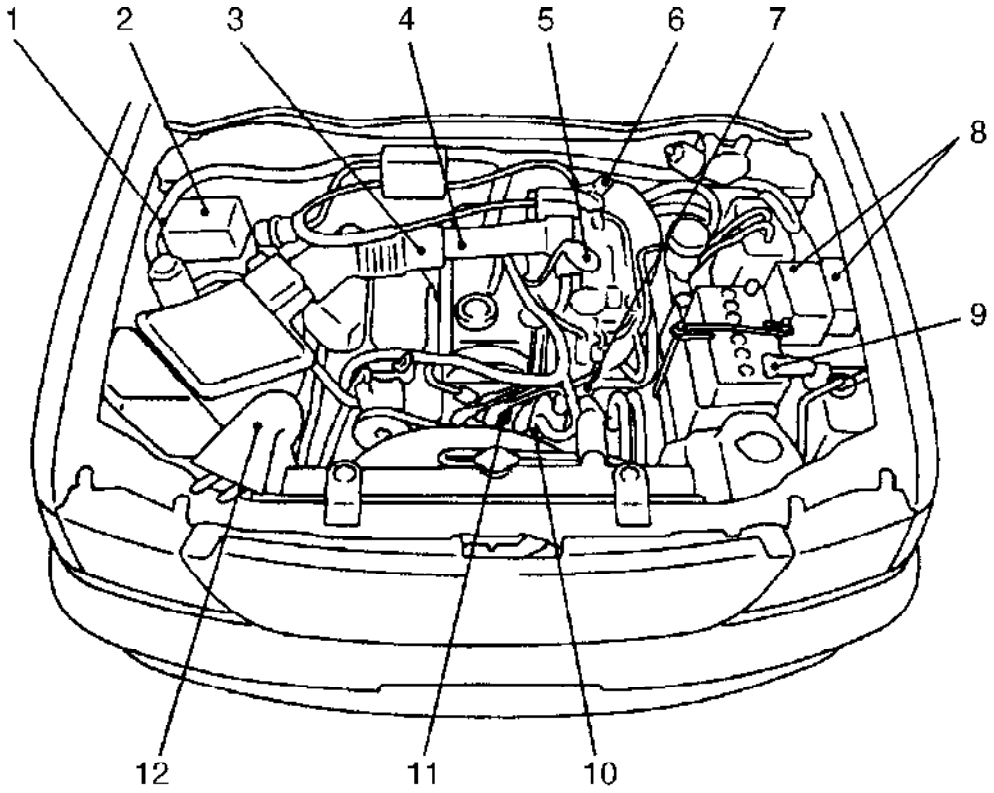
97H00379

Crankshaft Position Sensor	On front center of engine.
Engine Coolant Temperature Gauge	In rear center of engine compartment.



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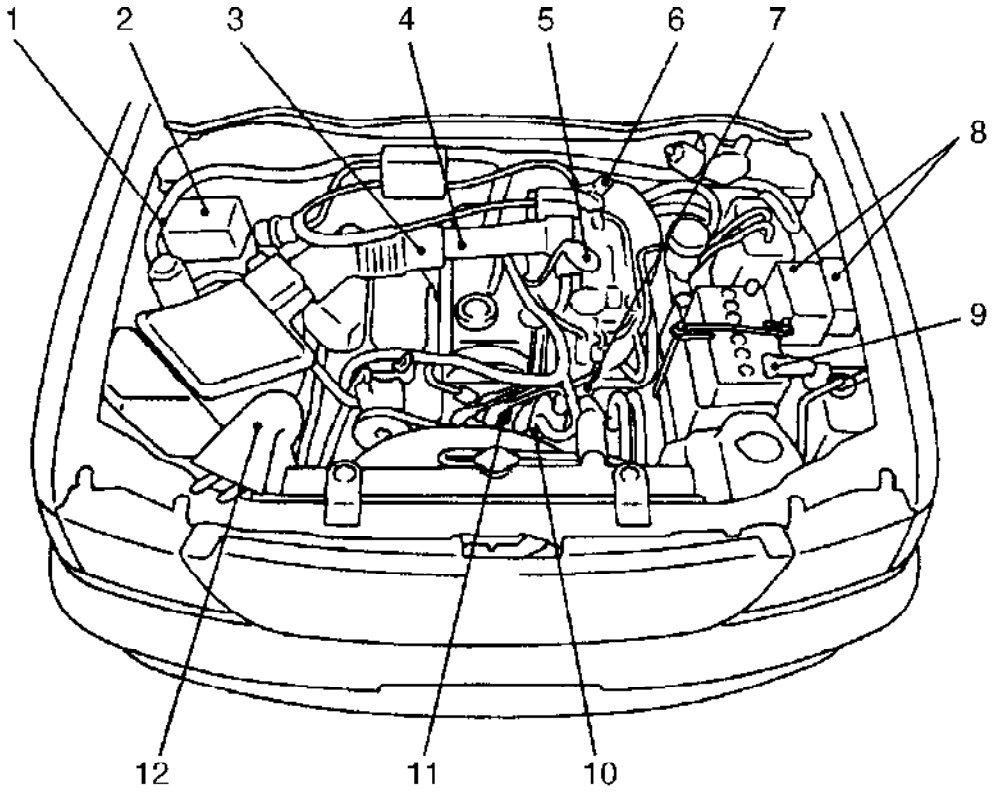
12. Front Impact Sensor (Right)

97H00379

Engine Coolant Temperature Sensor	In left front of engine compartment.
Front Impact Sensor (Left)	In left front of engine compartment.



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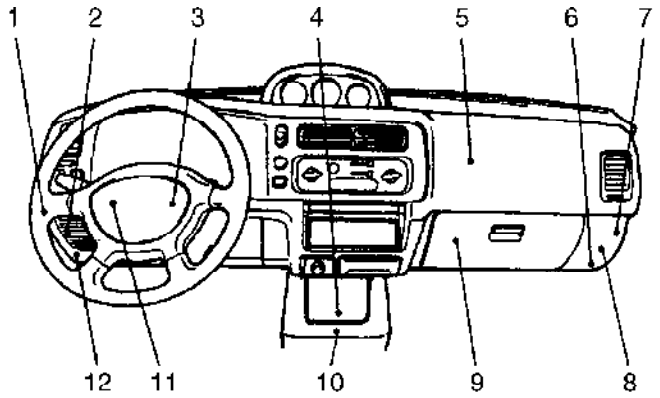
12. Front Impact Sensor (Right)

97H00379

Front Impact Sensor (Right)	In right front of engine compartment.
Fuel Tank Differential Pressure Sensor	Top of fuel tank.



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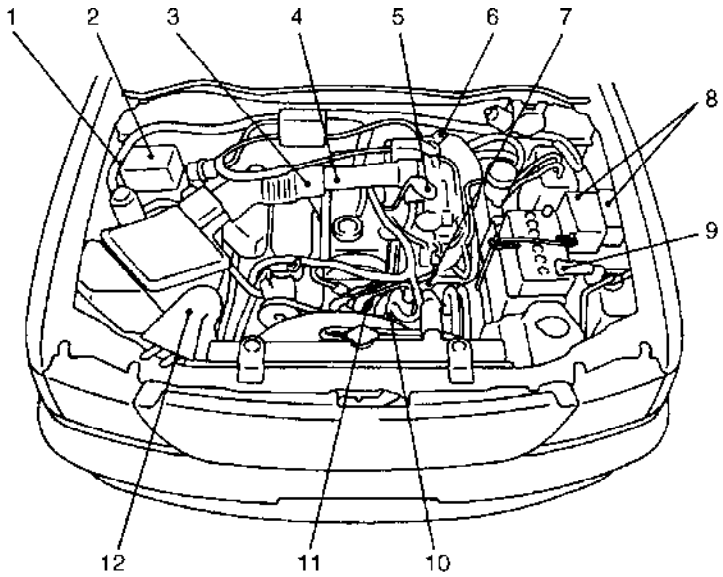
97B00381

G Sensor (4WD & ABS)	Behind center console.



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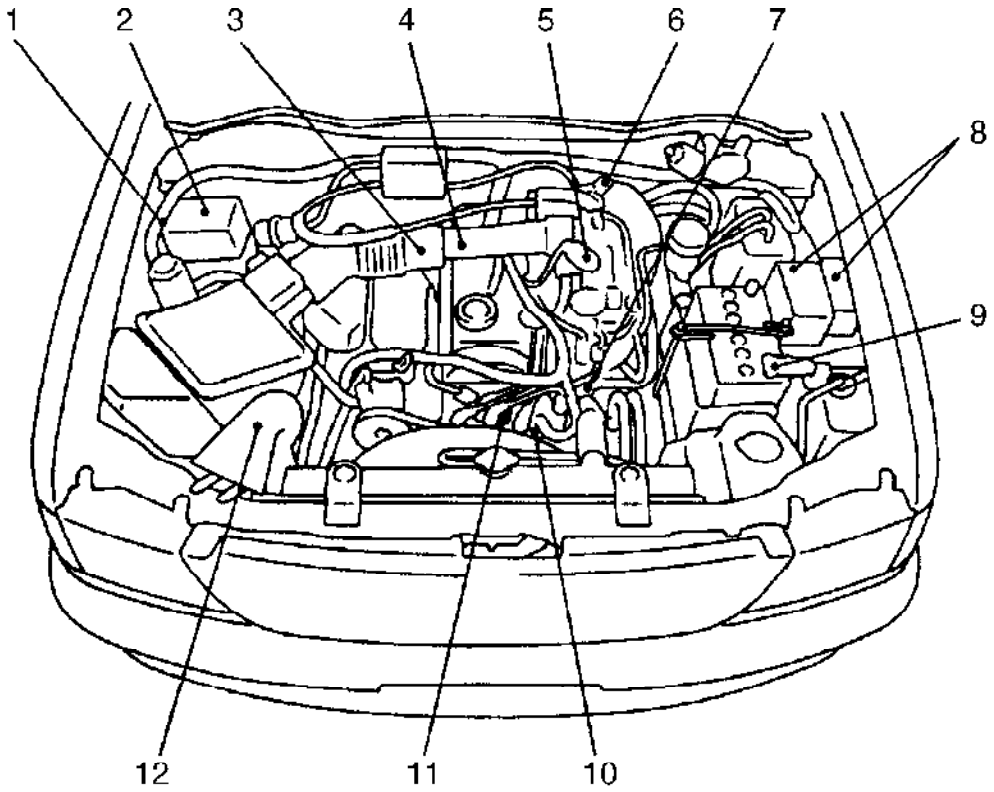
12. Front Impact Sensor (Right)

97H00379

Heated Oxygen Sensor (Front) (Calif.)	In rear center of engine compartment.

Heated Oxygen Sensor (Front)

(Federal)	Underside of vehicle, forward of catalytic converter.
Heated Oxygen Sensor (Rear) (Calif.)	Underside of vehicle, rear of catalytic converter.
Heated Oxygen Sensor (Rear) (Federal)	Underside of vehicle, rear of catalytic converter.



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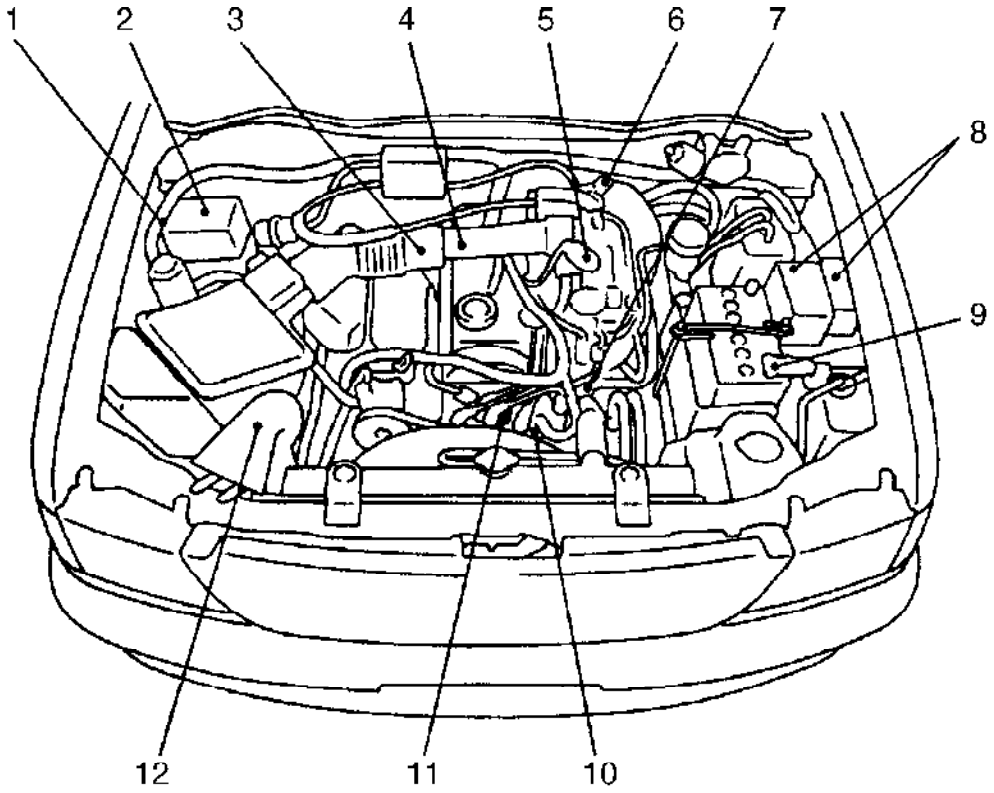
97H00379

Manifold Differential Pressure Sensor	In left rear of engine compartment.
Oil Pressure Gauge Unit	On lower left front of engine.
Outside Air Temperature Sensor	Below left headlamp.



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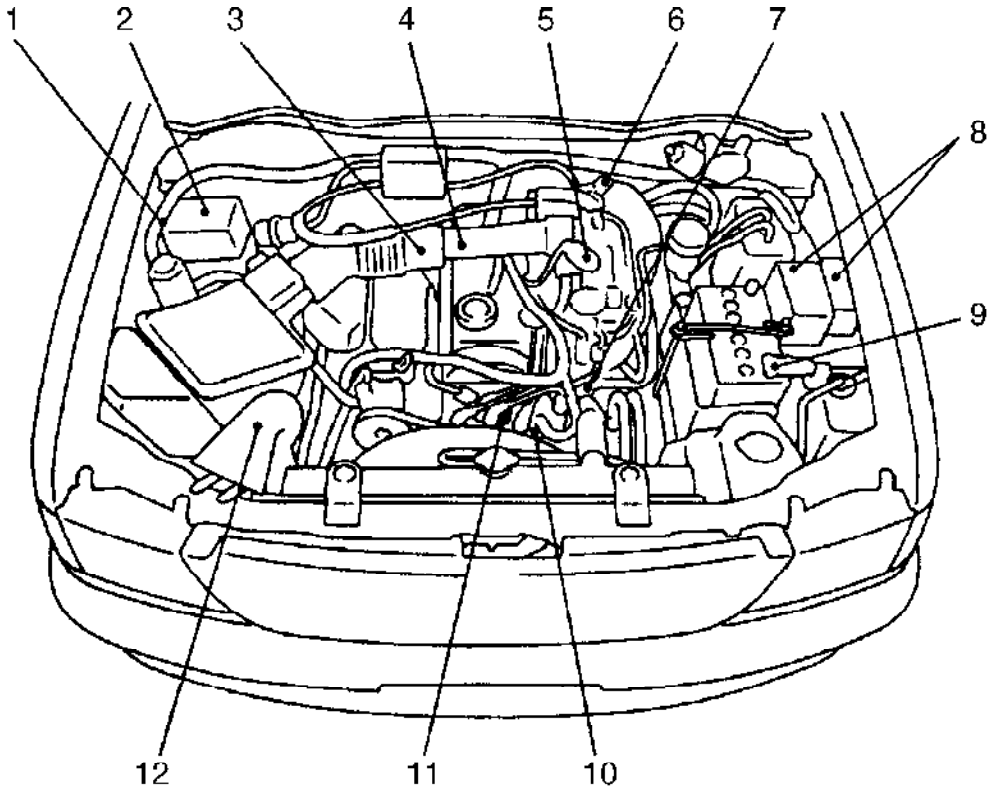
97H00379

Throttle Position Sensor	On throttle body.
Vehicle Speed Sensor (VSS)	On transmission tailshaft.



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97H00379

Volume Air Flow Sensor	In air cleaner duct (includes intake air temperature sensor & barometric pressure sensor).
Wheel Speed Sensors (4)	On bracket, on each wheel hub.

SOLENOIDS & SOLENOID VALVES

Component	Component Location
EGR Solenoid	In left side of engine compartment.
ELC 4-Speed A/T Control Solenoid	On top of transmission.
Evaporative Emission Purge Solenoid	In left side of engine

	compartment.
Evaporative Ventilation Solenoid	In left rear of engine compartment.
Solenoid Valves A & B	In right side of engine compartment.

SWITCHES

Component	Component Location
Back-Up Lamp Switch	On transmission.
Brake Fluid Level Switch	In left rear corner of engine compartment.
Clutch Pedal Position Switch	On bracket, above clutch pedal.
Dual Pressure Switch	On high pressure line, on receiver-drier.
Free Wheeling Engage Switch	In right rear of engine compartment.
High Range/Low Range Detection Switch	On transfer case.
Low Range Operation Detection Switch	On transfer case.
Oil Pressure Switch	On lower right front of engine.
Park/Neutral Position Switch	On top of transmission.
Parking Brake Switch	At base of parking brake lever.
Power Steering Pressure Switch	In right side of engine compartment.
Refrigerant Temperature Switch	In left front of engine compartment.
Seat Belt Switch	On driver-side seat belt buckle.
Stop Lamp Switch	On bracket, above brake pedal.
4WD Detection Switch	On transfer case.

MISCELLANEOUS

Component	Component Location

Amplifier	Above right rear wheelwell, behind trim panel.
Blower Resistor	Behind right side of dash, near blower motor.
Capacitor	Top left side of engine, near ignition coil.
Data Link Connector (DLC)	Under left side of dash, near fuse/relay block.
Diode (For MFI System Circuit)	Behind right side of dash.
Engine Speed Detection Connector	In left rear corner of engine compartment.
Fuel Pump Check Connector	In right rear corner of engine compartment.
Ignition Power Transistor	On top left side of engine, near ignition coil.
Noise Filter	On top left side of engine, near ignition coil.
Rear Fan Motor Resistor	In rear of center console, near fan motor assembly.

ELECTRICAL COMPONENT LOCATOR - 3.0L V6

1997-99 Mitsubishi Montero Sport

1997-99 ELECTRICAL COMPONENT LOCATION
Mitsubishi Electrical Components - 3.0L V6

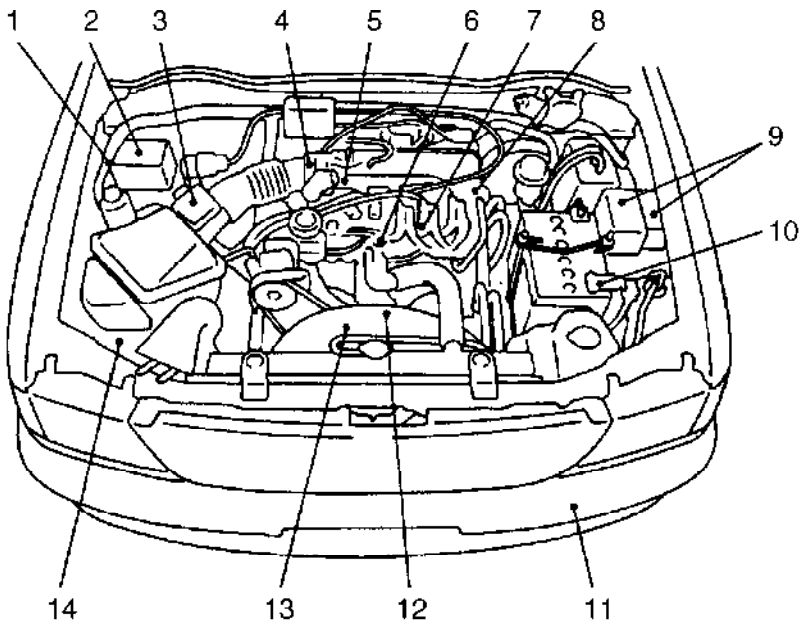
Mitsubishi; Montero Sport

SAFETY PRECAUTION

WARNING: When working on vehicles equipped with Supplemental Restraint System (SRS), never apply electrical voltage to the system. This could cause the SRS (air bag) to be deployed.

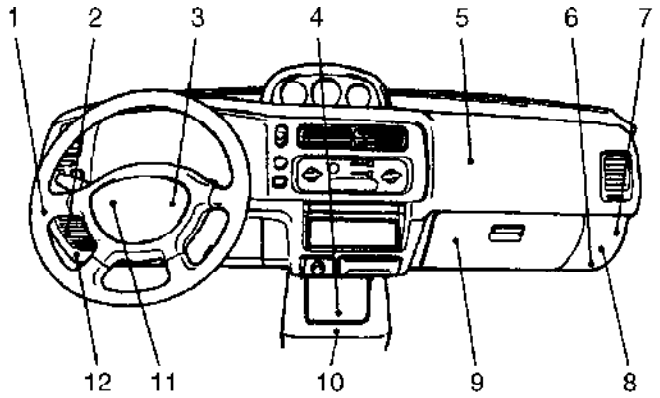
BUZZERS, RELAYS & TIMERS

Component	Component Location
97A00380	
ABS Relay	On right rear side of engine compartment.



3.0L

1. ABS Relay & Horn Relay
2. ABS ECU
3. Volume Air Flow Sensor
4. Throttle Position Sensor
5. Heated Oxygen Sensor (Right Bank Front) (Calif.)
6. Engine Coolant Temperature Sensor
7. Manifold Differential Pressure Sensor
8. Heated Oxygen Sensor (Left Bank Front) (Calif.)
9. Fuse/Relay Block (Engine Compartment)
10. Fusible Link No. 9
11. Outside Air Temperature Sensor
12. Camshaft Position Sensor
13. Crankshefft Position Sensor
14. Front Impact Sensor (Right)



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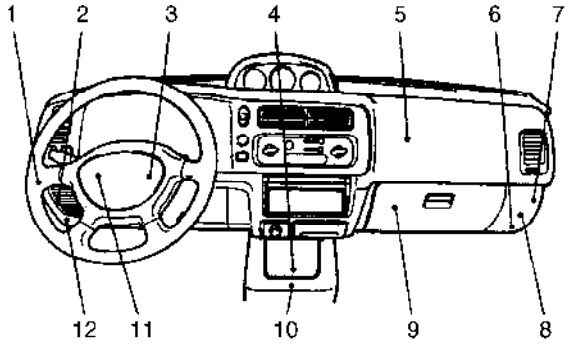
7. Engine Control Module (ECM)
8. Fuel Pump Relay & Multiport Fuel Injection Relay
9. Defogger Relay
10. G Sensor (4WD & ABS)
11. Fuse/Relay Block (Passenger Compartment) Accessory Socket Relay, Defogger Timer, Power Window Relay, Rear Heater Relay & Intermittent Wiper Relay (Rear)
12. Auto-Cruise Control ECU

97B00381

Accessory Socket Relay	On passenger compartment fuse/relay block.
A/C Compressor Clutch Relay	In engine compartment fuse/relay block.
Blower Motor Relay	In engine compartment fuse/relay block.
Condenser Fan Motor Relay	In engine compartment fuse/relay block.



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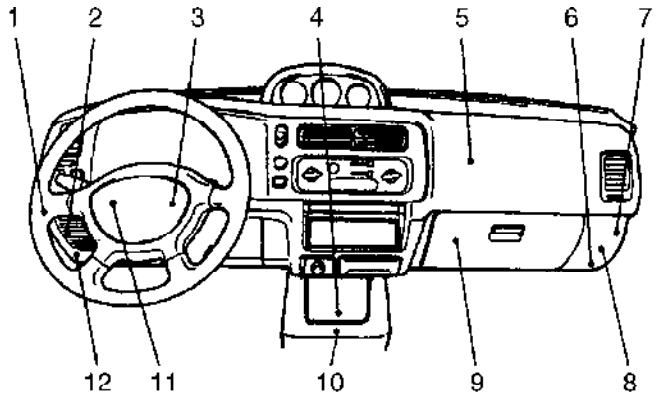
97B00381

Defogger Relay	Behind left side of glove box.



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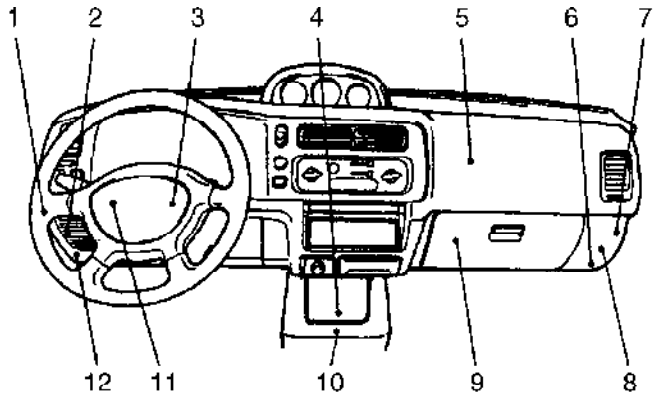
Defogger Timer	On passenger compartment fuse/relay block.



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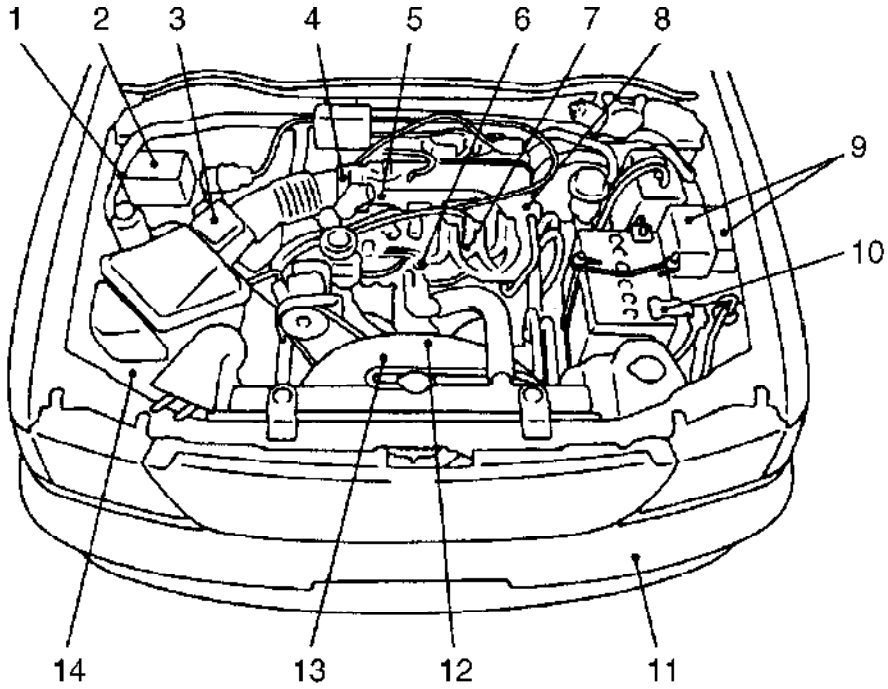
12. Auto-Cruise Control ECU

97B00381

Fuel Pump Relay	Behind right kick panel.
Generator Relay	In engine compartment fuse/relay block.
Headlamp Relay	In engine compartment fuse/relay block.



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8. Heated Oxygen Sensor (Left Bank Front) (Calif.)
9. Fuse/Relay Block (Engine Compartment)
10. Fusible Link No. 9
11. Outside Air Temperature Sensor
12. Camshaft Position Sensor
13. Crankshaft Position Sensor
14. Front Impact Sensor (Right)

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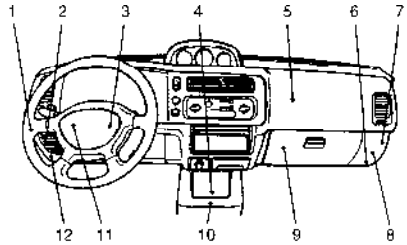
Horn Relay	On right rear side of engine compartment.
Intermittent Wiper Relay (Front)	Built-in steering column switch.



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12. Auto-Cruise Control ECU

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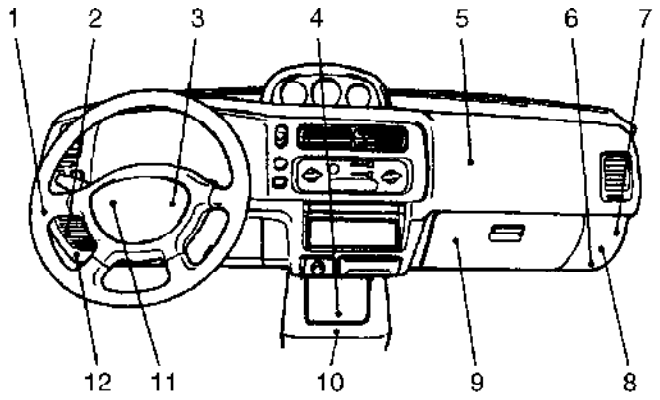
Intermittent Wiper Relay (Rear)	On passenger compartment

fuse/relay block.



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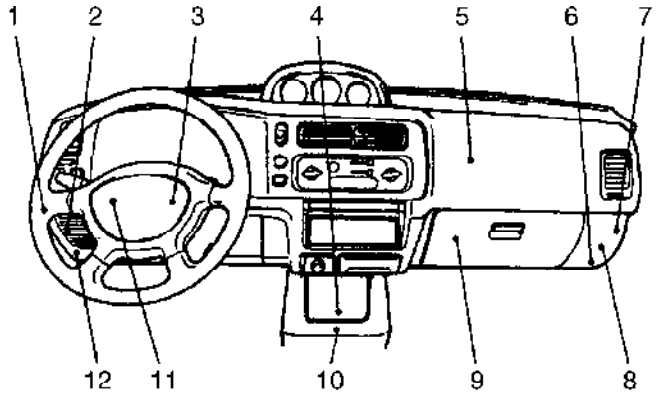
97B00381

Multiport Fuel Injection Relay

Behind right kick panel.



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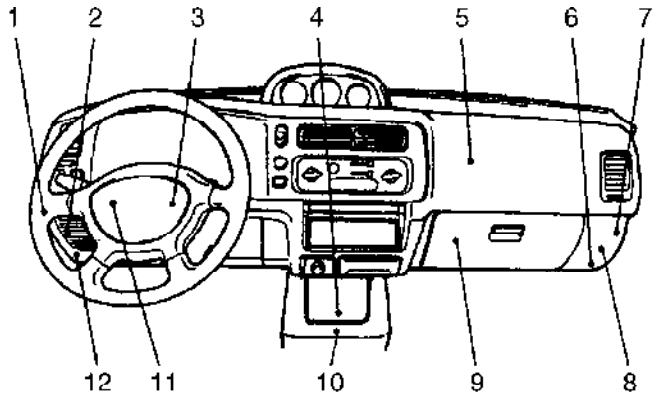
Power Window Relay

On passenger compartment fuse/relay block.



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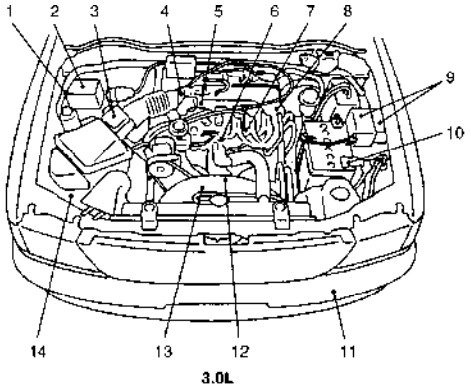
Rear Heater Relay	On passenger compartment fuse/relay block.
Starter Relay	In engine compartment fuse/relay block.
Turn Signal & Hazard Warning Flasher Unit	Under left side of dash.

CIRCUIT PROTECTION DEVICES

Component	Component Location



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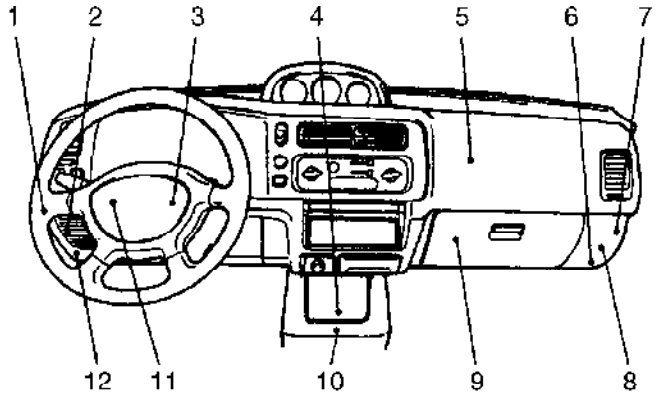
9. Fuse/Relay Block (Engine Compartment)
10. Fusible Link No. 9
11. Outside Air Temperature Sensor
12. Camshaft Position Sensor
13. Crankshaft Position Sensor
14. Front Impact Sensor (Right)

97A00380

Fuse/Relay Block (Engine Compartment)	On left inner fender panel.



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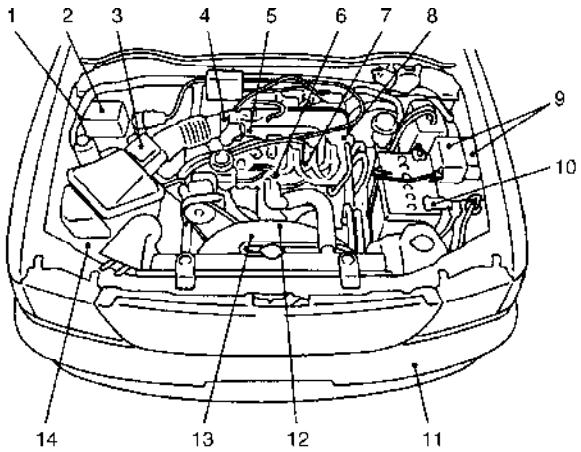
12. Auto-Cruise Control ECU

97B00381

Fuse/Relay Block (Passenger Compartment)	Behind left side of dash.
Fusible Links No. 1-8	In engine compartment fuse/relay block.



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12. Camshaft Position Sensor
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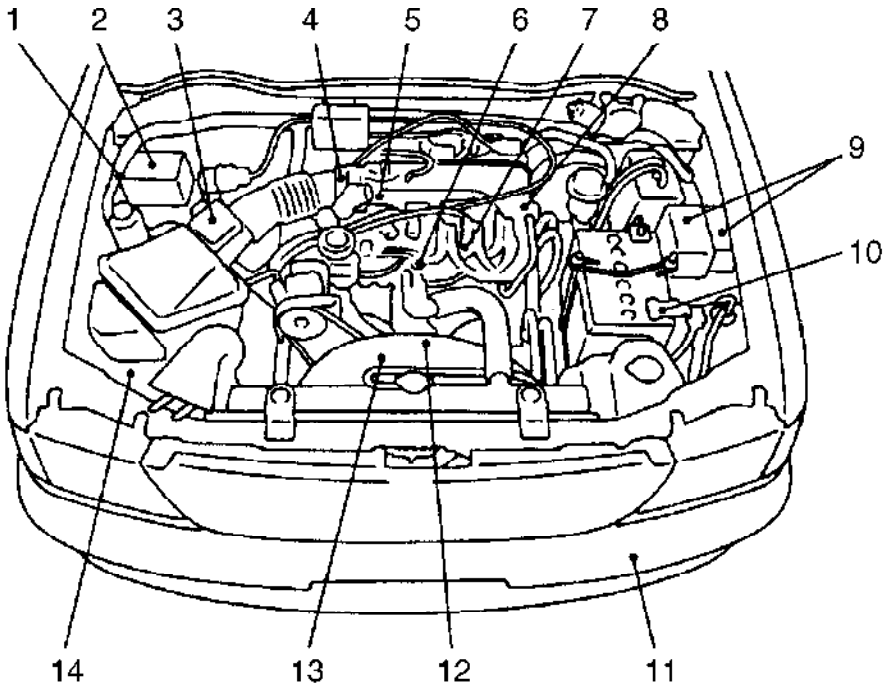
14. Front Impact Sensor (Right)

97A00380

Fusible Link No. 9	On positive battery terminal.

CONTROL UNITS

Component	Component Location



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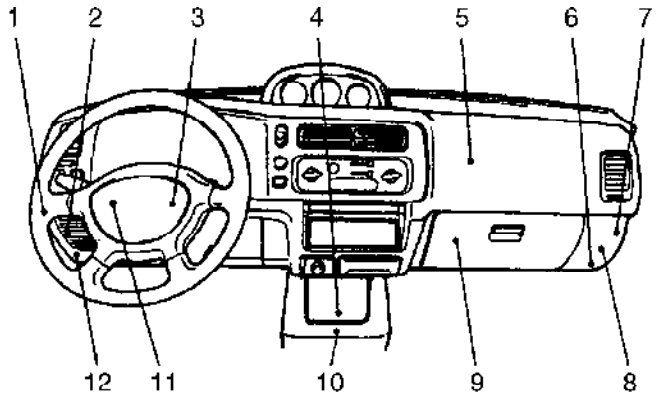
97A00380

ABS ECU	In right rear corner of engine compartment.



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12. Auto-Cruise Control ECU

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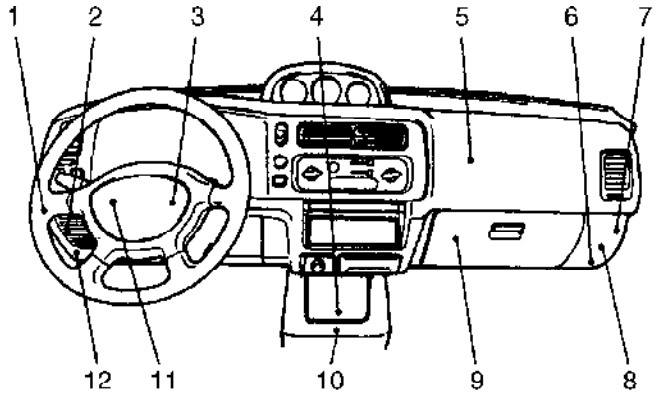
Antenna Motor ECU — Under left side of dash.



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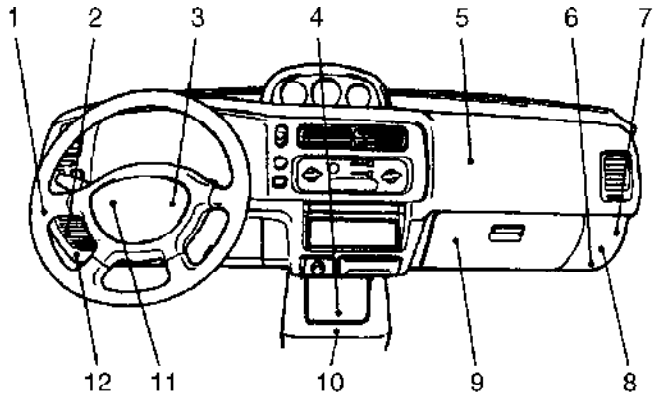
97B00381

Auto Cruise Control ECU — Behind left kick panel.



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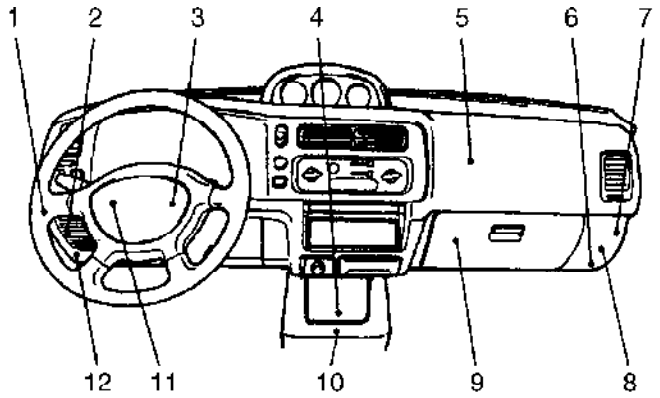
Automatic Compressor ECU — Behind right side of dash, on top of evaporator case.



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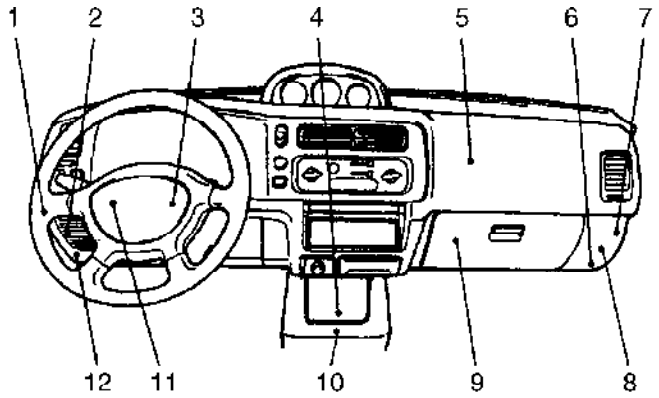
97B00381

Engine Control Module (ECM) — Behind right side of dash.



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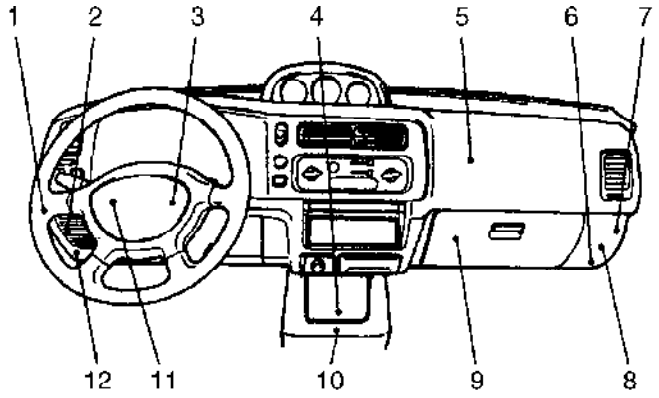
ETACS ECU — Under left side of dash.



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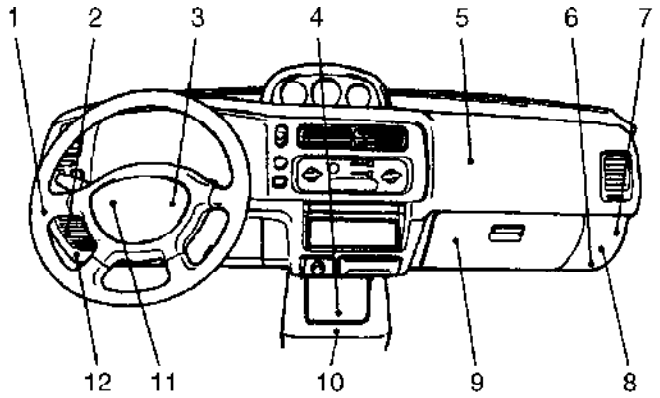
Fuel Pump Control Module — Behind right kick panel.



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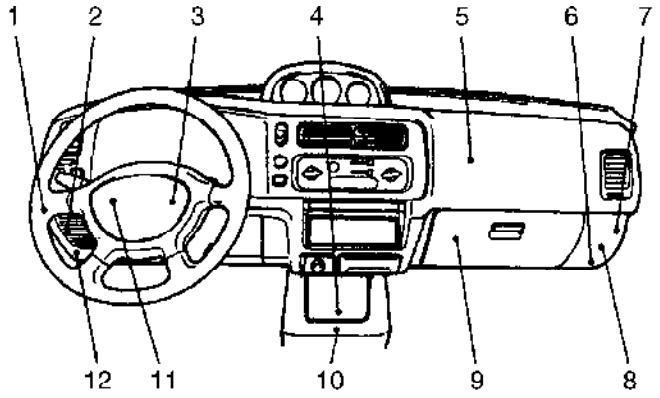
97B00381

SRS ECU — Behind center console.

Sunroof ECU — Under headliner, on right side of sunroof control panel.



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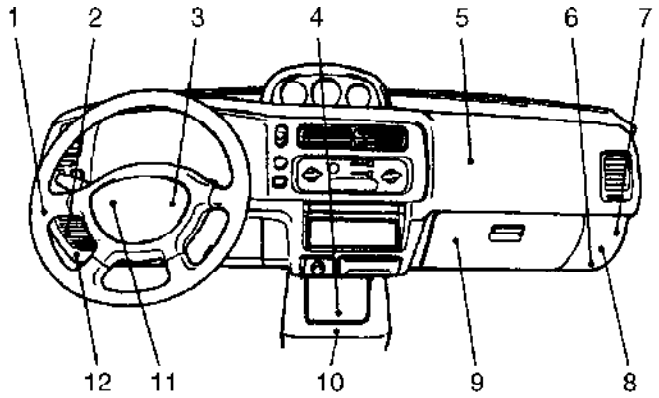
97B00381

Tone Alarm ECU — Under left side of dash.



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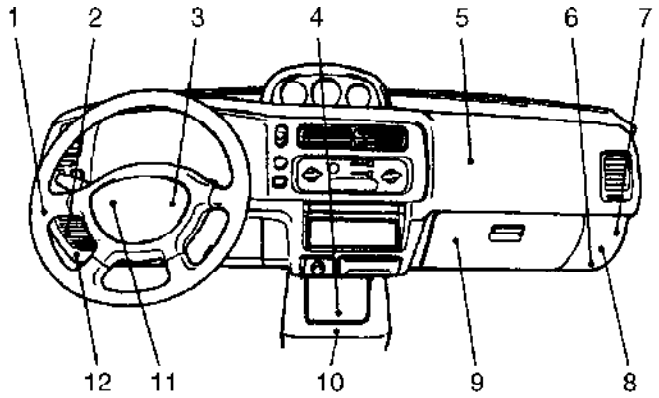
97B00381

Transmission Control Module	Behind left side of dash, above steering column.



1. Antenna Motor ECU
2. ETACS ECU & Tone Alarm ECU
3. Transmission Control Module
4. SRS ECU
5. Automatic Compressor ECU
6. 4WD Indicator ECU & Fuel Pump Control Module
7. Engine Control Module (ECM)
8. Fuel Pump Relay & Multiport Fuel Injection Relay
9. Defogger Relay
10. G Sensor (4WD & ABS)
11. Fuse/Relay Block (Passenger Compartment) Accessory Socket Relay, Defogger Timer, Power Window Relay, Rear Heater Relay & Intermittent Wiper Relay (Rear)
12. Auto-Cruise Control ECU

97B00381

4WD Indicator ECU	Behind right kick panel.

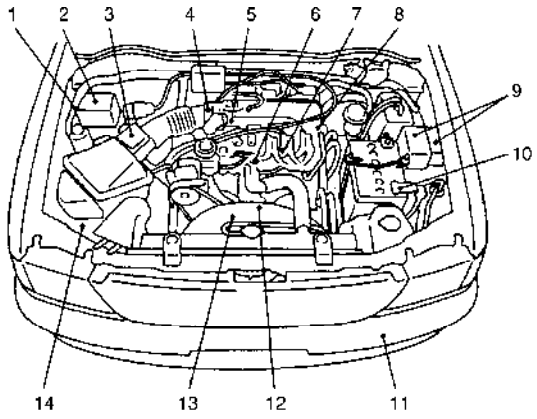
MOTORS

Component	Component Location
Auto-Cruise Vacuum Pump	In right rear corner of engine compartment

Blower Motor	Behind right side of dash.
Condenser Fan Motor	In left front of engine compartment.
Idle Air Control Motor	On throttle body.
Motor Antenna	Rear of right front wheelwell.
Rear Fan Motor Assembly	In rear of center console.
Rear Washer Motor	In right rear of vehicle.
Rear Wiper Motor	On center of tailgate.
Sunroof Motor	Behind headliner, in front of sunroof.
Windshield Washer Motor	Bottom of windshield washer reservoir.
Windshield Wiper Motor	On left side of firewall.

SENDING UNITS & SENSORS

Component	Component Location
A/T Fluid Temperature Sensor	On top of transmission.



3.0L

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4. Throttle Position Sensor
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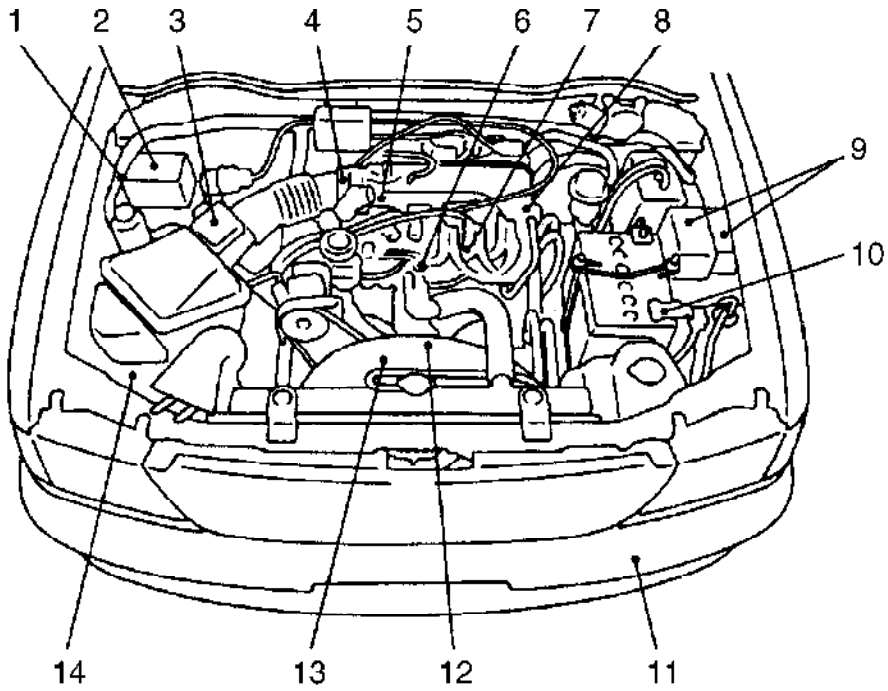
8. Heated Oxygen Sensor (Left Bank Front) (Calif.)
9. Fuse/Relay Block (Engine Compartment)
10. Fusible Link No. 9
11. Outside Air Temperature Sensor
12. Camshaft Position Sensor
13. Crankshaft Position Sensor
14. Front Impact Sensor (Right)

97A00380

Camshaft Position Sensor	On front center of engine.



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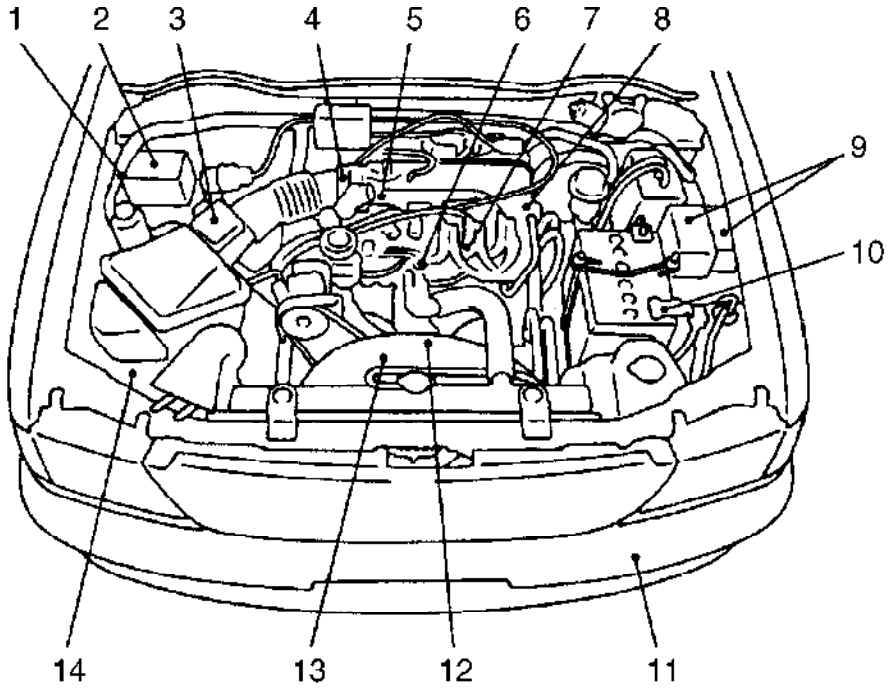
14. Front Impact Sensor (Right)

97A00380

Crankshaft Position Sensor	On front center of engine.
Engine Coolant Temperature Gauge	In right side of engine compartment.



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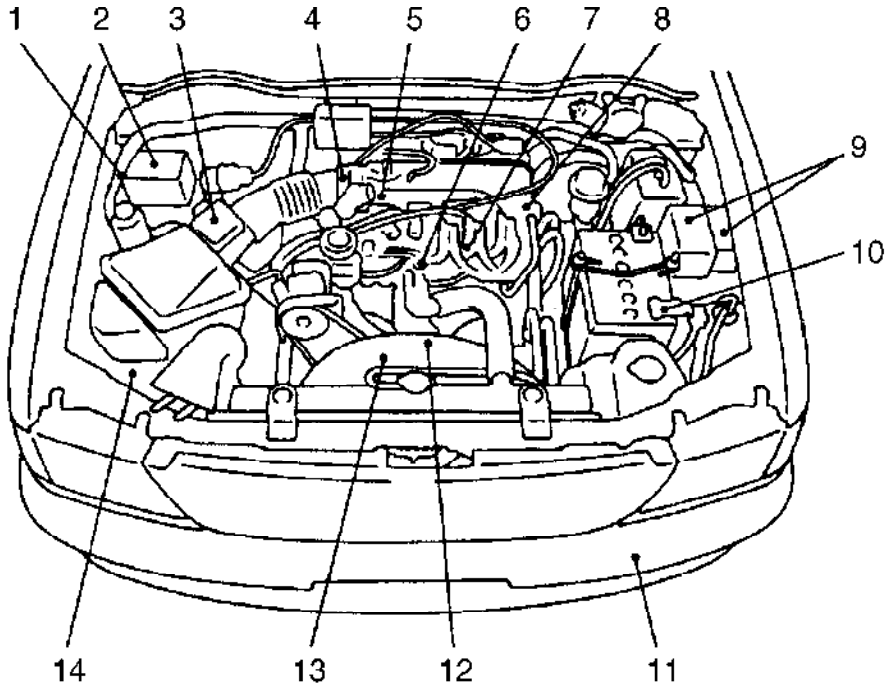
13. Cranksheft Position Sensor
14. Front Impact Sensor (Right)

97A00380

Engine Coolant Temperature Sensor	On front center of engine.
Front Impact Sensor (Left)	In left front of engine compartment.



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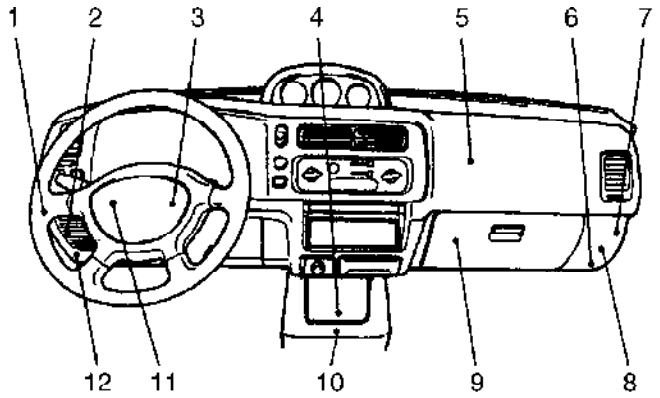
12. Camshaft Position Sensor
13. Cranksheft Position Sensor
14. Front Impact Sensor (Right)

97A00380

Front Impact Sensor (Right)	In right front of engine compartment.
Fuel Tank Differential Pressure Sensor	Top of fuel tank.



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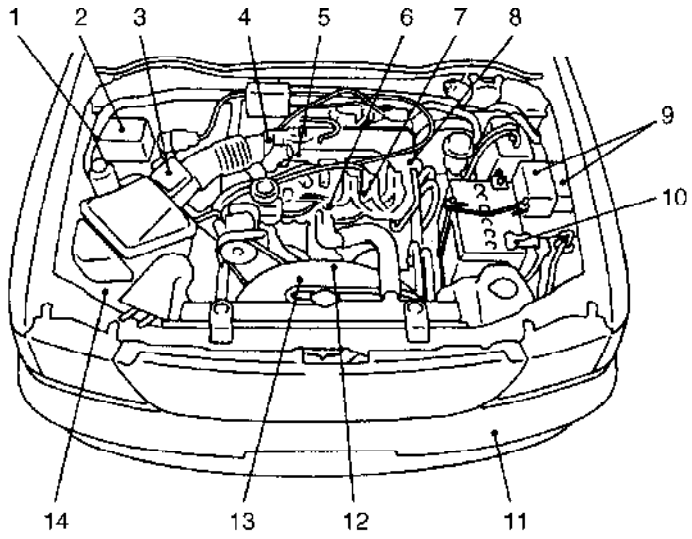
12. Auto-Cruise Control ECU

97B00381

G Sensor (4WD & ABS)	Behind center console.



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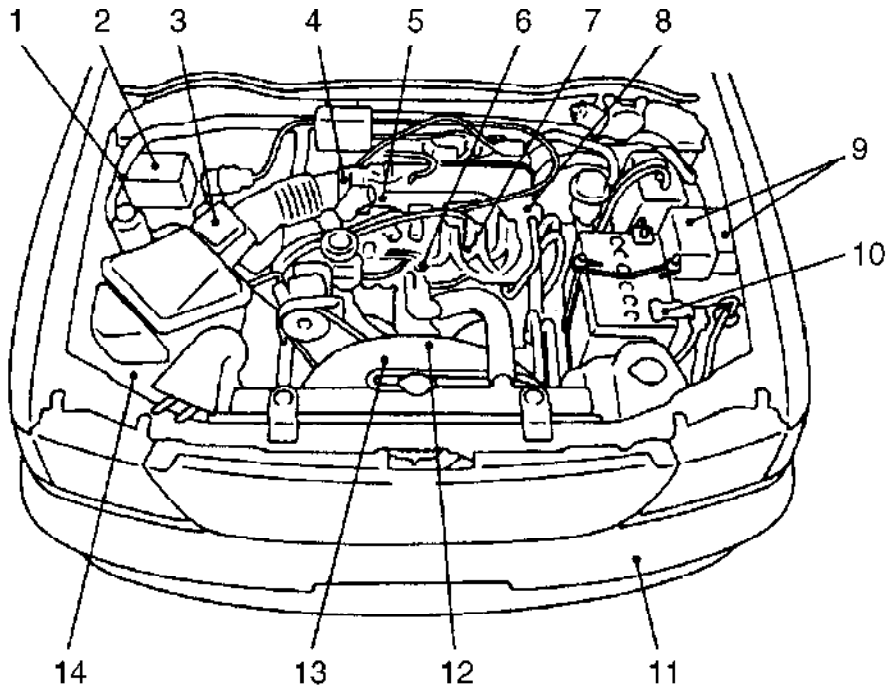
13. Crankshaft Position Sensor
14. Front Impact Sensor (Right)

97A00380

Heated Oxygen Sensor (Left Bank Front) (Calif.)	In left rear of engine compartment.



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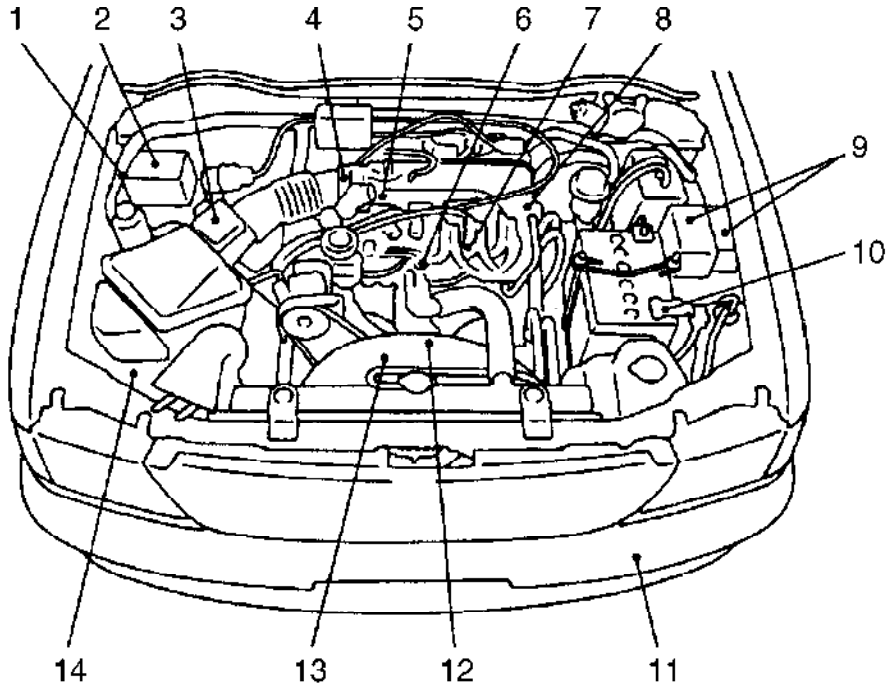
12. Camshaft Position Sensor
13. Cranksheft Position Sensor
14. Front Impact Sensor (Right)

97A00380

Heated Oxygen Sensor (Right Bank Front) (Calif.)	In rear center of engine compartment.
Heated Oxygen Sensor (Left Bank Rear) (Calif.) (3.0L)	Under side of vehicle, rear of catalytic converter.
Heated Oxygen Sensor (Right Bank Rear) (Calif.)	Underside of vehicle, rear of catalytic converter.



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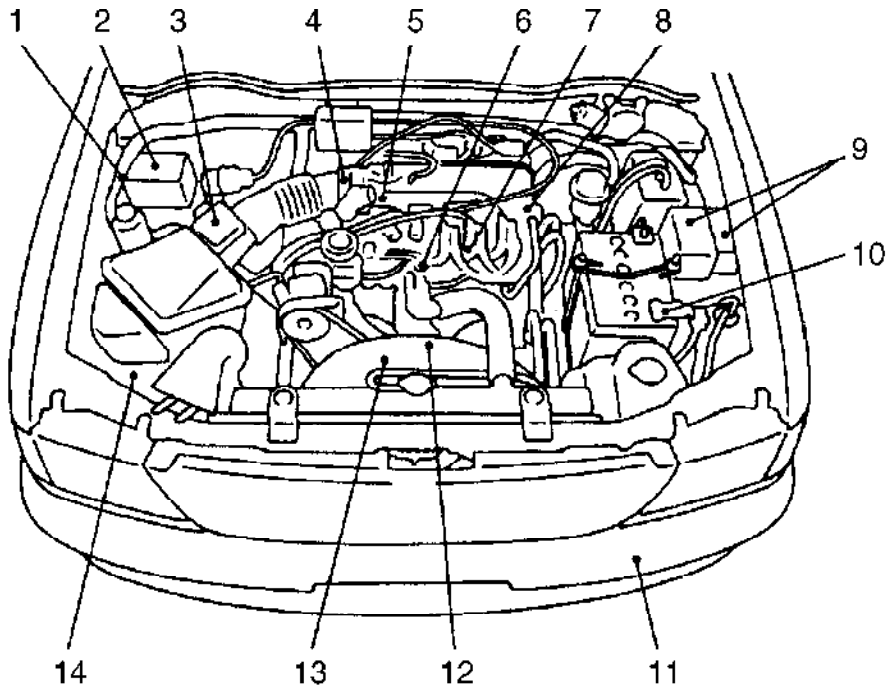
14. Front Impact Sensor (Right)

97A00380

Manifold Differential Pressure Sensor	In left side of engine compartment.
Oil Pressure Gauge Unit	On lower left front of engine.



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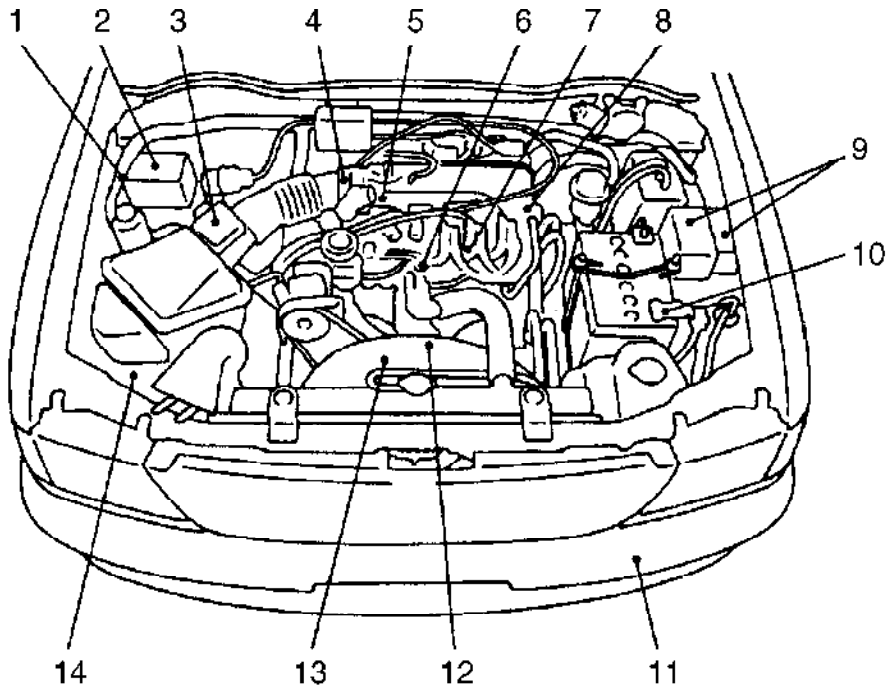
14. Front Impact Sensor (Right)

97A00380

Outside Air Temperature Sensor	Below left headlamp.



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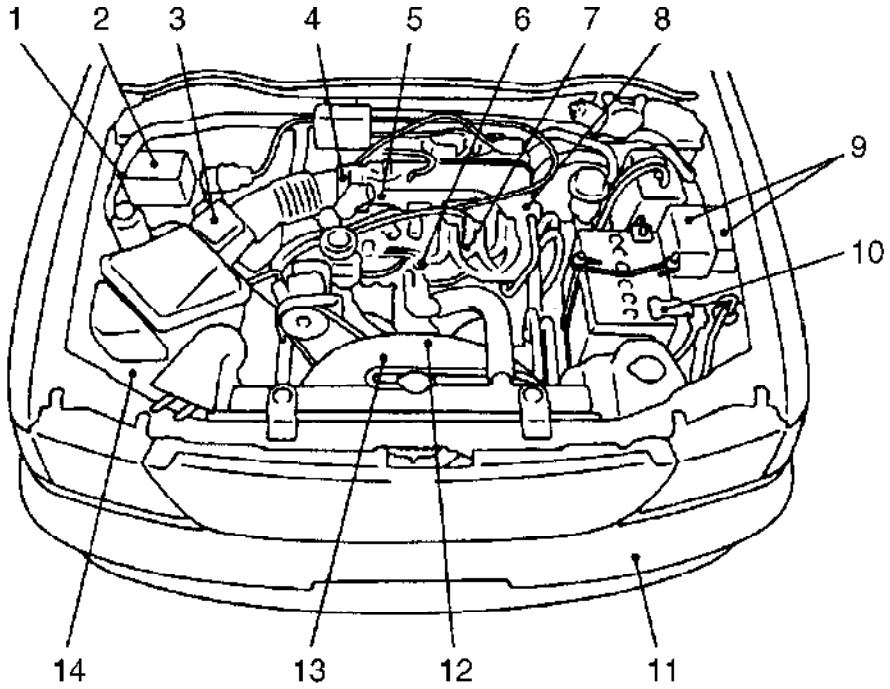
14. Front Impact Sensor (Right)

97A00380

Throttle Position Sensor	On throttle body.
Vehicle Speed Sensor (VSS)	On transmission tailshaft.



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12. Camshaft Position Sensor
13. Crankshaft Position Sensor
14. Front Impact Sensor (Right)

97A00380

Volume Air Flow Sensor	In air cleaner duct (includes intake air temperature sensor & barometric pressure sensor).
Wheel Speed Sensors (4)	On bracket, on each wheel hub.

SOLENOIDS & SOLENOID VALVES

Component	Component Location
EGR Solenoid	In left side of engine compartment.
ELC 4-Speed A/T Control Solenoid	On top of transmission.
Evaporative Emission Purge Solenoid	In left side of engine compartment.
Evaporative Ventilation	

Solenoid	In left rear of engine compartment.
Solenoid Valves A & B	In right side of engine compartment.

SWITCHES

Component	Component Location
Back-Up Lamp Switch	On transmission.
Brake Fluid Level Switch	In left rear corner of engine compartment.
Clutch Pedal Position Switch	On bracket, above clutch pedal.
Dual Pressure Switch	On high pressure line, on receiver-drier.
Free Wheeling Engage Switch	In right rear of engine compartment.
High Range/Low Range Detection Switch	On transfer case.
Low Range Operation Detection Switch	On transfer case.
Oil Pressure Switch	On lower left front of engine.
Park/Neutral Position Switch	On top of transmission.
Parking Brake Switch	At base of parking brake lever.
Power Steering Pressure Switch	In right side of engine compartment.
Refrigerant Temperature Switch	In left front of engine compartment.
Seat Belt Switch	On driver-side seat belt buckle.
Stop Lamp Switch	On bracket, above brake pedal.
4WD Detection Switch	On transfer case.

MISCELLANEOUS

Component	Component Location
Amplifier	Above right rear wheelwell, behind trim panel.
Blower Resistor	Behind right side of dash,

	near blower motor.
Capacitor	Top right side of engine, near ignition coil.
Data Link Connector (DLC)	Under left side of dash, near fuse/relay block.
Diode (For MFI System Circuit)	Behind right side of dash.
Engine Speed Detection Connector	In left rear corner of engine compartment.
Fuel Pump Check Connector	In right rear corner of engine compartment.
Ignition Power Transistor	On top right side of engine, near ignition coil.
Noise Filter	On top left side of engine, near ignition coil.
Rear Fan Motor Resistor	In rear of center console, near fan motor assembly.

* ELECTRICAL SYSTEM UNIFORM INSPECTION GUIDELINES *

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Electrical System Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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OVERVIEW OF MOTORIST ASSURANCE PROGRAM
OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS
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ALTERNATORS AND GENERATORS
AMPLIFIERS
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BATTERIES
BATTERY CABLES
BATTERY CABLES
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DEFOGGERS
DEFROSTERS
DELAYS
DIMMERS
ELECTRIC HEATERS
EQUALIZERS
FUSE BLOCKS
FUSE BOXES AND BLOCKS
FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS
FUSIBLE LINKS
GAUGES
GENERATORS
GROUND CABLES AND STRAPS
GROUND STRAPS
HEADLIGHT ADJUSTERS
HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS)
HORNS AND SIRENS

IGNITION SWITCHES
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KEYLESS ENTRY KEYPADS AND TRANSMITTERS
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MICROPHONES
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MOTORS
NEUTRAL SAFETY SWITCHES
ODOMETERS
ODOMETERS, SPEEDOMETERS AND TACHOMETERS (CABLE-DRIVEN)
PULLEYS
RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS
RELAY BOXES
RELAYS
SEALED BEAMS
SEAT HEATERS
SECURITY ALARM SENSORS
SIRENS
SOLENOIDS
SPEAKERS AND MICROPHONES
SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES
SPEEDOMETER CABLES
SPEEDOMETERS
STARTERS
SUB-WOOFER VOLUME CONTROLS
SWITCHES
TACHOMETER CABLES
TACHOMETERS
TAPE PLAYERS AND CD PLAYERS
TENSIONERS
TIMERS
TIRE PRESSURE SENSORS
TRANSCEIVERS
TRANSDUCERS
VACUUM ACCUMULATORS (RESERVOIRS)
VACUUM RESERVOIRS
VOLTAGE REGULATORS
WASHER FLUID LEVEL SENDERS
WASHER PUMPS
WIPER ARMS AND BLADES
WIPER BLADES
WIPER HOSES AND NOZZLES
WIPER LINKAGES
WIPER NOZZLES
WIPER PUMP RESERVOIRS
WIRING HARNESSES AND CONNECTORS

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper,

manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published.

In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

1444 I Street, NW Suite 700
Washington, DC 20005
Phone (202) 712-9042 Fax (202) 216-9646
January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement
A - Part no longer performs intended purpose
B - Part does not meet a design specification (regardless of performance)
C - Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement
1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

ELECTRICAL SYSTEMS

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

NOTE: When working on electrical systems, if a potentially hazardous condition is observed, require repair or replacement of affected components prior to performing further work.

ACTUATOR MOTORS (SOLENOIDS) (ELECTRIC)

ACTUATOR MOTOR (SOLENOIDS) (ELECTRIC) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.

Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Linkage bent, affecting performance	A	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage broken	A	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	Suggest repair or replacement of linkage.
Linkage missing	C	Require replacement.
Linkage noisy	2	Suggest repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	1	(1) Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	1	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

ACTUATOR MOTORS (VACUUM)

ACTUATOR MOTOR (VACUUM) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of

			hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Inoperative	A	.....	(2) Require replacement.
Leaking (vacuum)	A	..	Require repair or replacement.
Linkage bent, affecting performance	A	...	Require repair or replacement of linkage.
Linkage bent, not affecting performance	2	...	Suggest repair or replacement of linkage.
Linkage binding, affecting performance	A	...	Require repair or replacement of linkage.
Linkage binding, not affecting performance	1	..	Suggest repair or replacement of linkage.
Linkage broken	A	...	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	...	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	...	Suggest repair or replacement of linkage.
Linkage missing	C	.....	Require replacement.
Linkage noisy	2	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Noisy	2	..	Suggest repair or replacement.
Out of adjustment	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AIR BAGS

For all air bag components and conditions, refer to vehicle manufacturer's specifications for diagnosis and parts replacement.

ALTERNATORS AND GENERATORS

NOTE: If components have been added that increase vehicle electrical load requirement (for example, sound systems, air conditioning, alarm systems, etc.), charging system output must meet the increased demand.

ALTERNATOR AND GENERATOR INSPECTION

Condition	Code	Procedure
Alternator output meets OEM specification but is insufficient for add-on		

electrical load	2	...	Suggest upgrade of alternator or removal of excess electrical load.
Alternator's rated output is below OEM specification	B	.....	Require replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware non-functioning	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Diode inoperative	A	.....	(2) Require repair or replacement.
Housing broken, affecting performance	A	..	Require repair or replacement.
Housing broken, not affecting performance ..	..	.....	No service suggested or required.
Housing cracked, affecting performance	A	..	Require repair or replacement.
Housing cracked, not affecting performance ..	1	..	Suggest repair or replacement.
Inoperative	A	.....	(2) Require repair or replacement.
Noisy	2	..	Suggest repair or replacement.
Pulley incorrect	B	.....	Require replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	..	Require repair or replacement.
Terminal corroded, not affecting performance ..	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance ..	1	..	Suggest repair or replacement.
Terminal resistance (voltage drop) out of specification	A	..	Require repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Voltage drop out of specification	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AMPLIFIERS

See
RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS.

ANTENNAS

ANTENNA INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require replacement.
Bent	2	Suggest repair or replacement.
Binding	2	Suggest repair or replacement.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Missing	C	Require replacement.
Motor runs continuously	A	Require or replacement.
Power antenna noisy	2	Suggest repair or replacement.
Sticking	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of specification.

BATTERIES

Proper operation of any electrical system or component can be affected by battery condition. The battery(ies) must meet or exceed

minimum specification for vehicle as equipped and test to that specific battery's CCA.

Definition of Terms

* Battery Performance Testing
  Testing that determines whether or not a battery meets both vehicle OEM and battery manufacturer's specifications.

* Cold Cranking Amp (CCA) Rating
  The number of amperes a new, fully charged battery at 0° F (-17.8° C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).

* Cranking Amps (CA)
  The number of amperes a new, fully charged battery, typically at 32° F (0° C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).

* OEM Cranking Amps
  The minimum CCA required by the original vehicle manufacturer for a specific vehicle.

BATTERY INSPECTION

Condition	Code	Procedure
Battery frozen	..	(1) Further inspection required.
Case leaking	A	Require replacement.
Casing swollen	A	(2) Further inspection required.
Circuit open internally	A	Require replacement.
Electrolyte contamination	A	(2) Further inspection required.
Electrolyte discoloration	A	(2) Further inspection required.
Fails to accept and hold charge	A	(3) Require replacement.
Fluid level low	B	(4) Further inspection required.
Out of performance specification for battery	B	(5) Require replacement.
Out of specification for application	B	(5) Require replacement.
Post (top or side) burned, affecting performance	A	(6) Require repair or replacement.
Post (top or side) burned, not affecting performance	2	(6) Suggest repair or replacement.
Post (top or side) corroded, affecting performance	A	Require repair.
Post (top or side) corroded, not affecting performance	2	Suggest repair.

Post (top or side) loose	A	Require replacement.
Post (top or side) melted, affecting performance	A	(6) Require repair or replacement.
Post (top or side) melted, not affecting performance	2	(6) Suggest repair or replacement.
Specific gravity low	B	(7) Further inspection required.
State of charge low	A	(7) Further inspection required.
Top dirty	2	Suggest cleaning battery.
Top wet	A	(8) Require cleaning battery. Further inspection required.
Vent cap loose	A	Require repair or replacement of vent cap.
Vent cap missing	C	Require replacement of vent cap.

(1) - DO NOT attempt to charge a frozen battery. Allow battery to warm thoroughly and then performance-test. If battery fails performance test, require replacement.
(2) - No service suggested or required unless the battery fails performance test, in which case, require replacement.
(3) - This phrase refers to a battery that fails to either accept and/or retain a charge using appropriate times listed in the Battery Charging Guide of the BCI Service Manual, battery charger operating manual, or battery manufacturer's specifications.
(4) - Determine cause of low fluid level. Refill to proper level(s) with water (distilled water preferred). Recharge battery and performance-test. If battery does not meet specifications, require replacement. If battery is sealed type (non-removable filler caps), require replacement.
(5) - The battery may meet battery manufacturer's specifications but test below the minimum specification defined by the vehicle's OEM for that vehicle.
(6) - Determine cause and correct prior to repair or replacement of part.
(7) - Recharge and test to manufacturer's specifications. If battery fails performance test, require replacement.
(8) - Check fluid level and adjust to manufacturer's specification. Suggest checking charging system for proper operation.

BATTERY CABLES

See BATTERY CABLES, WIRES AND CONNECTORS.

BATTERY CABLES, WIRES AND CONNECTORS

BATTERY CABLE, WIRE AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware		

missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Insulation damaged, conductors exposed	A	.....	(2) Require repair or replacement.
Insulation damaged, conductors not exposed	1	.....	Suggest replacement.
Open	A	..	Require repair or replacement.
Protective shield (conduit) melted	2	.....	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	..	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	..	Require repair or replacement.
Routed incorrectly	B	.....	Require repair.
Secured incorrectly	B	.....	Require repair.
Shorted	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Voltage drop out of specification	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Exposed conductor at replacement (aftermarket) terminal end does not require repair or replacement.

BATTERY HOLD DOWN HARDWARE

See BATTERY TRAYS AND HOLD DOWN HARDWARE.

BATTERY TRAYS AND HOLD DOWN HARDWARE

BATTERY TRAY AND HOLD DOWN HARDWARE INSPECTION

Condition	Code		Procedure
Battery improperly secured	2	.....	Suggest repair.
Bent, affecting performance	A	..	Require repair or replacement.
Bent, not affecting			

performance	..	.....	No service suggested or required.
Broken, affecting performance	A	..	Require repair or replacement.
Broken, not affecting performance	..	.....	No service suggested or required.
Corroded, affecting performance	A	..	Require repair or replacement.
Corroded, not affecting performance	2	..	Suggest repair or replacement.
Cracked, affecting performance	A	..	Require repair or replacement.
Cracked, not affecting performance	1	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Water drain clogged	A	.....	Require repair.

BATTERY WIRES

See BATTERY CABLES, WIRES AND CONNECTORS.

BELTS

BELT INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	(1) Further inspection required.
Cracked	1	Suggest replacement.
Frayed	1	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	(2) Further inspection required.
Plies separated	A	Require replacement.
Tension out of specification	B	Require adjustment or replacement.
Worn beyond adjustment range	B	Require replacement.
Worn so it contacts bottom of pulley	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.

BULB SOCKETS

BULB SOCKET INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of

			hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Bulb seized in socket	A	..	Require repair or replacement.
Burned, affecting performance	A	.....	(1) Require repair or replacement.
Burned, not affecting performance	2	.....	(1) Suggest repair or replacement.
Broken	A	..	Require repair or replacement.
Connector broken	A	..	Require repair or replacement.
Connector missing	C	.....	Require replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Corroded, affecting performance	A	..	Require repair or replacement.
Corroded, not affecting performance	2	..	Suggest repair or replacement.
Leaking	A	..	Require repair or replacement.
Melted	A	.....	(2) Require replacement.
Shorted	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of socket.
(2) - Determine cause and correct prior to replacement of part.

BULBS, SEALED BEAMS AND LEDS

NOTE: Does not include soldered-in components.

BULB, SEALED BEAM AND LED INSPECTION

Condition	Code		Procedure
Adjustment out of specification	B	..	Require repair or replacement.
Application incorrect	B	.....	(1) Require replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not			

functioning	A	Require repair or replacement of hardware.
Base burned, affecting performance	A	(2) Require repair or replacement.
Base burned, not affecting performance	2	(2) Suggest repair or replacement.
Base corroded, affecting performance	A	Require repair or replacement.
Base corroded, not affecting performance	2	Suggest repair or replacement.
Base leaking	A	Require repair or replacement.
Base loose, affecting performance	B	Require repair or replacement.
Base loose, not affecting performance	1	Suggest repair or replacement.
Base melted	A	(2) Require replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance		No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance		No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Burned out	A	Require replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	C	Require replacement.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Cracked	A	Require replacement.
Intermittent	A	Require replacement.
Lamp base melted	A	(2) Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Seized in socket	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not		

affecting performance	2	(2) Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Application incorrect includes wrong bulb coating or color.
(2) - Determine cause and correct prior to repair or replacement of part.

CD PLAYERS

See TAPE PLAYERS AND CD PLAYERS.

CIGARETTE LIGHTER ASSEMBLIES

CIGARETTE LIGHTER ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require repair or replacement.
Loose	A	Require repair or replacement.
Missing	2	Suggest replacement.
Sticking	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

CIRCUIT BREAKERS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

CLUTCH SWITCHES

See SWITCHES.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

CONTROL MODULES

CONTROL MODULE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Inoperative	B	(4) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(4) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

CRUISE CONTROL BRAKE SWITCHES

See SWITCHES.

CRUISE CONTROL CABLES

See CRUISE CONTROL LINKAGES AND CABLES.

CRUISE CONTROL CLUTCH SWITCHES

See SWITCHES.

CRUISE CONTROL LINKAGES AND CABLES

CRUISE CONTROL LINKAGE AND CABLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Binding	A	Require repair or replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance	..	No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance	..	No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.

Condition	Code	Procedure
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Kinked	A	Require repair or replacement.
Melted	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(2) Require repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

CRUISE CONTROL RESERVOIRS

See CRUISE CONTROL VACUUM HOSES, TUBES AND RESERVOIRS.

CRUISE CONTROL TUBES

See CRUISE CONTROL VACUUM HOSES, TUBES AND RESERVOIRS.

CRUISE CONTROL VACUUM DUMP RELEASE VALVES

CRUISE CONTROL VACUUM DUMP RELEASE VALVE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair or replacement.
Inoperative	A	(1) Require replacement.
Leaking	2	Suggest replacement.
Out of adjustment	B	(2) Further inspection required.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

CRUISE CONTROL VACUUM HOSES, TUBES AND RESERVOIRS

CRUISE CONTROL VACUUM HOSE, TUBE AND RESERVOIR INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Melted	A	Require replacement.
Missing	C	Require replacement.
Oil-soaked (spongy)	1	Suggest replacement.
Restricted	A	Require repair or replacement.
Surface cracks (dry-rotted)	1	Suggest replacement.

CRUISE CONTROL VEHICLE SPEED SENSORS

CRUISE CONTROL VEHICLE SPEED SENSOR INSPECTION

Condition	Code	Procedure
Air gap incorrect	B	(1) Require adjustment to vehicle manufacturer's specifications.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require replacement.
Housing cracked	A	Require replacement.
Internal resistance does not meet specifications	B	(2) Require replacement.
Lead routing incorrect	B	Require rerouting according to vehicle manufacturer's specifications.
Loose	B	(3) Require adjustment to vehicle manufacturer's specifications.
Missing	C	Require replacement.
Output signal incorrect	B	(2) Require repair or replacement.
Surface contaminated	2	Suggest cleaning; identify and correct source.
Tip bent	B	Require replacement.
Tip broken	B	Require replacement.
Tip missing	B	Require replacement.
Wire lead burned	A	Require replacement.
Wire lead conductors exposed	B	Require replacement.
Wire lead corroded	A	Require replacement.
Wire lead open	A	Require replacement.
Wire lead shorted	A	Require replacement.

(1) - If a sensor is not adjustable, further inspection is required to identify and correct cause.
(2) - Component failure may be caused by water intrusion into the wiring harness. Always check insulation for damage

and wiring for excessive resistance.
(3) - Some integral bearing assemblies with sensors may require replacement.

DEFOGGERS

See HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS).

DEFROSTERS

See HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS).

DELAYS

DELAY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding, affecting performance	A	Require repair or replacement.
Binding, not affecting performance	2	Suggest repair or replacement.
Broken	A	Require repair or replacement.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(2) Require repair or replacement.
Melted, affecting performance	A	(1) Require repair or replacement.
Melted, not affecting performance	2	(1) Suggest repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not		

affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

DIMMERS

DIMMER INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Binding, affecting performance	A	..	Require repair or replacement.
Binding, not affecting performance	2	..	Suggest repair or replacement.
Broken	A	..	Require repair or replacement.
Burned, affecting performance	A	.....	(1) Require repair or replacement.
Burned, not affecting performance	2	.....	(1) Suggest repair or replacement.
Cracked, affecting performance	A	..	Require repair or replacement.
Cracked, not affecting performance	1	..	Suggest repair or replacement.
Inoperative	A	.....	(2) Require repair or replacement.
Melted, affecting performance	A	.....	(1) Require repair or replacement.
Melted, not affecting performance	2	.....	(1) Suggest repair or replacement.
Missing	C	.....	Require replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.

Condition	Code	Procedure
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

ELECTRIC HEATERS

See HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS).

EQUALIZERS

See RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS.

FUSE BLOCKS

See FUSE BOXES AND BLOCKS.

FUSE BOXES AND BLOCKS

FUSE BOX AND BLOCK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken, affecting performance	A	Require replacement.
Broken, not affecting performance	..	No service suggested or required.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Cover missing	C	Require replacement of cover.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Melted, affecting performance	A	(1) Require replacement.

Melted, not affecting performance	2	(1) Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS

FUSE, FUSIBLE LINK AND CIRCUIT BREAKER INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Blown	A	(1) Require replacement.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Inoperative	A	(2) Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Missing	C	Require replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation.

FUSIBLE LINKS

See FUSES, FUSIBLE LINKS AND CIRCUIT BREAKERS.

GAUGES

NOTE: Includes odometers, speedometers and tachometers (except cable-driven).

GAUGE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Leaking	A	Require replacement.
Lens broken	A	(2) Require repair or replacement.
Lens cloudy	2	(2) Suggest repair or replacement.
Lens missing	C	(2) Require repair or replacement.
Malfunctioning	A	(3) Require repair or replacement.
Mechanical head noisy	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - If lens is available as a separate part, require replacement of lens only.
(3) - Includes inoperative, intermittent operation, failure to perform all functions, out of OEM specification, or out of range.

GENERATORS

See ALTERNATORS AND GENERATORS.

GROUND CABLES AND STRAPS

GROUND CABLE AND STRAP INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Insulation damaged, exposing conductors	2	Suggest replacement.
Loose	A	Require repair.
Missing	C	Require replacement.
Open	A	Require repair or replacement.
Resistance high	A	Require repair or replacement.
Terminal resistance (voltage drop) is out of specification	B	Require repair or replacement.
Voltage drop out of specification	B	Require repair or replacement.

GROUND STRAPS

See GROUND CABLES AND STRAPS.

HEADLIGHT ADJUSTERS

HEADLIGHT ADJUSTER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent, preventing adjustment	A	Require repair or replacement.
Broken	A	Require repair or replacement.
Indicator broken	A	Require replacement.
Indicator missing	C	Require replacement.
Missing	C	Require replacement of

			adjusters.
Seized	A	..	Require repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS)

HEATING ELEMENT (DEFROSTER, DEFOGGER, ELECTRIC HEATER AND SEAT) INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Inoperative	A	.....	(2) Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead burned	A	..	Require repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

HORNS AND SIRENS

HORN AND SIREN INSPECTION

Condition	Code	Procedure

Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Inoperative	A	.....	(2) Require repair or replacement.
Missing	C	.....	Require replacement.
Out of adjustment	B	.....	Require adjustment.
Sound quality poor	A	..	Require repair or replacement. Further inspection required.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead burned	A	..	Require repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation.

IGNITION SWITCHES

See SWITCHES.

INDICATOR LIGHTS

INDICATOR LIGHT INSPECTION

Condition	Code		Procedure
Does not come on during bulb check	..	.....	(1) Further inspection required.
Fails to function properly during test mode	..	.....	(1) Further inspection required.
On constantly	..	.....	(1) Further inspection required.

On intermittently		(1) Further inspection required.

(1) - See service manual for further information.

KEYLESS ENTRY KEYPADS AND TRANSMITTERS

KEYLESS ENTRY KEYPAD AND TRANSMITTER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	..... (1) Require repair or replacement.
Connector missing	C	..... Require replacement.
Malfunctioning	A	..... (2) Require repair or replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	..... (1) Require repair or replacement.
Terminal burned, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance ..	A	.. Require repair or replacement.
Terminal corroded, not affecting performance ..	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance ..	1	.. Suggest repair or replacement.
Wire lead burned	A	.. Require repair or replacement.
Wire lead conductors exposed	B	.. Require repair or replacement.
Wire lead open	A	.. Require repair or replacement.
Wire lead shorted	A	.. Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Malfunctioning includes inoperative, intermittent operation, or failure to perform all functions.

KEYLESS ENTRY TRANSMITTERS

See KEYLESS ENTRY KEYPADS AND TRANSMITTERS.

LEDS

See BULBS, SEALED BEAMS AND LEDS.

LENSES

LENSE INSPECTION

Condition	Code	Procedure
Adjustment out of specification	B	Require repair.
Application incorrect	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken, affecting performance	A	Require replacement.
Broken, not affecting performance	..	No service suggested or required.
Cracked	A	Require replacement.
Discolored	A	Require replacement.
Leaking	A	Require repair or replacement.
Melted, affecting performance	A	Require replacement.
Melted, not affecting performance	2	Suggest replacement.
Missing	C	Require replacement.

MICROPHONES

See SPEAKERS AND MICROPHONES.

MIRRORS (ELECTROCHROMATIC AND HEATED)

MIRROR (ELECTROCHROMATIC AND HEATED) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Cracked	A	Require replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or

			replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead burned	A	..	Require repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation.

MOTORS

MOTOR INSPECTION

Condition	Code		Procedure
Amperage draw out of specification	A	..	Require repair or replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Bracket bent	A	..	Require repair or replacement.
Bracket broken	A	..	Require repair or replacement.
Bracket cracked	A	..	Require repair or replacement.
Bracket holes elongated, affecting performance	A	..	Require repair or replacement.
Bracket holes elongated, not affecting performance	..	.....	No service suggested or required.
Bracket missing	C	.....	Require replacement.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Drive mechanism damaged, affecting performance	A	.....	(2) Require repair or replacement.
Drive mechanism damaged, not affecting performance	2	.....	(2) Suggest repair or replacement.
Fails to disengage	A	..	Require repair or replacement.

Housing broken, affecting performance	2	..	Suggest repair or replacement.
Housing broken, not affecting performance	..	..	No service suggested or required.
Housing cracked, affecting performance	A	..	Require repair or replacement.
Housing cracked, not affecting performance	1	..	Suggest repair or replacement.
Inoperative	A	..	(3) Require repair or replacement.
Linkage bent, affecting performance	A	..	Require repair or replacement of linkage.
Linkage bent, not affecting performance	..	..	No service suggested or required.
Linkage binding, affecting performance	A	..	Require repair or replacement of linkage.
Linkage binding, not affecting performance	2	..	Suggest repair or replacement of linkage.
Linkage broken	A	..	Require repair or replacement of linkage.
Linkage loose, affecting performance	A	..	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	..	Suggest repair or replacement of linkage.
Linkage missing	C	..	Require replacement.
Linkage noisy	2	..	Suggest repair or replacement.
Missing	C	..	Require replacement.
Noisy	2	..	Suggest repair or replacement.
Out of adjustment	B	..	(4) Further inspection required.
Resistance out of specification	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	..	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead burned	A	..	Require repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Further inspection required to determine cause.
(3) - Inoperative includes intermittent operation.

(4) - Follow OEM recommended adjustment procedures. Repair or replace if out of specification.

NEUTRAL SAFETY SWITCHES

See SWITCHES.

ODOMETERS

See GAUGES.

ODOMETERS, SPEEDOMETERS AND TACHOMETERS (CABLE-DRIVEN)

ODOMETER, SPEEDOMETER AND TACHOMETER (CABLE-DRIVEN) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Drive cable broken	A	Require replacement.
Drive cable noisy	2	Suggest repair or replacement.
Inoperative	A	(2) Further inspection required.
Leaking	A	Require replacement.
Lens broken	A	(3) Require repair or replacement.
Lens cloudy	2	(3) Suggest repair or replacement.
Lens missing	C	(3) Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - If lens is available as a separate part, require

replacement of lens only.
(3) - Includes inoperative, intermittent operation, failure to perform all functions, out of OEM specification, or out of range.

PULLEYS

PULLEY INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Pulley damaged, affecting belt life	A	Require replacement.

RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS

RECEIVER, AMPLIFIER, EQUALIZER AND SUB-WOOFER VOLUME CONTROL INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Malfunctioning	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Sound quality poor	A	(3) Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.

Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead burned	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Malfunctioning includes inoperative, intermittent operation, or failure to perform all functions.
(3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical interference.

RELAY BOXES

RELAY BOX INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken, affecting performance	A	Require replacement.
Broken, not affecting performance	..	No service suggested or required.
Burned, affecting performance	A	(1) Require repair or replacement.
Burned, not affecting performance	2	(1) Suggest repair or replacement.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Cover missing	C	Require replacement of cover.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Melted, affecting performance	A	(1) Require replacement.
Melted, not affecting		

performance	2	(1) Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

RELAYS

RELAY INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Housing broken	A	Require replacement.
Housing cracked	2	Suggest replacement.
Inoperative	A	(1) Require replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

SEALED BEAMS

See BULBS, SEALED BEAMS AND LEDS.

SEAT HEATERS

See HEATING ELEMENTS (DEFROSTERS, DEFOGGERS, ELECTRIC HEATERS AND SEATS).

SECURITY ALARM SENSORS

SECURITY ALARM SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

SIRENS

See HORNS AND SIRENS.

SOLENOIDS

See ACTUATOR MOTORS (SOLENOIDS) (ELECTRIC).

NOTE: For starter solenoids that are integral to the starter assembly, see STARTERS.

NOTE: For starter relays, see RELAYS.

SPEAKERS AND MICROPHONES

SPEAKER AND MICROPHONE INSPECTION

Condition	Code	Procedure
Application incorrect	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Membrane torn	A	Require replacement.
Missing	C	Require replacement.
Polarity reversed	A	Require repair.
Sound quality poor	A	(3) Require repair or replacement. Further inspection required.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.
(3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical

interference.

SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES

SPEEDOMETER AND TACHOMETER LINKAGE AND CABLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require repair or replacement.
Binding	A	Require repair or replacement.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance		No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance		No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Kinked	A	Require repair or replacement.
Melted	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

SPEEDOMETER CABLES

See SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES.

SPEEDOMETERS

See GAUGES.

STARTERS

NOTE: To prevent misdiagnosis, care should be taken to eliminate the possibilities of mechanical problems or high resistance in power and/or ground circuits.

STARTER INSPECTION

Condition	Code	Procedure
Amperage draw does not meet OEM specifications	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	(1) Require repair or replacement of hardware.
Bracket bent, affecting performance	A	Require repair or replacement.
Bracket bent, not affecting performance		No service suggested or required.
Bracket broken, affecting performance	A	Require replacement.
Bracket broken, not affecting performance		No service suggested or required.
Bracket corroded, affecting performance	A	Require repair or replacement.
Bracket corroded, not affecting performance	2	Suggest repair or replacement.
Bracket cracked, affecting performance	A	Require repair or replacement.
Bracket cracked, not affecting performance	1	Suggest repair or replacement.
Bracket holes elongated, affecting performance	A	Require repair or replacement.
Bracket holes elongated, not affecting performance)		No service suggested or required.
Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Drive gear damaged, affecting performance	A	(2) Require repair or replacement.
Drive gear damaged, not affecting performance	2	(2) Suggest repair or replacement.
Fails to disengage	A	Require repair or replacement.
Housing broken, affecting performance	2	Require repair or replacement.
Housing broken, not		

affecting performance	..	.. .. No service suggested or required.
Housing cracked, affecting performance	.....	A ... Require repair or replacement.
Housing cracked, not affecting performance	..	2 .. Suggest repair or replacement.
Inoperative	.....	A ..... (3) Require repair or replacement.
Noisy	.....	2 .. Suggest repair or replacement.
Shimmed incorrectly	.....	B ..... Require repair.
Starter shaft bushing missing	.....	C ..... (4) Require replacement.
Starter shaft bushing worn, affecting performance	.....	A ..... Require replacement.
Starter shaft bushing worn, not affecting performance	.....	1 ..... Suggest replacement.
Terminal broken	.....	A .. Require repair or replacement.
Terminal burned, affecting performance	.....	A ..... (5) Require repair or replacement.
Terminal burned, not affecting performance	..	2 .. Suggest repair or replacement.
Terminal corroded, affecting performance	..	A .. Require repair or replacement.
Terminal corroded, not affecting performance	..	2 .. Suggest repair or replacement.
Terminal loose, affecting performance	.....	B .. Require repair or replacement.
Terminal loose, not affecting performance	..	1 .. Suggest repair or replacement.

(1) - Inspect block or bell housing mounting surface.
(2) - Further inspection required to determine cause. Require inspection of ring gear.
(3) - Inoperative includes intermittent operation.
(4) - Bushing may be in bell housing.
(5) - Determine cause and correct prior to repair or replacement of part.

SUB-WOOFER VOLUME CONTROLS

See RECEIVERS, AMPLIFIERS, EQUALIZERS AND SUB-WOOFER VOLUME CONTROLS.

SWITCHES

SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware broken	..... A	... Require repair or replacement of hardware.
Attaching hardware missing	 C	..... Require replacement of hardware.
Attaching hardware not functioning	..... A	... Require repair or replacement of hardware.
Binding, affecting		

performance	A	..	Require repair or replacement.
Binding, not affecting performance	2	..	Suggest repair or replacement.
Broken	A	..	Require repair or replacement.
Burned, affecting performance	A	.....	(1) Require repair or replacement.
Burned, not affecting performance	2	.....	(1) Suggest repair or replacement.
Cracked, affecting performance	A	..	Require repair or replacement.
Cracked, not affecting performance	1	..	Suggest repair or replacement.
Leaking	A	..	Require repair or replacement.
Malfunctioning	A	.....	(2) Require repair or replacement.
Melted, affecting performance	A	.....	(1) Require repair or replacement.
Melted, not affecting performance	2	.....	(1) Suggest repair or replacement.
Missing	C	.....	Require replacement.
Out of adjustment	B	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Won't return	A	..	Require repair or replacement.
Worn	1	.....	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

TACHOMETER CABLES

See SPEEDOMETER AND TACHOMETER LINKAGES AND CABLES.

TACHOMETERS

See GAUGES.

TAPE PLAYERS AND CD PLAYERS

TAPE PLAYER AND CD PLAYER INSPECTION

Condition	Code	Procedure
Attaching hardware		

broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Malfunctioning	A	.....	(2) Require repair or replacement.
Missing	C	.....	Require replacement.
Skips	A	..	Require repair or replacement.
Sound quality poor	A	.....	(3) Require repair or replacement.
Speed incorrect	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead burned	A	..	Require repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Malfunctioning includes inoperative, intermittent operation, or failure to perform all functions.
(3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical interference.

TENSIONERS

TENSIONER INSPECTION

Condition	Code		Procedure
Alignment incorrect	B	..	Require repair or replacement.
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement

			of hardware.
Bearings worn	1	.....	Suggest replacement.
Belt tension incorrect	B	...	Require adjustment or repair.
Cracked	2	.....	Suggest replacement.
Missing	C	.....	Require replacement.
Noisy	2	.....	Suggest replacement.
Pulley damaged, affecting belt life	A	.....	Require replacement.
Seized	A	..	Require repair or replacement.

TIMERS

TIMER INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Broken	A	..	Require repair or replacement.
Burned, affecting performance	A	.....	(1) Require repair or replacement.
Burned, not affecting performance	2	.....	(1) Suggest repair or replacement.
Cracked, affecting performance	A	..	Require repair or replacement.
Cracked, not affecting performance	1	..	Suggest repair or replacement.
Inoperative	A	.....	(2) Require repair or replacement.
Melted, affecting performance	A	.....	(1) Require repair or replacement.
Melted, not affecting performance	2	.....	(1) Suggest repair or replacement.
Missing	C	.....	Require replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

(2) - Inoperative includes intermittent operation or out of OEM specification.

TIRE PRESSURE SENSORS

TIRE PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require repair or replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

TRANSCEIVERS

TRANSCEIVER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Malfunctioning	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Sound quality poor	A	(3) Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting		

performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance ..	1	..	Suggest repair or replacement.
Wire lead burned	A	..	Require repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Malfunctioning includes inoperative, intermittent operation, or failure to perform all functions.
(3) - Make sure poor sound quality is not caused by ignition/charging system or other forms of electrical interference.

TRANSDUCERS

TRANSDUCER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	..... (1) Require repair or replacement.
Connector missing	C	..... Require replacement.
Drive mechanism damaged, affecting performance ..	A	..... (2) Require repair or replacement.
Drive mechanism damaged, not affecting performance	2	..... (2) Suggest repair or replacement.
Inoperative	A	..... (3) Require repair or replacement.
Leaking (vacuum/fluid/air)	A	..... Require replacement.
Linkage bent, affecting performance	A	... Require repair or replacement of linkage.
Linkage bent, not affecting performance ..	..	..... No service suggested or required.
Linkage binding, affecting performance	A	... Require repair or replacement of linkage.
Linkage binding, not affecting performance ..	2	... Suggest repair or replacement of linkage.
Linkage broken	A	... Require repair or replacement

			of linkage.
Linkage loose, affecting performance	A	...	Require repair or replacement of linkage.
Linkage loose, not affecting performance	1	...	Suggest repair or replacement of linkage.
Linkage missing	C	...	Require replacement.
Linkage noisy	2	..	Suggest repair or replacement.
Out of adjustment	B	...	(4) Further inspection required.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	...	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Further inspection required to determine cause.
(3) - Inoperative includes intermittent operation or out of specification.
(4) - Follow OEM recommended adjustment procedures. Repair or replace if out of specification.

VACUUM ACCUMULATORS (RESERVOIRS)

VACUUM ACCUMULATOR (RESERVOIR) INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	...	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Leaking	A	..	Require repair or replacement.

VACUUM RESERVOIRS

See VACUUM ACCUMULATORS (RESERVOIRS).

VOLTAGE REGULATORS

VOLTAGE REGULATOR INSPECTION

Condition	Code	Procedure

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - NOTE: Inoperative includes intermittent operation or out of OEM specification.

WASHER FLUID LEVEL SENDERS

WASHER FLUID LEVEL SENDER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.

Condition	Code	Procedure
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

WASHER PUMPS

WASHER PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Leaking externally	A	Require repair or replacement.
Leaking internally	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.

Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation.

WIPER ARMS AND BLADES

NOTE: Windshield coatings or waxes can cause blades to not function as intended. Clean surface before making final judgment about blade replacement.

WIPER ARM AND BLADE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Attaching socket stripped	A	Require replacement.
Bent	A	Require repair or replacement.
Loose	2	Suggest repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Size incorrect	2	Suggest replacement.
Tension insufficient	B	Require repair or replacement.
Torn	A	Require replacement.
Worn, affecting performance	A	Require replacement.
Worn, not affecting performance	1	Suggest replacement.

WIPER BLADES

See WIPER ARMS AND BLADES.

WIPER HOSES AND NOZZLES

WIPER HOSE AND NOZZLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Blocked	A	Require repair or replacement.

Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Oil-soaked (spongy)	1	.....	Suggest replacement.
Spray pattern incorrect	2	..	Suggest repair or replacement.
Surface cracks (dry-rotted)	1	.....	Suggest replacement.

WIPER LINKAGES

WIPER LINKAGE INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Attaching stud stripped	A	.....	Require replacement.
Bent	A	..	Require repair or replacement.
Inoperative	A	.....	(1) Require replacement.
Loose	2	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Noisy	2	..	Suggest repair or replacement.
Tension insufficient	B	..	Require repair or replacement.
Worn, affecting performance	A	.....	Require replacement.
Worn, not affecting performance	1	.....	Suggest replacement.

(1) - Inoperative includes intermittent operation.

WIPER NOZZLES

See WIPER HOSES AND NOZZLES.

WIPER PUMP RESERVOIRS

WIPER PUMP RESERVOIR INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Cap missing	C	.....	Require replacement.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

ELECTROSTATIC DISCHARGE WARNING - BASIC INFORMATION

1997-99 Mitsubishi Montero Sport

ARTICLE BEGINNING

GENERAL INFORMATION
Electrostatic Discharge (ESD) Warning - Basic Information

All Makes amd Models

* PLEASE READ THIS FIRST *

NOTE: This article is intended for general information purposes only.

INTRODUCTION

All Electrostatic Discharge (ESD) sensitive components contain solid state circuits (transistors, diodes, semiconductors) that may become damaged when contacted with an electrostatic charge. The following information applies to all ESD sensitive devices. The ESD symbol shown in Fig. 1 may be used on schematics to indicate which components are ESD sensitive. See Fig. 1. Although different manufactures may display different symbols to represent ESD sensitive devices, the handling and measuring precautions and procedures are the same.

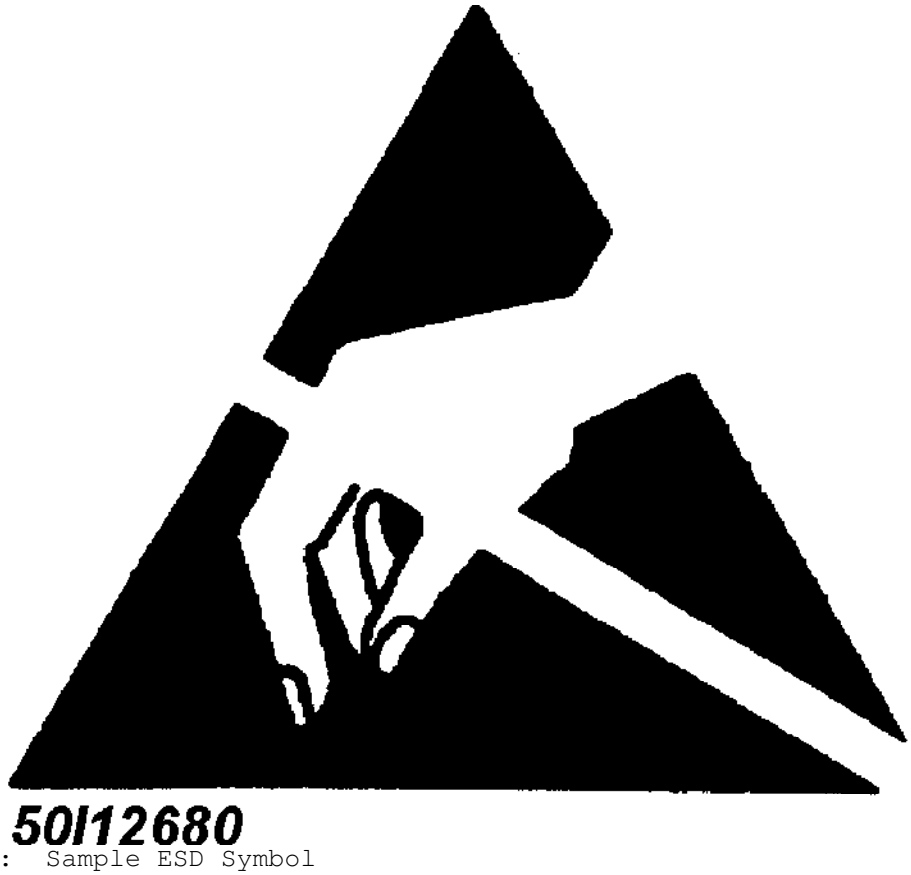


Fig. 1: Sample ESD Symbol

HANDLING STATIC-SENSITIVE CIRCUITS/DEVICES

When handling an electronic part that is ESD sensitive, the technician should follow these guidelines to reduce any possible electrostatic charge build-up on the technician's body and the electronic part.

1) Always touch a known good ground source before handling the part. This should be repeated while handling the part and more frequently after sitting down from a standing position, sliding across the seat or walking a distance.
2) Avoid touching electrical terminals of the part, unless instructed by a diagnostic procedure.
3) DO NOT open the package of a new part until it is time to install the part.
4) Before removing the part from its package, ground the package to a known good ground source.

CHECKING STATIC-SENSITIVE CIRCUITS/DEVICES

1) Solid State circuits in electronic devices are shown greatly simplified in schematics. See Fig. 2. Due to the simplification of the electronic devices on the schematic, resistance measurements could be misleading or could lead to an electrostatic discharge. Always follow the recommended diagnostic procedure.

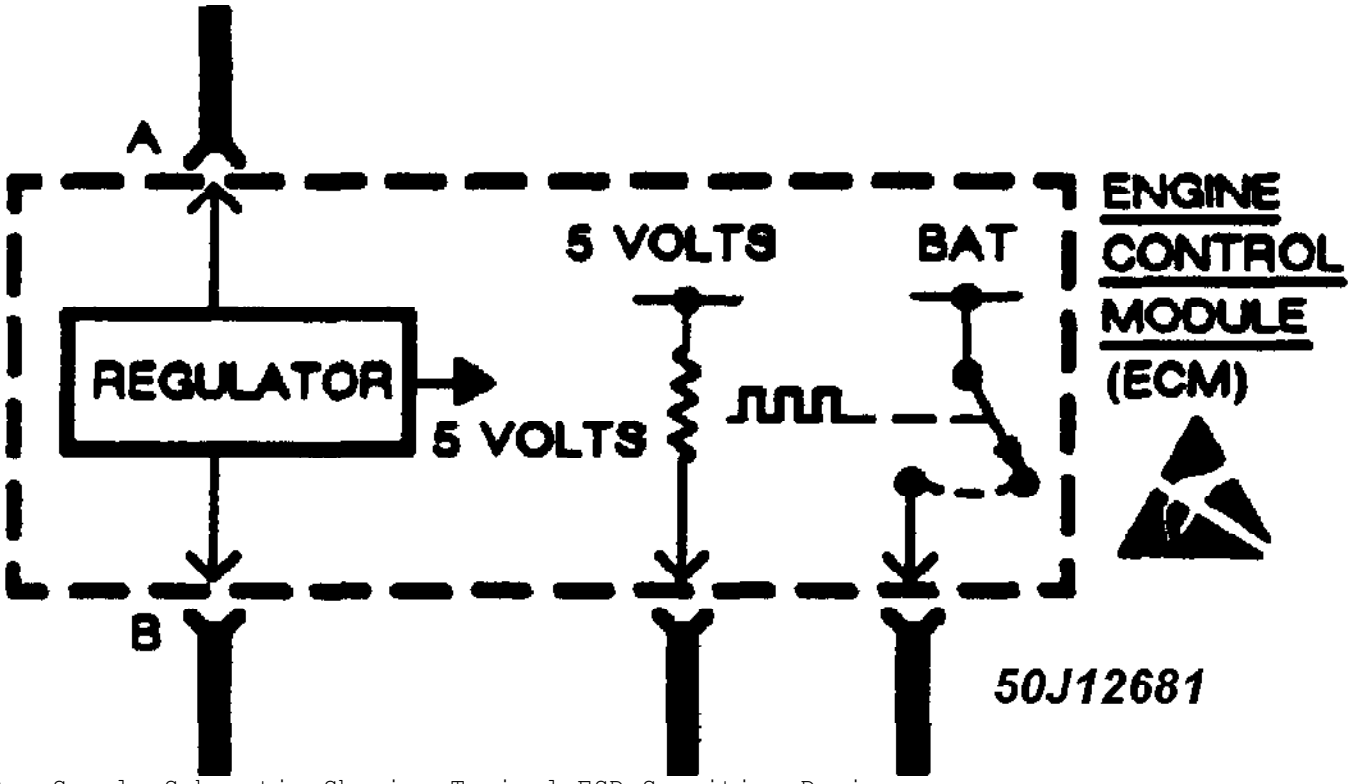


Fig. 2: Sample Schematic Showing Typical ESD Sensitive Device

2) Only measure resistance at the terminals of the devices when instructed by the recommended diagnostic procedure.
3) When using a voltmeter, be sure to connect the ground lead first.

B - EMISSION APPLICATION

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Emission Applications

All Models

EMISSION APPLICATIONS

EMISSION APPLICATIONS TABLE (7)

Model, Engine & Fuel System	Emission Control Systems & Devices
Diamante	
3.5L V6 MFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, EGR-CS, EGR-VCV, SPK-CC
Eclipse	
2.0L 4-Cyl. Non-Turbo & Turbo MFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices ...	EVAP-CPCS, EVAP-CS, EVAP-VC, EGR-CS, (2) EGR-TS, SPK-CC
Eclipse Spyder	
2.0L 4-Cyl. Turbo MFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices ...	EVAP-CPCS, EVAP-CS, EVAP-VC, EGR-CS, SPK-CC
2.4L 4-Cyl. MFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, EGR-CS, EGR-VCV, SPK-CC
Galant	
2.4L 4-Cyl. MFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, (3) EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, (3) EGR-CS, (3) EGR-VCV, SPK-CC
Mirage	
1.5L 4-Cyl. MFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, EGR-CS, EGR-VCV, SPK-CC
1.8L 4-Cyl. MFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, EGR-CS, EGR-VCV, SPK-CC
Montero	
3.5L V6 MFI	
Major Control Systems/Devices	PCV, EVAP, TWC, (3) EGR, FR, SPK, (4) (5) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, (3) EGR-CS, (3) EGR-VCV, SPK-CC
Montero Sport	
2.4L 4-Cyl. MFI	

Major Control Systems/Devices	PCV, EVAP, TWC, FR, (3) EGR, SPK, (1) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-VC, (3) EGR-CS, (3) EGR-VCV, SPK-CC
3.0L V6 MFI	
Major Control Systems/Devices	PCV, EVAP, TWC, (3) EGR, FR, SPK, (4) (5) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-CS, EVAP-VC, (3) EGR-VCV, SPK-CC
3000GT	
3.0L V6 Non-Turbo & Turbo MFI	
Major Control Systems/Devices	PCV, EVAP, TWC, FR, EGR, SPK, (6) HO2S, CEC, MIL
Components/Other Related Devices	EVAP-CPCS, EVAP-CS, EVAP-VC, EGR-CS, (2) EGR-VCV, SPK-CC

(1) - Equipped with 2 HO2S.
(2) - Non-Turbo.
(3) - Federal.
(4) - Federal equipped with 2 HO2S.
(5) - California equipped with 4 HO2S.
(6) - Equipped with 4 HO2S.
(7) - California or Federal refers to installed emissions equipment. California emissions models may be available in all states.

ABBREVIATION DEFINITIONS

ABBREVIATION DEFINITIONS TABLE

Abbreviation	Definition
CEC	Computerized Engine Control
EGR	Exhaust Gas Recirculation
EGR-CS	EGR Control Solenoid
EGR-TS	EGR Transducer Solenoid
EGR-VCV	EGR Vacuum Control Valve
EVAP	Fuel Evaporative System
EVAP-CS	EVAP Control Solenoid
EVAP-CPCS	EVAP Canister Purge Control Solenoid
EVAP-VC	EVAP Vapor Canister
FR	Fill Pipe Restrictor
HO2S	Heated Oxygen Sensor
MFI	Multiport Fuel Injection
MIL	Malfunction Indicator Light
PCV	Positive Crankcase Ventilation
SPK	Spark Controls
SPK-CC	SPK Computer Controlled
TWC	Three-Way Catalyst

3.0L V6 VINS [H,J,K,P]

1997-99 Mitsubishi Montero Sport

1997-99 ENGINES
Mitsubishi 3.0L V6

Montero Sport, 3000GT

* PLEASE READ THIS FIRST *

NOTE: For engine repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

ENGINE IDENTIFICATION

Engine may be identified by Vehicle Identification Number (VIN) stamped on a metal pad located near lower left corner of windshield. The eighth character of VIN identifies engine, and tenth character identifies model year ("V" for 1997; "W" for 1998). Engine model number is stamped on front upper edge of cylinder block, below cylinder head, or on vehicle information plate on firewall. Engine serial number is stamped near the engine model number.

ENGINE IDENTIFICATION CODES

Application	Engine Model	Engine Code
Montero Sport	6G72	P
3000GT		
SOHC	6G72	H
DOHC Non-Turbo	6G72	J
DOHC Turbo	6G72	K

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: All engines are equipped with hydraulic lash adjusters. Adjustment is not required.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

NOTE: For reassembly reference, label all electrical connectors, vacuum hoses, and fuel lines before removal. Also place mating marks on engine hood and other major assemblies before removal.

FUEL PRESSURE RELEASE

Perform these steps to release fuel system pressure:

* Remove fuel pump cover in luggage compartment.
* Disconnect fuel pump harness connector at fuel tank.
* Start engine. After it stalls, turn ignition switch to OFF position.
* Disconnect battery (-) terminal. Reconnect fuel pump harness.
* Wrap shop towels around fuel return and high pressure hoses to prevent fuel splashing on engine. Disconnect fuel return hose and high pressure fuel hose to drain any residual fuel.

ENGINE

Removal (Montero Sport)

1) Remove hood. Drain cooling system. Remove radiator. Remove skid plate and splash shields. Release fuel system pressure. See FUEL PRESSURE RELEASE. Remove battery. Remove cruise control actuator and linkage (if equipped).

2) Remove air cleaner ducts. Remove accessory drive belts. Remove and support A/C compressor and power steering pump, leaving hoses connected. Disconnect oil cooler hoses. Cover fuel hose with shop towel, and disconnect high pressure fuel hose and "O" ring. Disconnect fuel return hose.

3) Label and disconnect all vacuum hoses. Disconnect cooling system hoses. Label and unplug all electrical connections from engine. Remove heat shield from motor mounts. Remove motor mount bolts. Ensure all hoses and wires are disconnected and set aside.

4) Disconnect exhaust pipe from exhaust manifolds. Remove starter. Attach engine hoist to engine. Support transmission. Disconnect engine from transmission. Remove engine.

Installation

To install, reverse removal procedure. Install and lubricate NEW "O" rings on fuel lines. Install NEW exhaust gaskets and nuts. See TORQUE SPECIFICATIONS. Replenish fluids.

CAUTION: DO NOT allow foreign material into turbocharger air intake hoses or pipes.

Removal (3000GT)

1) Release fuel pressure. See FUEL PRESSURE RELEASE. Remove hood. Remove cruise control vacuum pump and linkage. On turbo models, remove necessary turbo air intake hoses and pipes. On all other models, remove air cleaner hoses.

2) On all models, drain cooling system. Drain engine oil and transaxle oil. Remove heater hoses and radiator hoses. Remove transaxle assembly. On M/T models, see CLUTCH article in the POWERTRAIN category. On A/T models, see TRANSMISSION REMOVAL & INSTALLATION - A/T article in AUTOMATIC TRANSMISSION SERVICING.

3) Remove radiator. Label and disconnect all vacuum hoses. Label and unplug all electrical connections and harnesses from engine. Remove accessory drive belts.

4) Remove and support A/C compressor and power steering pump. DO NOT disconnect hoses from compressor or pump. Cover fuel hose with shop towel, and disconnect high pressure fuel hose and "O" ring. Disconnect fuel return hose.

5) On turbo models, disconnect oil cooler and vacuum hoses. On all models, remove motor mount bolts and brackets. Ensure all hoses and wires are disconnected and set aside. Attach engine hoist to engine. Remove engine.

Installation

To install, reverse removal procedure. Install and lubricate NEW "O" rings on fuel lines. Install NEW exhaust gaskets and nuts. See

TORQUE SPECIFICATIONS. Replenish fluids.

INTAKE MANIFOLD

CAUTION: Fuel system is under pressure. Fuel pressure must be released before disconnecting fuel lines. See FUEL PRESSURE RELEASE.

Removal (Montero Sport)

1) Release fuel pressure. Drain cooling system. Remove air intake hose and ducts. Remove throttle body. Remove ignition coils and accelerator cable bracket. Remove EGR valve (if equipped).

2) Label and disconnect all cables, vacuum hoses, cooling system hoses, and electrical connections. Remove manifold bracket. Remove upper intake manifold. See Fig. 1. Remove fuel pressure regulator, fuel injectors, fuel rails, and insulators. Remove retaining nuts and lower intake manifold. See Fig. 2.

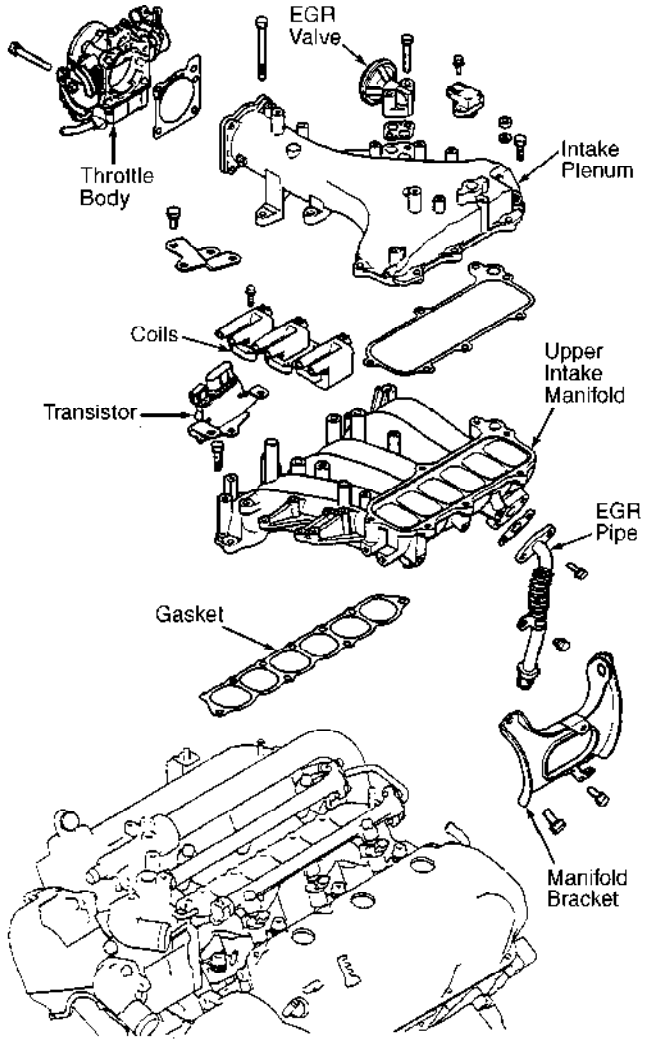


Fig. 1: Exploded View Of Typical Upper Intake Manifold Components (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America, Inc.

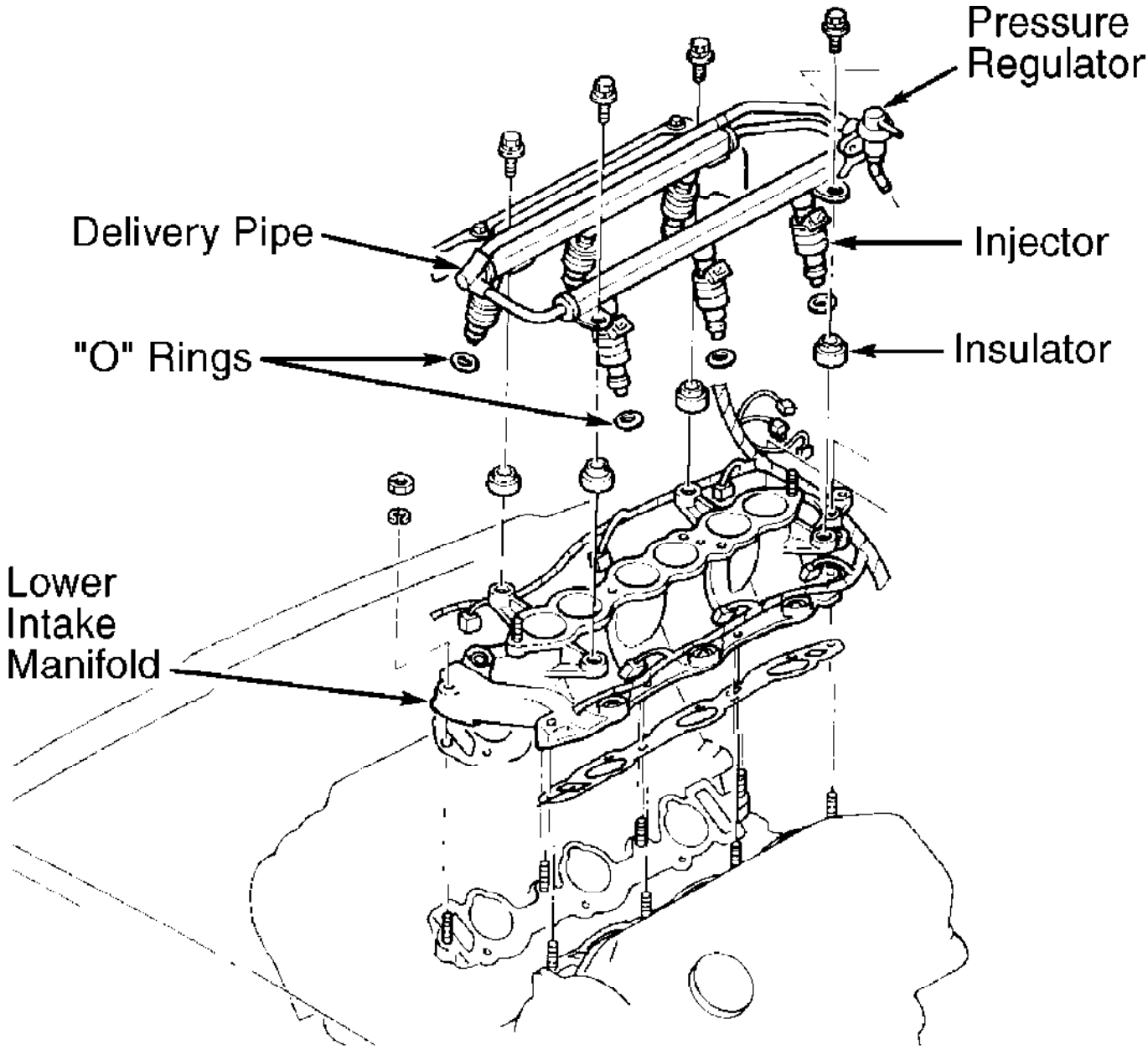


Fig. 2: Exploded View Of Typical Lower Intake Manifold
Courtesy of Mitsubishi Motor Sales of America, Inc.

Removal (3000GT SOHC)

1) Release fuel pressure. Drain cooling system. Remove air intake hose. Remove throttle body. Remove EGR valve and tube. Remove front and rear manifold brackets. Remove upper intake manifold. See Fig. 3.

2) Remove spark plug cables, spark plugs, distributor, and coil. Remove fuel pressure regulator, fuel injectors, fuel rails, and grommets. Remove coolant and heater hoses. Remove temperature sensors and thermoswitch. Remove coolant outlet fitting and thermostat. Remove retaining nuts and lower intake manifold.

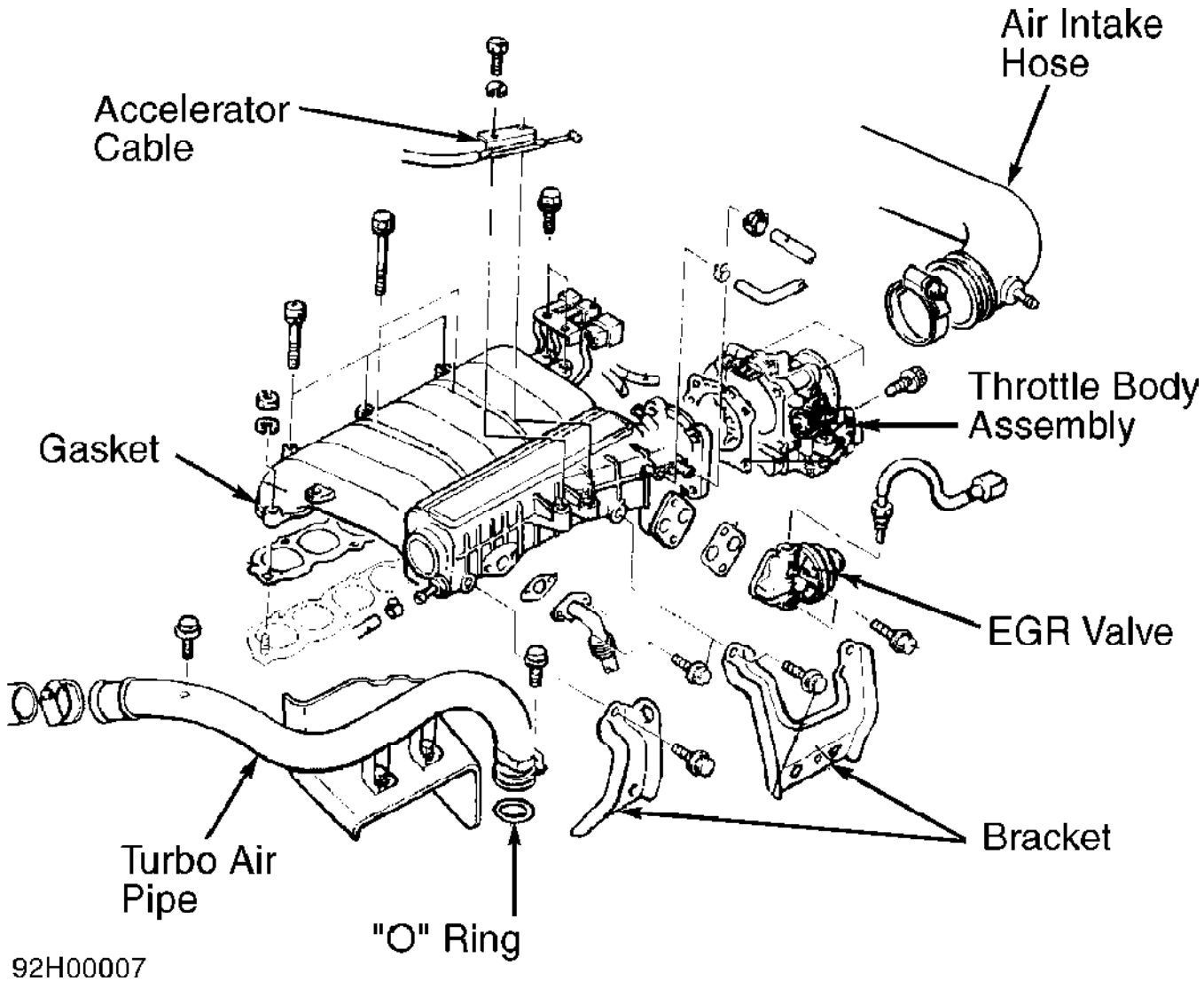


Fig. 3: Exploded View Of Typical Upper Intake Manifold Components (3000GT - SOHC & DOHC With Turbo)
Courtesy of Mitsubishi Motor Sales of America, Inc.

Removal (3000GT DOHC Non-Turbo)

1) Release fuel pressure. Remove air intake hose. Remove EGR tube. Remove both intake plenum braces. Remove EGR valve. Remove throttle body. Remove accelerator cable bracket. Drain coolant. Label and disconnect all vacuum hoses, cooling system hoses, and electrical connections. Remove intake plenum.

2) Disconnect high pressure fuel hose and fuel return hose. Remove timing belt upper cover. Disconnect fuel injector wiring harness connectors. Remove fuel injectors, fuel rails, and insulators. Remove retaining nuts and lower intake manifold. See Figs. 2 and 4.

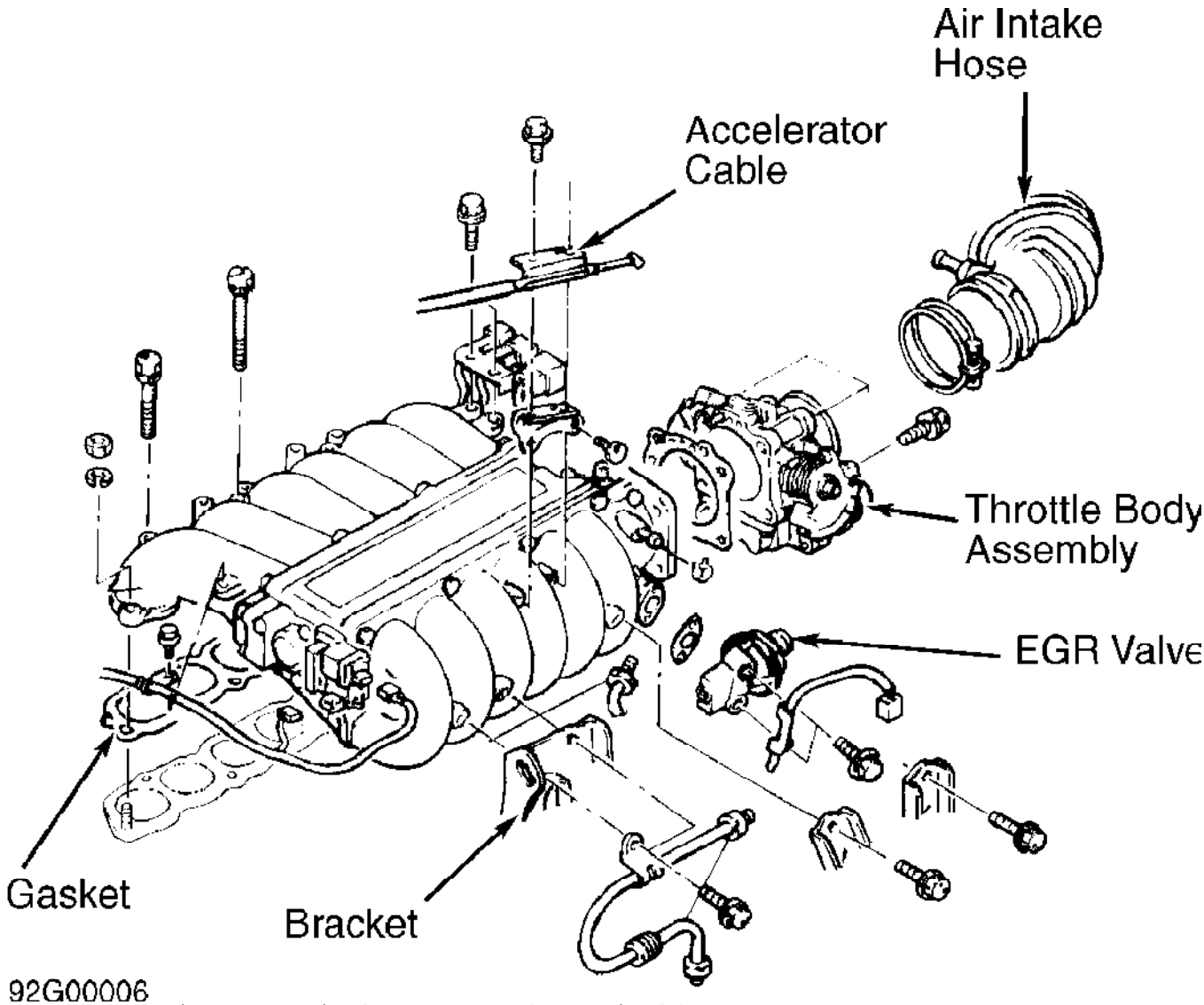


Fig. 4: Exploded View Of Typical Upper Intake Manifold Components (3000GT - DOHC Without Turbo)
Courtesy of Mitsubishi Motor Sales of America, Inc.

Removal (DOHC Turbo)

1) Release fuel pressure. Drain cooling system. Remove air intake hose. Remove turbo air pipe. Remove EGR tube. Remove both intake plenum braces. Remove EGR valve. Remove throttle body. Label and disconnect all vacuum hoses, cooling system hoses, and electrical connections. Remove intake plenum.

2) Disconnect high pressure fuel hose and fuel return hose. Remove timing belt upper cover. Disconnect fuel injector wiring harness connectors. Remove fuel injectors, fuel rails, and insulators. Remove retaining nuts and lower intake manifold. See Figs. 2 and 3.

Installation (All Models)

Clean all gasket mating surfaces. Inspect for damage and cracks on all mounting surfaces. To install, reverse removal procedure using NEW gaskets and "O" rings. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

TURBOCHARGER

CAUTION: DO NOT allow foreign material into turbocharger air intakes or coolant and oil passages.

Removal (Front)

1) Drain coolant. Remove radiator. Remove right transaxle brace. Disconnect exhaust pipe from turbocharger. Remove all air intake ducts. Note match marks and installation depth on air pipes and hoses for reinstallation reference. Remove accessory drive belt. Remove generator. Remove A/C compressor and bracket, leaving hoses connected, and support aside.

2) Remove oxygen sensor. Remove dipstick assembly. Remove turbocharger heat shield. Disconnect turbo coolant feed and return lines. Disconnect turbocharger oil feed and return lines. Remove turbocharger assembly.

Removal (Rear)

1) Drain coolant. Remove battery. Disconnect accelerator cable at bracket and throttle body. Disconnect exhaust pipe from turbo. Remove all air intake pipes and heat shields. Note match marks and installation depth on air pipes and hoses for reinstallation reference. Disconnect accelerator cable at pedal.

2) Remove clutch booster vacuum hose. Remove oxygen sensor. Remove EGR tube. Remove turbocharger heat shield. Disconnect turbocharger coolant feed and return lines. Disconnect turbocharger oil feed and return lines. Remove turbocharger assembly.

Installation (Front & Rear)

Inject clean engine oil into turbocharger through oil pipe installation hole. To complete installation, reverse removal procedure. Align match marks, and install air ducts and hoses to proper depth.

EXHAUST MANIFOLD

Removal (Montero Sport)

Disconnect exhaust pipes from manifolds. Lower exhaust pipes. Remove air cleaner. Remove battery and battery tray. Remove engine oil dipstick assembly. Remove EGR tube and gasket (if equipped). Remove heat shields. Remove front intake manifold plenum bracket. Remove exhaust manifolds and gaskets.

Removal (3000GT)

1) Remove turbocharger(s) (if equipped). See TURBOCHARGER. On front manifold, remove drive belt and alternator. Remove oil dipstick assembly. On rear manifold, remove EGR tube (if equipped).

NOTE: Note locations and orientation of exhaust manifold washers for installation reference. DO NOT mix these fasteners.

2) On all manifolds, remove exhaust pipe-to-manifold nuts. Lower exhaust pipe. Remove heat shield. Remove exhaust manifold nuts and washers. Note locations and orientation of all washers for reinstallation reference. DO NOT mix these fasteners. Remove exhaust manifold and gasket.

Installation (All Models)

To install, reverse removal procedure. Install NEW gaskets. Lubricate NEW dipstick tube "O" ring with engine oil before installation. Install manifold nuts and washers in original locations. On 3000GT, tighten nuts in sequence. See Fig. 5. On Montero Sport, tighten nuts to specification. See TORQUE SPECIFICATIONS.

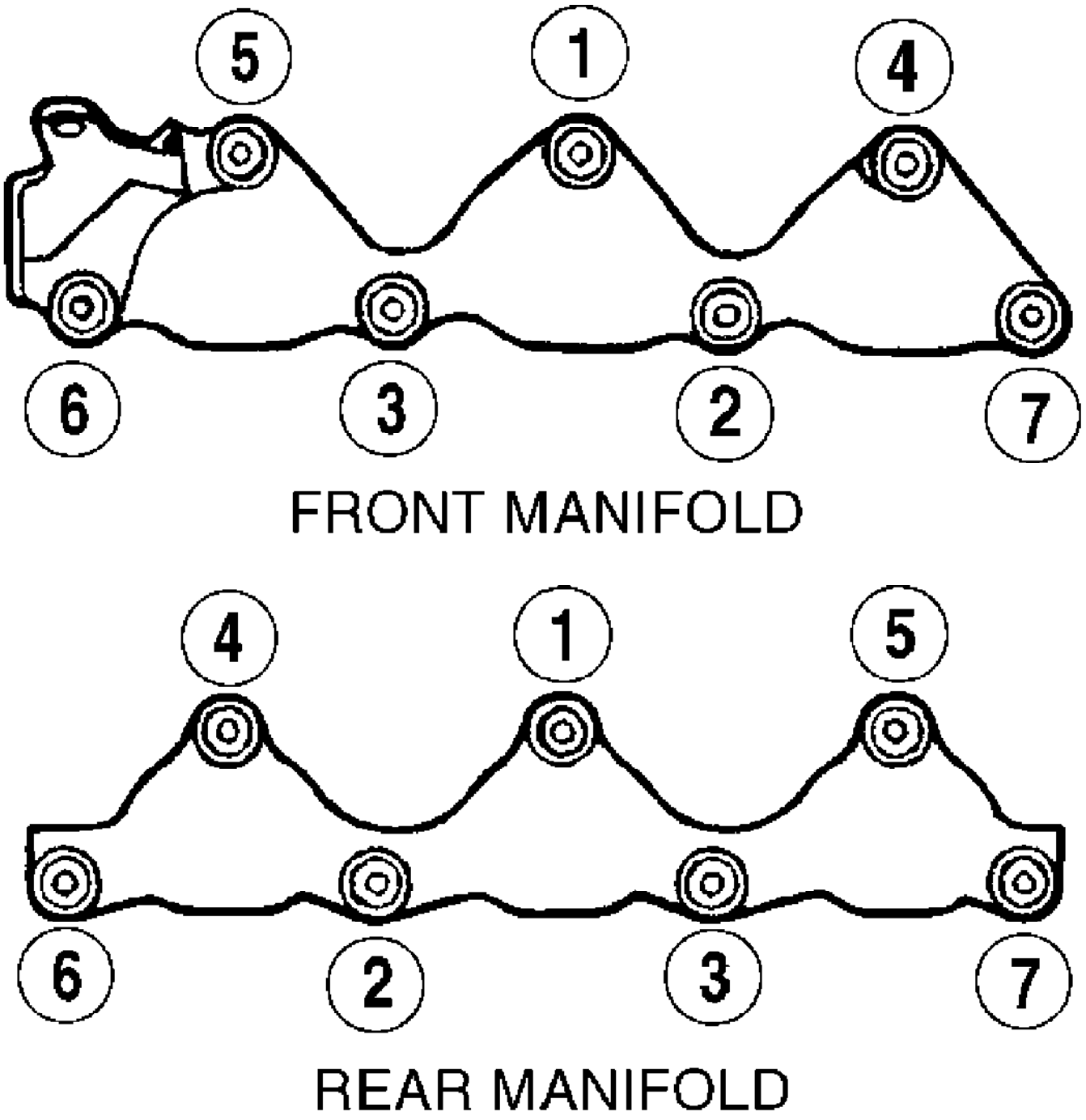


Fig. 5: Exhaust Manifold Tightening Sequence (3000GT)
Courtesy of Mitsubishi Motor Sales of America, Inc.

CYLINDER HEAD

Removal (SOHC)
1) Drain cooling system. Remove intake manifolds and

brackets. See INTAKE MANIFOLD. Remove spark plug wires. Remove splash shields. Disconnect oxygen sensor. Remove heat shields and exhaust manifolds. See EXHAUST MANIFOLD.

2) Remove distributor. Remove timing belt outer covers, camshaft sprockets, timing belt, and timing belt inner covers. See TIMING BELT. Remove accessory bracket bolts from front of cylinder head. Remove rocker cover and gasket.

NOTE: To prevent cylinder head warpage and cracking, loosen cylinder head bolts in 2 or 3 stages in proper sequence.

3) Using Socket (MD998051), unscrew cylinder head bolts in 2 or 3 stages in proper sequence. See Fig. 6. Remove cylinder head and camshaft assemblies. Note orientation of washers under cylinder head bolts.

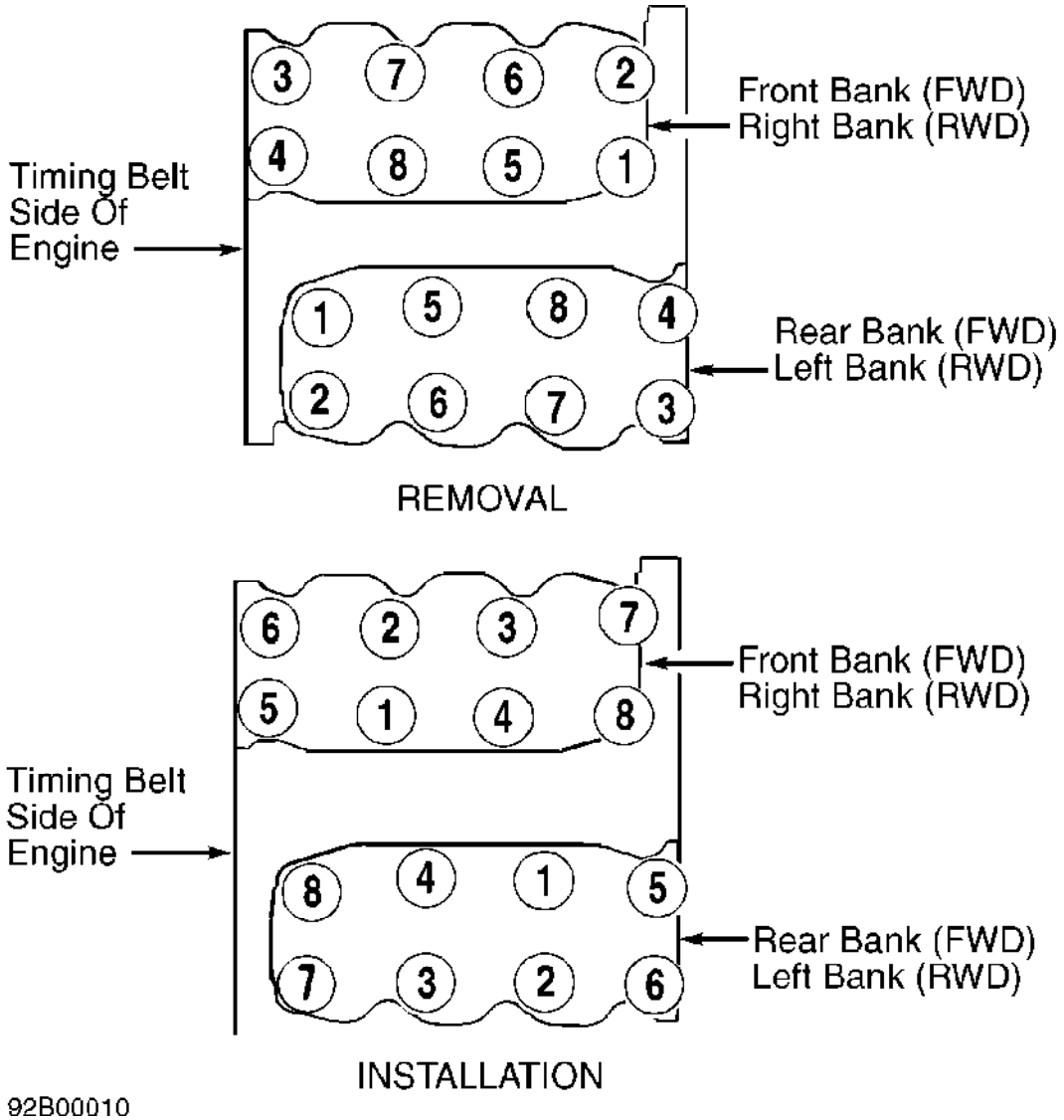


Fig. 6: Removing & Installing Cylinder Head Bolts
Courtesy of Mitsubishi Motor Sales of America, Inc.

Inspection

Measure cylinder head height. Measure warpage at gasket and

manifold surfaces. Resurface head if warpage exceeds specification. See CYLINDER HEAD (SOHC) table under ENGINE SPECIFICATIONS. Replace cylinder head if it is not within specification after resurfacing.

Installation

1) Ensure mating surfaces are clean and dry. Note identification mark located on front of head gasket. Identification marks are 72S2 for SOHC, and 72D4 for DOHC engines. Install head gasket with identification mark toward timing belt side of engine, facing upward.

2) Install cylinder head. Install cylinder head bolt washers with chamfered side toward bolt head. Using proper sequence, tighten bolts to specification in 2 or 3 stages in proper sequence. See Fig. 6 . See TORQUE SPECIFICATIONS.

3) Apply sealant to rocker cover sealing surfaces before installation. See Fig. 7. Align rocker cover gasket projections with notches in rocker cover. Lubricate all "O" rings with engine oil before installation. Install NEW "O" rings onto distributor adapter and oil dipstick tube.

4) Lubricate camshaft area with oil prior to installing distributor adapter. To complete installation, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. After engine reaches normal operating temperature, allow engine to cool. Retighten cylinder head bolts to specification.

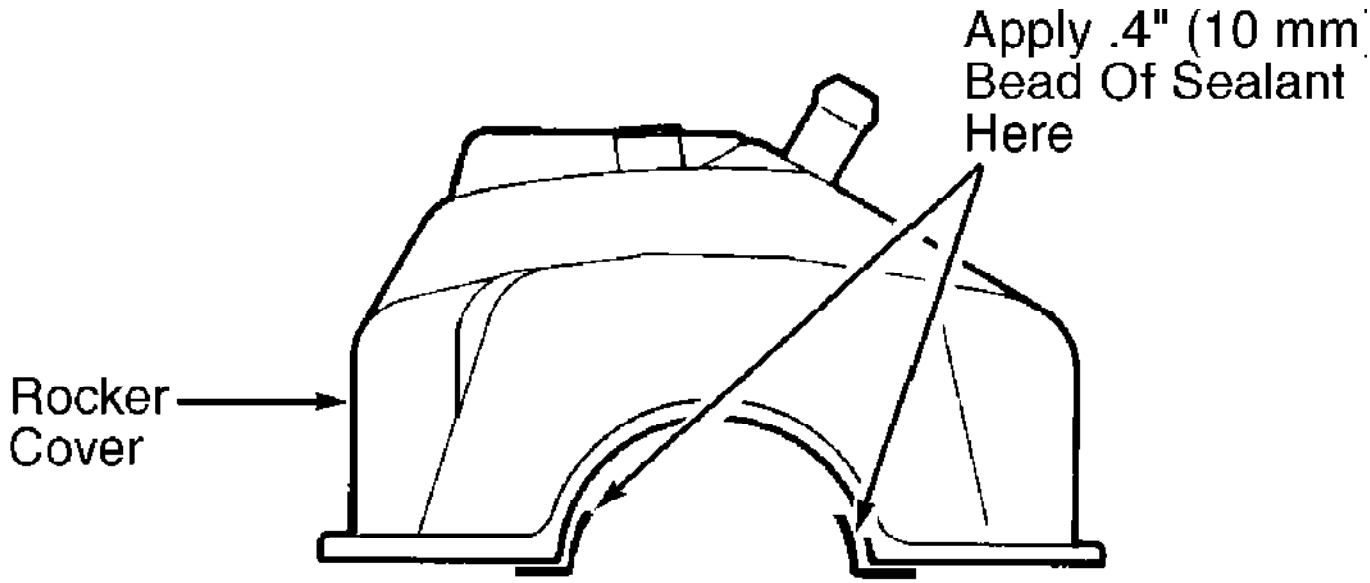


Fig. 7: Applying Sealant To Rocker Cover (SOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

Removal (DOHC)

1) Drain cooling system. Remove intake manifolds and brackets. See INTAKE MANIFOLD. Remove turbocharger(s) (if equipped). See TURBOCHARGER. Remove exhaust manifolds. See EXHAUST MANIFOLD.

2) Remove spark plug wires and ignition coils. Remove rocker cover and gasket. Remove timing belt and timing belt inner covers. See TIMING BELT. Remove intake camshaft sprockets.

3) Remove coolant manifold and coolant inlet pipe. Using Socket (MD998051), loosen cylinder head bolts evenly in 2 or 3 stages.

Remove cylinder head. For installation reference, note orientation of washers under cylinder head bolts.

Inspection

Measure cylinder head height. Measure warpage at gasket and manifold surfaces. Resurface head if warpage exceeds specification. See CYLINDER HEAD (DOHC) table under ENGINE SPECIFICATIONS. After resurfacing, remeasure cylinder head height. Replace cylinder head if it is not within specification.

Installation

1) Ensure mating surfaces are clean and dry. Note identification mark located on front of head gasket. Identification marks are 72S2 for SOHC, and 72D4 for DOHC engines. Install head gasket with identification mark toward timing belt side of engine, facing upward. Align all holes in head gasket.

2) Install cylinder head. Install cylinder head bolt washers with chamfered side toward bolt head. Using proper sequence, tighten bolts to specification in 2 or 3 stages in sequence. See Fig. 6. See TORQUE SPECIFICATIONS.

3) To reinstall camshaft sprocket, hold hexagonal area of camshaft with wrench while tightening sprocket bolt. Tighten rocker cover bolts in a crisscross pattern. Start at 4 corners of rocker cover and work toward center.

NOTE: Rocker cover bolts are color-coded. Front cylinder bank bolts are Black and rear cylinder bank bolts are Green.

4) To complete installation, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

FRONT CRANKSHAFT OIL SEAL

Removal & Installation

Remove timing belt and crankshaft sprocket. See TIMING BELT. Pry oil seal from oil pump. Before installation, coat seal lip with grease. Using Seal Driver (MD998717), install seal in oil pump. Install remaining components. See TORQUE SPECIFICATIONS.

TIMING BELT

Removal (Montero Sport)

1) Drain cooling system. Disconnect upper radiator hose. Remove upper radiator shroud. Remove cooling fan and fan clutch assembly. Remove cooling fan pulley. Remove drive belts. Remove power steering pump, leaving hoses connected. Set power steering pump aside.

2) Remove power steering pump brackets. Remove A/C tensioner pulley and mounting bracket. Remove A/C compressor with hoses connected, and remove mounting bracket. Remove cooling fan bracket assembly. Note location and length of bolts for reassembly reference.

3) Remove upper timing belt cover and gasket. See Fig. 8. Remove lower timing belt cover and gasket. Use Holder (MB990767) and Holder Pin (MD998715). Remove crankshaft pulley.

4) Rotate crankshaft to align all timing marks. See Fig. 9. Loosen belt tensioner bolt, and rotate belt tensioner counterclockwise to relieve belt tension.

5) If reusing timing belt, place arrow on belt to indicate belt running direction. Remove timing belt and belt tensioner. If camshaft sprocket requires removal, install Holder (MB990767) and Holder Pin (MD998715) onto camshaft sprocket. Remove retaining bolt and camshaft sprocket.

Installation (Montero Sport)

1) Install camshaft sprockets (if removed). Using holder, hold camshaft and tighten retaining bolt to specification. See TORQUE SPECIFICATIONS.

2) Install belt tensioner arm. Ensure auto-tensioner rod is not fully extended. If tensioner rod is fully extended, position auto-tensioner in vise and slowly close vise to align rod hole and set hole. Insert a 1.4 mm wire into set holes. Install auto-tensioner.

3) Rotate belt tensioner counterclockwise as far as possible, and temporarily tighten bolt. Align all timing marks with No. 1 cylinder at TDC of compression stroke. See Fig. 9.

4) Install timing belt onto crankshaft sprocket first, then onto left camshaft sprocket, with all slack removed from tension side of belt. Route timing belt onto water pump pulley, right camshaft sprocket, and tensioner. Remove any slack from belt by rotating left and then right camshaft sprockets counterclockwise.

5) Ensure belt is installed in original direction of rotation, and all timing marks are aligned. Loosen belt tensioner bolts slightly, and allow tensioner to apply belt tension.

6) Using Crankshaft Socket (MD998769), rotate crankshaft 1/4 turn counterclockwise, then 2 revolutions clockwise. Ensure all timing marks are aligned. Use Tension Pulley Wrench (MD998767) to push tensioner pulley into timing belt, then temporarily tighten center bolt.

7) Rotate crankshaft 1/4 turn counterclockwise and then clockwise until all timing marks are aligned. Loosen tensioner center bolt, then tighten to 35 ft. lbs. (48 N.m). Using Tension Pulley Wrench (MD998767) and a torque wrench, check timing belt tension. Timing belt tension should be 39 INCH lbs. (4.4 N.m).

8) Tighten center bolt to 35 ft. lbs. (48 N.m). Remove setting pin from auto-tensioner. Turn crankshaft 2 revolutions and align timing marks. Wait about 5 minutes, then check if auto-tensioner push rod extends .15-.20" (4-5 mm). If pushrod extension is not as specified, repeat step 6). To install remaining components, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

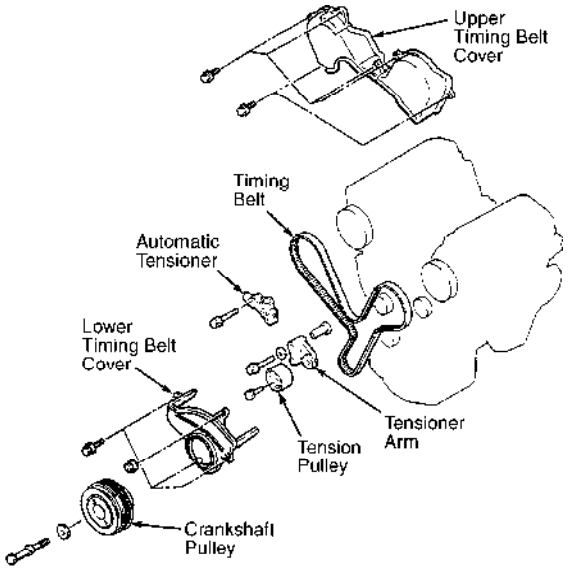


Fig. 8: Exploded View Of Timing Belt Components (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America, Inc.

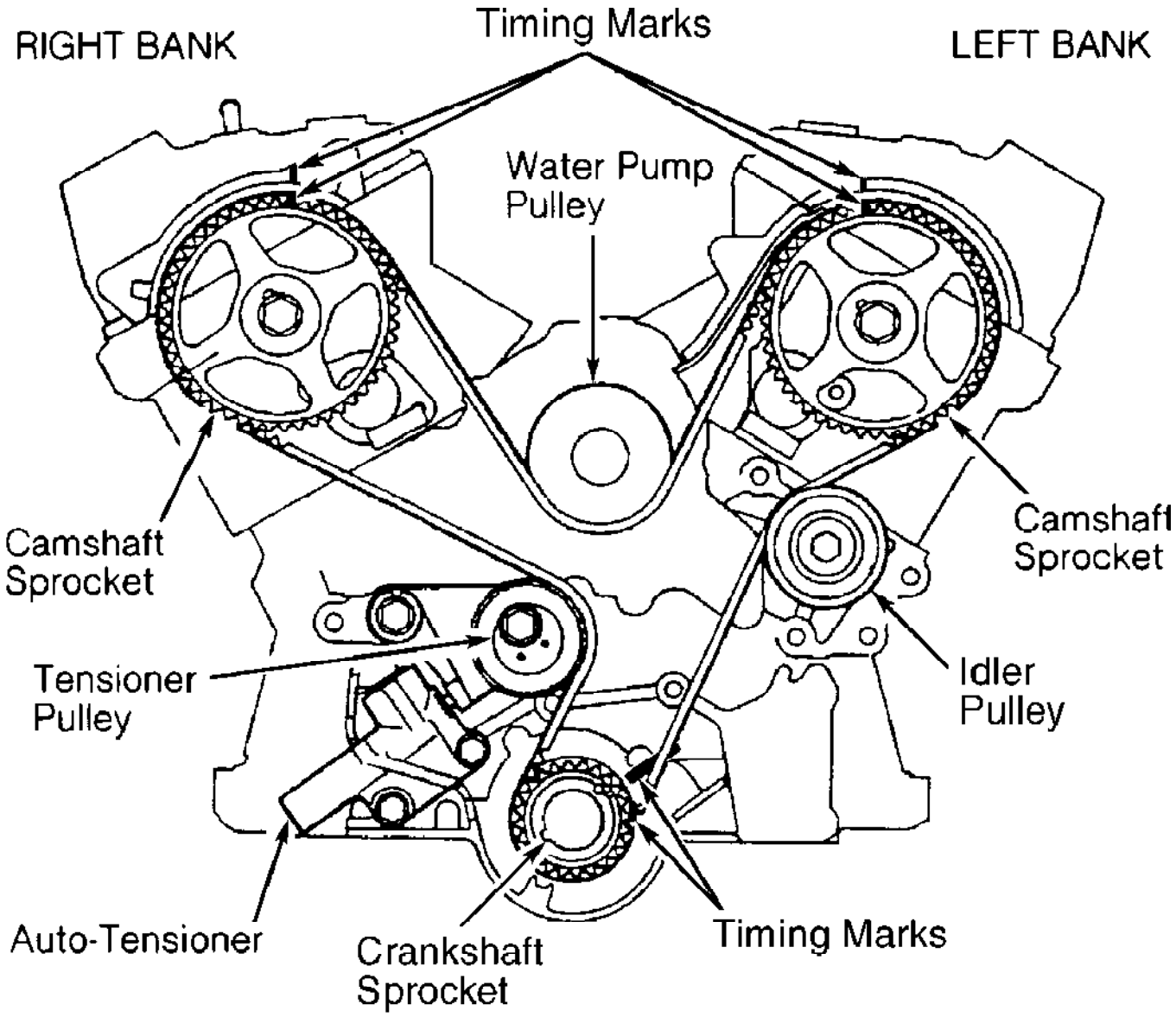


Fig. 9: Aligning Timing Marks (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America, Inc.

Removal (3000GT SOHC)

1) Remove lower splash shields. Remove cruise control actuator (if equipped). Remove all drive belts. Unplug electrical connector at power steering pump. Remove A/C tensioner pulley and mounting bracket.

2) Remove power steering pump, leaving hoses connected, and wire aside. Support engine. Remove front engine mount through-bolt and front engine mount. Remove timing belt No. 1 upper cover and gaskets. See Fig. 10.

NOTE: Engine support bracket reamer bolt may be seized. Apply penetrating lubricant to bolt during removal.

3) Remove engine support bracket bolts in proper sequence. See Fig. 11. Remove engine support bracket. Remove timing cover cap,

timing belt cover, and gaskets. Using Holder (MB990767) and Adapter Bolts (MD998754), remove crankshaft pulley.

4) Remove lower timing belt cover, gaskets, and flange. See Fig. 10. Rotate crankshaft to align all timing marks. See Fig. 12. Loosen belt tensioner bolt. Rotate belt tensioner counterclockwise to relieve belt tension.

5) If reusing timing belt, place arrow on belt to indicate belt running direction. Remove timing belt and belt tensioner.

6) If camshaft sprocket requires removal, install Holder (MB990767) with Adapter Bolts (MD998754) onto camshaft sprocket. Remove camshaft sprocket bolt and camshaft sprocket. Remove rear timing belt cover if necessary.

Installation

1) Install rear timing belt cover. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Install camshaft sprockets (if removed). Using holder, hold camshaft and tighten camshaft sprocket bolt to specification.

2) Install belt tensioner and spring. Ensure spring is secured on pin of water pump and engaged in hole of belt tensioner, with hook of spring pointing away from cylinder block.

3) Rotate belt tensioner counterclockwise as far as possible. Temporarily tighten bolt. Align all timing marks with No. 1 cylinder at TDC of compression stroke. See Fig. 12.

4) Install timing belt onto crankshaft sprocket, rear cylinder bank camshaft sprocket, water pump pulley, front cylinder bank camshaft sprocket, and timing belt tensioner. Ensure belt is installed in original direction of rotation, and all timing marks are aligned. Install flange onto crankshaft. Loosen belt tensioner bolts slightly, and allow tensioner to apply belt tension.

5) Using Crankshaft Socket (MD990998), rotate crankshaft 2 revolutions clockwise. DO NOT rotate counterclockwise. Realign all timing marks. Tighten belt tensioner bolts to specification. See TORQUE SPECIFICATIONS. Using belt tension gauge, measure belt tension halfway between crankshaft sprocket and camshaft sprocket on side opposite belt tensioner.

NOTE: Engine support bracket reamer bolt must be tightened slowly. Apply lubricant onto bolt during installation.

6) Belt tension should be 46-68 lbs. (21-31 kg). To install remaining components, reverse removal procedure. Install bolts into proper holes. Install covers and engine support bracket. See Figs. 11 and 13. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

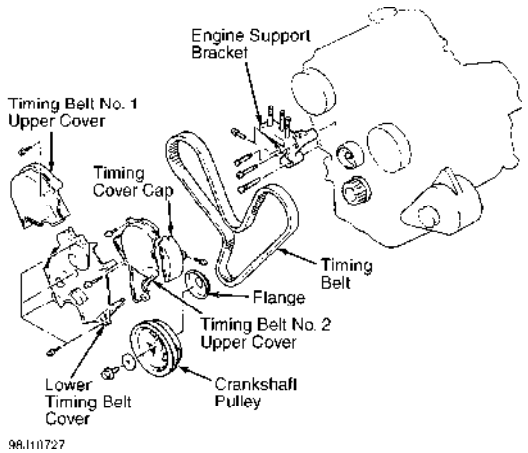


Fig. 10: Exploded View Of Timing Belt Components (3000GT - SOHC) Courtesy of Mitsubishi Motor Sales of America, Inc.

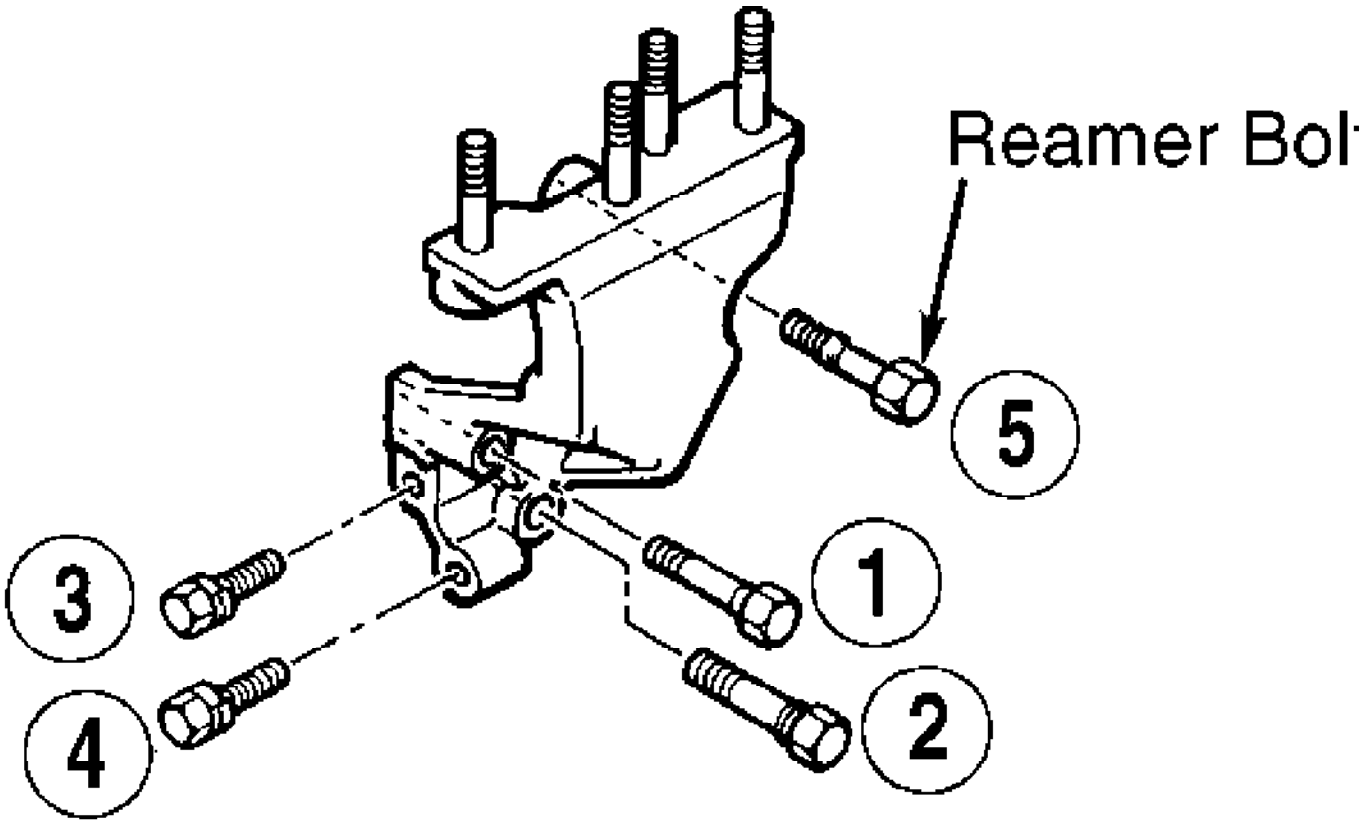


Fig. 11: Removing Engine Support Bracket
Courtesy of Mitsubishi Motor Sales of America, Inc.

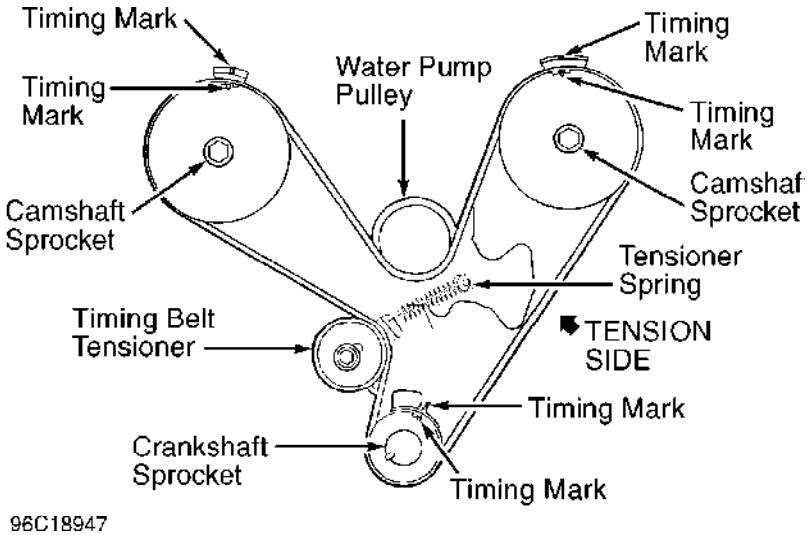


Fig. 12: Aligning Timing Marks (3000GT - SOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

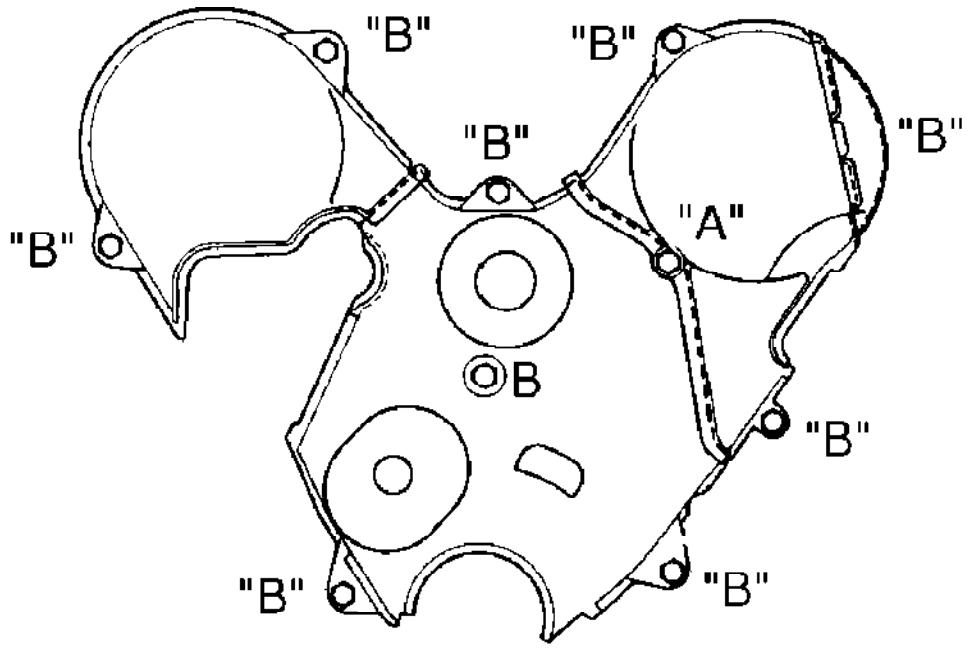
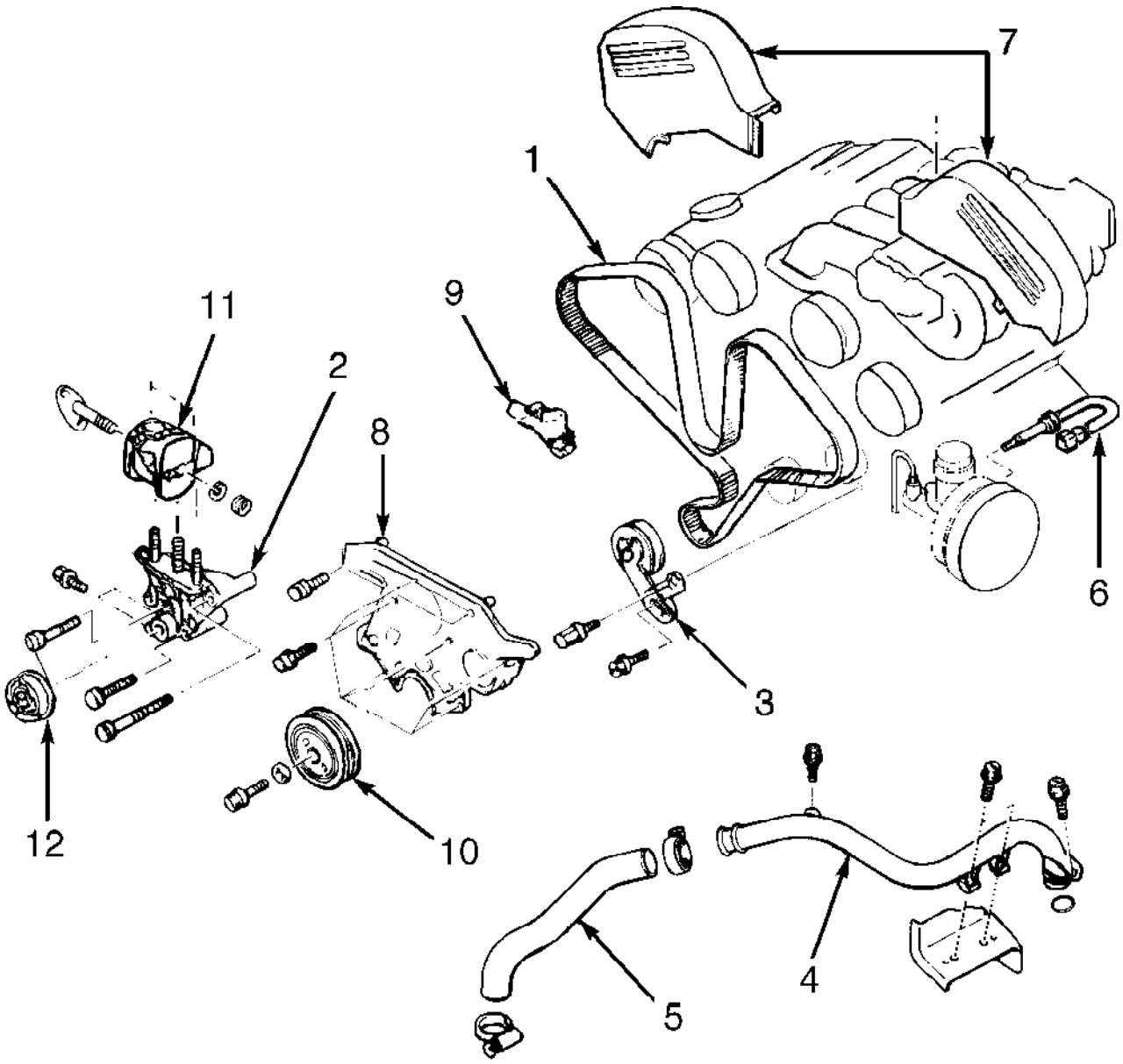


Fig. 13: Identifying Timing Belt Cover Bolts (3000GT - SOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

Removal (3000GT DOHC)

1) Remove lower splash shields. Remove cruise control actuator (if equipped). Remove drive belts. Remove generator. Remove drive belt tensioner assembly.

2) Using Holder (MB990767) and Adapter Bolts (MD998754), remove crankshaft pulley. See Fig. 14. Disconnect brake fluid level sensor. Remove upper timing belt covers. Support engine. Remove front engine mount through-bolt and front engine mount.



1. Timing Belt
2. Engine Support Bracket
3. Belt Tensioner
4. Turbo Air Hose
5. Turbo Air Pipe
6. Brake Fluid Level Sensor
7. Upper Timing Belt Covers
8. Lower Timing Belt Cover
9. Automatic Tensioner
10. Crankshaft Pulley
11. Engine Mount Bracket
12. Drive Belt Idler Pulley

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Fig. 14: Exploded View Of Timing Belt Components (3000GT - DOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

NOTE: Engine support bracket reamer bolt may be seized. Apply penetrating lubricant to bolt during removal.

3) Remove drive belt idler pulley. Remove engine support bracket bolts in sequence. See Fig. 11. Remove engine support bracket. Remove timing belt upper and lower covers, noting length and location of cover bolts.

4) If reusing timing belt, place arrow on belt to indicate running direction. Remove timing belt and belt tensioner. Rotate crankshaft to align all timing marks. See Fig. 15. Loosen tensioner center bolt. Remove timing belt.

5) If camshaft sprocket requires removal, hold camshaft with wrench on hexagonal portion of camshaft. Remove camshaft sprocket bolt and camshaft sprocket.

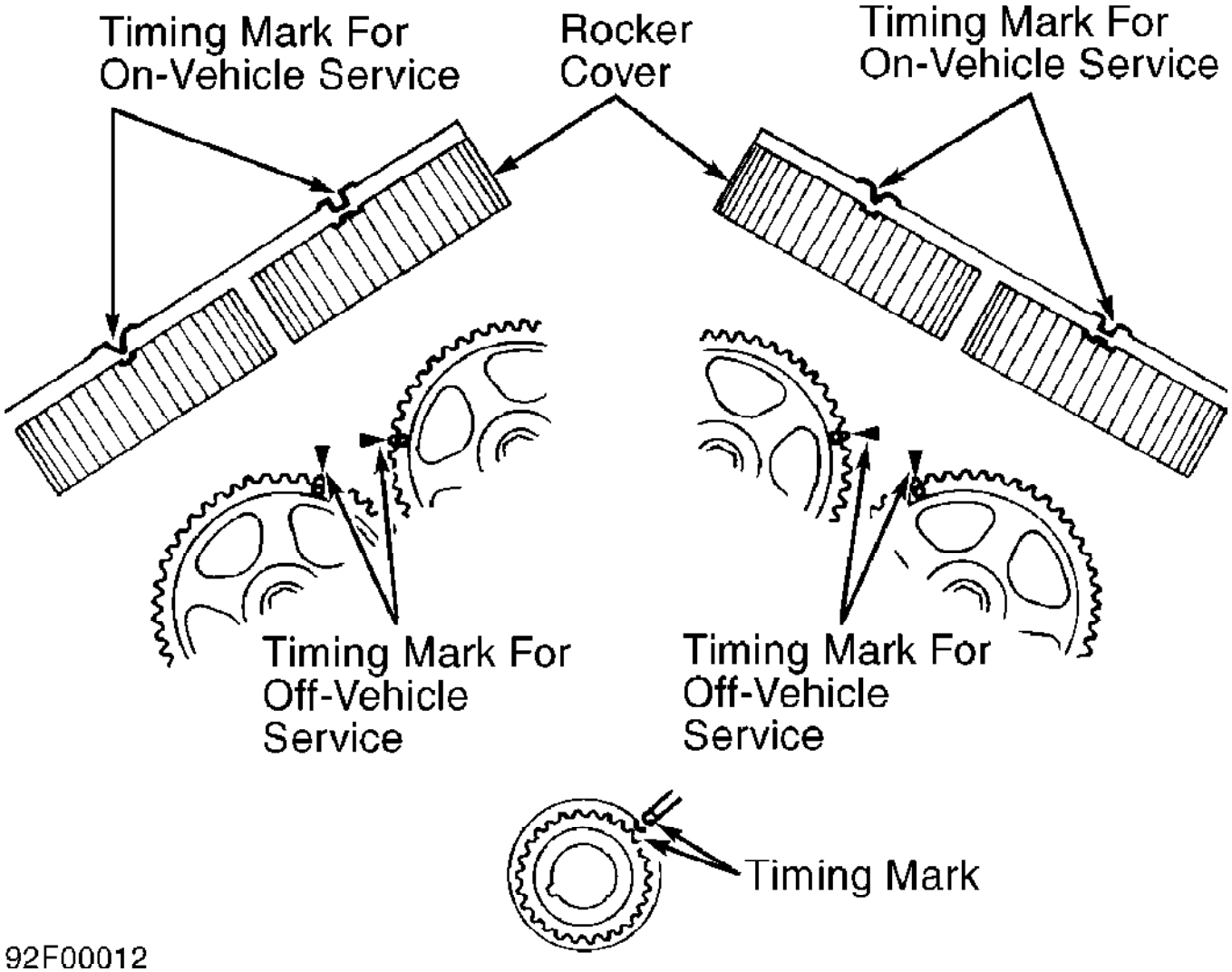

Fig. 15: Aligning Timing Marks - Initial Alignment (3000GT - DOHC) Courtesy of Mitsubishi Motor Sales of America, Inc.

Installation (3000GT DOHC)

1) Install camshaft sprockets (if removed). See TORQUE SPECIFICATIONS.

2) Place automatic tensioner assembly in a soft-jawed vise. Slowly close vise to press rod back into tensioner until both rod and housing holes are aligned. Install a .055" (1.40 mm) diameter wire through both holes.

3) Remove tensioner from vise, and install assembly with wire in place. Install crankshaft sprocket (if removed). Align timing marks on crankshaft and camshaft sprockets. See Fig. 15.

CAUTION: Turning camshaft sprockets while No. 1 cylinder is at TDC may damage valve and piston. Use care when aligning timing marks.

4) To lower No. 1 piston from TDC and prevent valve and piston contact, turn crankshaft back 3 sprocket teeth (measured at timing mark). Starting with front bank of cylinders, verify intake and exhaust camshaft timing marks are not within shaded area of figure. See Fig. 16.

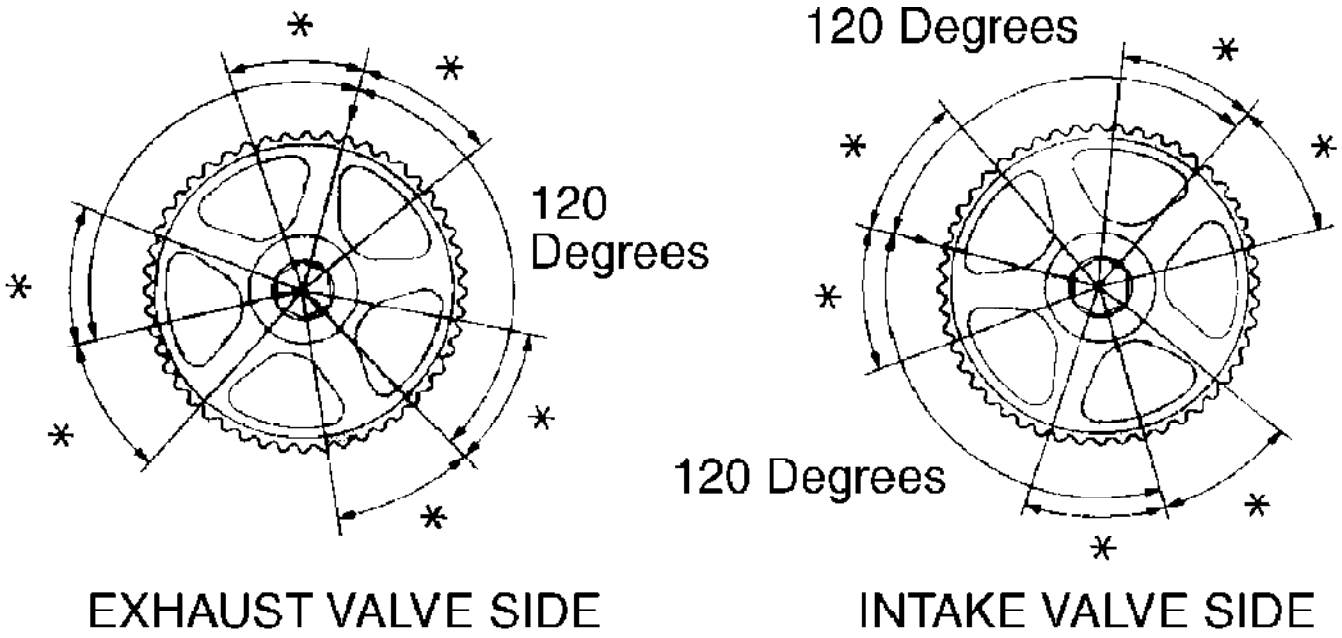

Fig. 16: Aligning Timing Marks To Prevent Valve & Piston Damage (3000GT - DOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

WARNING: Use care when aligning timing marks. When camshaft sprocket timing marks are in indicated area, camshaft is under valve spring pressure and may rotate suddenly, pinching hand between sprockets.

5) If camshaft sprocket timing mark is within indicated area, carefully rotate camshaft sprocket until timing mark is located in nearest safe area. See Fig. 16.

6) Rotate either camshaft sprocket clockwise to align timing marks as shown in illustration. See Fig. 17. If camshaft sprocket is rotated past timing mark, rotate it counterclockwise to realign it. Repeat procedure for other front bank camshaft sprocket.

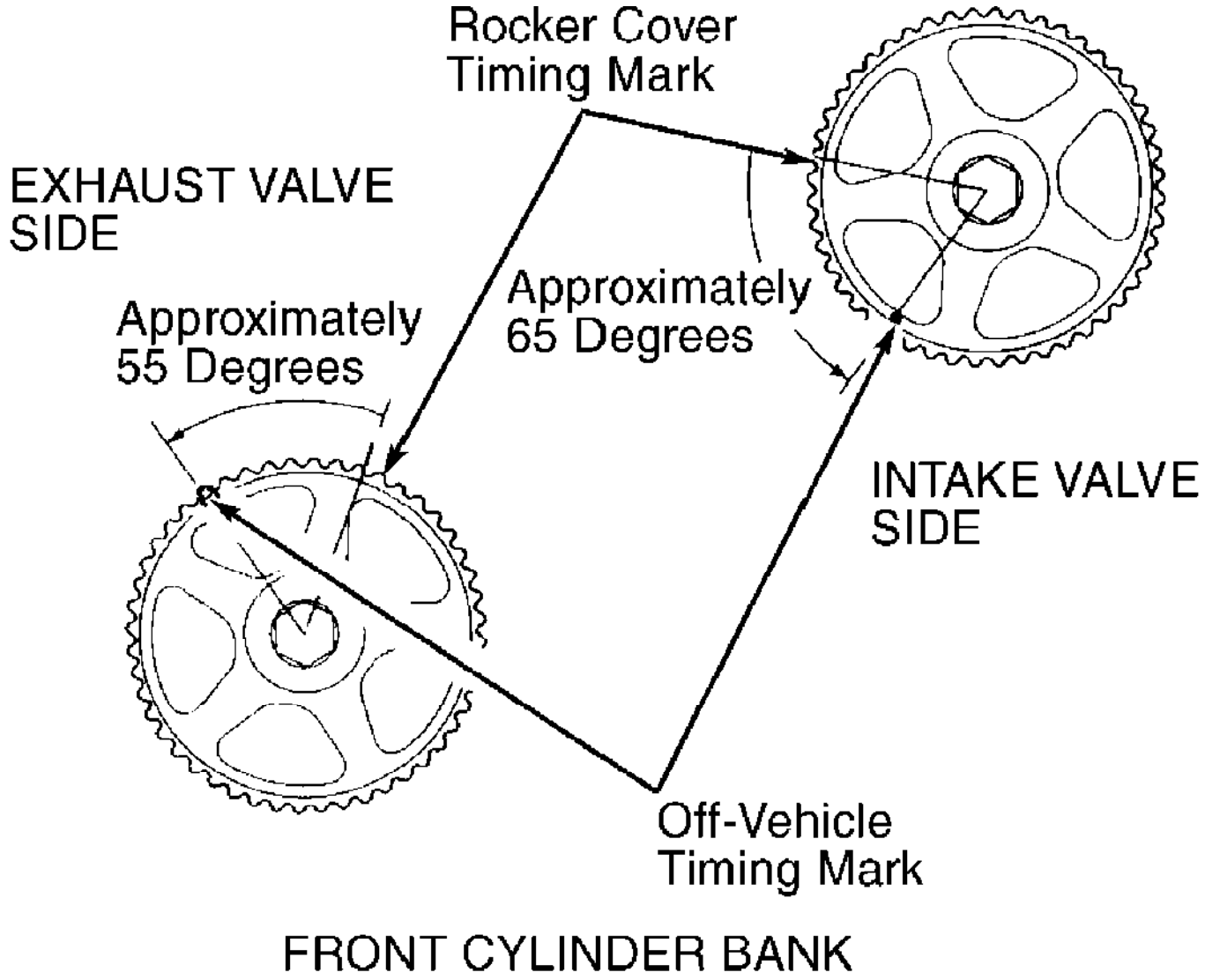

Fig. 17: Aligning Timing Marks - Final Alignment (3000GT - DOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

NOTE: If necessary, crankshaft sprocket may be turned one tooth counterclockwise to aid belt installation.

7) Repeat steps 4) through 6) for rear cylinder bank camshafts. Align crankshaft timing mark. Install timing belt onto sprockets in sequence. See Fig. 18. Use spring-type paper clips to secure belt on sprockets. Use wrenches on camshaft sprocket bolts to prevent camshafts from turning during belt installation.

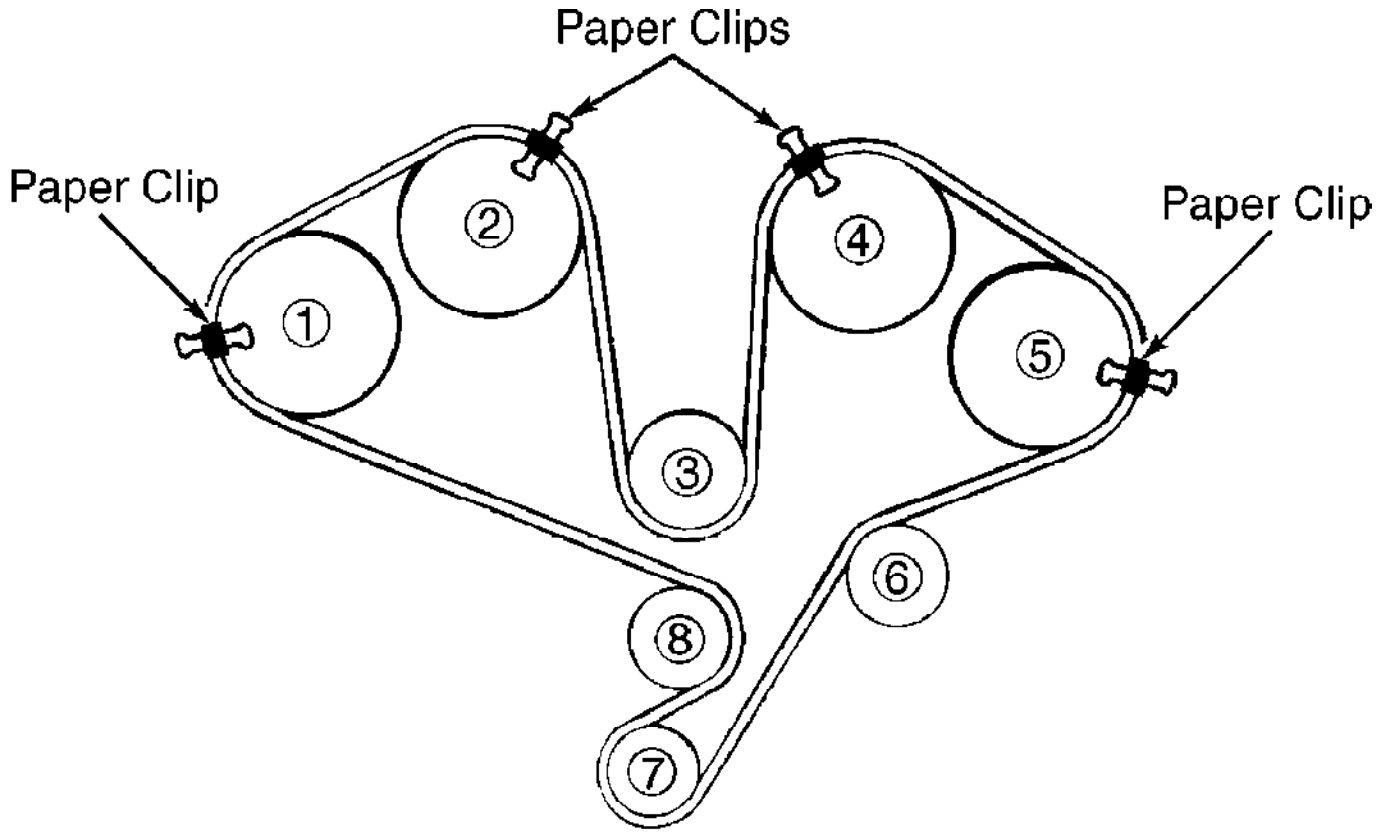

Fig. 18: Installing Timing Belt (3000GT - DOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

8) Rotate timing belt tensioner pulley until pin holes are located above center bolt. See Fig. 19. Push tensioner pulley against belt, and temporarily tighten center bolt. Ensure all timing marks are aligned, and remove clips.

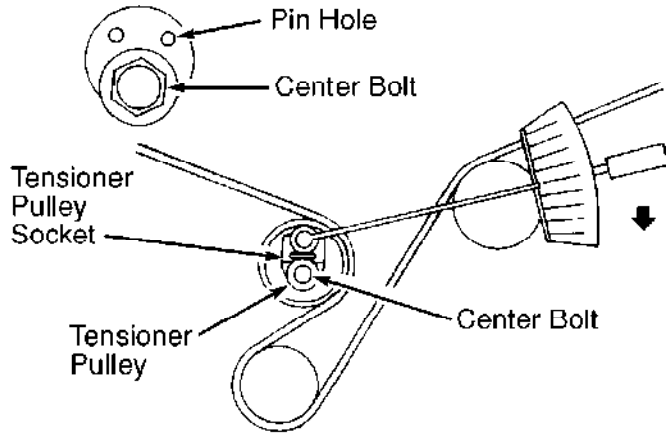

Fig. 19: Adjusting Timing Belt Tensioner (3000GT - DOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

9) Rotate crankshaft 1/4 revolution counterclockwise. Rotate crankshaft clockwise until timing marks are realigned. Loosen

tensioner center bolt. Using Tensioner Pulley Socket (MD998767), apply about 90 INCH lbs. (10 N.m) torque to tensioner pulley to prevent it from turning. See Fig. 19. Retighten center bolt to specification. See TORQUE SPECIFICATIONS. Ensure tensioner pulley does not rotate while tightening center bolt.

10) Rotate crankshaft 2 revolutions clockwise. Wait 5 minutes. Verify wire can still be moved easily, or automatic tensioner rod projects from tensioner body .15-.18" (3.8-4.5 mm). If wire does not move easily, or rod projection is not to specification, repeat steps 6) and 10). Remove wire.

NOTE: Lubricate engine support bracket reamer bolt while it is tightened slowly.

11) To complete installation, reverse removal procedure. Install bolts into correct timing belt cover holes. Install bolts into engine support bracket in reverse order of removal sequence. See Fig. 11. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

CAMSHAFT & ROCKER ARMS

Removal (SOHC)

1) Remove PCV valve and breather hoses. Remove timing belt, camshaft sprocket, and rear timing belt cover. See TIMING BELT5. Remove rocker covers and gaskets. Remove circular packing from rear of camshafts.

2) Remove camshaft oil seal from front of cylinder head or distributor adapter. Remove distributor adapter and "O" ring. Install Valve Lash Adjuster Holder (MD998443) onto rocker arm. See Fig. 20. Note arrow marks on bearing caps and cylinder head. See Fig. 21.

3) Bearing cap location number is stamped on front side of bearing cap. Remove bearing cap bolts. Keep components in order for reassembly reference. Remove rocker arm assembly. Remove camshaft from cylinder head.

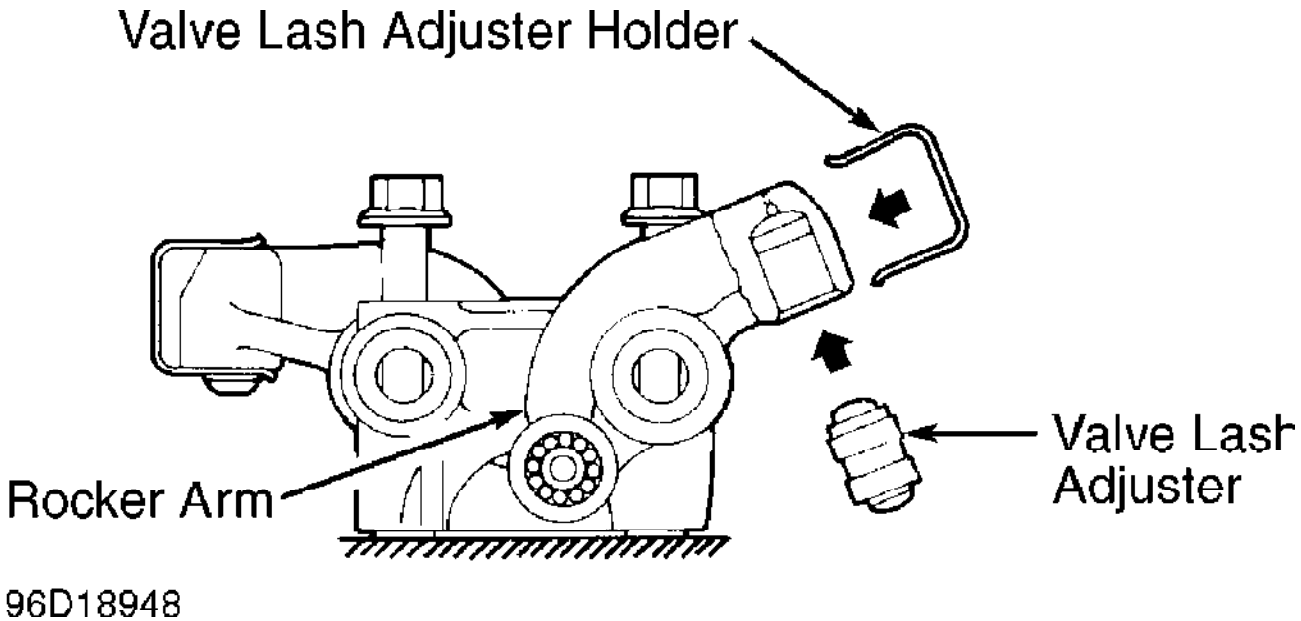

Fig. 20: Installing Valve Lash Adjuster Holder (SOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

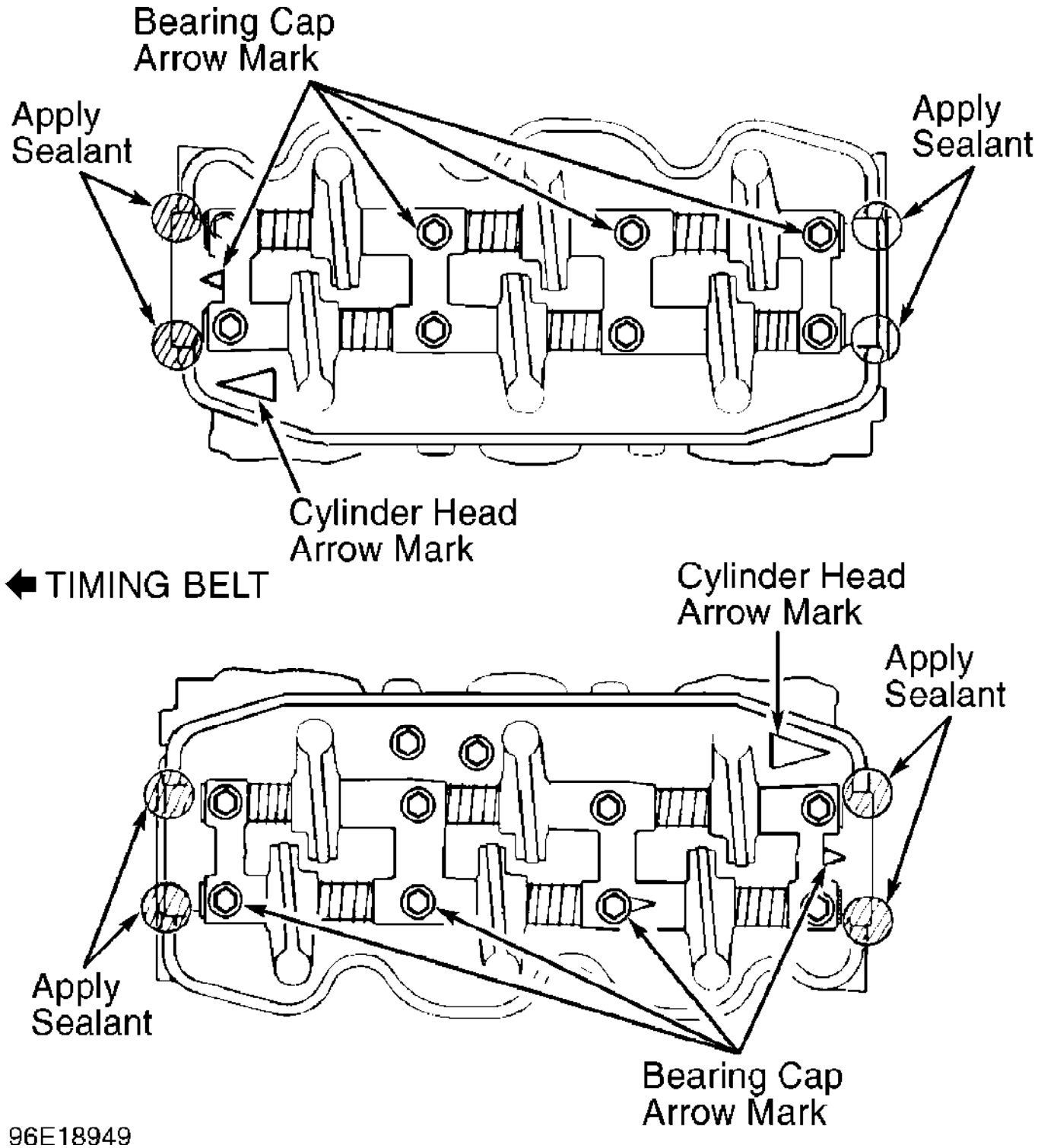

Fig. 21: Identifying Bearing Cap & Sealant Locations (SOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

Inspection

1) Remove bearing caps, rocker arms, and springs from shafts. Mark component location for reassembly reference. Inspect rocker arm and shaft for wear or damage. See CAMSHAFT (SOHC) table under ENGINE

SPECIFICATIONS. Replace as necessary.

2) Lubricate components with engine oil. Reassemble rocker arms, springs, and lash adjuster. Ensure oil holes and notch of shafts are properly positioned. See Fig. 22.

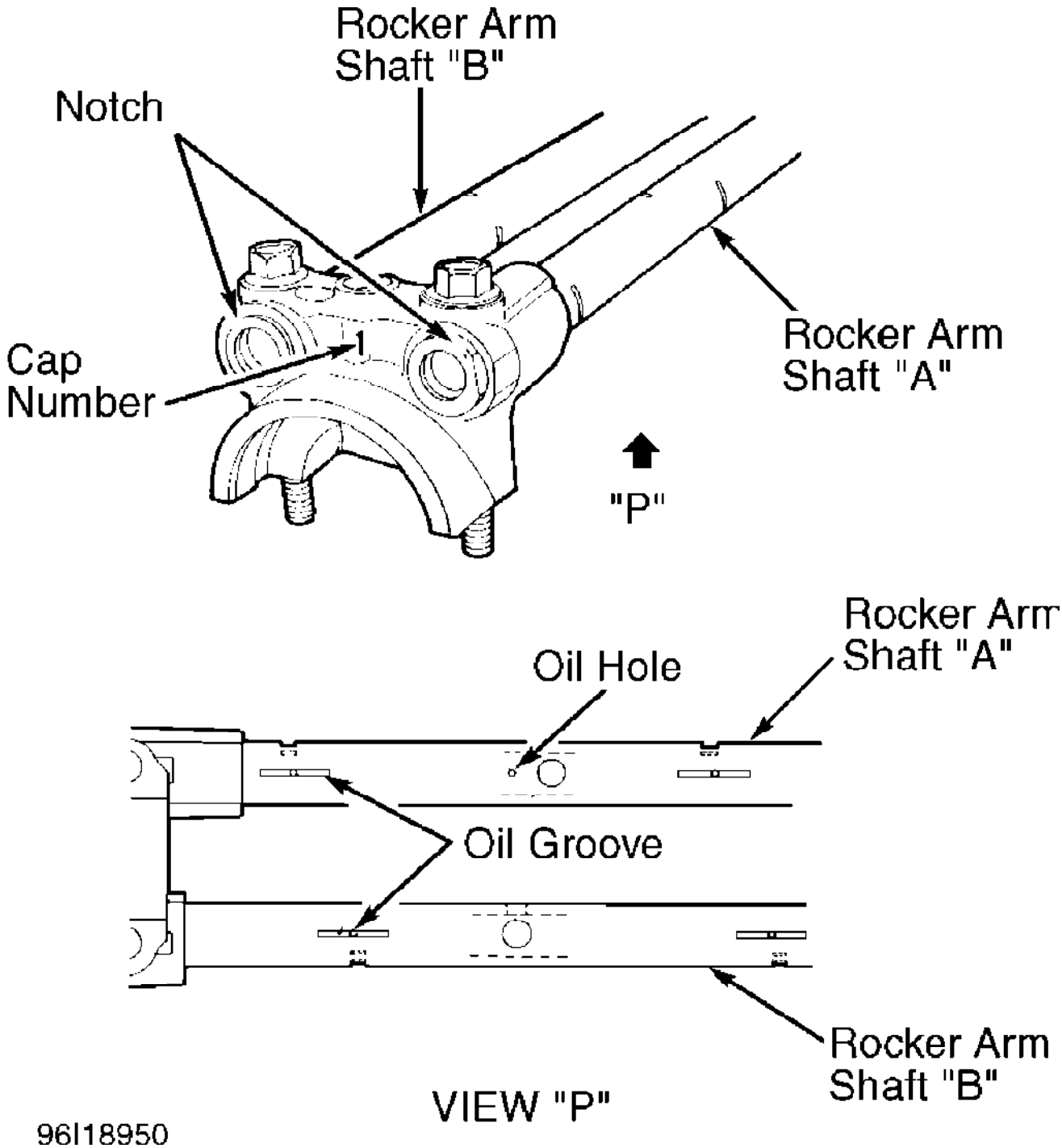

Fig. 22: Installing Rocker Arm Shafts (SOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

Installation

1) Lubricate camshaft with engine oil, and install into

cylinder head. Install valve lash adjusters and valve lash adjuster holders (if removed). See Fig. 20.

2) Apply 3M Sealant (4171) to designated areas of cylinder head. See Fig. 21. Use care so sealant does not get onto camshaft or camshaft bearings. Install rocker arm assembly. Ensure arrow on bearing cap faces same direction as arrow on cylinder head. See Fig. 21. Tighten bearing cap bolts to specification. See TORQUE SPECIFICATIONS. Remove valve lash adjuster holders.

3) Lubricate camshaft oil seal area with engine oil. Using Seal Driver (MD998713), install camshaft oil seal. Using Circular Packing Installer (MD998306), install circular packing to press-in depth of .02" (.5 mm).

4) Apply Three Bond (1212D) sealant to rocker cover sealing surfaces before installation. See Fig. 7. Lubricate NEW "O" ring with oil, and install onto distributor adapter (if removed).

5) Lubricate camshaft area with oil before installing distributor adapter. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

Removal (DOHC)

1) Remove intake manifold if necessary. See INTAKE MANIFOLD. Remove timing belt, camshaft sprockets, and rear timing belt covers. See TIMING BELT.

2) Remove center cover and spark plug wires. Remove PCV and breather hoses. Remove rocker covers and gaskets. Remove crankshaft angle sensor adapter. Remove front and rear camshaft bearing caps together with seals and packing.

3) Remove remaining camshaft bearing caps in sequence: No. 2, No. 4, and No. 3. Remove camshaft, rocker arms, and lash adjusters. Mark component location for reassembly reference.

Inspection

Inspect rocker arms for damage. Inspect camshaft for damage. Measure camshaft end play, journal diameter, and lobe height. Replace camshaft if it is not within specification. See CAMSHAFT (DOHC) table under ENGINE SPECIFICATIONS.

Installation

1) Lubricate components with engine oil. Install lash adjusters and rocker arms. Bring No. 1 cylinder to TDC. Install intake and exhaust camshafts into correct locations. Intake camshaft is marked with a "J" an hexagon section. Exhaust camshaft is marked with a "K" (non-turbo) or "N" (turbo). Position camshaft dowels as shown. See Fig. 23.

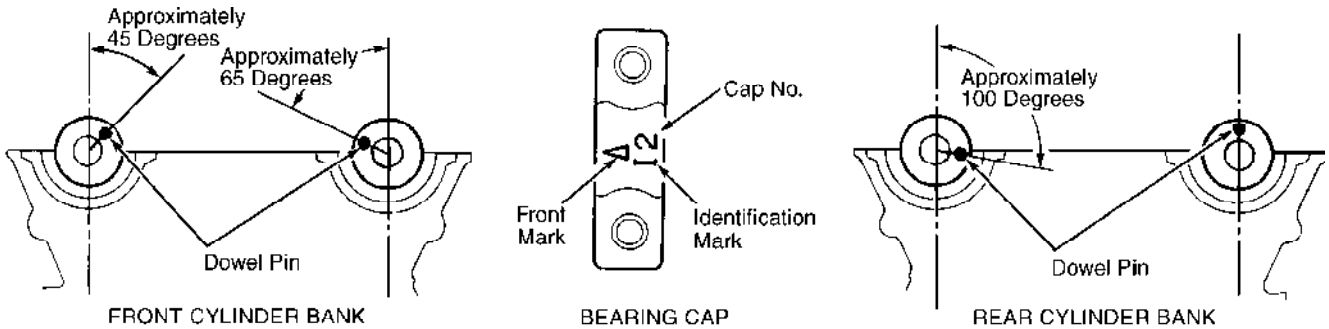

Fig. 23: Installing Camshafts & Bearing Caps (DOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

NOTE: If cylinder head is off vehicle, support cylinder head at least .4" (10 mm) above work surface to prevent valve damage

while installing camshaft bearing caps.

2) Install camshaft bearing caps in sequence: No. 3, No. 4, and No. 2. Install bearing caps with front mark arrow facing the same direction as similar mark on cylinder head beside bearing journal. Note bearing cap number and identification mark ("I" for intake camshaft and "E" for exhaust). See Fig. 23.

3) Install front and rear bearing caps. Tighten bearing cap bolts to specification. See TORQUE SPECIFICATIONS. Lubricate camshaft oil seal area with engine oil. Using Seal Driver (MD998761), install camshaft oil seal. Using Circular Packing Installer (MD998761), install packing.

4) Install crankshaft angle sensor adapter. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

REAR CRANKSHAFT OIL SEAL

Removal (Montero Sport)

Remove transmission. On M/T models, see CLUTCH article in the POWERTRAIN category. On A/T models, see TRANSMISSION REMOVAL & INSTALLATION - A/T article in AUTOMATIC TRANSMISSION SERVICING. Remove flywheel or drive plate. Remove rear oil seal housing. Pry seal from seal housing.

Removal (3000GT)

Remove transaxle. On M/T models, see CLUTCH article in the POWERTRAIN category. On A/T models, see TRANSMISSION REMOVAL & INSTALLATION - A/T article in AUTOMATIC TRANSMISSION SERVICING. Remove flywheel or drive plate. Remove rear oil seal housing. Pry seal from seal housing.

Installation

Lubricate seal lip with engine oil. Using Seal Driver (MD998718), install seal into seal housing. Apply sealant to sealing surface of seal case. Install seal case. Install flywheel or drive plate. Tighten bolts to specification. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure.

WATER PUMP

Removal

Drain cooling system. Remove timing belt and crankshaft sprocket. See TIMING BELT. Remove coolant ducts to water pump if necessary. Remove water pump bolts, noting length and location for reassembly reference. Remove water pump.

Installation

To install, reverse removal procedure, using NEW gasket and "O" rings. Coat all "O" rings with water before installation. Install water pump and gasket. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

OIL PAN

Removal (Montero Sport)

1) Raise and support vehicle. Remove skid plate and lower covers. Drain engine oil. Remove accessory drive belt. Remove generator. Remove front stabilizer bar. Disconnect and remove exhaust pipe from exhaust manifolds.

2) Remove oil dipstick. Remove crossmember assembly. Remove transmission dipstick and transmission-to-engine braces. Remove oil pan bolts. Using Seal Cutter (MD998727), separate lower oil pan from

upper oil pan. Remove lower oil pan. Remove oil pump pick-up screen. Remove baffle plate. Remove upper oil pan.

Removal (3000GT)

1) Raise and support vehicle. Remove engine undercovers. Drain engine oil. Unplug oxygen sensor connector. Disconnect front exhaust pipe from manifolds. On All-Wheel Drive (AWD) models, drain transfer case. Remove front air dam. Remove AWD drive shaft and transfer case.

2) On turbocharged models, remove oil return lines from oil pan. On all models, remove starter. Remove crossmember and transaxle braces. Remove bellhousing cover. Remove oil pan bolts. Using Seal Cutter (MD998727), separate oil pan from cylinder block. Remove oil pan.

Inspection (All Models)

Clean sealant from mating surfaces on engine block and oil pan. Inspect oil pan for cracks and damage. Inspect sealing surface for damage and deformation. Inspect oil pick-up screen for damage.

Installation (All Models)

1) To install, reverse removal procedure. Apply sealant to oil pan flange in a continuous .16" (4 mm) diameter bead. See Fig. 24. Install oil pan within 15 minutes of applying sealant.

2) Tighten bolts to specification in proper sequence. See TORQUE SPECIFICATIONS. Wait at least 30 minutes before adding oil and starting engine. On AWD models, refill transfer assembly with GL-4 hypoid gear oil. On all models, complete installation by reversing removal procedure.

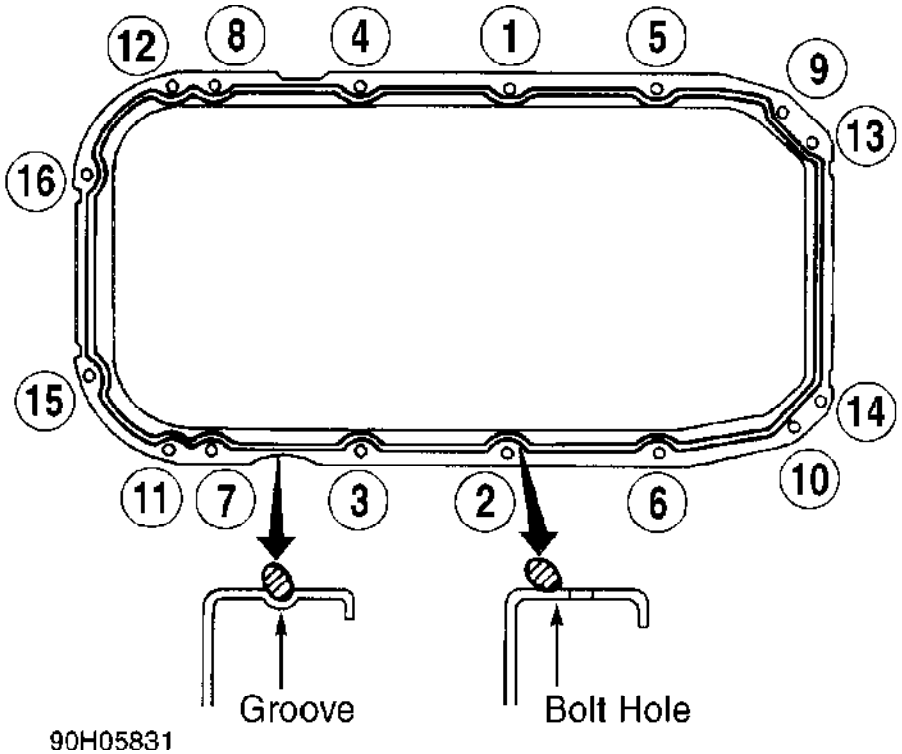

Fig. 24: Applying Sealant & Tightening Oil Pan Bolts
Courtesy of Mitsubishi Motor Sales of America, Inc.

OVERHAUL

CYLINDER HEAD

Cylinder Head

Measure cylinder head height. Measure warpage at gasket and manifold surfaces. Resurface head if warpage exceeds specification. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS. Replace cylinder head if it is not within specification after resurfacing.

NOTE: Install valve springs with enamel-coated side toward valve spring retainer.

Valve Springs

Measure free length of valve springs. Measure spring pressure at specified height. Replace springs if not within specification. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS. Inspect valve spring for squareness. Replace spring if out-of-square exceeds 4 degrees.

Valve Stem Oil Seals

With valves removed, remove oil seals from cylinder head. Lubricate new seals with engine oil. Using Valve Stem Oil Seal Installer (MD998774 for Montero Sport; MD998729 for 3000GT SOHC, or MD998763 3000GT DOHC), install valve stem oil seal.

Valve Guides

1) Measure valve stem oil clearance. Replace valve guide if not within specification. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

2) Note length of valve guides. Use press and appropriate driver to press valve guide out toward combustion chamber side of head. Cylinder head must be bored to install oversized valve guide once guide is removed. DO NOT install valve guide of same O.D. as old guide. Bore cylinder head to specification for oversize valve guide.

3) Using valve guide remover/installer, install valve guide. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS. Ensure valve slides smoothly in valve guide. Recondition valve seat.

Valve Seat (SOHC)

1) Measure valve spring installed height after valve and valve seat have been reconditioned and lightly lapped. With valve assembly installed, measure installed height of valve spring between spring seat and retainer. Valve seat must be replaced if measurement exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) To replace seat, grind seat wall until seat can be removed. Machine cylinder head to accommodate an oversize valve seat. See OVERSIZE VALVE SEAT SPECIFICATIONS (SOHC) table. Heat cylinder head to about 480°F (250°C), and install valve seat. Grind valve seat using 45-degree stone. Use 30-degree and 65-degree stones to set seat height.

OVERSIZE VALVE SEAT SPECIFICATIONS (SOHC)

Application	In. (mm)
Intake	
Seat Ring Bore Diameter	
12-Valve	
.012" (.3 mm) Oversize	1.744-1.745 (44.30-44.33)
.024" (.6 mm) Oversize	1.756-1.757 (44.60-44.63)
24-Valve	

.012" (.3 mm) Oversize	1.350-1.352 (34.30-34.33)
.024" (.6 mm) Oversize	1.362-1.363 (34.60-34.63)
Exhaust	
Seat Ring Bore Diameter	
12-Valve	
.012" (.3 mm) Oversize	1.508-1.509 (38.30-38.33)
.024" (.6 mm) Oversize	1.520-1.521 (38.60-38.63)
24-Valve	
.012" (.3 mm) Oversize	1.252-1.253 (31.80-31.83)
.024" (.6 mm) Oversize	1.264-1.265 (32.10-32.13)

Valve Seat (DOHC)

Grind seat wall until seat can be removed. Machine cylinder head to accommodate an oversize valve seat. See OVERSIZE VALVE SEAT SPECIFICATIONS (DOHC) table. Heat cylinder head to about 480°F (250°C), or chill valve seat with liquid nitrogen, and install valve seat. Grind valve seat using 45-degree stone. Use 30-degree and 65-degree stones to adjust seat height.

OVERSIZE VALVE SEAT SPECIFICATIONS (DOHC)

Application	In. (mm)
Intake	
Seat Ring Bore Diameter	
.012" (.3 mm) Oversize	1.429-1.430 (36.30-36.33)
.024" (.6 mm) Oversize	1.441-1.442 (36.60-36.63)
Exhaust	
Seat Ring Bore Diameter	
.012" (.3 mm) Oversize	1.311-1.312 (33.30-33.33)
.024" (.6 mm) Oversize	1.323-1.324 (33.60-33.63)

Valves

Disassemble cylinder head. Measure valve stem diameter, valve margin, and overall length. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS. Inspect valve for worn stem tip. Measure valve margin after grinding valves. Replace valves if not within specification.

Lash Adjusters

Before installation, submerge lash adjuster in diesel fuel. Using a small wire, hold down internal check valve. Pump plunger up and down 4-5 times to bleed air from lash adjuster.

CYLINDER BLOCK ASSEMBLY

Cylinder Block

1) Inspect cylinder block for cracks, warpage, cylinder bore taper, and out-of-round. Replace or repair cylinder block if it is not within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

2) Measure cylinder bore and piston skirt diameter. Piston skirt diameter should be measured at 90-degrees to piston pin. Clearance between piston and cylinder bore must be within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

Piston & Rod Assembly

1) Remove cylinder heads and oil pan. See CYLINDER HEAD and OIL PAN under REMOVAL & INSTALLATION. Remove cylinder ridge. Mark connecting rod and cap for cylinder identification and remove rod cap.

2) Note front mark on piston and connecting rod. See Fig. 25. Mark is positioned toward timing belt side of engine. Remove rod and piston assembly.

3) Piston ring end gap and side clearance must be within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Install rings onto piston with ring code identification marks toward top of piston. On DOHC, top ring is marked "T", and No. 2 ring is marked T2. On SOHC, top ring is marked 1R, and No. 2 ring is marked 2R. Lubricate piston, rings, and cylinder bore with engine oil.

NOTE: Front mark "R" on piston indicates installation in cylinders No. 1, 3, or 5; front mark "L" indicates installation in cylinders No. 2, 4, or 6. Ensure front mark on piston and connecting rod are toward timing belt side of engine. See Fig. 25.

4) Distribute ring end gaps properly around piston. See Fig. 25. Install piston and rod into cylinder bore, with front mark toward timing belt side of engine.

5) Measure bearing clearance using Plastigage. Tighten rod cap nuts to specification. See TORQUE SPECIFICATIONS. Connecting rod must move freely on crankshaft. Measure connecting rod side play. Repair or replace connecting rod if not within specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

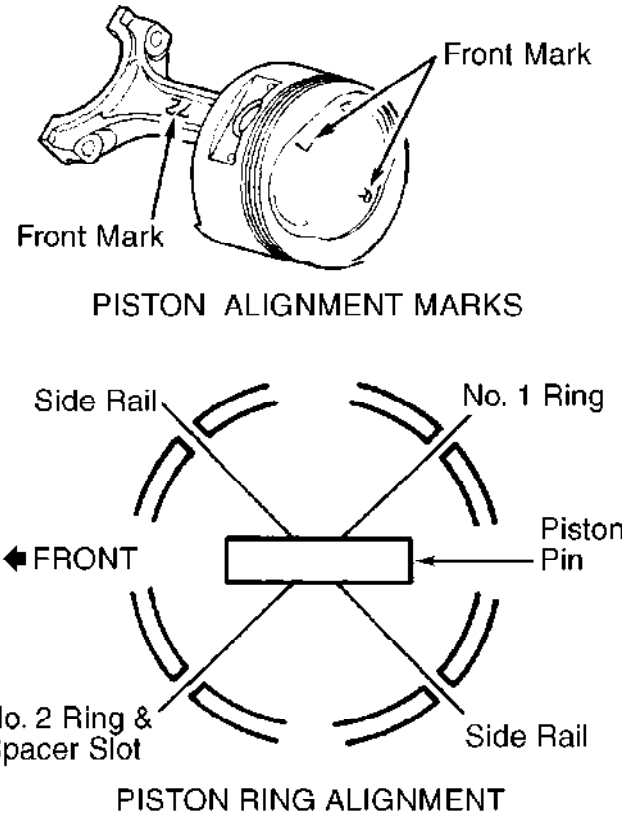

Fig. 25: Aligning Piston & Rings
Courtesy of Mitsubishi Motor Sales of America, Inc.

Fitting Pistons
Measure cylinder bore and piston skirt diameter. Piston skirt

diameter should be measured at 90-degree angle to piston pin. Clearance between piston and cylinder bore must be within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

Piston Pin Replacement

1) Note reference mark on top of piston and connecting rod. See Fig. 25. Using press and Piston Pin Remover/Installer (MIT216941), remove pin.

2) Inspect piston for cracks and damage. Measure ring side clearance. Replace piston if not within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

3) Measure connecting rod for bend and twist. Replace connecting rod if twist exceeds .004" (.10 mm) or bend exceeds .002" (.05 mm).

NOTE: Install piston with reference mark aligned with connecting rod reference mark. See Fig. 25.

4) Position piston onto connecting rod. Align reference marks on top of piston and connecting rod. See Fig. 25. Lubricate all components with oil. Press piston pin into piston and connecting rod. To install, reverse removal procedure. Ensure piston pin is centered in piston.

Crankshaft & Main Bearings

1) Remove flywheel or drive plate. Remove transaxle/transmission mounting plate and rear seal case. Remove oil pump, oil pan, and oil pick-up tube. Mark connecting rod and main bearing caps for location.

2) Remove connecting rod caps and bearings. Note direction of arrow on main bearing cap. Remove main bearing cap. See Fig. 26. Remove crankshaft. Remove main bearings from cylinder block. Mark bearings for location.

3) Inspect crankshaft for cracks and damaged gear or threads. Measure crankshaft for taper and out-of-round. Replace or repair crankshaft if it is not within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

4) Install upper main bearings into cylinder block. Ensure oil holes are aligned, and bearings are properly seated. Lubricate bearings with engine oil. Install thrust bearing with oil grooves toward crankshaft thrust surface.

5) Install crankshaft into block. Install thrust bearing with oil grooves toward crankshaft thrust surface. Install main bearing caps with arrow toward front of engine.

6) Measure oil clearance using Plastigage. Tighten bolts to specification in proper sequence. See Fig. 26. See TORQUE SPECIFICATIONS. Clearance must be within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table. If oil clearance is not within specification, replace bearings or crankshaft.

7) Ensure crankshaft rotates freely with main bearing cap installed. Measure crankshaft end play. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table.

8) Install connecting rod caps and bearings. Install components in original locations. Tighten rod nuts to specification. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure. Tighten bolts to specification.

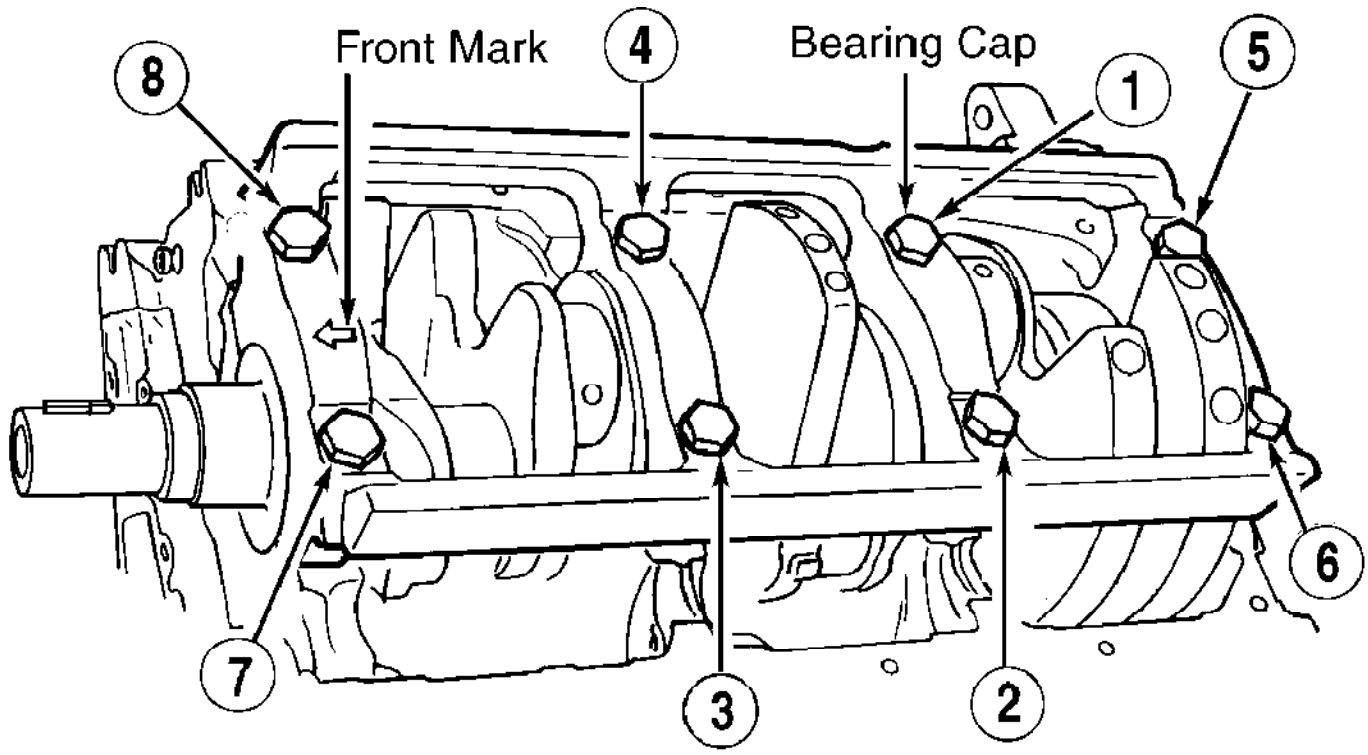

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Fig. 26: Tightening Sequence For Main Bearing Cap Bolts
Courtesy of Mitsubishi Motor Sales of America, Inc.

Connecting Rod Bearings

1) Mark bearing cap and connecting rod for location. Remove connecting rod cap and bearing. Install replacement bearing.

2) Align reference marks on rod cap and connecting rod. Measure bearing clearance with Plastigage. Connecting rods must move freely on crankshaft. Measure connecting rod side play. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

Crankshaft End Play

If end play is not within specification, inspect thrust bearings and crankshaft. Replace thrust bearing or crankshaft to obtain correct end play. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pressure is provided by a rotor-type pump driven by crankshaft. Pressure relief valve is located in oil pump body.

CRANKCASE CAPACITY SPECIFICATIONS

Application	(1) Qts. (L)
Montero Sport	5.2 (4.9)
3000GT	
Non-Turbo	4.5 (4.3)

Turbo	4.9 (4.6)

(1) - Includes oil filter.

Oil Pressure

Oil pressure should be at least 11 psi (.8 kg/cm²) at idle and engine oil temperature of 167-194°F (75-90°C).

OIL PUMP

Removal

Remove timing belt and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Remove oil pan. See OIL PAN under REMOVAL & INSTALLATION. Remove oil filter and mounting bracket. Remove oil pump and gasket from cylinder block. Note bolt length and location for installation reference.

Disassembly & Inspection

1) Disassemble pump. Inspect for scoring and cracks. Install rotors into pump body. Measure clearance between driven rotor and pump body. Measure rotor tip clearance. Using a straightedge and feeler gauge, measure rotor side clearance (end play). See OIL PUMP SPECIFICATIONS table.

2) Replace rotor set or pump assembly if measurements are not within specification. Ensure relief valve slides freely in pump body bore. Inspect relief valve spring for damage.

OIL PUMP SPECIFICATIONS

Application		In. (mm)
Rotor Tip Clearance		.0024-.0071 (.060-.180)
Housing Clearance	(1)	.0039-.0071 (.100-.180)
Side Clearance		.0016-.0039 (.040-.100)

(1) - Maximum clearance 0.138" (.35 mm).

Reassembly & Installation

1) Reassemble pump. Tighten pump rear cover bolts to specification. See TORQUE SPECIFICATIONS. Install oil pump and gasket. Align splined teeth of oil pump with crankshaft. Install bolts, and tighten to specification.

2) If oil seal was removed, coat new seal with grease. Using Seal Driver (MD998717), install seal in oil pump until flush with case. Install remaining components.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS (MONTERO SPORT)

TORQUE SPECIFICATIONS (MONTERO SPORT)

Application	Ft. Lbs. (N.m)
Camshaft Bolt	23 (31)
Camshaft Sprocket Bolt	65 (88)
Cooling Fan Bracket Bolt	30 (41)
Crankshaft Bearing Cap Bolt	69 (93)
Crankshaft Pulley Bolt	134 (182)
Cylinder Head Bolt	80 (108)

Drive Plate Bolt	55 (75)
Engine Support Bracket Bolt	
M8	18 (25)
M10	30 (41)
M12	54 (74)
Exhaust Manifold Nut	33 (44)
Flywheel Bolt	55 (75)
Idler Pulley Bolt	33 (44)
Intake Manifold Bolt	16 (21)
Intake Manifold Plenum Bolt/Nut	13 (17)
Oil Filter Bracket Bolt	
M8	17 (23)
M10	30 (41)
Oil Pan Baffle Bolt	13 (18)
Relief Valve Plug	34 (47)
Timing Belt	
Auto-Tensioner Bolt	17 (23)
Tensioner Arm Bolt	33 (44)
Tensioner Pulley Bolt	36 (49)
Water Pump Bolt	17 (23)

	INCH Lbs. (N.m)
Cooling Fan Bolt	96 (11)
Delivery Pipe Bolt	84-108 (9-12)
Oil Pan Bolt	52 (6)
Oil Pump Case Bolt	117 (13)
Oil Pump Cover Bolt	87 (9.8)
Rear Plate Bolt	96 (11)
Rear Seal Case Bolt	96 (11)
Rocker Cover Bolt	30 (3.4)
Throttle Body Bolt	96 (11)
Timing Belt Cover	
M6 Bolt	96 (11)
M8 Bolt	117 (13)
Nut	43 (4.9)
Transmission Mounting Plate Bolt	96 (11)

TORQUE SPECIFICATIONS (3000GT)

TORQUE SPECIFICATIONS (3000GT)

Application	Ft. Lbs. (N.m)
Air Intake Plenum Brace Bolts	13 (18)
Automatic Tensioner Bolt	17 (23)
Camshaft Bearing Cap Bolt	
Front & Rear	15 (20)
No. 2, 3 & 4	(1)
Camshaft Sprocket Bolt	66 (90)
Connecting Rod Nut	38 (52)
Crankshaft Pulley Bolt	
SOHC	108-116 (146-157)
DOHC	130-137 (176-186)
Cylinder Head Bolt (2)	
DOHC Turbo	91 (123)
Except DOHC Turbo	80 (108)
Distributor Adapter Bolt	(3)
Drive Plate Bolt	55 (75)
Engine Support Bracket Bolt	
Except 10 x 40-mm	30 (41)
10 x 40-mm	54 (73)

Exhaust Manifold Nut	
SOHC	13 (18)
DOHC Non-Turbo	33 (45)
DOHC Turbo	22 (30)
Flywheel Bolt	55 (75)
Intake Manifold Bolt	
SOHC	13 (18)
DOHC	16 (22)
Main Bearing Cap Bolt	
SOHC	57 (77)
DOHC Non-Turbo	67 (91)
DOHC Turbo	54 (73)
Oil Filter Bracket Bolt	
M8 Bolt	(3)
M10 Bolt	17 (23)
Oil Pick-Up Tube Bolt	14 (19)
Oil Pump Mounting Bolt	11 (15)
Rear Engine Support Bracket-To-Engine Bolt	13-18 (18-25)
Relief Valve Plug	33 (45)
Rocker Shaft	15 (20)
Roll Stopper Bracket Through-Bolts	36-43 (49-58)
Turbocharger-To-Exhaust Fitting	40-47 (54-64)
Timing Belt Tensioner Arm Bolt	31 (42)
Timing Belt Tensioner Pulley Bolt	36 (49)
Water Pump Bolt	17 (23)

	INCH Lbs. (N.m)
Delivery Pipe Bolt	108 (12)
Oil Pan Bolt	48-60 (5-7)
Oil Pump Cover Bolt	96 (11)
Rear Seal Case Bolt	117 (13)
Rocker Cover Bolt	
DOHC	26 (3)
SOHC	72-84 (8-9)
Throttle Body Bolt	84-108 (9-12)
Timing Belt Cover Bolt	84-108 (9-12)
Transmission Mounting Plate Bolt	84-108 (9-12)

(1) - Tighten to 96 INCH lbs. (11 N.m)
(2) - Tighten in 2 stages in sequence. See Fig. 6.
(3) - Tighten to 117 INCH lbs. (13 N.m)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
Displacement	181.4 Cu. In.
Bore	3.587" (91.1 mm)
Stroke	2.992" (76.0 mm)
Compression Ratio	
SOHC	
12-Valve	8.9:1
24-Valve	9.0:1
DOHC Non-Turbo	10.0:1
DOHC Turbo	8.0:1
Fuel System	MFI

Horsepower @ RPM	
Montero Sport	
California	165 @ 5000
Federal	173 @ 5000
3000GT	
SOHC	161 @ 6000
DOHC Non-Turbo	218 @ 6000
DOHC Turbo	320 @ 6000
Torque Ft. Lbs. @ RPM	
Montero Sport	
California	(1) 186
Federal	(1) 188
3000GT	
SOHC	(1) 185
DOHC Non-Turbo	(1) 205
DOHC Turbo	(1) 315

(1) - RPM information not available from manufacturer.

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0020-.0098 (.050-.250)
Limit	.012 (.30)
Main Bearings	
Journal Diameter	2.36 (59.9)
Journal Out-Of-Round	
SOHC	.0002 (.005)
DOHC	.00012 (.003)
Journal Taper	
SOHC	.0002 (.005)
DOHC	.00012 (.003)
Oil Clearance	
Standard	.0008-.0020 (.020-.050)
Limit	.004 (.10)
Connecting Rod Bearings	
Journal Diameter	1.965 (49.91)
Journal Out-Of-Round	
SOHC	.0002 (.005)
DOHC	.00012 (.003)
Journal Taper	.0002 (.005)
Oil Clearance	
Standard	.0008-.0020 (.020-.050)
Limit	.004 (.10)

CONNECTING RODS

CONNECTING RODS

Application	In. (mm)
Maximum Bend	.0020 (.050)
Maximum Twist (Total Rod Length)	.004 (.10)
Side Play	
Standard	.0039-.0099 (.099-.251)
Limit	.016 (.41)

PISTONS, PINS & RINGS (SOHC)

PISTONS, PINS & RINGS (SOHC)

Application	In. (mm)
Pistons	
Clearance	.0008-.0016 (.020-.040)
Diameter	3.587 (91.11)
Pins	
Piston Fit	(1)
Rod Fit	(2)
Rings	
No. 1	
End Gap	
Standard	.0120-.0170 (.300-.450)
Limit	.031 (.79)
Side Clearance	
Standard	.0012-.0027 (.030-.070)
Limit	.004 (.10)
No. 2	
End Gap	
Standard	.0180-.0230 (.450-.600)
Limit	.031 (.79)
Side Clearance	
Standard	.0008-.0024 (.020-.060)
Limit	.004 (.10)
No. 3 (Oil)	
End Gap	
Standard	.008-.024 (.20-.60)
Limit	.039 (.99)

(1) - Slip.
(2) - At press load of 1653-3867 lbs. (750-1754 kg).

CYLINDER BLOCK

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Standard Diameter	3.590 (91.19)
Maximum Taper & Out-Of-Round	.0004 (.010)
Maximum Deck Warpage	
Standard	.002 (.05)
Limit	.008 (.20)

VALVES & VALVE SPRINGS (SOHC)

VALVES & VALVE SPRINGS (SOHC)

Application	Specification
Intake Valves	
Face Angle	45-45.5°
Minimum Margin	
12-Valve	.028" (.71 mm)
24-Valve	.020" (.50 mm)

Stem Diameter	
12-Valve	.315" (8.00 mm)
24-Valve	.236" (6.00 mm)
Exhaust Valves	
Face Angle	45-45.5°
Minimum Margin	
12-Valve	.059" (1.50 mm)
24-Valve	.028" (0.71 mm)
Stem Diameter	
12-Valve	.311" (7.90 mm)
24-Valve	.236" (6.00 mm)
Valve Springs	
Free Length	
Standard	
12-Valve	1.960" (49.78 mm)
24-Valve	2.010" (51.00 mm)
Limit	
12-Valve	1.920" (48.77 mm)
24-Valve	1.970" (50.00 mm)
Installed Height	
12-Valve	1.591" (40.41 mm)
24-Valve	1.740" (44.20 mm)
Out-Of-Square	
Standard	2°
Limit	4°
Pressure (Valves Closed)	(1)

(1) - Specification is 74 Lbs. @ 1.591 In. (33.6 kg @ 40.41 mm).

VALVES & VALVE SPRINGS (DOHC)

VALVES & VALVE SPRINGS (DOHC)

Application	Specification
Intake Valves	
Face Angle	45-45.5°
Minimum Margin	.019" (.48 mm)
Standard Length	4.185" (106.30 mm)
Stem Diameter	.260" (6.60 mm)
Exhaust Valves	
Face Angle	45-45.5°
Minimum Margin	.039" (.99 mm)
Standard Length	4.150" (105.41 mm)
Stem Diameter	.260" (6.60 mm)
Valve Springs	
Free Length	
Standard	1.830" (46.48 mm)
Limit	1.790" (45.47 mm)
Installed Height	1.492" (37.90 mm)
Out-Of-Square	
Standard	2°
Limit	4°
Pressure (Valves Closed)	(1)

(1) - Specification is 62 Lbs. @ 1.492 In. (28.1 kg @ 37.90 mm).

CYLINDER HEAD (SOHC)

CYLINDER HEAD (SOHC)

Application	Specification
Cylinder Head Height	
12-Valve	3.310" (84.07 mm)
24-Valve	4.720" (120.00 mm)
Maximum Warpage	.008" (.20 mm)
Valve Seats (Intake & Exhaust)	
Seat Angle	45-45.5°
Seat Width	.035-.051" (.90-1.30 mm)
Valve Guides	
Intake Valve	
Valve Guide Cyl. Head Bore I.D.	
12-Valve	.516" (13.10 mm)
24-Valve	.433" (11.00 mm)
Valve Guide Length	
12-Valve	1.732" (44 mm)
24-Valve	1.790" (46 mm)
Stem-To-Guide Clearance	
Standard	
12-Valve	.0012-.0024" (.030-.060 mm)
24-Valve	.0008-.0020" (.020-.050 mm)
Limit	.004" (.10 mm)
Exhaust Valve	
Valve Guide Cyl. Head Bore I.D.	
12-Valve	.516" (13.10 mm)
24-Valve	.433" (11.00 mm)
Valve Guide Length	
12-Valve	1.890" (48 mm)
24-Valve	1.990" (51 mm)
Stem-To-Guide Clearance	
Standard	
12-Valve	.0020-.0035" (.051-.089 mm)
24-Valve	.0016-.0028" (.040-.070 mm)
Limit	.006" (.15 mm)

CYLINDER HEAD (DOHC)

CYLINDER HEAD (DOHC)

Application	Specification
Cylinder Head Height	5.20" (132.1 mm)
Maximum Warpage	.008" (.20 mm)
Valve Seats (Intake & Exhaust)	
Seat Angle	45-45.5°
Seat Width	.035-.051" (.90-1.30 mm)
Valve Guides	
Intake Valve	
Valve Guide Cyl. Head Bore I.D.	.5118-.5189" (13.00-13.18 mm)
Valve Guide Installed Height	.689" (17.50 mm)
Stem-To-Guide Clearance	
Standard	.0008-.0020" (.020-.050 mm)
Limit	.0040" (.102 mm)
Exhaust Valve	
Valve Guide Cyl. Head Bore I.D.	.5118-.5189" (13.00-13.18 mm)
Valve Guide Installed Height	.689" (17.50 mm)
Valve Stem-To-Guide Clearance	
Standard	.0020-.0035" (.050-.089 mm)
Limit	.0060" (.152 mm)

CAMSHAFT (SOHC)

CAMSHAFT (SOHC)

Application	In. (mm)
End Play	(1)
Journal Diameter	
12-Valve	1.34 (34.0)
24-Valve	1.77 (44.9)
Lobe Height	
12-Valve	
Standard	1.620 (41.15)
Limit	1.600 (40.64)
24-Valve	
Intake	
Standard	1.480 (37.60)
Limit	1.500 (37.00)
Exhaust	
Standard	1.450 (37.00)
Limit	1.400 (36.50)
Oil Clearance	(1)

(1) - Information not available from manufacturer.

CAMSHAFT (DOHC)

CAMSHAFT (DOHC)

Application	In. (mm)
End Play	(1)
Journal Diameter	1.020 (25.91)
Lobe Height	
Intake	
Standard	1.370 (34.80)
Limit	1.350 (34.29)
Exhaust	
Standard	1.370 (34.80)
Limit	1.350 (34.29)
Oil Clearance	(1)

(1) - Information not available from manufacturer.

* ENGINE SYSTEMS UNIFORM INSPECTION GUIDELINES *

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Engine Performance and Maintenance Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

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COOLING FAN MOTOR SENSORS AND SWITCHES
COOLING FAN MOTOR SWITCHES
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DISTRIBUTOR ADVANCES AND RETARDERS (MECHANICAL AND VACUUM)
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DISTRIBUTOR ROTORS
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ELECTRONIC SPARK CONTROL MODULES
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EXHAUST GAS RECIRCULATION DEVICES
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FUEL PRESSURE REGULATORS
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HEATER CONTROL VALVES
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HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS
HOSE CLAMPS
HOSE CONNECTORS
HOSE COUPLERS
HOSES AND TUBES (FUEL LINES, RADIATOR, VACUUM, BY PASS,
  HEATER, RECOVERY TANK AND OIL COOLERS)
HOUSINGS
IDLE AIR CONTROLS
IDLE SPEED CONTROL ACTUATORS
IGNITION BOOTS
IGNITION COIL TOWERS
IGNITION COILS
IGNITION CONTROL MODULES (ICM)
IGNITION SWITCHES
IGNITION TERMINALS
IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY)
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INERTIA FUEL SHUT-OFF SWITCHES
INTAKE AIR TEMPERATURE SENSORS
INTAKE MANIFOLDS
INTERCOOLERS
KNOCK SENSORS
LIQUID VAPOR SEPARATORS
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSORS
MASS AIR FLOW (MAF) SENSORS
METAL AIR MANIFOLDS AND PIPES
METAL AIR PIPES
MIX CONTROL SOLENOIDS
MOTOR MOUNTS
O-RINGS, GASKETS, SEALS AND SPRING LOCKS
O2 SENSORS
OIL PRESSURE SENDING UNITS
OIL PUMP PICK-UP SCREENS
OIL PUMPS
PARK NEUTRAL POSITION SWITCHES
PCV BREATHER ELEMENTS
PCV ORIFICES
PCV VALVES
PICK-UP ASSEMBLIES (INCLUDES MAGNETIC, HALL EFFECT AND
  OPTICAL)
POWER STEERING PRESSURE SENSORS
POWERTRAIN CONTROL MODULES (PCM) AND PROM
POWERTRAIN CONTROL PROM
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RADIATOR CAPS AND PRESSURIZED EXPANSION TANK CAPS
RADIATOR FAN BLADES
RADIATOR FAN CLUTCHES
RADIATORS
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SENSORS AND ACTUATORS
SHROUDS, BAFFLES AND DEFLECTORS
SPARK PLUGS
SPRING LOCKS

SUPER CHARGERS
SWITCHES
THERMAL VACUUM VALVES
THERMOSTATIC AIR DOOR ASSEMBLIES
THERMOSTATS AND HOUSINGS
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THROTTLE LINKAGES AND CABLES
THROTTLE POSITION SENSORS
THROTTLE POSITION SWITCHES
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TUBE CONNECTORS
TUBE COUPLERS
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TURBO CHARGERS
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VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC)
VACUUM REGULATOR SOLENOIDS
VACUUM TUBES
VEHICLE SPEED SENSORS
VOLUME AIR FLOW SENSORS
WASTE GATE CONTROL SOLENOIDS
WASTE GATES AND BOOST CONTROL MECHANISMS
WATER PUMPS (ELECTRIC)
WATER PUMPS (NON-ELECTRIC)
WIRING HARNESSES AND CONNECTORS

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication

Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

1444 I Street, NW Suite 700
Washington, DC 20005
Phone (202) 712-9042 Fax (202) 216-9646

January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer’s best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer’s recommended service interval and must be documented.

Some conditions indicate that service or part replacement is

required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A – Part no longer performs intended purpose
B – Part does not meet a design specification (regardless of performance)
C – Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

ENGINE ASSEMBLIES

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

CYLINDER HEAD ASSEMBLIES

NOTE: A Cylinder Head Assembly is a cylinder head fitted with valves, associated springs, retainers, and on overhead camshaft cylinder heads (OHC), camshaft, camshaft bearings, lash adjusters, tappets and rockers.

CYLINDER HEAD ASSEMBLY INSPECTION

Condition	Code	Procedure
Adjustable valve lash is out of specification ...	B	Require repair.
Internal component failure (any component)	A	(1) Require repair or replacement of cylinder head assembly.

(1) - It is Required that all other failure related components be inspected for cause and condition. Additional components or assemblies may be Suggested for repair or replacement, such as a water pump on a short block (reason code 4, technician's recommendation based on substantial and informed experience).

Example:
If there is a failed head gasket with an external coolant leak, in addition to Requiring replacement of the head gasket, inspection of the following for cause and condition is Required: Block, Cooling System, Cylinder Head. It may be Suggested that additional inspections be performed, such as the other head gasket on a V-type engine.

LONG BLOCK ASSEMBLIES

NOTE: A Long Block Assembly is a short block assembly together with a cylinder head assembly and all those components fitted within the rocker or cam cover, and timing cover

(the whole presented as an assembly). A rebuilt or new oil pump, or kit shall be supplied or fitted as appropriate.

LONG BLOCK ASSEMBLY INSPECTION

Condition	Code	Procedure
Internal component failure (any component)	A	(1) Require repair or replacement of the long block assembly.

(1) - It is Required that all other failure related components be inspected for cause and condition. Additional components or assemblies may be Suggested for repair or replacement such as a water pump on a short block (reason code 4, technician's recommendation based on substantial and informed experience).

Example:
If there is a failed head gasket with an external coolant leak, in addition to Requiring replacement of the head gasket, inspection of the following for cause and condition is Required: Block, Cooling System, Cylinder Head. It may be Suggested that additional inspections be performed, such as the other head gasket on a V-type engine.

SHORT BLOCK ASSEMBLIES

NOTE: A Short Block Assembly is a cylinder block and all those components contained within the limits of the block deck or decks, the pan rail, the block rear face and the timing cover (where fitted), including the crankshaft.

SHORT BLOCK ASSEMBLY INSPECTION

Condition	Code	Procedure
Any internal component failure	A	(1) Require repair or replacement of the short block assembly.

(1) - It is Required that all other failure related components be inspected for cause and condition. Additional components or assemblies may be Suggested for repair or replacement, such as a water pump on a short block (reason code 4, technician's recommendation based on substantial and informed experience).

Example:
If there is a failed head gasket with an external coolant leak, in addition to Requiring replacement of the head gasket, inspection of the following for cause and condition is Required: Block, Cooling System, Cylinder Head. It may be Suggested that additional inspections be performed, such as the other head gasket on a V-type engine.

ENGINE COMPONENTS

ACCELERATOR PEDAL POSITION SENSORS

ACCELERATOR PEDAL POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

ACCESSORY BELTS

ACCESSORY BELT INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	(1) Further inspection required.
Cracked	1	Suggest replacement.
Frayed	1	Suggest replacement.
Missing	C	Require replacement.
Noisy	2	(2) Further inspection required.
Plies separated	A	Require replacement.
Tension out of specification	B	Require adjustment or replacement.
Worn beyond adjustment range	B	Require replacement.
Worn so it contacts bottom of pulley	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.

ACCESSORY PULLEYS

ACCESSORY PULLEY INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Pulley damaged, affecting belt life	A	Require replacement.

ACTUATORS

See SENSORS AND ACTUATORS.

AIR CONDITIONING CYCLING SWITCHES

AIR CONDITIONING CYCLING SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.

Condition	Code	Procedure
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR CONDITIONING PRESSURE SENSORS

AIR CONDITIONING PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.

Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR DUCTS AND TUBES

AIR DUCT AND TUBE INSPECTION

Condition	Code	Procedure

Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require repair or replacement.

AIR FILTER ELEMENTS

AIR FILTER ELEMENT INSPECTION

Condition	Code	Procedure
Leaking	A	Require replacement.
Paper filter element oil-soaked	A	(1) Require replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.
Melted	A	Required replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Water-contaminated	A	(1) Require replacement.

(1) - Further inspection required to determine cause.

AIR FILTER GASKETS

See AIR FILTER HOUSINGS AND GASKETS.

AIR FILTER HOUSINGS AND GASKETS

AIR FILTER HOUSING AND GASKET INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

AIR FUEL RATIO SENSORS

AIR FUEL RATIO SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR INJECTION CONTROL SOLENOIDS

AIR INJECTION CONTROL SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

AIR PLENUMS

AIR PLENUM INSPECTION

Condition	Code	Procedure
Integrated air or fuel control components inoperative	A	(1) Require repair or replacement.
Internal air or fuel components damaged, affecting performance	A	Require repair or replacement of component.
Internal air or fuel components damaged, not affecting performance		No service suggested or required.
Internal air or fuel components missing	C	Require replacement of component.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

AIR PUMP BELTS

AIR PUMP BELT INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	(1) Further inspection required.
Cracked	1	Suggest replacement.
Frayed	1	Suggest replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle OEM recommended service intervals.
Missing	C	Require replacement.
Noisy	2	(2) Further inspection required.
Plies separated	A	Require replacement.
Tension out of specification	B	Require adjustment or replacement.
Worn beyond adjustment range	B	Require replacement.
Worn so it contacts bottom of pulley	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.

AIR PUMPS (ELECTRIC-DRIVEN)

AIR PUMP (ELECTRIC-DRIVEN) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

AIR TUBES

See AIR DUCTS AND TUBES.

ASPIRATOR, CHECK AND DECEL VALVES

ASPIRATOR, CHECK AND DECEL VALVE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement

			of hardware.
Inoperative	A	(1)	Require repair or replacement.
Leaking	A		Require replacement.
Melted, affecting performance	A		Require replacement.
Melted, not affecting performance	..		No service suggested or required.
Missing	C		Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	..	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

BAFFLES

See SHROUDS, BAFFLES AND DEFLECTORS.

BALLAST PRIMARY SUPPLY RESISTOR WIRES

See BALLAST RESISTORS AND PRIMARY SUPPLY RESISTOR WIRES.

BALLAST RESISTORS AND PRIMARY SUPPLY RESISTOR WIRES

BALLAST RESISTOR AND PRIMARY SUPPLY RESISTOR WIRE INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C		Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Conductor exposed	A		Require replacement.
Connector broken	A	..	Require repair or replacement.
Connector melted	A	(1)	Require repair or replacement.
Connector missing	C		Require replacement.
Inoperative	A	(2)	Require replacement.
Insulation overheated	A		Require replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A		Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

BAROMETRIC PRESSURE SENSORS

BAROMETRIC PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or

replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

BATTERIES

Proper operation of any electrical system or component can be affected by battery condition. The battery(ies) must meet or exceed minimum specification for vehicle as equipped and test to that specific battery's CCA.

Definition of Terms

* Battery Performance Testing
  Testing that determines whether or not a battery meets both vehicle OEM and battery manufacturer's specifications.

* Cold Cranking Amp (CCA) Rating
  The number of amperes a new, fully charged battery at 0° F (-17.8° C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).

* Cranking Amps (CA)
  The number of amperes a new, fully charged battery, typically at 32° F (0° C) can deliver for 30 seconds and maintain at least a voltage of 1.2 volts per cell (7.2 volts for a 12-volt battery).

* OEM Cranking Amps
  The minimum CCA required by the original vehicle manufacturer for a specific vehicle.

BATTERY INSPECTION

Condition	Code	Procedure
Battery frozen	..	(1) Further inspection required.
Case leaking	A	Require replacement.
Casing swollen	A	(2) Further inspection required.
Circuit open internally	A	Require replacement.
Electrolyte contamination	A	(2) Further inspection required.
Electrolyte discoloration	A	(2) Further inspection required.
Fails to accept and hold charge	A	(3) Require replacement.
Fluid level low	B	(4) Further inspection required.
Out of performance specification for battery	B	(5) Require replacement.
Out of specification for application	B	(5) Require replacement.

Post (top or side) burned, affecting performance ..	A	.....	(6) Require repair or replacement.
Post (top or side) burned, not affecting performance	2	.....	(6) Suggest repair or replacement.
Post (top or side) corroded, affecting performance	A	.....	Require repair.
Post (top or side) corroded, not affecting performance	2	.....	Suggest repair.
Post (top or side) loose	A	.....	Require replacement.
Post (top or side) melted, affecting performance	A	.....	(6) Require repair or replacement.
Post (top or side) melted, not affecting performance	2	.....	(6) Suggest repair or replacement.
Specific gravity low	B	.....	(7) Further inspection required.
State of charge low	A	.....	(7) Further inspection required.
Top dirty	2	.....	Suggest cleaning battery.
Top wet	A	...	(8) Require cleaning battery. Further inspection required.
Vent cap loose	A	...	Require repair or replacement of vent cap.
Vent cap missing	C	.....	Require replacement of vent cap.

(1) - DO NOT attempt to charge a frozen battery. Allow battery to warm thoroughly and then performance-test. If battery fails performance test, require replacement.
(2) - No service suggested or required unless the battery fails performance test, in which case, require replacement.
(3) - This phrase refers to a battery that fails to either accept and/or retain a charge using appropriate times listed in the Battery Charging Guide of the BCI Service Manual, battery charger operating manual, or battery manufacturer's specifications.
(4) - Determine cause of low fluid level. Refill to proper level(s) with water (distilled water preferred). Recharge battery and performance-test.
(5) - The battery may meet battery manufacturer's specifications but test below the minimum specification defined by the vehicle's OEM for that vehicle.
(6) - Determine cause and correct prior to repair or replacement of part.
(7) - Recharge and test to manufacturer's specifications. If battery fails performance test, require replacement.
(8) - Check fluid level and adjust to manufacturer's specification. Suggest checking charging system for proper operation.

BATTERY CABLE, WIRE AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	(2) Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Exposed conductor at replacement (aftermarket) terminal end does not require repair or replacement.

BATTERY CONNECTORS

See BATTERY CABLES, WIRES AND CONNECTORS.

BATTERY TRAYS AND HOLD DOWN HARDWARE

BATTERY TRAY AND HOLD DOWN HARDWARE INSPECTION

Condition	Code	Procedure
Battery improperly secured	2	Suggest repair.
Bent, affecting performance	A	Require repair or replacement.
Bent, not affecting performance	..	No service suggested or required.
Broken, affecting performance	A	Require repair or replacement.
Broken, not affecting performance	..	No service suggested or required.
Corroded, affecting performance	A	Require repair or replacement.
Corroded, not affecting performance	2	Suggest repair or replacement.
Cracked, affecting performance	A	Require repair or replacement.
Cracked, not affecting performance	1	Suggest repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Water drain clogged	A	Require repair.

BATTERY WIRES

See BATTERY CABLES, WIRES AND CONNECTORS.

BELT-DRIVEN AIR PUMPS

BELT-DRIVEN AIR PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Pulley alignment incorrect	B	Require repair or replacement.
Pulley bent	A	Require replacement.
Pulley cracked	A	Require replacement.
Pulley loose	A	Require repair or replacement.
Pulley missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads		

missing)	A	..	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

BELT IDLER ASSEMBLIES (ACCESSORY AND CAM BELTS)

BELT IDLER ASSEMBLY (ACCESSORY AND CAM BELT) INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	.. Require repair or replacement.
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Bearings worn	1	..... Suggest replacement.
Cracked	2	..... Suggest replacement.
Missing	C	..... Require replacement.
Noisy	2	..... Suggest replacement.
Seized	A	.. Require repair or replacement.

BELT TENSIONERS (ACCESSORY AND CAM BELTS)

BELT TENSIONER (ACCESSORY AND CAM BELT) INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	.. Require repair or replacement.
Attaching hardware broken	A	.. Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Bearings worn	1	..... Suggest replacement.
Belt tension incorrect ..	B	... Require adjustment or repair.
Cracked	2	..... Suggest replacement.
Missing	C	..... Require replacement.
Noisy	2	..... Suggest replacement.
Pulley damaged, affecting belt life	A	..... Require replacement.
Seized	A	.. Require repair or replacement.

BOOST CONTROL MECHANISMS

See WASTE GATES AND BOOST CONTROL MECHANISMS.

CAMSHAFT POSITION SENSORS

CAMSHAFT POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

CARBURETORS AND CHOKES

NOTE: Proper operation of a carburetor includes the ability to control air/fuel mixtures during all phases or driving operation to comply with all federal and local emissions standards. Adjustments are to be considered repairs.

CARBURETOR AND CHOKE INSPECTION

Condition	Code	Procedure
Air/fuel control incorrect	B	Require repair or replacement.
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Components binding	A	Require repair or replacement.
Components damaged, affecting operation or performance	A	Require repair or replacement.
Components missing	C	Require replacement of components.
Contaminated	A	(1) Require repair or replacement. Further inspection required.
Controlling linkages binding	A	Require repair or replacement of linkage.
Leaking	A	Require repair or replacement.
Mechanical operation incorrect	B	Require repair or replacement.
Operating incorrectly	B	Require repair or replacement.

(1) - Some components may be serviceable; check for accepted cleaning procedure. Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.

CASTING CORE PLUGS AND EXPANSION PLUGS

CASTING CORE PLUG AND EXPANSION PLUG INSPECTION

Condition	Code	Procedure
Leaking	A	Require replacement.
Material type incorrect	2	Suggest replacement.

CHARGE AIR COOLERS "INTERCOOLERS" (CAC)

CHARGE AIR COOLER "INTERCOOLER" (CAC) INSPECTION

Condition	Code	Procedure
Air-to-air intercooler leaking, affecting boost performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware		

missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Leaking coolant	A ..	Require repair or replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A ..	Require repair or replacement.

CHECK VALVES

See ASPIRATOR, CHECK AND DECEL VALVES.

CHOKES

See CARBURETORS AND CHOKES.

CLUTCH PEDAL POSITION SWITCHES

CLUTCH PEDAL POSITION SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A ...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A ...	Require repair or replacement of hardware.
Connector broken	A ..	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B ..	Require repair or replacement.
Terminal broken	A ..	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A ..	Require repair or replacement.
Terminal corroded, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal loose, affecting performance	B ..	Require repair or replacement.
Terminal loose, not affecting performance ..	1 ..	Suggest repair or replacement.
Threads damaged	A ..	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors		

exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

COLD START INJECTORS

See FUEL AND COLD START INJECTORS.

CONNECTORS

See WIRING HARNESSES AND CONNECTORS.

COOLANT

COOLANT INSPECTION

Condition	Code	Procedure
Acidity (pH) incorrect	1	Suggest correction or replacement.
Contaminated	B	(1) Require replacement or recycling. Further inspection required.
Level low	B	(2) Require filling to proper level.
Maintenance intervals	3	(3) Suggest replacement.
Mixture incorrect	B	Require correction or replacement.
Type incorrect	B	Require replacement.

(1) - Determine source of contamination and require correction prior to coolant replacement.
(2) - Determine source of incorrect level and suggest repair.
(3) - The system should be drained and/or flushed and refilled with correct coolant according to OEM recommended service interval and procedures.

COOLANT RECOVERY TANKS

COOLANT RECOVERY TANK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require repair or replacement.

Missing (if original equipment)	C	Require replacement.

COOLING FAN MOTOR MODULES

See COOLING FAN MOTOR RELAYS AND MODULES.

COOLING FAN MOTOR RELAYS AND MODULES

COOLING FAN MOTOR RELAY AND MODULE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Connector broken	A ..	Require repair or replacement.
Connector (Weatherpack type) leaking	A ..	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Housing cracked	2 ..	Suggest repair or replacement.
Malfunctioning	A	(2) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A ..	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal corroded, affecting performance ..	A ..	Require repair or replacement.
Terminal corroded, not affecting performance ..	2 ..	Suggest repair or replacement.
Terminal loose, affecting performance	B ..	Require repair or replacement.
Terminal loose, not affecting performance ..	1 ..	Suggest repair or replacement.
Wire lead conductors exposed	B ..	Require repair or replacement.
Wire lead corroded	A ..	Require repair or replacement.
Wire lead open	A ..	Require repair or replacement.
Wire lead shorted	A ..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, failure to perform all functions, or out of OEM specification.

COOLING FAN MOTOR RESISTORS

COOLING FAN MOTOR RESISTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Missing	C	Require replacement.
Open	A	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Shorted	A	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

COOLING FAN MOTOR SENSORS AND SWITCHES

COOLING FAN MOTOR SENSOR AND SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or

			replacement.
Inoperative	B		(3) Require repair or replacement. Further inspection required.
Leaking	A		Require repair or replacement.
Missing	C		Require replacement.
Resistance out of specification	B		Require repair or replacement.
Terminal broken	A		Require repair or replacement.
Terminal burned, affecting performance	A		(1) Require repair or replacement.
Terminal burned, not affecting performance	2		Suggest repair or replacement.
Terminal corroded, affecting performance	A		Require repair or replacement.
Terminal corroded, not affecting performance	2		Suggest repair or replacement.
Terminal loose, affecting performance	B		Require repair or replacement.
Terminal loose, not affecting performance	1		Suggest repair or replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A		Require replacement.
Wire lead conductors exposed	B		Require repair or replacement.
Wire lead corroded	A		Require repair or replacement.
Wire lead open	A		Require repair or replacement.
Wire lead shorted	A		Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

COOLING FAN MOTOR SWITCHES

See COOLING FAN MOTOR SENSORS AND SWITCHES.

COOLING FAN MOTORS

COOLING FAN MOTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.

Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Hydraulic fan motor leaking	A	Require repair or replacement.
Inoperative	A	(2) Require replacement.
Missing	C	Require replacement.
Noisy	2	Suggest replacement.
Rotation incorrect for application	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

CRANKSHAFT POSITION SENSORS

CRANKSHAFT POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	Require repair or replacement.
Inoperative	B	Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.

Missing	C		Require replacement.
Resistance out of specification	B		Require repair or replacement.
Terminal broken	A		Require repair or replacement.
Terminal burned, affecting performance	A		(1) Require repair or replacement.
Terminal burned, not affecting performance	2		Suggest repair or replacement.
Terminal corroded, affecting performance	A		Require repair or replacement.
Terminal corroded, not affecting performance	2		Suggest repair or replacement.
Terminal loose, affecting performance	B		Require repair or replacement.
Terminal loose, not affecting performance	1		Suggest repair or replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A		Require replacement.
Wire lead conductors exposed	B		Require repair or replacement.
Wire lead corroded	A		Require repair or replacement.
Wire lead open	A		Require repair or replacement.
Wire lead shorted	A		Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

DECEL VALVES

See ASPIRATOR, CHECK AND DECEL VALVES.

DEFLECTORS

See SHROUDS, BAFFLES AND DEFLECTORS.

DIP STICKS AND TUBES

DIP STICK AND TUBE INSPECTION

Condition	Code		Procedure
Application incorrect	B		Require replacement.
Bent	2		Suggest repair or replacement.
Broken, affecting performance (for example, fuel mixture)	A		Require repair or replacement.
Broken, not affecting performance	2		Suggest repair or replacement.
Leaking, affecting performance (for example, fuel mixture)	A		Require repair or replacement.
Leaking, not affecting performance	2		Suggest repair or replacement.
Missing	C		Require replacement.

DIP STICK TUBES

See DIP STICKS AND TUBES.

DISTRIBUTOR ADVANCES AND RETARDERS (MECHANICAL AND VACUUM)

DISTRIBUTOR ADVANCE AND RETARDER (MECHANICAL AND VACUUM) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Binding	A	Require repair or replacement.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Out of specification	B	Require repair or replacement.

(1) - Inoperative includes intermittent operation.

DISTRIBUTOR BOOTS AND SHIELDS

DISTRIBUTOR BOOT AND SHIELD INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Deteriorated	A	Require replacement.
Leaking	A	Require replacement.
Missing	A	Require replacement.
Torn	A	Require replacement.

DISTRIBUTOR CAPS

DISTRIBUTOR CAP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Arcing	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Burned	A	Require replacement.
Carbon button missing	A	Require replacement.
Carbon button worn, affecting performance	A	Require replacement.
Carbon button worn, not affecting performance	1	Suggest replacement.
Carbon-tracked	A	Require replacement.
Cracked	A	Require replacement.
Loose	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal eroded, affecting performance	A	Require repair or replacement.
Terminal eroded, not affecting performance	..	No service suggested or required.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

DISTRIBUTOR RETARDERS (MECHANICAL AND VACUUM)

See DISTRIBUTOR ADVANCES AND RETARDERS (MECHANICAL AND VACUUM).

DISTRIBUTOR ROTORS

DISTRIBUTOR ROTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Carbon-tracked	A	Require replacement.
Contact burned	A	Require replacement.
Corroded	1	Suggest replacement.

Eroded	1	Suggest replacement.
Loose	A	Require repair or replacement.
Out of specification	B	Require replacement.

DISTRIBUTOR SHIELDS

See DISTRIBUTOR BOOTS AND SHIELDS.

DISTRIBUTORS

DISTRIBUTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bushings worn, affecting performance	A	Require repair or replacement.
Bushings worn, not affecting performance	1	Suggest repair or replacement.
Cam lobes worn, affecting performance	A	Require repair or replacement.
Cam lobes worn, not affecting performance	1	Suggest repair or replacement.
Gear broken	A	Require repair or replacement.
Gear worn, affecting performance	A	Require replacement.
Gear worn, not affecting performance		No service suggested or required.
Integrated pickup triggering device loose	A	Require repair or replacement.
Integrated pickup triggering device magnetism incorrect	A	Require repair or replacement.
Leaking oil internally	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Pickup triggering device (reluctor) broken	A	Require repair or replacement.
Pickup triggering device (reluctor) loose	A	Require repair or replacement.
Pickup triggering device (reluctor) weak	A	Require repair or replacement.
Reluctor (pickup triggering device) broken	A	Require repair or replacement.
Reluctor (pickup triggering device) loose	A	Require repair or replacement.
Reluctor (pickup triggering device) weak	A	Require repair or replacement.
Shaft bent	A	Require replacement.
Thrust washer broken	A	Require repair or replacement.

Thrust washer missing	C	..	Require repair or replacement.
Thrust washer worn, affecting performance	A	..	Require repair or replacement.
Thrust washer worn, not affecting performance	1	..	Suggest repair or replacement.

EARLY FUEL EVAPORATION VALVES (HEAT RISER ASSEMBLIES)

EARLY FUEL EVAPORATION VALVE (HEAT RISER ASSEMBLY) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement of affected parts.
Diaphragm inoperative	A	(1) Further inspection required.
Leaking	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Seized	A	Require replacement of affected parts.
Spring broken	B	Require replacement of spring(s).
Spring inoperative	A	(2) Require replacement of spring(s).

(1) - Inoperative includes intermittent operation or out of OEM specification. If the inoperative diaphragm is separate from the heat riser, then require replacement of the inoperative diaphragm. If the inoperative diaphragm is part of the heat riser, then replace the heat riser.
(2) - Inoperative includes intermittent operation or out of OEM specification.

EGR COOLERS

See EGR PLATES AND COOLERS.

EGR EXHAUST MANIFOLD PASSAGES

See EGR INTAKE AND EXHAUST MANIFOLD PASSAGES.

EGR INTAKE AND EXHAUST MANIFOLD PASSAGES

EGR INTAKE AND EXHAUST MANIFOLD PASSAGE INSPECTION

Condition	Code		Procedure
Leaking	A	..	Require repair or replacement.
Restricted, affecting performance	A	..	Require repair or replacement.

EGR PLATES AND COOLERS

EGR PLATE AND COOLER INSPECTION

Condition	Code		Procedure
Leaking	A	..	Require repair or replacement.

Missing	C	Require replacement.
Restricted, affecting performance	A	Require repair or replacement.

ELECTRONIC SPARK CONTROL MODULES

ELECTRONIC SPARK CONTROL MODULE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(3) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement of source.
(3) - Includes inoperative, intermittent operation, failure to

perform all functions, or out of OEM specification.

ELECTRONIC TRANSMISSION CONTROL DEVICES

ELECTRONIC TRANSMISSION CONTROL DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(3) Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.

(3) - Includes inoperative, intermittent operation, failure to perform all functions, or out of OEM specification.

ELECTRONIC TRANSMISSION FEEDBACK DEVICES

ELECTRONIC TRANSMISSION FEEDBACK DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant,

fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

ENGINE COOLANT TEMPERATURE SENSORS

ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

ENGINE COOLING SYSTEMS

NOTE: Overheating, poor engine performance, and insufficient cabin heat can be affected by, but are not limited to, all of the components in the engine cooling system.

ENGINE COVERS (OIL PAN, VALVE COVER, TIMING COVER)

ENGINE COVER (OIL PAN, VALVE COVER, TIMING COVER) INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	B	Require replacement.
Attaching hardware loose	A	Require repair or replacement.
Attaching hardware missing	C	Require replacement.
Baffle loose	2	Suggest repair or replacement.
Baffle missing	C	Require replacement.
Bent, affecting performance	A	Require repair or replacement.
Bent, not affecting performance		No service suggested or required.
Cracked (not leaking)	2	Suggest repair or replacement.
Leaking externally	A	Require repair or replacement.
Leaking internally, causing fluid contamination	A	Require repair or replacement.
Missing	C	Require replacement.
Restricted passage	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.

ENGINE OIL

ENGINE OIL INSPECTION

Condition	Code	Procedure
Contaminated	A	(1) Require replacement of oil and filter.
Level high	B	Determine source of incorrect level and require repair.
Level low	B	Determine source of incorrect level and require repair.
Maintenance intervals	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.

(1) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water when changing oil. Require

repair or replacement.

ENGINE OIL CANISTERS

See ENGINE OIL FILTERS AND CANISTERS.

ENGINE OIL COOLERS (EXTERNAL)

ENGINE OIL COOLER (EXTERNAL) INSPECTION

Condition	Code	Procedure
Air flow restriction	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bypassed	A	Require repair or replacement.
Connection leaking	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Fins damaged, affecting performance	A	Require repair or replacement.
Fins damaged, not affecting performance	2	Suggest repair or replacement.
Fluid flow restrictions	A	Require repair or replacement.
Internal restrictions, affecting performance	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

ENGINE OIL DRAIN PLUGS AND GASKETS

ENGINE OIL DRAIN PLUG AND GASKET INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	(1) Require repair or replacement.

(1) - Some OEMs require replacement of drain plug gasket when removing drain plug. Inspect threads in oil pan for damage.

ENGINE OIL FILTERS AND CANISTERS

ENGINE OIL FILTER AND CANISTER INSPECTION

Condition	Code	Procedure
Bulged	A	(1) Require replacement.

			Further inspection required.
Canister attaching hardware broken	A	...	Require repair or replacement of hardware.
Canister attaching hardware loose	A	...	Require repair.
Canister attaching hardware missing	C	...	Require replacement.
Canister attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Center tube collapsed	A	...	(2) Require replacement.
			Further inspection required.
Contaminated	A	...	(3) Require replacement of oil and filter.
Dented	2	...	(4) Suggest replacement.
			Further inspection required.
Leaking	A	..	Require repair or replacement.
Maintenance intervals	3	...	Suggest replacement to comply with vehicle's OEM recommended service intervals.

(1) - Inspect pressure relief valve.
(2) - Inspect bypass.
(3) - Determine cause of contamination, such as engine coolant, fuel, metal particles, or water when changing oil. Require repair or replacement.
(4) - Determine cause, such as broken motor mount.

ENGINE OIL GASKETS

See ENGINE OIL DRAIN PLUGS AND GASKETS.

ENGINE OIL PRESSURE GAUGES (MECHANICAL)

ENGINE OIL PRESSURE GAUGE (MECHANICAL) INSPECTION

Condition	Code	Procedure
Indicates out of range	B	(1) Further inspection required.
Inoperative	A	(2) Further inspection required.
Leaking	A	Require repair or replacement.
Reads inaccurately	2	Suggest repair or replacement.

(1) - Gauge may indicate problem with contaminated oil, level, pressure, or temperature, or problem with gauge.
(2) - Gauge may indicate problem with contaminated oil, level, pressure, or temperature, or problem with gauge. Inoperative includes intermittent operation, out of OEM specification, or out of range. Further inspection required to determine cause.

EVAPORATIVE EMISSION (EVAP) CANISTER FILTERS

EVAPORATIVE EMISSION (EVAP) CANISTER FILTER INSPECTION

Condition	Code	Procedure

Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Maintenance interval	3	Suggest replacement to comply with OEM recommended service interval.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Restricted, not affecting performance	1	Suggest replacement.
Water-contaminated	A	Require replacement.

EVAPORATIVE EMISSION (EVAP) CANISTER PURGE DEVICES

EVAPORATIVE EMISSION (EVAP) CANISTER PURGE DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.

Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EVAPORATIVE EMISSION (EVAP) CANISTERS

EVAPORATIVE EMISSION (EVAP) CANISTER INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Saturated	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

EVAPORATIVE EMISSION (EVAP) FEEDBACK DEVICES

EVAPORATIVE EMISSION (EVAP) FEEDBACK DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.

Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EXHAUST GAS RECIRCULATION DEVICES

EXHAUST GAS RECIRCULATION DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.

Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	1	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EXHAUST GAS RECIRCULATION FEEDBACK DEVICES

EXHAUST GAS RECIRCULATION FEEDBACK DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.

Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(2) Require repair or replacement.
Inoperative	B	.....	(3) Require repair or replacement. Further inspection required.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Resistance out of specification	B	..	Require repair or replacement.
Restricted, affecting performance	A	..	Require repair or replacement.
Restricted, not affecting performance	1	..	Suggest repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

EXPANSION PLUGS

See CASTING CORE PLUGS AND EXPANSION PLUGS.

FAN CONTROL SENSORS

FAN CONTROL SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware		

missing	C	.....	Require replacement of hardware.
Attaching hardware threads damaged	A	...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(2) Require repair or replacement.
Inoperative	B	.....	(3) Require repair or replacement. Further inspection required.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Resistance out of specification	B	..	Require repair or replacement.
Restricted, affecting performance	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

FUEL

FUEL INSPECTION

Condition	Code	Procedure
Contaminated	B	(1) Require repair or replacement.
Fuel incorrect	B	(2) Require flushing of system.

(1) - Determine of source of contamination. Require repair or replacement.
(2) - If a fuel other than specification fuel is present in the system, the required service is to flush and fill with the correct fuel.

FUEL ACCUMULATORS AND DAMPERS

FUEL ACCUMULATOR AND DAMPER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Connections leaking	A ..	Require repair or replacement.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

FUEL AND COLD START INJECTORS

NOTE: You are not required to replace injectors in sets. However, you may suggest replacement of all injectors for preventive maintenance.

FUEL AND COLD START INJECTOR INSPECTION

Condition	Code	Procedure
Application incorrect ...	B	Require replacement.
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Connector broken	A ..	Require repair or replacement.
Connector (Weatherpack type) leaking	A ..	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.

Condition	Code	Procedure
Flow restricted	B	Require repair or replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Resistance out of specification	B	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation, out of OEM specification. Some components may be serviceable.

FUEL DAMPERS

See FUEL ACCUMULATORS AND DAMPERS.

FUEL DELIVERY CHECK VALVES

FUEL DELIVERY CHECK VALVE INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require replacement.
Leaking externally	A	Require repair or replacement.
Missing	C	Require replacement.
Pressure leaking (bleeds down)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

FUEL DISTRIBUTORS (BOSCH CIS)

FUEL DISTRIBUTOR (BOSCH CIS) INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Out of specification	B	Require repair or replacement.
Restricted, affecting		

performance	A	(2) Require repair or replacement. Further inspection required.

(1) - Inoperative includes intermittent operation.
(2) - Some components may be serviceable; check for accepted cleaning procedure.

FUEL FILLER NECKS AND RESTRICTORS

FUEL FILLER NECK AND RESTRICTOR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Leaking	A ..	Require repair or replacement.
Missing	C	Require replacement.
Restricted	2 ..	Suggest repair or replacement.

FUEL FILTERS

FUEL FILTER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement of hardware.
Leaking	A ..	Require repair or replacement.
Maintenance interval	3 ...	Suggest replacement to comply with OEM recommended service interval.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Restricted, not affecting performance	1	Suggest replacement.
Water-contaminated	2	Suggest replacement.

FUEL INJECTORS

FUEL INJECTOR INSPECTION

Condition	Code	Procedure
Attaching hardware		

missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	2	Suggest repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

FUEL LEVEL SENDER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.
(2) - Determine cause and correct prior to repair or replacement of part.

FUEL PRESSURE REGULATORS

FUEL PRESSURE REGULATOR INSPECTION

Condition	Code	Procedure
Contaminated	2	(1) Suggest repair or replacement. Further inspection required.
Inoperative	B	(2) Require repair or replacement.
Leaking (internally or externally)	A	Require repair or replacement.
Pressure out of specification	B	Require repair or replacement.
Vapor bypass restricted	A	Require repair or replacement.

(1) - Some components may be serviceable; check for accepted cleaning procedure. Determine source of contamination. Require repair or replacement.

(2) - Inoperative includes intermittent operation or out of OEM specification.

FUEL PUMPS (IN-TANK AND EXTERNAL, ELECTRICAL OR MECHANICAL)

FUEL PUMP (IN-TANK AND EXTERNAL, ELECTRICAL OR MECHANICAL) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require replacement.
Inoperative	A	(3) Require repair or replacement.
Leaking externally (includes pulsator)	A	Require repair or replacement.
Leaking internally (includes pulsator)	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination. Require repair or replacement.
(3) - Inoperative includes intermittent operation.

FUEL RAILS

FUEL RAIL INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Contaminated	A	(1) Require replacement.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.
Rust-pitted	1	Suggest replacement.

(1) - Determine source of contamination. Require repair or replacement.

FUEL RESTRICTORS

See FUEL FILLER NECKS AND RESTRICTORS.

FUEL TANKS

FUEL TANK INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Baffles loose	A	Require repair or replacement.
Contaminated	A	(1) Require repair.
Corroded internally	A	Require repair or replacement.
Distorted, affecting performance	B	Require replacement.
Distorted, not affecting performance	..	No service suggested or required.
Leaking	A	Require repair or replacement.

(1) - Determine source of contamination. Require repair or replacement.

GAS CAPS

GAS CAP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Fails to maintain proper pressure	A	Require replacement.
Gaskets missing	C	Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Plugged (vacuum and pressure relief)	A	Require replacement.
Seals missing	C	Require replacement.

GASKETS

GASKET INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

GROMMETS (VALVE COVER)

GROMMET (VALVE COVER) INSPECTION

Condition	Code	Procedure
Leaking	2	(1) Suggest repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

HARMONIC DAMPERS

HARMONIC DAMPER INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Cracked	A	Require replacement.
Dented (fluid type only)	A	Require replacement.
Keyway distorted	A	Require repair or replacement.
Leaking (Fluid damper only)	A	Require replacement.
Loose	A	Require replacement.
Noisy	A	Require replacement.

Outer ring slipped out of position	A	Require replacement.
Positioned incorrectly	A	Require repair or replacement.
Rubber damping material deteriorated	1	Suggest replacement.
Seal surface worn, causing a leak	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

HEATER CONTROL VALVES

HEATER CONTROL VALVE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bypassed	A	Require replacement.
Coolant leak	A	Require repair or replacement.
Malfunctioning	A	(1) Require repair or replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Vacuum leak	A	Require repair or replacement.

(1) - Includes inoperative, intermittent operation, or failure to perform all functions.

HEATER CORES

HEATER CORE INSPECTION

Condition	Code	Procedure
Air flow restriction	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bypassed	A	Require repair or replacement.
Connection leaking	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Fins damaged, affecting performance	A	Require repair or replacement.
Fins damaged, not affecting performance	2	Suggest repair or replacement.
Internal restrictions,		

affecting performance	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS

NOTE: When replacing fuel lines and hoses, replace with product that meets or exceeds OEM design specifications.

HOSE AND TUBE COUPLER, CONNECTOR AND CLAMP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Connected incorrectly	A	Require repair.
Corroded, not reusable	1	Suggest replacement.
Cracked	A	Require replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Safety clip missing (not leaking)	C	Require replacement of safety clip.
Stripped	A	Require replacement.

HOSE CLAMPS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

HOSE CONNECTORS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

HOSE COUPLERS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

HOSES AND TUBES (FUEL LINES, RADIATOR, VACUUM, BY PASS, HEATER, RECOVERY TANK AND OIL COOLERS)

HOSE AND TUBE (FUEL LINE, RADIATOR, VACUUM, BY PASS, HEATER, RECOVERY TANK AND OIL COOLER) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Connected incorrectly	A	Require repair.
Corroded, not reusable	1	Suggest replacement.
Cracked	A	Require replacement.
Dry-rotted	1	Suggest repair or replacement.
Hard	1	Suggest repair or replacement.
Inner fabric (webbing) damaged	A	Require replacement.
Insufficient clamping force, allowing hose to leak	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Maintenance intervals	3	Suggest replacement.

Melted	1	Suggest repair or replacement.
Missing	C	Require replacement.
Outer covering damaged	1	Suggest replacement.
Outer covering damaged to the extent that the inner fabric is visible	A	Require replacement.
Protective sleeves damaged	2	Suggest replacement of sleeves.
Protective sleeves missing	2	Suggest replacement of sleeves.
Restricted, affecting performance	A	Require repair or replacement.
Restricted, not affecting performance	2	Suggest repair or replacement.
Routed incorrectly	2	Suggest repair or replacement.
Safety clip missing	C	Require replacement.
Spongy	1	Suggest repair or replacement.
Stripped	A	Require replacement.
Swollen	B	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Type incorrect	1	Suggest repair or replacement.

HOUSINGS

See THERMOSTATS AND HOUSINGS.

IDLE AIR CONTROLS

IDLE AIR CONTROL INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

IDLE SPEED CONTROL ACTUATORS

IDLE SPEED CONTROL ACTUATOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.

Condition	Code	Procedure
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

IGNITION BOOTS

See IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION COIL TOWERS

See IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION COILS

IGNITION COIL INSPECTION

Condition	Code	Procedure
Arcing	A	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or

			replacement.
Connector missing	C	Require replacement.	
Corroded, affecting performance	A	Require replacement.	
Corroded, not affecting performance	2	Suggest replacement.	
Distorted	..	(2)	No service suggested or required.
Inoperative	A	(3)	Require replacement.
Oil leaking	A	Require replacement.	
Out of specification	B	Require replacement.	
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	(1)	Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Distortion may be the result of overheating; coil should be tested.
(3) - Inoperative includes intermittent operation.

IGNITION CONTROL MODULES (ICM)

IGNITION CONTROL MODULE (ICM) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.

Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(4) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) - Determine cause and correct prior to repair or replacement of part.
(3) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(4) - Includes inoperative, intermittent operation, or failure to perform all functions.

IGNITION SWITCHES

See SWITCHES.

IGNITION TERMINALS

See IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY).

IGNITION WIRES, BOOTS, COIL TOWERS AND TERMINALS (SECONDARY)

NOTE: You are not required to replace ignition wires in sets. However, you may suggest replacement of the entire secondary wire set for preventive maintenance.

IGNITION WIRE, BOOT, COIL TOWER AND TERMINAL (SECONDARY) INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.

Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Carbon-tracked	A	.....	Require replacement.
Corroded	1	..	Suggest repair or replacement.
Insulation leaking (shorted)	A	..	Require repair or replacement.
Metal heat shield bent	2	..	Suggest repair or replacement.
Missing	C	.....	Require replacement.
Oil-soaked (spongy)	1	.....	Suggest replacement.
Resistance incorrect	B	.....	Require replacement.
Routed incorrectly	2	.....	(1) Suggest repair.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.

(1) - If improper routing affects the performance of other systems, require repair. Proper routing, hardware, heatshields, etc., are intended to prevent premature failure of secondary ignition components.
(2) - Determine cause and correct prior to repair or replacement of part.

IN-TANK FUEL STRAINERS

IN-TANK FUEL STRAINER INSPECTION

Condition	Code		Procedure
Missing	C	.....	Require replacement.
Restricted	A	..	Require repair or replacement.
Torn	A	.....	Require replacement.

INERTIA FUEL SHUT-OFF SWITCHES

INERTIA FUEL SHUT-OFF SWITCH INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement

			of hardware.
Connector broken	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(2) Require replacement.
Inoperative	A	.....	(3) Require repair or replacement.
Missing	C	.....	Require replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification.

INTAKE AIR TEMPERATURE SENSORS

INTAKE AIR TEMPERATURE SENSOR INSPECTION

Condition	Code		Procedure
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware threads damaged	A	...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(2) Require repair or replacement.
Inoperative	B	.....	(3) Require repair or

			replacement. Further inspection required.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Resistance out of specification	B	..	Require repair or replacement.
Restricted, affecting performance	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

INTAKE MANIFOLDS

INTAKE MANIFOLD INSPECTION

Condition	Code		Procedure
Corroded, affecting sealability	A	..	Require repair or replacement.
Integrated air or fuel control components inoperative	A	.....	(1) Require repair or replacement.
Internal air or fuel components damaged, affecting performance	A	...	Require repair or replacement of component.
Internal air or fuel components damaged, not affecting performance	..	.....	No service suggested or required.
Internal air or fuel components missing	C	.....	Require replacement of

			component.
Leaking	A	..	Require repair or replacement.
Out of specification	B	.....	Require replacement.
Restricted	A	..	Require repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	..	Require repair or replacement.
Warped	B	..	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

INTERCOOLERS

See CHARGE AIR COOLERS "INTERCOOLERS" (CAC).

KNOCK SENSORS

KNOCK SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware threads damaged	A	... Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	..... (1) Require repair or replacement.
Connector missing	C	..... Require replacement.
Inoperative	B	..... (2) Require repair or replacement. Further inspection required.
Leaking	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Resistance out of specification	B	.. Require repair or replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal burned, affecting performance	A	..... (1) Require repair or replacement.
Terminal burned, not affecting performance	2	.. Suggest repair or replacement.
Terminal corroded, affecting performance	A	.. Require repair or replacement.
Terminal corroded, not affecting performance	2	.. Suggest repair or replacement.
Terminal loose, affecting performance	B	.. Require repair or replacement.
Terminal loose, not affecting performance	1	.. Suggest repair or replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

LIQUID VAPOR SEPARATORS

LIQUID VAPOR SEPARATOR INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require repair or replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSORS

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

MASS AIR FLOW (MAF) SENSORS

MASS AIR FLOW (MAF) SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.

Restricted, affecting performance	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

METAL AIR MANIFOLDS AND PIPES

METAL AIR MANIFOLD AND PIPE INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	...	Require repair or replacement of hardware.
Broken	A	.....	Require repair of injection tube or replacement of manifold.
Corroded, affecting structural integrity	1	.....	Suggest replacement of injection tube or manifold.
Leaking	A	.....	Require repair of injection tube or replacement of manifold.
Loose	A	.....	Require repair.
Missing	C	.....	Require replacement.
Restricted	A	.....	Require replacement of injection tube or manifold.

Threads damaged	A	Require repair.
Threads stripped (threads missing)	A	Require replacement.

METAL AIR PIPES

See METAL AIR MANIFOLDS AND PIPES.

MIX CONTROL SOLENOIDS

MIX CONTROL SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.

Condition	Code	Procedure
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

MOTOR MOUNTS

MOTOR MOUNT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require replacement.
Leaking (hydraulic mount)	A	Require replacement.
Mounting hole worn, affecting performance	A	Require replacement.
Mounting hole worn, not affecting performance		No service suggested or required.
Rubber deteriorated, affecting performance	A	Require replacement.
Rubber deteriorated, not affecting performance		No service suggested or required.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

O-RINGS, GASKETS, SEALS AND SPRING LOCKS

O-RING, GASKET, SEAL AND SPRING LOCK INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

O2 SENSORS

O2 SENSOR INSPECTION

Condition	Code	Procedure

Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

OIL PRESSURE SENDING UNITS

OIL PRESSURE SENDING UNIT INSPECTION

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	A	(2) Require repair or replacement.
Leaking	A	Require replacement.
Output signal incorrect	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification.

OIL PUMP PICK-UP SCREENS

OIL PUMP PICK-UP SCREEN INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bypass stuck	A	Require repair or replacement.
Cracked	A	Require repair or replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Positioned incorrectly	A	Require repair or replacement.
Restricted	A	Require repair or replacement.
Screen torn	A	Require replacement.

OIL PUMPS

OIL PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Broken	A	Require repair or replacement.
Housing cracked	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Pressure relief valve stuck	A	Require repair or replacement.
Seized	A	Require repair or replacement.
Worn beyond specifications	B	Require repair or replacement.

PARK NEUTRAL POSITION SWITCHES

PARK NEUTRAL POSITION SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.

Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

PCV BREATHER ELEMENTS

PCV BREATHER ELEMENT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Leaking	A	Require replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.
Melted	A	Required replacement.
Missing	C	Require replacement.
Restricted, affecting performance	A	Require replacement.
Restricted, not affecting performance	1	Suggest replacement.
Water-contaminated	A	Require replacement.

PCV ORIFICES

PCV ORIFICE INSPECTION

Condition	Code	Procedure
Leaking	A	Require replacement.
Maintenance interval	3	Suggest repair or replacement to comply with OEM recommended service intervals.

Missing	C	Require replacement.
Restricted	A	Require repair or replacement.

PCV VALVES

PCV VALVE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Grommet broken	A	Require repair or replacement of grommet.
Grommet missing	C	Require replacement of grommet.
Grommet not functioning	A	Require repair or replacement of grommet.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Maintenance interval	3	Suggest replacement to comply with vehicle's OEM recommended service intervals.
Missing	C	Require replacement.
Restricted	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

PICK-UP ASSEMBLIES (INCLUDES MAGNETIC, HALL EFFECT AND OPTICAL)

PICK-UP ASSEMBLY (MAGNETIC, HALL EFFECT AND OPTICAL) INSPECTION

Condition	Code	Procedure
Adjustment incorrect	B	Require repair.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require replacement.
Oil-soaked	A	Require replacement.

Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Refer to OEM recommended service' procedures.

POWER STEERING PRESSURE SENSORS

POWER STEERING PRESSURE SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or

			replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	..	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

POWERTRAIN CONTROL MODULES (PCM) AND PROM

POWERTRAIN CONTROL MODULE (PCM) AND PROM INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Code set (if applicable)	A	(1) Further inspection required.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(2) Require repair or replacement.
Connector missing	A	Require repair.
Contaminated	A	(3) Require repair or replacement.
Leaking	A	Require repair or replacement.
Malfunctioning	A	(4) Require repair or replacement.
Missing	C	Require replacement.
Terminal broken	A	Require repair or replacement.

Terminal burned, affecting performance	A	(2) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) – Refer to manufacturer's diagnostic trouble code procedure and require repair or replacement of affected component(s).
(2) – Determine cause and correct prior to repair or replacement of part.
(3) – Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(4) – Includes inoperative, intermittent operation, failure to perform all functions, or out of OEM specification.

POWERTRAIN CONTROL PROM

See POWERTRAIN CONTROL MODULES (PCM) AND PROM.

PRESSURIZED EXPANSION TANK CAPS

See RADIATOR CAPS AND PRESSURIZED EXPANSION TANK CAPS.

RADIATOR CAPS AND PRESSURIZED EXPANSION TANK CAPS

RADIATOR CAP AND PRESSURIZED EXPANSION TANK CAP INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Coolant recovery check valve inoperative	A	(1) Require replacement.
Fails to maintain proper pressure	B	Require replacement.
Gasket missing	C	Require replacement of gasket.
Missing	C	Require replacement.
Seal missing	C	Require replacement of seal.

(1) – Inoperative includes intermittent operation or out of OEM specification.

RADIATOR FAN BLADES

RADIATOR FAN BLADE INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.

RADIATOR FAN CLUTCHES

NOTE: Some lateral movement, measured at the fan blade tip, may be normal.

RADIATOR FAN CLUTCH INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bearing noisy	A	Require replacement.
Bearing worn	A	Require replacement.
Fastener loose	A	Require repair or replacement of fastener.
Inoperative	A	(1) Require replacement.
Leaking	1	Suggest replacement.
Seized	A	Require replacement.
Slips (insufficient fan speed)	A	Require replacement.
Thermal control incorrect	B	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

RADIATORS

RADIATOR INSPECTION

Condition	Code	Procedure
Air flow restriction	A	Require repair.

Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connection leaking	A	Require repair or replacement.
Corroded	1	Suggest repair or replacement.
Fins damaged, affecting performance	A	Require repair or replacement.
Fins damaged, not affecting performance	2	Suggest repair or replacement.
Internal oil cooler leaking	A	Require repair or replacement.
Internal restrictions, affecting performance	B	Require repair or replacement.
Internal restrictions, not affecting performance	2	Suggest repair or replacement.
Leaking	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.
Tubes damaged, affecting performance	A	Require repair or replacement.
Tubes damaged, not affecting performance		No service suggested or required.

ROLL OVER VALVES

ROLL OVER VALVE INSPECTION

Condition	Code	Procedure
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Missing	C	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

SEALING COMPOUNDS

SEALING COMPOUND INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SEALS

SEAL INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SECONDARY AIR INJECTION SYSTEM MANAGEMENT DEVICES

SECONDARY AIR INJECTION SYSTEM MANAGEMENT DEVICE INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.

Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

SENSORS AND ACTUATORS

NOTE: Conditions pertaining to the sensors and actuators listed in this section may be found under the name of the sensor or actuator.

SENSOR ABBREVIATION TABLE

Sensor	Abbreviation
Accelerator Pedal Position Sensor	APP
Air Conditioning Cycling Switch	AC
Air Conditioning Pressure Sensor	..
Air Fuel Ratio Sensor	..
Barometric Pressure Sensor	BARO
Camshaft Position Sensor	CMP
Clutch Pedal Position Switch	CPP
Cooling Fan Motor Sensors and Switches	..
Crankshaft Position Sensor	CKP
Electronic Transmission Feedback Devices	..
Engine Coolant Temperature Sensor	ECT
Evaporative Emission feedback devices	..
Exhaust Gas Recirculation feedback devices	..
Fan Control Sensor	FC
Intake Air Temperature Sensor	IAT
Knock Sensor	KS
Manifold Absolute Pressure Sensor	MAP
Mass Air Flow Sensor	MAF
O2 Sensor	O2S
Park Neutral Position Switch	PNP
Power Steering Pressure Sensor	PSP
Thermal Vacuum Valve	TVV
Throttle Position Sensor	TP Sensor
Throttle Position Switch	..
Transmission Range Switch	TR Switch
Vehicle Speed Sensor	VSS
Volume Air Flow Sensor	VAF

ACTUATOR ABBREVIATION TABLE

Actuator	Abbreviation
Air Injection Control Solenoid	..
Electronic Transmission control devices	..
Evaporative Emission Canister	EVAP
Purge Device	..
Exhaust Gas Recirculation Device	EGR
Fuel Injector	..
Idle Air Control	IAC

Idle Speed Control Actuator	ISC
Mix Control Solenoid	MC Solenoid
Secondary Air Injection System Management Device	AIR, PAIR
Vacuum Regulator Solenoid	..
Waste Gate Control Solenoid	..

SHROUDS, BAFFLES AND DEFLECTORS

SHROUD, BAFFLE AND DEFLECTOR INSPECTION

Condition	Code	Procedure
Application incorrect, affecting cooling system performance	A	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent, affecting cooling system performance	A	Require repair or replacement.
Blocked, affecting cooling system performance	A	Require repair or replacement.
Broken, affecting cooling system performance	A	Require repair or replacement.
Cracked, affecting cooling system performance	A	Require repair or replacement.
Loose, affecting cooling system performance	A	Require repair.
Loose, not affecting cooling system performance	2	Suggest repair.
Missing, affecting cooling system performance	C	Require replacement.

SPARK PLUGS

NOTE: You are not required to replace spark plugs in sets. However, you may suggest replacement of the other plugs for preventive maintenance.

SPARK PLUG INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Electrode eroded	1	Suggest replacement.
Fouled	A	(1) Require repair or replacement.
Gap incorrect	B	Require repair or replacement.
Insulation broken	A	Require replacement
Insulator cracked	A	Require replacement.
Leaking compression	A	Require repair or replacement.
Maintenance interval	3	Suggest replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads		

missing)	A	Require replacement.

(1) - Determine cause of fouling and suggest repair.

SPRING LOCKS

SPRING LOCK INSPECTION

Condition	Code	Procedure
Leaking	A	(1) Require repair or replacement.

(1) - Require inspection of mating and sealing surface and repair or replace as necessary.

SUPER CHARGERS

SUPER CHARGER INSPECTION

Condition	Code	Procedure
Attaching hardware damaged, affecting operation or performance	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Bearing noisy	A	Require replacement.
Bearing worn	A	Require replacement.
Boost pressure incorrect	A	(1) Require repair or replacement.
Clearance out of specification	B ..	Require repair or replacement.
Leaking	A ..	Require repair or replacement.
Noisy	2 ..	Suggest repair or replacement.
Threads damaged	A ..	Require repair or replacement.
Threads stripped (threads missing)	A ..	Require repair or replacement.

(1) - Boost pressure problems may be caused by other systems or components.

SWITCHES

SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A ...	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A ...	Require repair or replacement

			of hardware.
Binding, affecting performance	A	..	Require repair or replacement.
Binding, not affecting performance	2	..	Suggest repair or replacement.
Broken	A	..	Require repair or replacement.
Burned, affecting performance	A	....	(1) Require repair or replacement.
Burned, not affecting performance	2	....	(1) Suggest repair or replacement.
Cracked, affecting performance	A	..	Require repair or replacement.
Cracked, not affecting performance	1	..	Suggest repair or replacement.
Leaking	A	..	Require repair or replacement.
Malfunctioning	A	....	(2) Require repair or replacement.
Melted, affecting performance	A	....	(1) Require repair or replacement.
Melted, not affecting performance	2	....	(1) Suggest repair or replacement.
Missing	C	....	Require replacement.
Out of adjustment	B	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Won’t return	A	..	Require repair or replacement.
Worn	1	....	Suggest replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Includes inoperative, intermittent operation, or failure to perform all functions.

THERMAL VACUUM VALVES

THERMAL VACUUM VALVE INSPECTION

Condition	Code		Procedure
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	....	(1) Require repair or replacement.
Connector missing	C	....	Require replacement.
Contaminated	A	....	(2) Require repair or

			replacement.
Inoperative	B	.....	(3) Require repair or replacement. Further inspection required.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Resistance out of specification	B	..	Require repair or replacement.
Restricted, affecting performance	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

THERMOSTATIC AIR DOOR ASSEMBLIES

THERMOSTATIC AIR DOOR ASSEMBLY INSPECTION

Condition	Code		Procedure
Attaching hardware damaged, affecting operation or performance	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Binding	A	..	Require repair or replacement.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Seized	A	..	Require repair or replacement.

THERMOSTATS AND HOUSINGS

THERMOSTAT AND HOUSING INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Housing corroded	1	Suggest replacement of housing.
Inoperative	A	(1) Require replacement.
Installation incorrect	B	Require repair or replacement.
Leaking	A	Require repair or replacement.
Thermostat missing	C	Require replacement of thermostat.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

THROTTLE BODIES

THROTTLE BODY INSPECTION

Condition	Code	Procedure
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted	A	(3) Require repair.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	..	Require repair or replacement.
Throttle shaft binding, affecting performance	A	..	Require repair or replacement.
Throttle shaft worn, affecting performance	A	..	Require repair or replacement.
Throttle shaft worn, not affecting performance	1	..	Suggest repair or replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Some components may be serviceable; check for accepted cleaning procedure.

THROTTLE CABLES

See THROTTLE LINKAGES AND CABLES.

THROTTLE LINKAGES AND CABLES

THROTTLE LINKAGE AND CABLE INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require repair or replacement of hardware.
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware not functioning	A	..	Require repair or replacement of hardware.
Bent	A	..	Require repair or replacement.
Binding	A	..	Require repair or replacement.
Bracket bent, affecting performance	A	..	Require repair or replacement.
Bracket bent, not affecting performance	..	.....	No service suggested or required.
Bracket broken, affecting performance	A		Require replacement.
Bracket broken, not affecting performance	..	.....	No service suggested or required.
Bracket corroded, affecting performance	A	..	Require repair or replacement.
Bracket corroded, not affecting performance	2	..	Suggest repair or replacement.
Bracket cracked, affecting performance	A	..	Require repair or replacement.
Bracket cracked, not affecting performance	1	..	Suggest repair or replacement.

Bracket loose, affecting performance	A	Require repair or replacement.
Bracket loose, not affecting performance	1	Suggest repair or replacement.
Bracket missing	C	Require replacement.
Broken	A	Require replacement.
Cracked	A	Require repair or replacement.
Disconnected	A	Require repair or replacement.
Kinked	A	Require repair or replacement.
Melted	A	Require repair or replacement.
Missing	C	Require replacement.
Noisy	2	Suggest repair or replacement.
Out of adjustment	B	(1) Require repair or replacement.
Routed incorrectly	2	Suggest repair.
Seized	A	Require repair or replacement.

(1) - Follow OEM recommended adjustment procedures. Require repair or replacement if out of specification.

THROTTLE POSITION SENSORS

THROTTLE POSITION SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not		

affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

THROTTLE POSITION SWITCHES

THROTTLE POSITION SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Inoperative	B	(2) Require repair or replacement. Further inspection required.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.

Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

TIMING BELT SPROCKETS

TIMING BELT SPROCKET INSPECTION

Condition	Code	Procedure
Alignment incorrect	B	Require repair.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Bent	A	Require replacement.
Cracked	A	Require replacement.
Key damaged	A	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Pulley damaged, affecting belt life	A	Require replacement.
Sprocket damaged, affecting belt life	A	Require repair or replacement.
Sprocket loose	B	Require repair or replacement.
Sprocket-to-shaft alignment incorrect	B	Require repair or replacement.

TIMING BELTS

TIMING BELT INSPECTION

Condition	Code	Procedure
Adjustment incorrect	2	(1) Suggest adjustment.
Alignment incorrect	B	(2) Further inspection required.
Broken	A	Require replacement.
Cam timing out of specification	B	Require repair.
Cracked	1	Suggest replacement.
Fluid-soaked	1	Suggest replacement. Further inspection required.
Frayed	1	Suggest replacement.
Maintenance intervals	3	Suggest replacement to comply with vehicle OEM recommended

			service intervals.
Missing	C	.....	(3) Require replacement.
Noisy	2	.....	(4) Further inspection required.
			See note below.
Plies separated	A	.....	Require replacement.
Tension out of specification	B	.....	Require adjustment or replacement.
Teeth missing	A	.....	Require replacement.

(1) - Inspect belt tensioners, pulleys, and cover.
(2) - Determine cause of incorrect alignment and require repair.
(3) - CAUTION: Internal engine damage may result from timing belt damage/failure.
(4) - Determine cause of noise and suggest repair.

TORQUE STRUTS

TORQUE STRUT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Binding	A	..... Require replacement.
Body dented	A	..... (1) Further inspection required.
Body punctured	A	..... Require replacement.
Bushing deteriorated, affecting performance	A	..... Require replacement.
Bushing deteriorated, not affecting performance	..	..... No service suggested or required.
Bushings missing	C	..... Require replacement.
Bushings separated from mounting eye	1	..... Suggest replacement.
Damping (none)	A	..... Require replacement.
Leaking oil, enough for fluid to be running down the body	A	..... Require replacement.
Missing	C	..... Require replacement.
Noisy	2	..... (2) Further inspection required.
Piston rod bent	A	..... Require replacement.
Piston rod broken	A	..... Require replacement.
Seized	A	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - Require replacement of units where dents restrict strut piston rod movement. If dents don't restrict movement, no service is suggested or required.
(2) - If noise is isolated to shock or strut, suggest replacement.

TRANSMISSION RANGE SWITCHES

TRANSMISSION RANGE SWITCH INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable;

check for accepted cleaning procedure.

TUBE CLAMPS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBE CONNECTORS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBE COUPLERS

See HOSE AND TUBE COUPLERS, CONNECTORS AND CLAMPS.

TUBES

See HOSES AND TUBES (FUEL LINES, RADIATOR, BY PASS, HEATER, RECOVERY TANK AND OIL COOLERS).

TURBO CHARGERS

TURBO CHARGER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Boost pressure incorrect	A	(1) Require repair or replacement.
Leaking	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement.
Oil seal (internal) leaking	A	Require repair or replacement.
Vibrates	A	Require repair or replacement.

(1) - Boost pressure problems may be caused by other systems or components.

VACUUM CONNECTIONS

See VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC).

VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC)

VACUUM HOSE, TUBE AND CONNECTION (NON-METALLIC) INSPECTION

Condition	Code	Procedure
Leaking	A	Require repair or replacement.
Melted	A	Require replacement.
Missing	C	Require replacement.
Oil-soaked (spongy)	1	Suggest replacement.

Restricted	A	..	Require repair or replacement.
Surface cracks (dry-rotted)	1	.....	Suggest replacement.

VACUUM REGULATOR SOLENOIDS

VACUUM REGULATOR SOLENOID INSPECTION

Condition	Code		Procedure
Attaching hardware missing	C	.....	Require replacement of hardware.
Attaching hardware threads damaged	A	...	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	...	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	.....	(1) Require repair or replacement.
Connector missing	C	.....	Require replacement.
Contaminated	A	.....	(2) Require repair or replacement.
Inoperative	B	.....	(3) Require repair or replacement. Further inspection required.
Leaking	A	..	Require repair or replacement.
Missing	C	.....	Require replacement.
Resistance out of specification	B	..	Require repair or replacement.
Restricted, affecting performance	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	.....	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

VACUUM TUBES

See VACUUM HOSES, TUBES AND CONNECTIONS (NON-METALLIC).

VEHICLE SPEED SENSORS

VEHICLE SPEED SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.

Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

VOLUME AIR FLOW SENSORS

VOLUME AIR FLOW SENSOR INSPECTION

Condition	Code		Procedure
Attaching hardware missing	C	..	Require replacement of hardware.
Attaching hardware threads damaged	A	..	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	..	Require repair or replacement of hardware.
Connector broken	A	..	Require repair or replacement.
Connector (Weatherpack type) leaking	A	..	Require repair or replacement.
Connector melted	A	..	(1) Require repair or replacement.
Connector missing	C	..	Require replacement.
Contaminated	A	..	(2) Require repair or replacement.
Inoperative	B	..	(3) Require repair or replacement. Further inspection required.
Leaking	A	..	Require repair or replacement.
Missing	C	..	Require replacement.
Resistance out of specification	B	..	Require repair or replacement.
Restricted, affecting performance	A	..	Require repair or replacement.
Terminal broken	A	..	Require repair or replacement.
Terminal burned, affecting performance	A	..	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	..	Suggest repair or replacement.
Terminal corroded, affecting performance	A	..	Require repair or replacement.
Terminal corroded, not affecting performance	2	..	Suggest repair or replacement.
Terminal loose, affecting performance	B	..	Require repair or replacement.
Terminal loose, not affecting performance	1	..	Suggest repair or replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	..	Require replacement.

Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

WASTE GATE CONTROL SOLENOIDS

WASTE GATE CONTROL SOLENOID INSPECTION

Condition	Code	Procedure
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware threads damaged	A	Require repair or replacement of hardware.
Attaching hardware threads stripped (threads missing)	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Contaminated	A	(2) Require repair or replacement.
Inoperative	B	(3) Require repair or replacement. Further inspection required.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Resistance out of specification	B	Require repair or replacement.
Restricted, affecting performance	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.

Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.
Wire lead conductors exposed	B	..	Require repair or replacement.
Wire lead corroded	A	..	Require repair or replacement.
Wire lead open	A	..	Require repair or replacement.
Wire lead shorted	A	..	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Determine source of contamination, such as engine coolant, fuel, metal particles, or water. Require repair or replacement.
(3) - Inoperative includes intermittent operation or out of OEM specification. Some components may be serviceable; check for accepted cleaning procedure.

WASTE GATES AND BOOST CONTROL MECHANISMS

WASTE GATE AND BOOST CONTROL MECHANISM INSPECTION

Condition	Code	Procedure
Boost pressure incorrect	A	(1) Require repair or replacement. Further inspection required.
Leaking	A	.. Require repair or replacement.

(1) - Incorrect boost pressure includes intermittent operation or out of OEM specification.

WATER PUMPS (ELECTRIC)

WATER PUMP (ELECTRIC) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require repair or replacement of hardware.
Attaching hardware missing	C	..... Require replacement of hardware.
Attaching hardware not functioning	A	... Require repair or replacement of hardware.
Connector broken	A	.. Require repair or replacement.
Connector (Weatherpack type) leaking	A	.. Require repair or replacement.
Connector melted	A	..... (1) Require repair or replacement.
Connector missing	C	..... Require replacement.
Inoperative	A	..... (2) Require replacement.
Leaking	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Noisy	2	..... Suggest replacement.
Rotation incorrect for application	B	.. Require repair or replacement.
Terminal broken	A	.. Require repair or replacement.

Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Vibration	1	Suggest replacement.
Wire lead conductors exposed	B	Require repair or replacement.
Wire lead corroded	A	Require repair or replacement.
Wire lead open	A	Require repair or replacement.
Wire lead shorted	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.
(2) - Check fan motor/controls. Inoperative includes intermittent operation or out of OEM specification.

WATER PUMPS (NON-ELECTRIC)

WATER PUMP (NON-ELECTRIC) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware corroded	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Corrosion (internal) is excessive, affecting performance	A	Require replacement.
Corrosion (internal) is excessive, not affecting performance	2	Suggest cooling system service.
Inoperative	A	(1) Require replacement.
Leaking	A	Require replacement.
Noisy	A	Require replacement.
Rotation incorrect for application	B	Require repair or replacement.
Shaft bent	A	Require replacement.

(1) - Inoperative includes intermittent operation or out of OEM specification.

WIRING HARNESSES AND CONNECTORS

WIRING HARNESS AND CONNECTOR INSPECTION

Condition	Code	Procedure
Application incorrect	B	Require repair or replacement.
Attaching hardware broken	A	Require repair or replacement of hardware.
Attaching hardware missing	C	Require replacement of hardware.
Attaching hardware not functioning	A	Require repair or replacement of hardware.
Connector broken	A	Require repair or replacement.
Connector (Weatherpack type) leaking	A	Require repair or replacement.
Connector melted	A	(1) Require repair or replacement.
Connector missing	C	Require replacement.
Insulation damaged, conductors exposed	A	Require repair or replacement.
Insulation damaged, conductors not exposed	1	Suggest replacement.
Open	A	Require repair or replacement.
Protective shield (conduit) melted	2	(1) Suggest repair or replacement.
Protective shield (conduit) missing	2	Suggest repair or replacement.
Resistance (voltage drop) out of specification	A	Require repair or replacement.
Routed incorrectly	B	Require repair.
Secured incorrectly	B	Require repair.
Shorted	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal burned, affecting performance	A	(1) Require repair or replacement.
Terminal burned, not affecting performance	2	Suggest repair or replacement.
Terminal corroded, affecting performance	A	Require repair or replacement.
Terminal corroded, not affecting performance	2	Suggest repair or replacement.
Terminal loose, affecting performance	B	Require repair or replacement.
Terminal loose, not affecting performance	1	Suggest repair or replacement.
Voltage drop out of specification	A	Require repair or replacement.

(1) - Determine cause and correct prior to repair or replacement of part.

A - ENGINE/VIN ID

1997 Mitsubishi Montero Sport

1997 ENGINE PERFORMANCE
Mitsubishi Introduction

1997 MODEL COVERAGE

1997 MODEL COVERAGE TABLE

MODEL	BODY CODE (1)	ENGINE (2)	ENGINE ID (3)	FUEL SYSTEM	IGNITION SYSTEM (4)
Diamante	7	3.5L V6 (6G74) SOHC	P	MFI	Hall Effect
Eclipse	4	2.0L 4-Cyl. (420A) DOHC	Y	MFI	DIS
		2.0L 4-Cyl. (4G63) DOHC Turbo	F	MFI	DIS
Eclipse Spyder	5	2.0L 4-Cyl. (4G63) DOHC Turbo	F	MFI	DIS
		2.4L 4-Cyl. (4G64) SOHC	G	MFI	DIS
Galant	6	2.4L 4-Cyl. (4G64) SOHC	G	MFI	Hall Effect
Mirage	1, 6	1.5L 4-Cyl. (4G15) SOHC	A	MFI	Optical (5)
		1.8L 4-Cyl. (4G93) SOHC	C	MFI	Hall Effect
Montero	1	3.5L V6 (6G74) DOHC	M	MFI	DIS
Montero Sport	1	2.4L 4-Cyl (4G64) SOHC	G	MFI	Hall Effect
		3.0L V6 (6G72) SOHC	P	MFI	DIS
3000GT	4, 5	3.0L V6 (6G72) SOHC	H	MFI	DIS
		3.0L V6 (6G72) DOHC	J	MFI	DIS
		3.0L V6 (6G72) DOHC Turbo	K	MFI	DIS

(1) - Body code is seventh character of Vehicle Identification Number (VIN). VIN is located on upper left corner of instrument panel.
(2) - See Figs. 1 and 2.
(3) - Engine ID is eighth character of VIN.
(4) - Ignition timing is computer-controlled.

VIN DEFINITION

```
     J A 3 A Y 3 6 A 1  V  U  0  0  0  0  0  1
     1 2 3 4 5 6 7 8 9  10 11 12 13 14 15 16 17
```

```
    1 - Indicates Nation of Origin.
    2 - Indicates Manufacturer.
    3 - Indicates Vehicle Type.
    4 - Indicates Restraint System. (1)
    5 - Indicates Model.
    6 - Indicates Vehicle Series.
    7 - Indicates Body Type.
    8 - Indicates Engine Type and Make.
    9 - Indicates Check Digit.
   10 - Indicates Model Year.
   11 - Indicates Assembly Plant.
12-17 - Indicates Plant Sequential Number.
```

(1) - On Montero, fourth character of VIN indicates GVWR.

MODEL YEAR VIN CODE APPLICATION TABLE

VIN Code	Model Year
S	1995
T	1996
V	1997

ENGINE CODE LOCATION

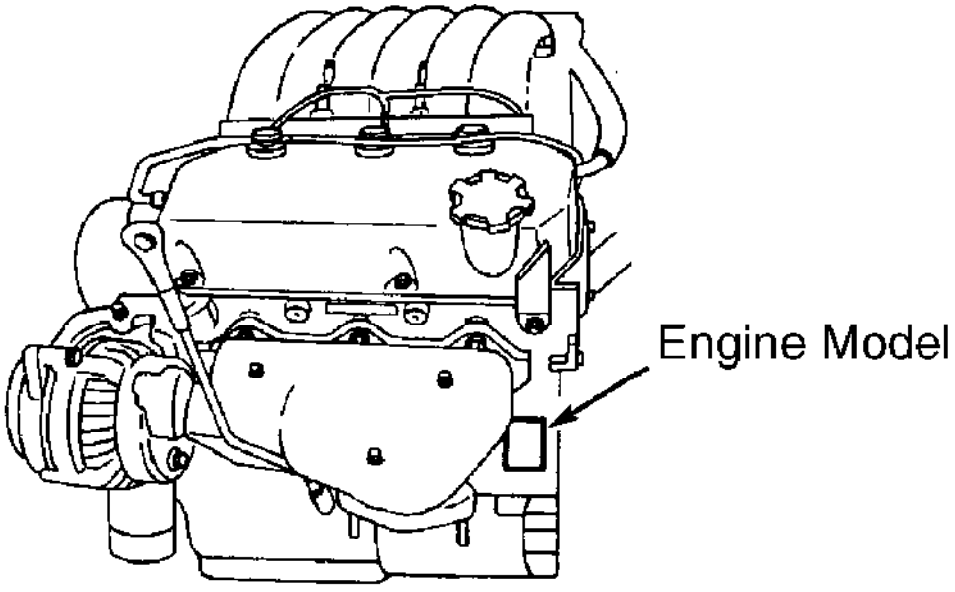

Fig. 1: Engine Code Locations (1 Of 2) Diamante
Courtesy of Chrysler Corp.

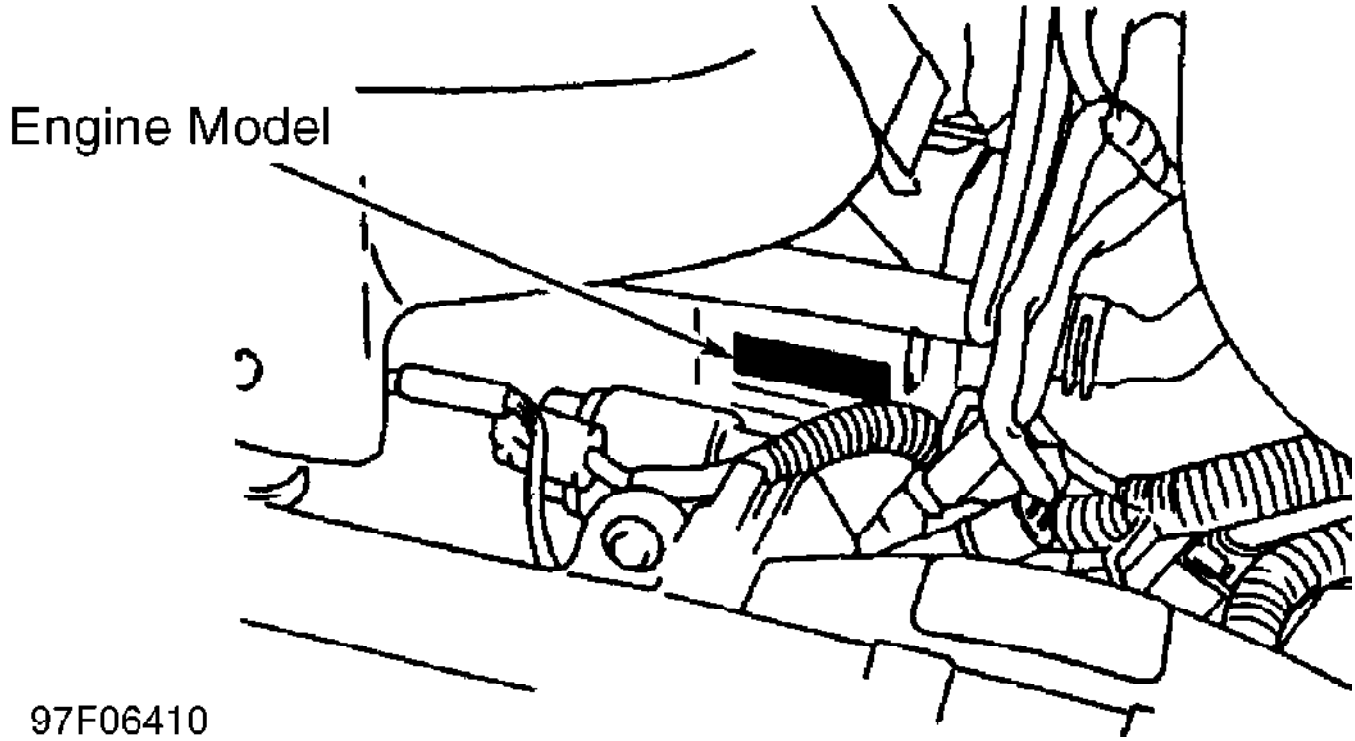

Fig. 2: Engine Code Locations (1 Of 2) Eclipse 2.0L Non-Turbo
Courtesy of Chrysler Corp.

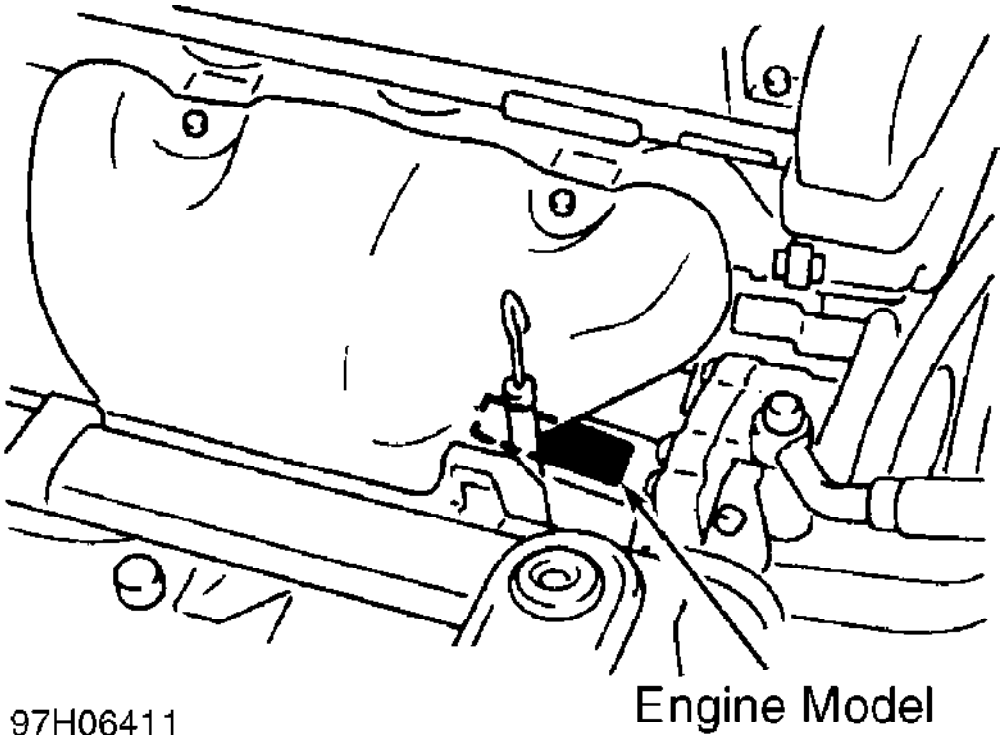

Fig. 3: Engine Code Locations (1 Of 2) Eclipse & Eclipse Spyder 2.0L Turbo & 2.4L, & Galant 2.4L
Courtesy of Chrysler Corp.

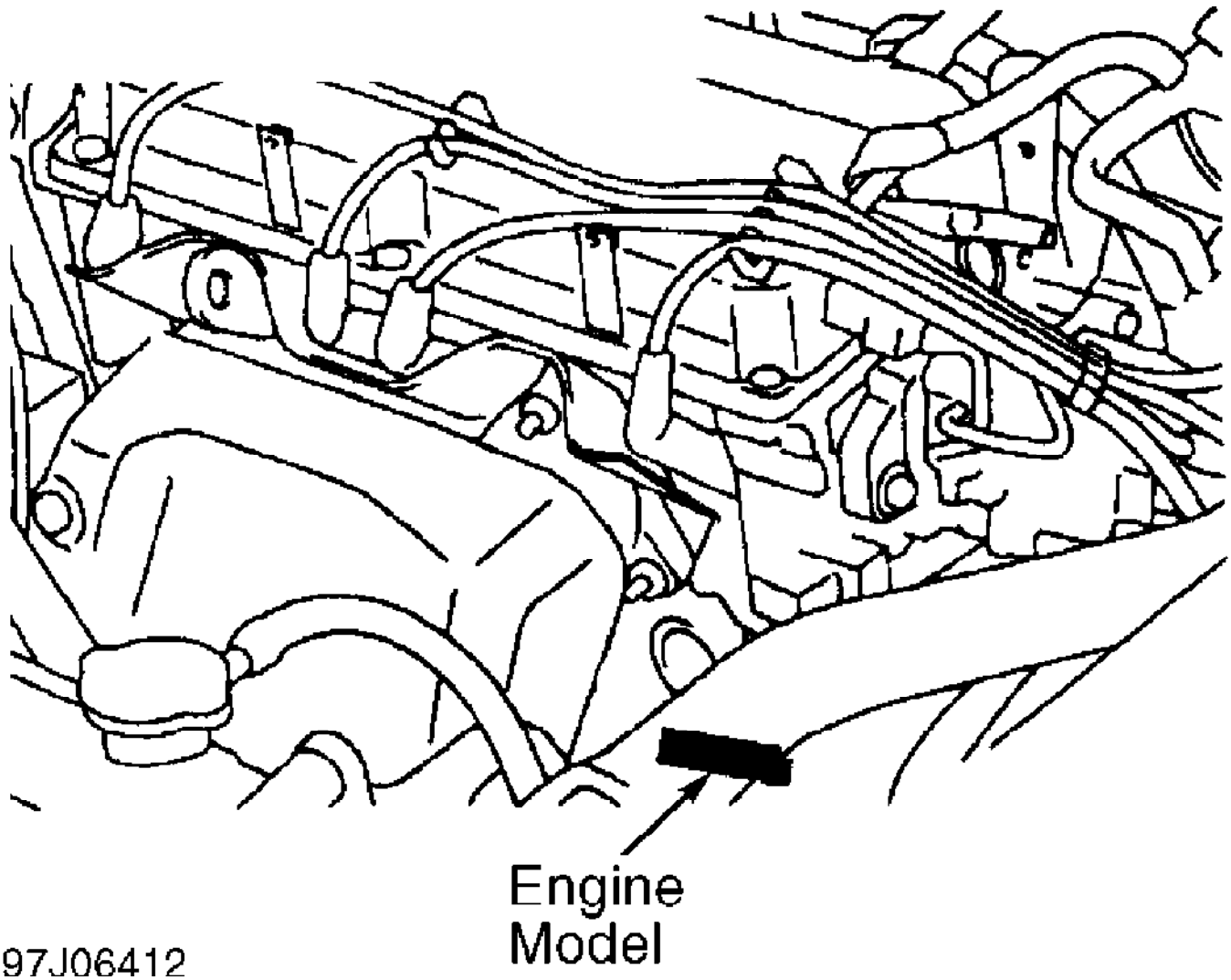

Fig. 4: Engine Code Locations (1 Of 2) Mirage 1.5L
Courtesy of Chrysler Corp.

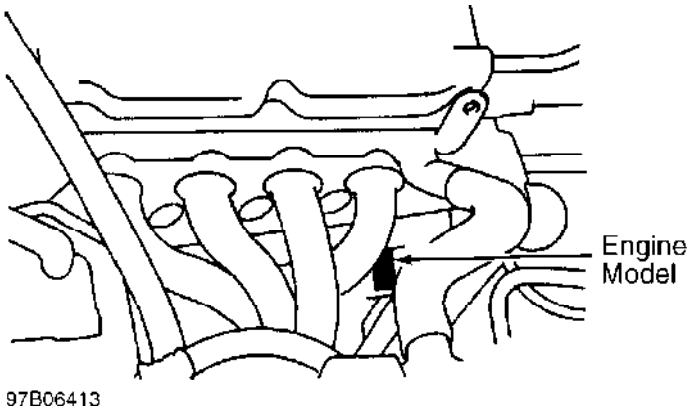

Fig. 5: Engine Code Locations (1 Of 2) Mirage 1.8L
Courtesy of Chrysler Corp.

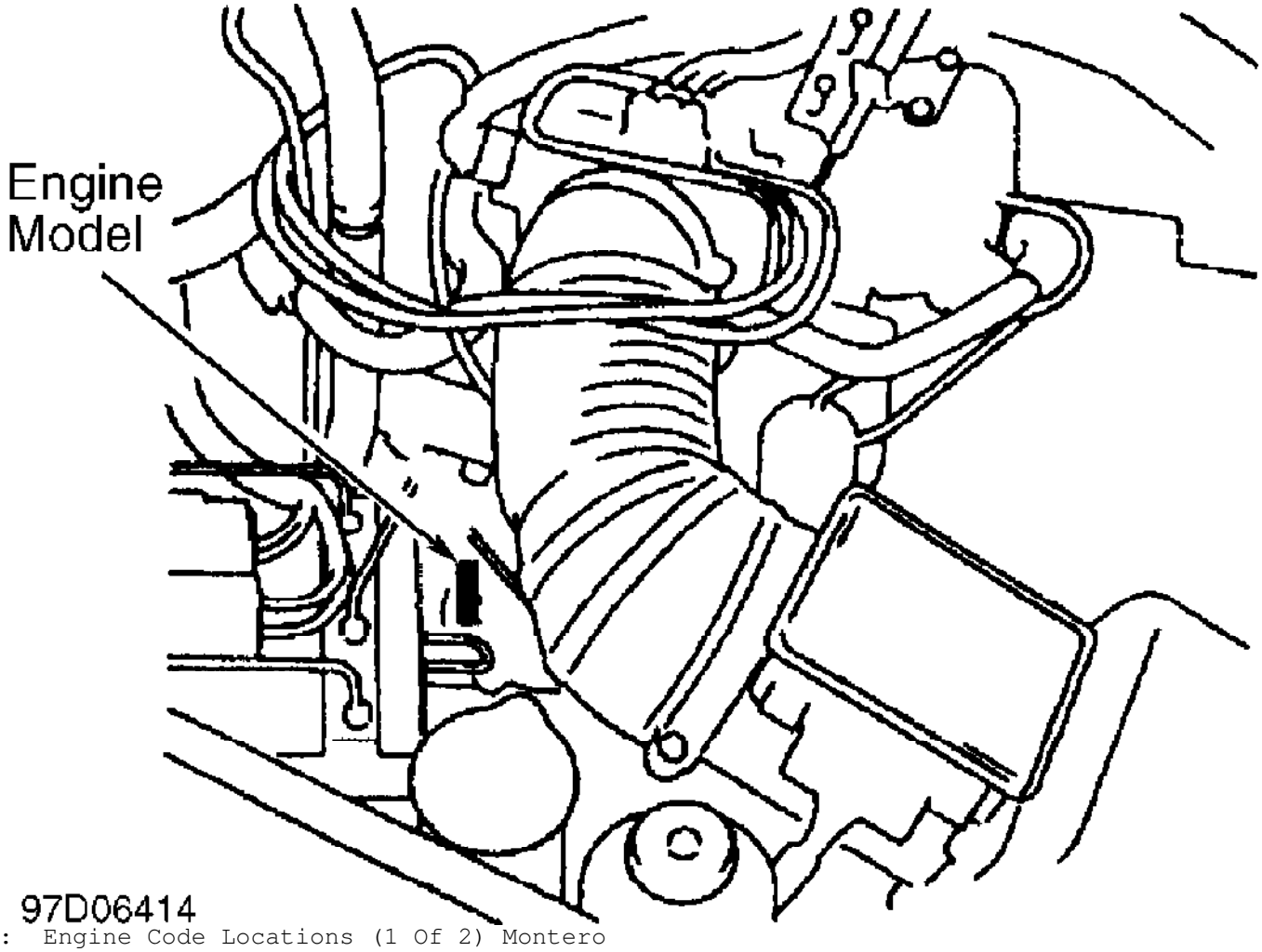

Fig. 6: Engine Code Locations (1 Of 2) Montero
Courtesy of Chrysler Corp.

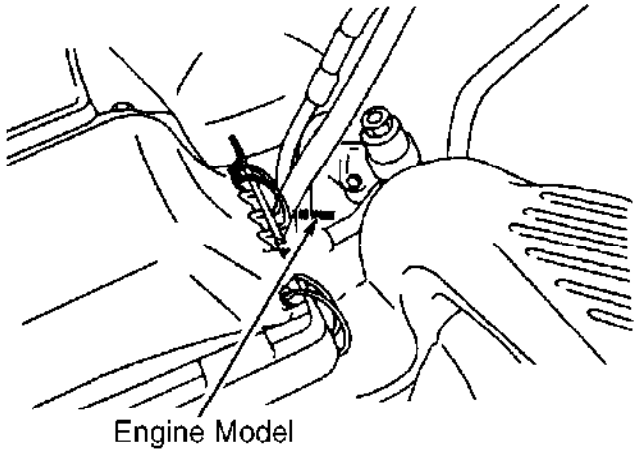

Fig. 7: Engine Code Locations (2 Of 2) Montero Sport 2.4L
Courtesy of Chrysler Corp.

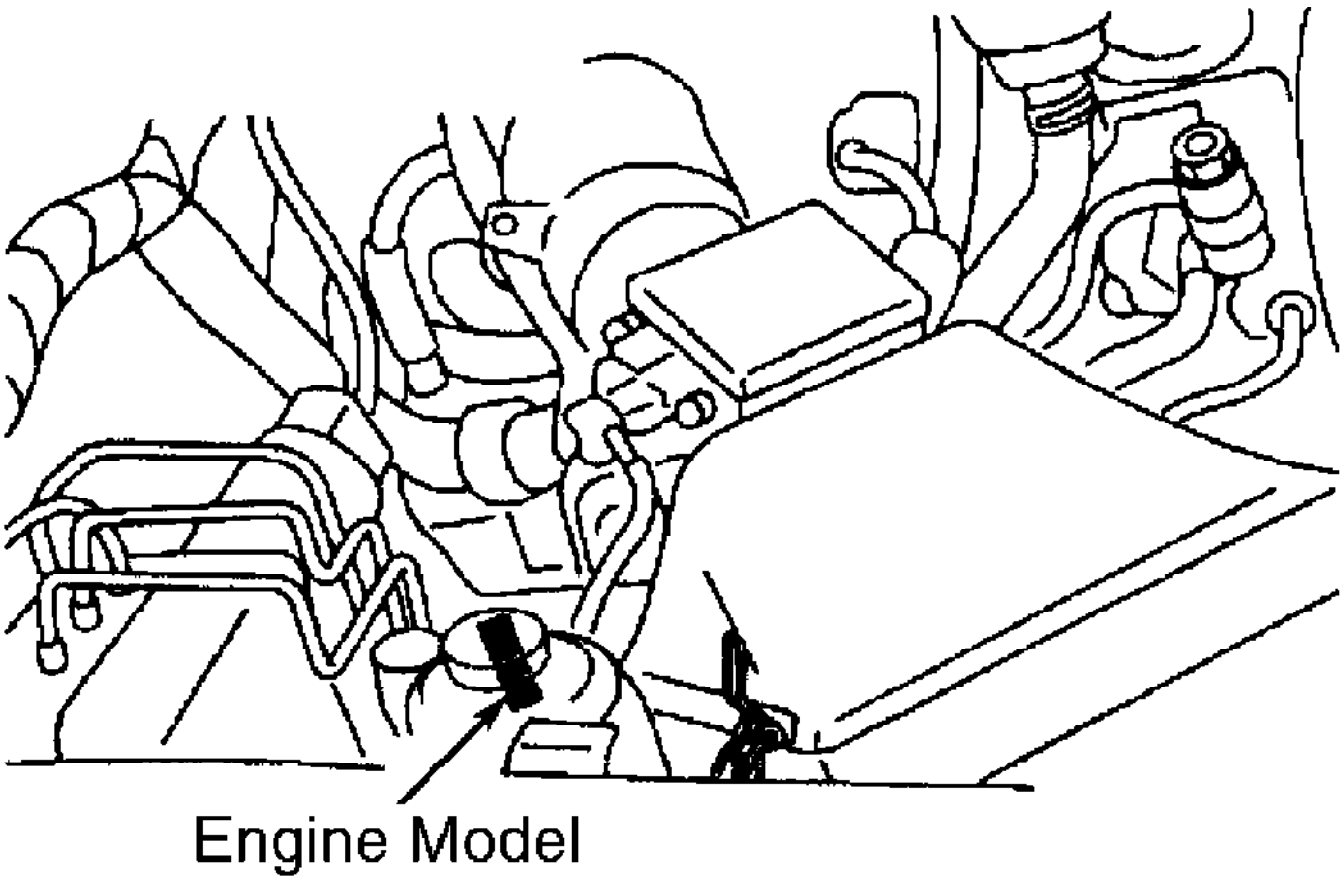

Fig. 8: Engine Code Locations (2 Of 2) Montero Sport 3.0L
Courtesy of Chrysler Corp.

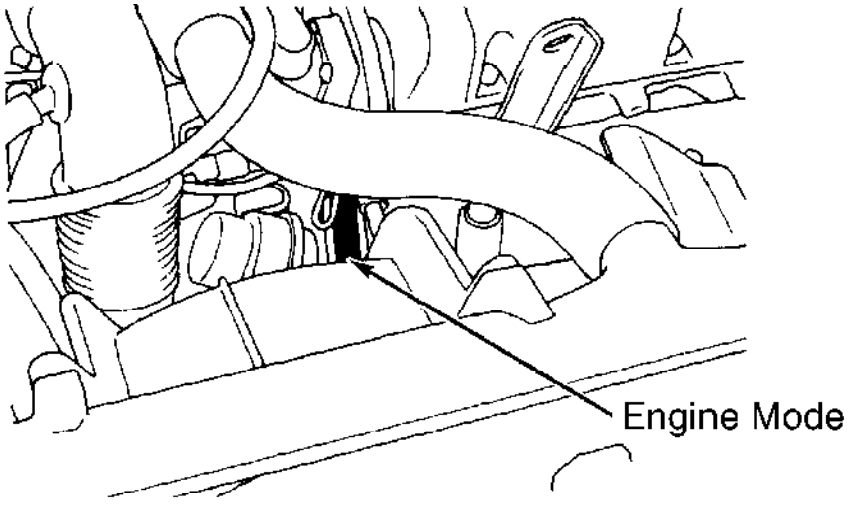

Fig. 9: Engine Code Locations (2 Of 2) 3000GT
Courtesy of Chrysler Corp.

ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION

1997-99 Mitsubishi Montero Sport

Engine Overhaul Procedures - General Information
ALL PISTON ENGINES

*** PLEASE READ THIS FIRST ***

Examples used in this article are general in nature and do not necessarily relate to a specific engine or system. Illustrations and procedures have been chosen to guide mechanic through engine overhaul process. Descriptions of processes of cleaning, inspection, assembly and machine shop practice are included.

Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

ENGINE IDENTIFICATION

The engine may be identified from its Vehicle Identification Number (VIN) stamped on a metal tab. Metal tab may be located in different locations depending on manufacturer. Engine identification number or serial number is located on cylinder block. Location varies with manufacturer.

INSPECTION PROCEDURES

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

GENERAL

Engine components must be inspected to meet manufacturer's specifications and tolerances during overhaul. Proper dimensions and tolerances must be met to obtain proper performance and maximum engine life.

Micrometers, depth gauges and dial indicator are used for checking tolerances during engine overhaul. Magnaflux, Magnaglo, dye-check, ultrasonic and x-ray inspection procedures are used for parts inspection.

MAGNETIC PARTICLE INSPECTION

Magnaflux & Magnaglo

Magnaflux is an inspection technique used to locate material flaws and stress cracks. The part in question is subjected to a strong magnetic field. The entire part, or a localized area, can be magnetized. The part is coated with either a wet or dry material that contains fine magnetic particles.

Cracks which are outlined by the particles cause an interruption in the magnetic field. The dry powder method of Magnaflux can be used in normal light. A crack will appear as an obvious bright line.

Fluorescent liquid is used in conjunction with a blacklight in a second Magnaflux system called Magnaglo. This type of inspection demands a darkened room. The crack will appear as a glowing line in this process. Both systems require complete demagnetizing upon

completion of the inspection. Magnetic particle inspection applies to ferrous materials only.

PENETRANT INSPECTION

Zyglo

The Zyglo process coats the material with a fluorescent dye penetrant. The part is often warmed to expand cracks that will be penetrated by the dye. When the coated part is subjected to inspection with a blacklight, a crack will glow brightly. Developing solution is often used to enhance results. Parts made of any material, such as aluminum cylinder heads or plastics, may be tested using this process.

Dye Check

Penetrating dye is sprayed on the previously cleaned component. Dye is left on component for 5-45 minutes, depending upon material density. Component is then wiped clean and sprayed with a developing solution. Surface cracks will show up as a bright line.

ULTRASONIC INSPECTION

If an expensive part is suspected of internal cracking, Ultrasonic testing is used. Sound waves are used for component inspection.

X-RAY INSPECTION

This form of inspection is used on highly stressed components. X-ray inspection maybe used to detect internal and external flaws in any material.

PRESSURE TESTING

Cylinder heads can be tested for cracks using a pressure tester. Pressure testing is performed by plugging all but one of the holes in the head and injecting air or water into the open passage. Leaks are indicated by the appearance of wet or damp areas when using water. When air is used, it is necessary to spray the head surface with a soap solution. Bubbles will indicate a leak. Cylinder head may also be submerged in water heated to specified temperature to check for cracks created during heat expansion.

CLEANING PROCEDURES

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

GENERAL

All components of an engine do not have the same cleaning requirements. Physical methods include bead blasting and manual removal. Chemical methods include solvent blast, solvent tank, hot tank, cold tank and steam cleaning of components.

BEAD BLASTING

Manual removal of deposits may be required prior to bead blasting, followed by some other cleaning method. Carbon, paint and

rust may be removed using bead blasting method. Components must be free of oil and grease prior to bead blasting. Beads will stick to grease or oil soaked areas causing area not to be cleaned.

Use air pressure to remove all trapped residual beads from components after cleaning. After cleaning internal engine parts made of aluminum, wash thoroughly with hot soapy water. Component must be thoroughly cleaned as glass beads will enter engine oil resulting in bearing damage.

CHEMICAL CLEANING

Solvent tank is used for cleaning oily residue from components. Solvent blasting sprays solvent through a siphon gun using compressed air.

The hot tank, using heated caustic solvents, is used for cleaning ferrous materials only. DO NOT clean aluminum parts such as cylinder heads, bearings or other soft metals using the hot tank. After cleaning, flush parts with hot water.

A non-ferrous part will be ruined and caustic solution will be diluted if placed in the hot tank. Always use eye protection and gloves when using the hot tank.

Use of a cold tank is for cleaning of aluminum cylinder heads, carburetors and other soft metals. A less caustic and unheated solution is used. Parts may be lift in the tank for several hours without damage. After cleaning, flush parts with hot water.

Steam cleaning, with boiling hot water sprayed at high pressure, is recommended as the final cleaning process when using either hot or cold tank cleaning.

COMPONENT CLEANING

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

SHEET METAL PARTS

Examples of sheet metal parts are the rocker covers, front and side covers, oil pan and bellhousing dust cover. Glass bead blasting or hot tank may be used for cleaning.

Ensure all mating surfaces are flat. Deformed surfaces should be straightened. Check all sheet metal parts for cracks and dents.

INTAKE & EXHAUST MANIFOLDS

Using solvent cleaning or bead blasting, clean manifolds for inspection. If the intake manifold has an exhaust crossover, all carbon deposits must be removed. Inspect manifolds for cracks, burned or eroded areas, corrosion and damage to fasteners.

Exhaust heat and products of combustion cause threads of fasteners to corrode. Replace studs and bolts as necessary. On "V" type intake manifolds, the sheet metal oil shield must be removed for proper cleaning and inspection. Ensure that all manifold parting surfaces are flat and free of burrs.

CYLINDER HEAD REPLACEMENT

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

REMOVAL

Remove intake and exhaust manifolds and valve cover. Cylinder head and camshaft carrier bolts (if equipped), should be removed only when the engine is cold. On many aluminum cylinder heads, removal while hot will cause cylinder head warpage. Mark rocker arm or overhead cam components for location.

Remove rocker arm components or overhead cam components. Components must be installed in original location. Individual design rocker arms may utilize shafts, ball-type pedestal mounts or no rocker arms. For all design types, wire components together and identify according to the corresponding valve. Remove cylinder head bolts. Note length and location. Some applications require cylinder head bolts be removed in proper sequence to prevent cylinder head damage. See Fig. 1. Remove cylinder head.

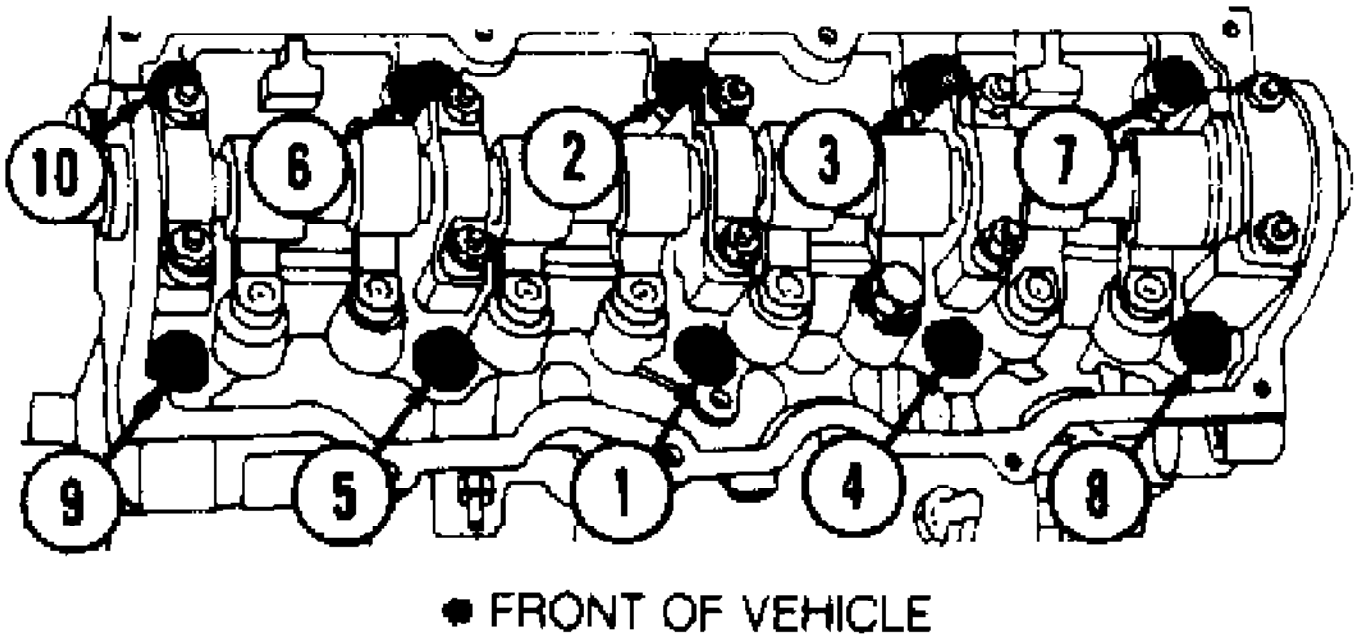

Fig. 1: Typical Cylinder Head Tightening or Loosening Sequence This Graphic For General Information Only

INSTALLATION

Ensure all surfaces and head bolts are clean. Check that head bolt holes of cylinder block are clean and dry to prevent block damage when bolts are tightened. Clean threads with tap to ensure accurate bolt torque.

Install head gasket on cylinder block. Some manufacturer's may recommend sealant be applied to head gasket prior to installation. Note that all holes are aligned. Some gasket applications may be marked so certain area faces upward. Install cylinder head using care not to damage head gasket. Ensure cylinder head is fully seated on cylinder block.

Some applications require head bolts be coated with sealant prior to installation. This is done if head bolts are exposed to water passages. Some applications require head bolts be coated with light coat of engine oil.

Install head bolts. Head bolts should be tightened in proper steps and sequence to specification. See Fig. 1. Install remaining components. Tighten all bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

NOTE: Some manufacturers require that head bolts be retightened after specified amount of operation. This must be done to prevent head gasket failure.

VALVE ADJUSTMENT

Engine specifications will indicate valve train clearance and temperature at which adjustment is to be made on most models. In most cases, adjustment will be made with a cold engine. In some cases, both a cold and a hot clearance will be given for maintenance convenience.

On some models, adjustment is not required. Rocker arms are tightened to specification and valve lash is automatically set. On some models with push rod actuated valve train, adjustment is made at push rod end of rocker arm while other models do not require adjustment.

Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge. Adjustment is made by rotating adjusting screw until proper clearance is obtained. Lock nut is then tightened. Engine will be rotated to obtain all valve adjustments to manufacturer's specifications.

Some models require hydraulic lifter to be bled down and clearance measured. Different length push rods can be used to obtain proper clearance. Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge.

On overhead cam engines designed without rocker arms actuate valves directly on a cam follower. A hardened, removable disc is installed between the cam lobe and lifter. Clearance will be checked between cam heel and adjusting disc in proper sequence using a feeler gauge. Engine will be rotated to obtain all valve adjustments.

On overhead cam engines designed with rocker arms, adjustment is made at push rod end of rocker arm. Ensure that the valve to be adjusted is riding on the heel of the cam on all engines. Clearance will be checked between tip of rocker arm and tip of valve stem in proper sequence using a feeler gauge. Adjustment is made by rotating adjusting screw until proper clearance is obtained. Lock nut is then tightened. Engine will be rotated to obtain all valve adjustments to manufacturer's specifications.

CYLINDER HEAD OVERHAUL

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

DISASSEMBLY

Mark valves for location. Using valve spring compressor, compress valve springs. Remove valve locks. Carefully release spring compressor. Remove retainer or rotator, valve spring, spring seat and valve. See Fig. 2.

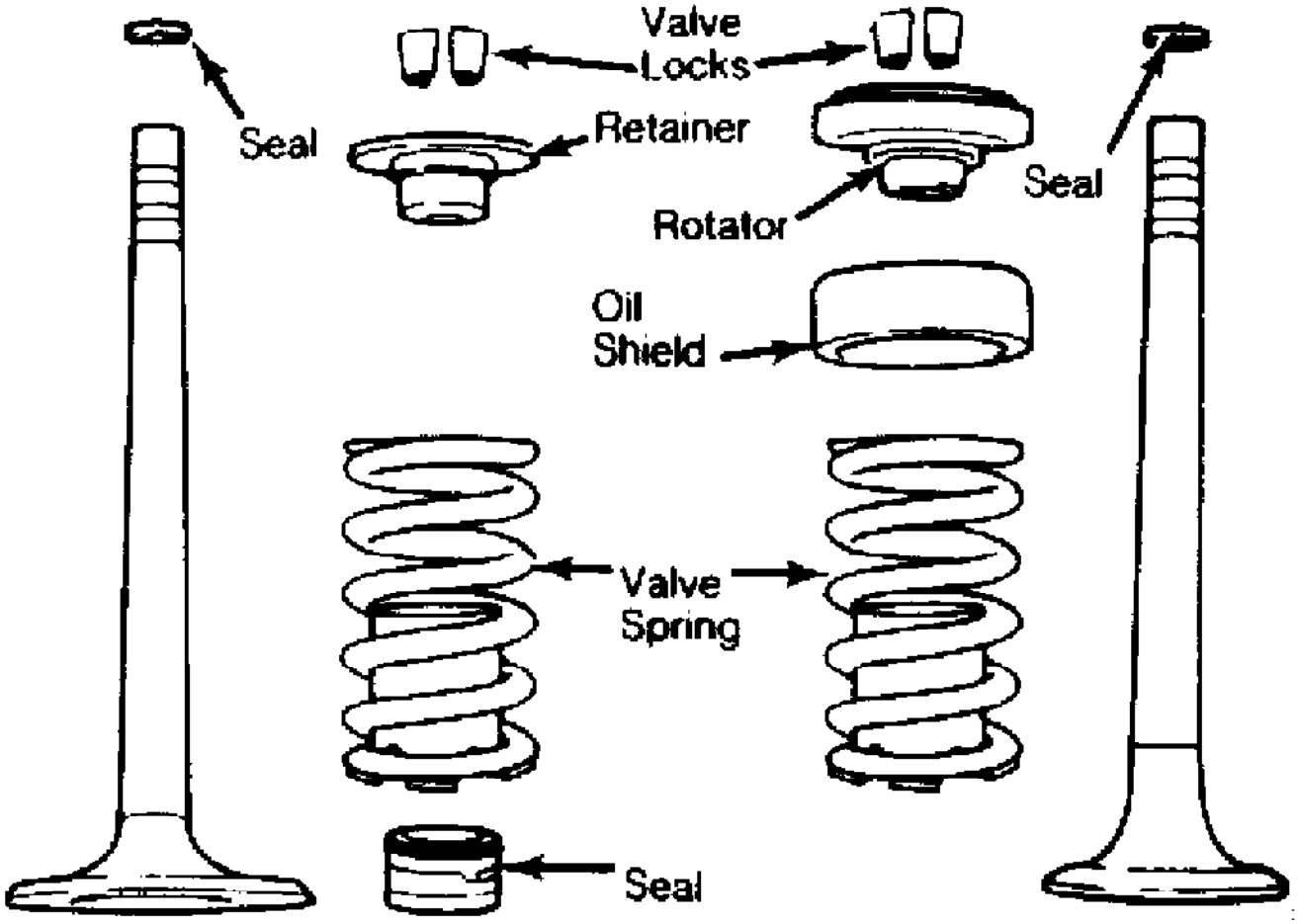

Fig. 2: Exploded View of Intake & Exhaust Valve Assemblies - Typical
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CLEANING & INSPECTION

Clean cylinder head and valve components using approved cleaning methods. Inspect cylinder head for cracks, damage or warped gasket surface. Place straightedge across gasket surface. Determine clearance at center of straightedge. Measure across both diagonals, longitudinal centerline and across the head at several points. See Fig. 3.

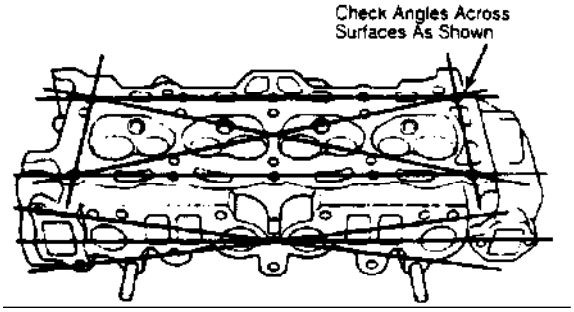

Fig. 3: Checking Cylinder Head for Warpage - Typical
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On cast cylinder heads, if warpage exceeds .003" (.08 mm) in a 6" span, or .006" (.15 mm) over total length, cylinder head must be resurfaced. On most aluminum cylinder heads, if warpage exceeds .002" (.05 mm) in any area, cylinder head must be resurfaced. Warpage specification may vary with manufacturer.

Cylinder head thickness should be measured to determine amount of material which can be removed before replacement is required. Cylinder head thickness must not be less than manufacturer's specifications.

If cylinder head required resurfacing, it may not align properly with intake manifold. On "V" type engines, misalignment is corrected by machining intake manifold surface that contacts cylinder head. Cylinder head may be machined on surface that contacts intake manifold.

Using oil stone, remove burrs or scratches from all sealing surfaces.

VALVE SPRINGS

Inspect valve springs for corroded or pitted valve spring surfaces which may lead to breakage. Polished spring ends caused by a rotating spring, indicates that spring surge has occurred. Replace springs showing evidence of these conditions.

Inspect valve springs for squareness using a 90 degree straightedge. See Fig. 4. Replace valve spring if out-of-square exceeds manufacturer's specification.

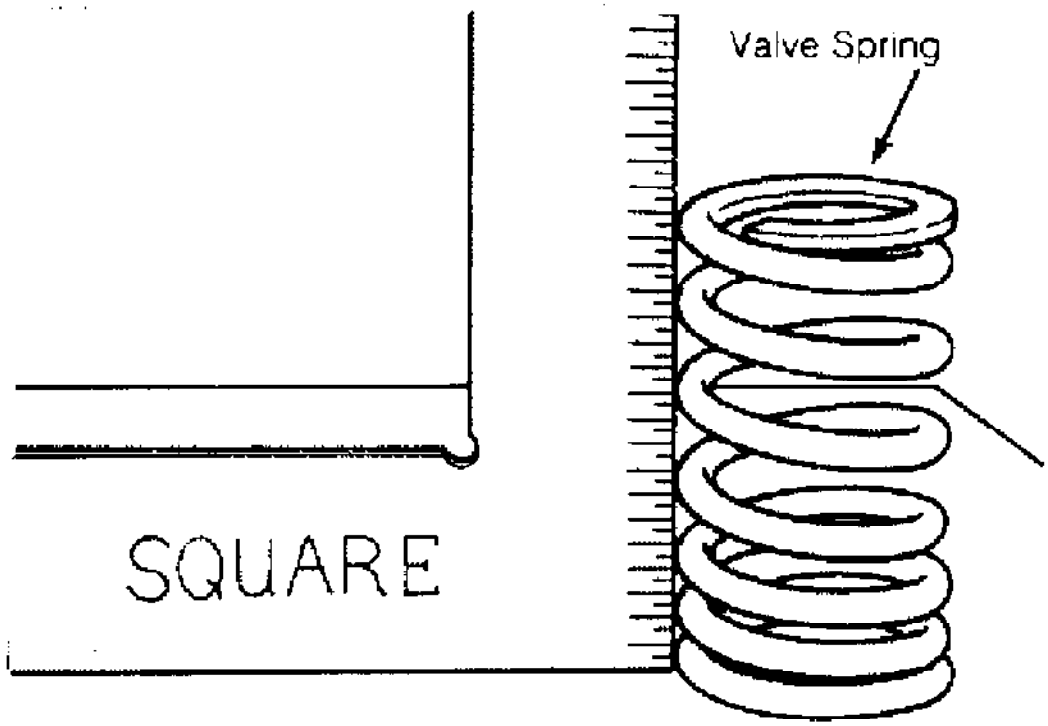

Fig. 4: Checking Valve Spring Squareness - Typical
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Using vernier caliper, measure free length of all valve springs. Replace springs if not within specification. Using valve

spring tester, test valve spring pressure at installed and compressed heights. See Fig. 5.

Usually compressed height is installed height minus valve lift. Replace valve spring if not within specification. It is recommended to replace all valve springs when overhauling cylinder head.

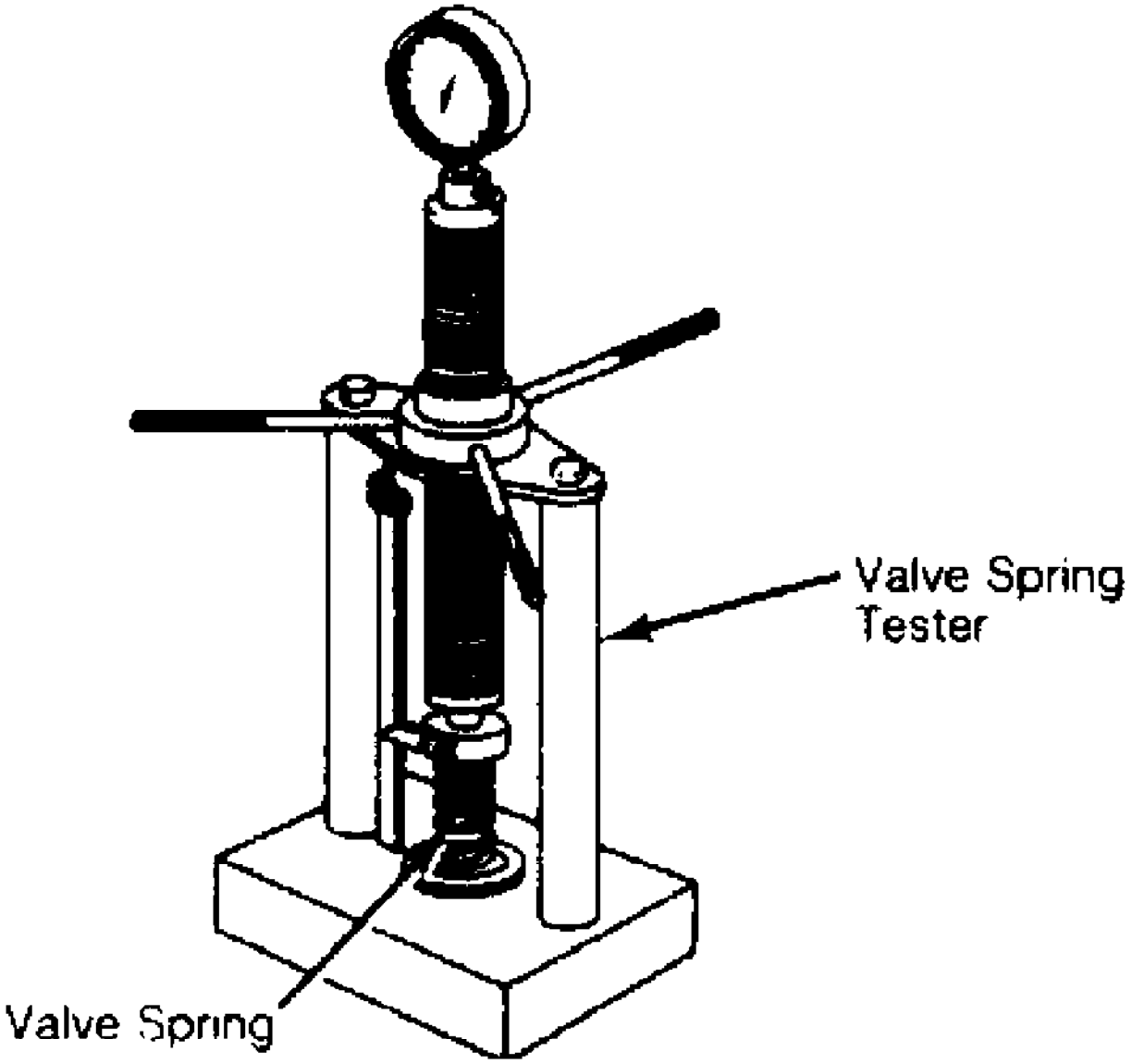

Fig. 5: Checking Valve Spring Pressure - Typical
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VALVE GUIDE

Measuring Valve Guide Clearance

Check valve stem-to-guide clearance. Ensure valve stem diameter is within specifications. Install valve in valve guide. Install dial indicator assembly on cylinder head with tip resting against valve stem just above valve guide. See Fig. 6.

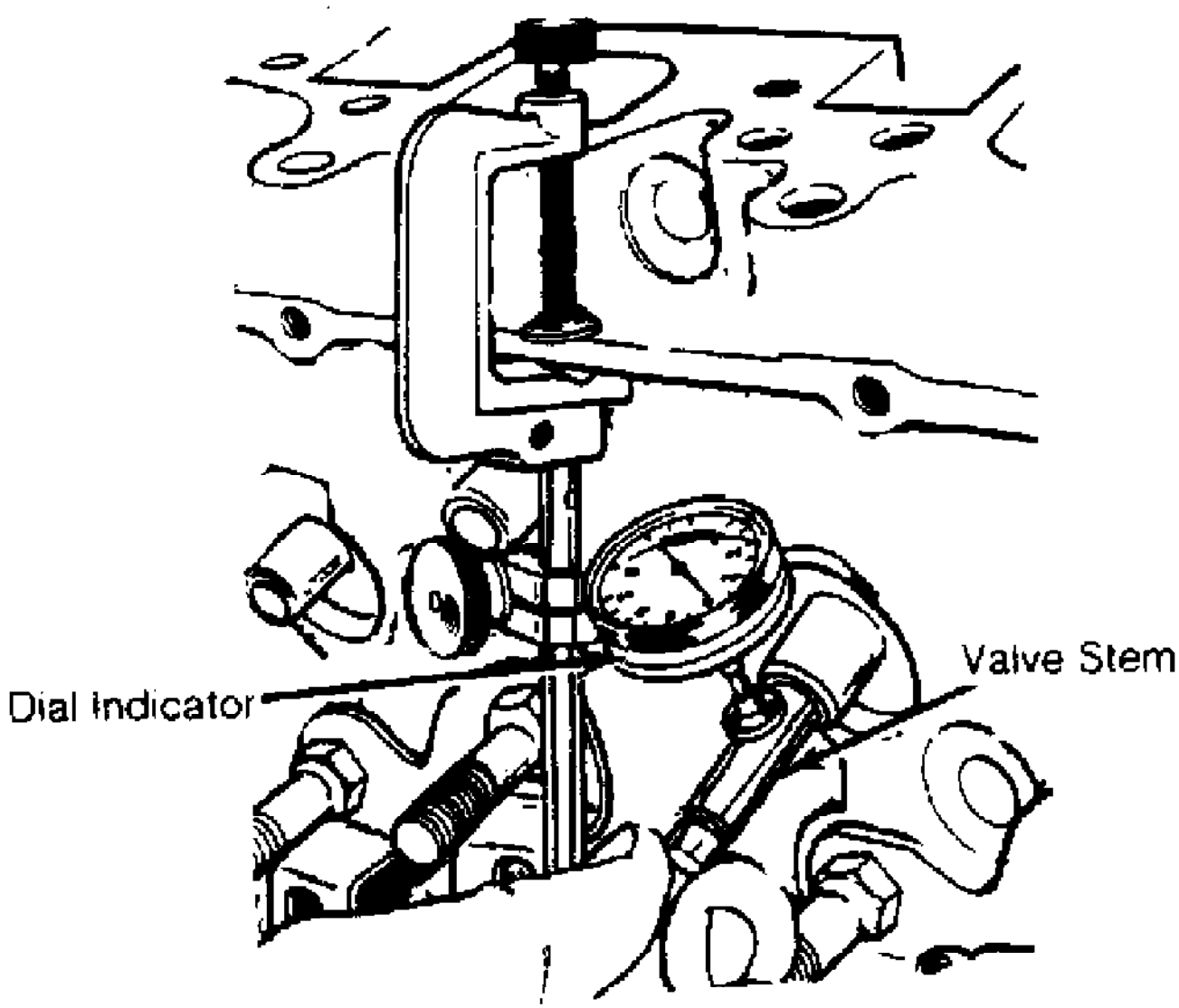

Fig. 6: Measuring Valve Stem-to-Guide Clearance - Typical
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Lower valve approximately 1/16" below valve seat. Push valve stem against valve guide as far as possible. Adjust dial indicator to zero. Push valve stem in opposite direction and note reading. Clearance must be within specification.

If valve guide clearance exceeds specification, valves with oversize stems may be used or valve guide must be replaced. On some applications, a false guide is installed, then reamed to proper specification. Valve guide reamer set is used to ream valve guide to obtain proper clearance for new valve.

Reaming Valve Guide

Select proper reamer for valve stem. Reamer must be of proper length to provide clean cut through entire length of valve guide. Install reamer in valve guide and rotate to cut valve guide. See Fig. 7.

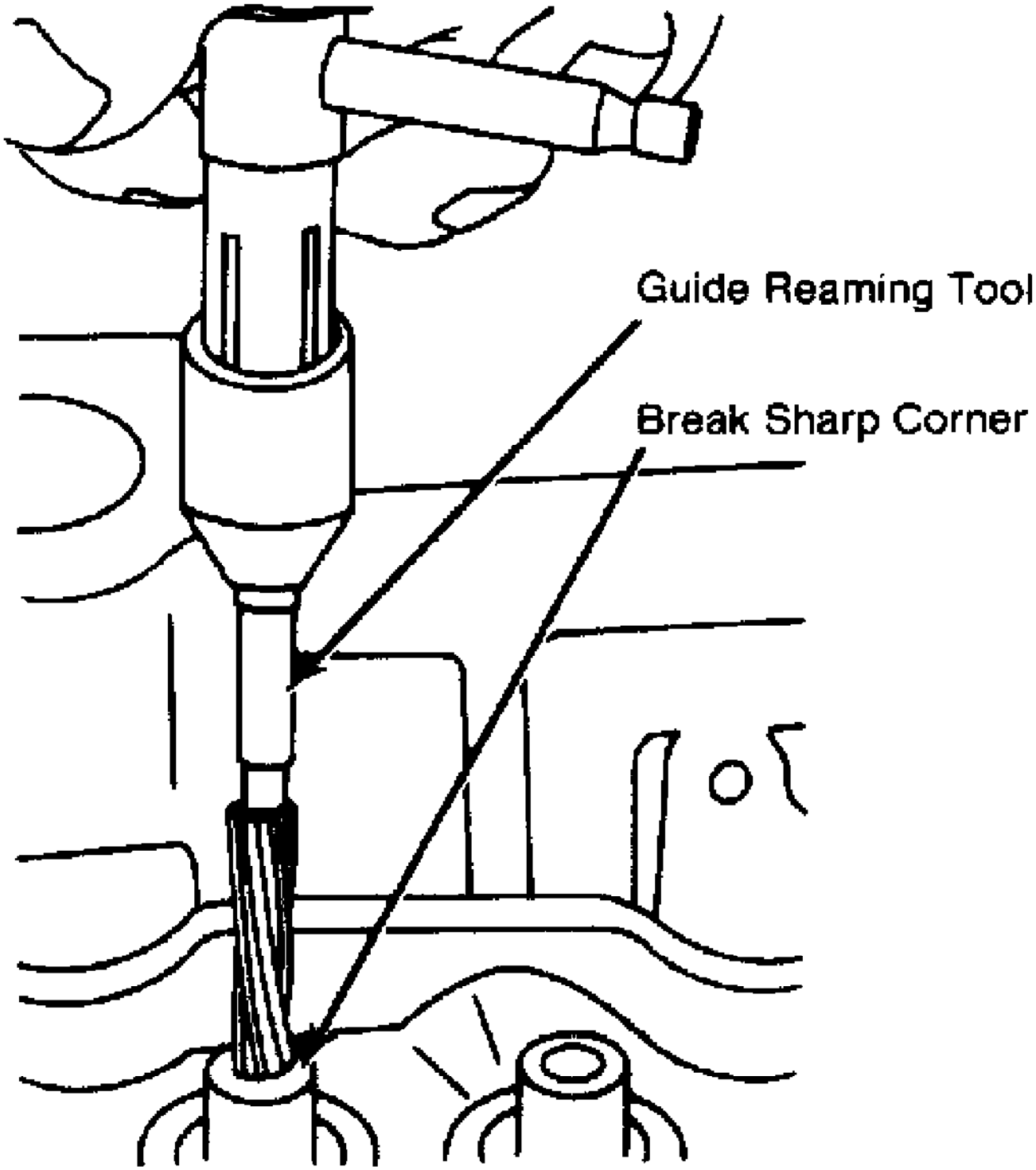

Fig. 7: Reaming Valve Guides - Typical
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Replacing Valve Guide

Replace valve guide if clearance exceeds specification. Valve guides are either pressed, hammered or shrunk in place, depending upon

cylinder head design and type of metal used.

Remove valve guide from cylinder head by pressing or tapping on a stepped drift. See Fig. 8. Once valve guide is installed, distance from cylinder head to top of valve guide must be checked. This distance must be within specification.

Aluminum heads are often heated before installing valve guide. Guide is sometimes chilled in dry ice before installation. Combination of a heated head and chilled guide insures a tight guide fit upon assembly. The new guide must be reamed to specification.

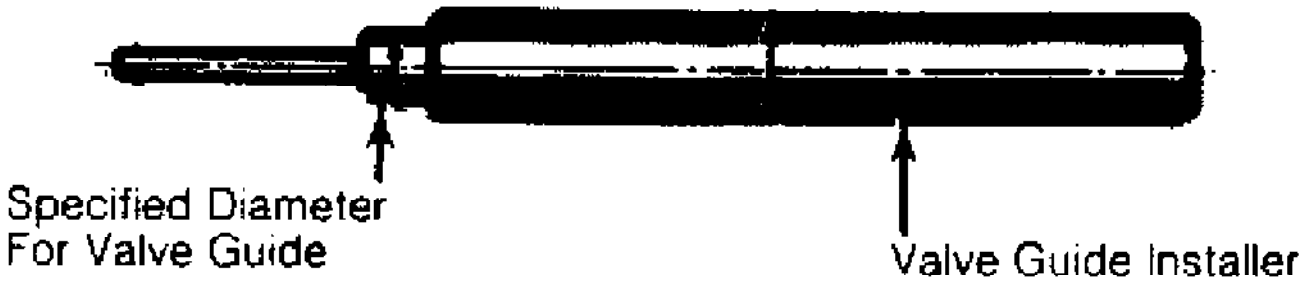

Fig. 8: Typical Valve Guide Remover & Installer
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VALVES & VALVE SEATS

Valve Grinding

Valve stem O.D. should be measured in several areas to indicate amount of wear. Replace valve if not within specification. Valve margin area should be measured to ensure that valve can be grounded. See Fig. 9.

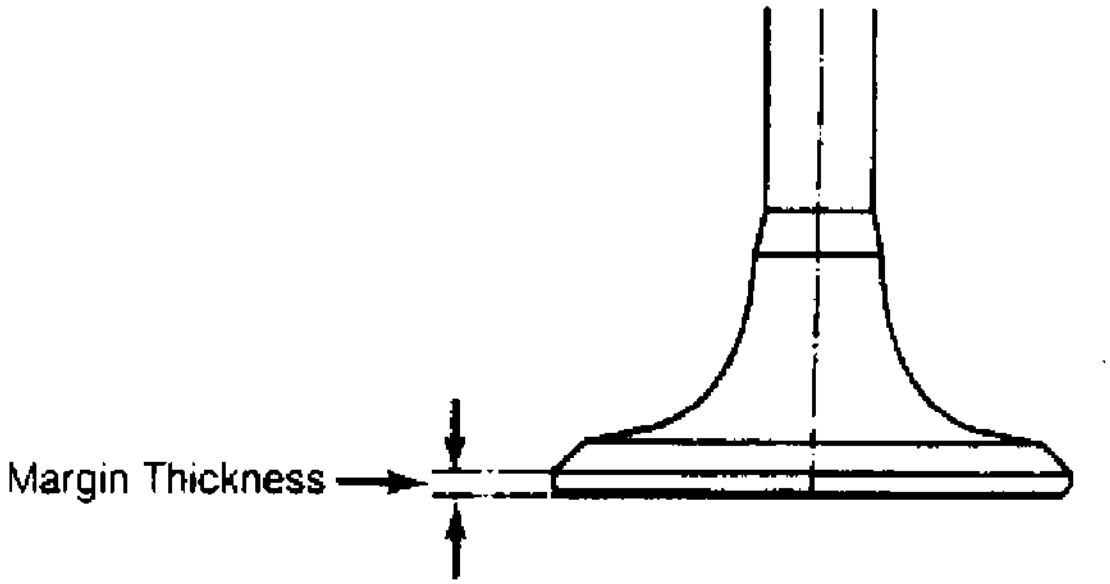

Fig. 9: Measuring Valve Head Margin - Typical
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If valve margin is less than specification, this will burn the valves. Valve must be replaced. Due to minimum margin dimensions

during manufacture, some new type valves cannot be reground.

Resurface valve on proper angle specification using valve grinding machine. Follow manufacturer's instructions for valve grinding machine. Specifications may indicate a different valve face angle than seat angle.

Measure valve margin after grinding. Replace valve if not within specification. Valve stem tip can be refinished using valve grinding machine.

Valve Lapping

During valve lapping of recent designed valves, be sure to follow manufacturers recommendations. Surface hardening and materials used with some valves do not permit lapping. Lapping process will remove excessive amounts of the hardened surface.

Valve lapping is done to ensure adequate sealing between valve face and seat. Use either a hand drill or lapping stick with suction cup attached.

Moisten and attach suction cup to valve. Lubricate valve stem and guide. Apply a thin coat of fine valve grinding compound between valve and seat. Rotate lapping tool between the palms or with hand drill.

Lift valve upward off the seat and change position often. This is done to prevent grooving of valve seat. Lap valve until a smooth polished seat is obtained. Thoroughly clean grinding compound from components. Valve to valve seat concentricity should be checked. See VALVE SEAT CONCENTRICITY.

CAUTION: Valve guides must be in good condition and free of carbon deposits prior to valve seat grinding. Some engines contain an induction hardened valve seat. Excessive material removal will damage valve seats.

Valve Seat Grinding

Select coarse stone of correct size and angle for seat to be ground. Ensure stone is true and has a smooth surface. Select correct size pilot for valve guide dimension. Install pilot in valve guide. Lightly lubricate pilot shaft. Install stone on pilot. Move stone off and on the seat approximately 2 times per second during grinding operation.

Select a fine stone to finish grinding operation. Grinding stones with 30 and 60 degree angles are used to center and narrow the valve seat as required. See Fig. 10.

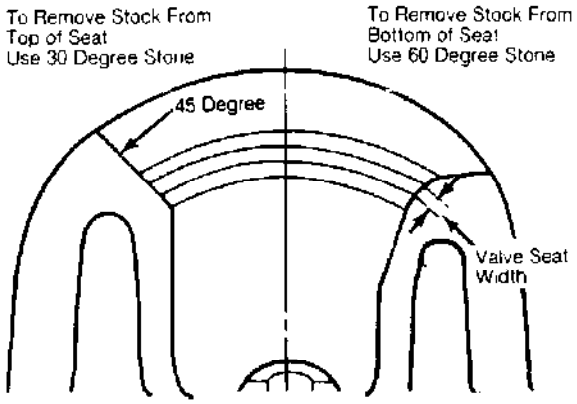

Fig. 10: Adjusting Valve Seat Width - Typical
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Valve Seat Replacement

Replacement of valve seat inserts is done by cutting out

the old insert and machining an oversize insert bore. Replacement oversize insert is usually chilled and the cylinder head is sometimes warmed. Valve seat is pressed into the head. This operation requires specialized machine shop equipment.

Valve Seat Concentricity

Using dial gauge, install gauge pilot in valve guide. Position gauge arm on the valve seat. Adjust dial indicator to zero. Rotate arm 360 degrees and note reading. Runout should not exceed specification.

To check valve-to-valve seat concentricity, coat valve face lightly with Prussian Blue dye. Install valve and rotate it on valve seat. If pattern is even and entire seat is coated at valve contact point, valve is concentric with the seat.

REASSEMBLY

Valve Stem Installed Height

Valve stem installed height must be checked when new valves are installed or when valves or valve seats have been ground. Install valve in valve guide. Measure distance from tip of valve stem to spring seat. See Fig. 11. Distance must be within specifications.

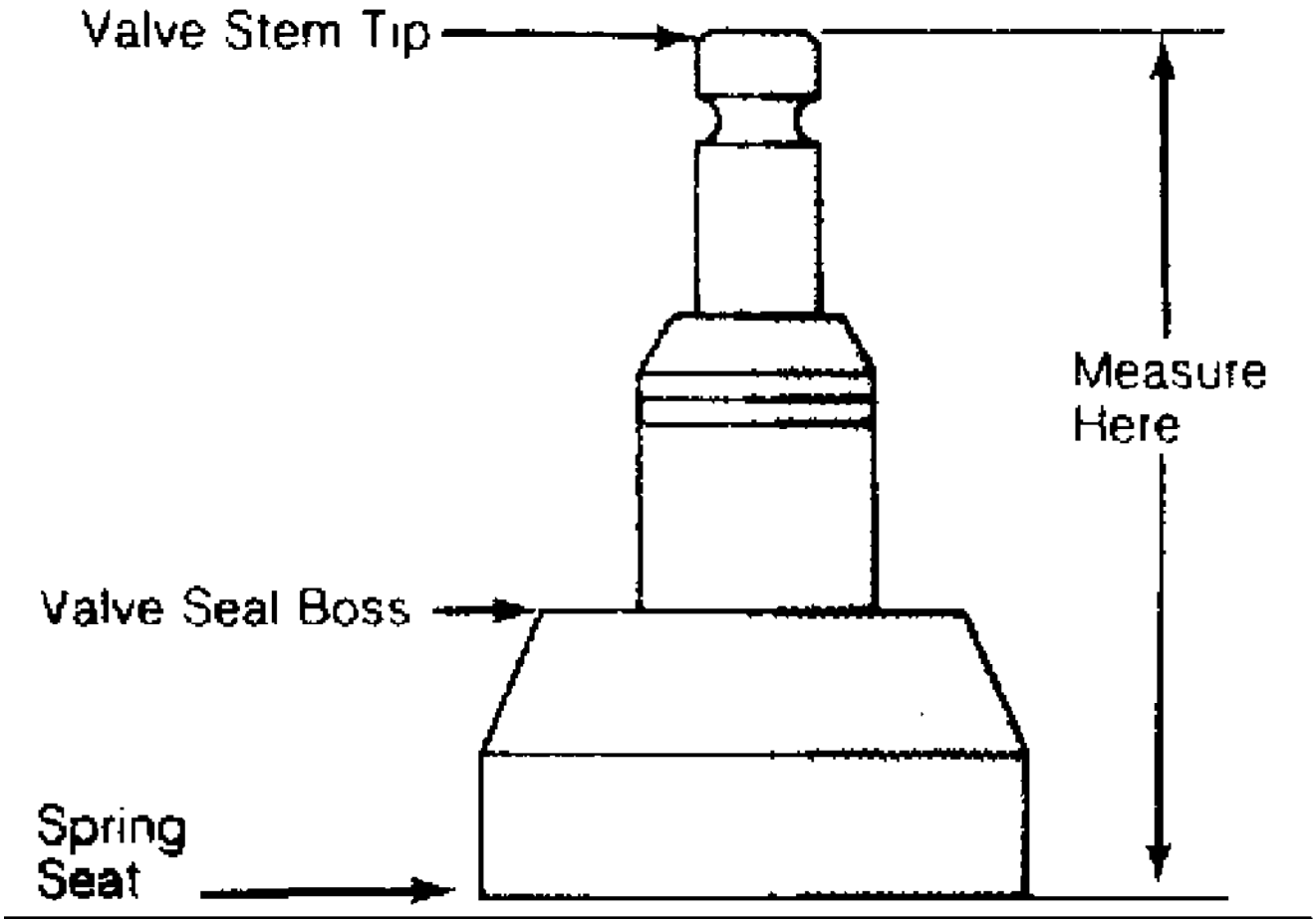

Fig. 11: Measuring Valve Stem Installed Height - Typical
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Remove valve and grind valve stem tip if height exceeds specification. Valve tips are surface hardened. DO NOT remove more

than .010" (.25 mm) from tip. Chamfer sharp edge of reground valve tip. Recheck valve stem installed height.

VALVE STEM OIL SEALS

Valve stem oil seals must be installed on valve stem. See Fig. 2. Seals are needed due to pressure differential at the ends of valve guides. Atmospheric pressure above intake guide, combined with manifold vacuum below guide, causes oil to be drawn into the cylinder.

Exhaust guides also have pressure differential created by exhaust gas flowing past the guide, creating a low pressure area. This low pressure area draws oil into the exhaust system.

Replacement (On Vehicle)

Mark rocker arm or overhead cam components for location. Remove rocker arm components or overhead cam components. Components must be installed in original location. Remove spark plugs. Valve stem oil seals may be replaced by holding valves against seats using air pressure.

Air pressure must be installed in cylinder using an adapter for spark plug hole. An adapter can be constructed by welding air hose connection to spark plug body with porcelain removed.

Install adapter in spark plug hole. Apply a minimum of 140 psi (9.8 kg/cm^2) to adapter. Air pressure should hold valve closed. If air pressure does not hold valve closed, check for damaged or bent valve. Cylinder head must be removed for service.

Using valve spring compressor, compress valve springs. Remove valve locks. Carefully release spring compressor. Remove retainer or rotator and valve spring. Remove valve stem oil seal.

If oversized valves have been installed, oversized oil seals must be used. Coat valve stem with engine oil. Install protective sleeve over end of valve stem. Install new oil seal over valve stem and seat on valve guide. Remove protective sleeve. Install spring seat, valve spring and retainer or rotator. Compress spring and install valve locks. Remove spring compressor. Ensure valve locks are fully seated.

Install rocker arms or overhead cam components. Tighten all bolts to specification. Adjust valves if required. Remove adapter. Install spark plugs, valve cover and gasket.

VALVE SPRING INSTALLED HEIGHT

Valve spring installed height should be checked during reassembly. Measure height from lower edge of valve spring to the upper edge. DO NOT include valve spring seat or retainer. Distance must be within specifications. If valves and/or seats have been ground, a valve spring shim may be required to correct spring height. See Fig. 12.

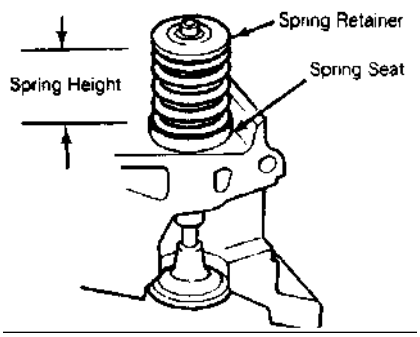

Fig. 12: Measuring Valve Spring Installed Height - Typical
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ROCKER ARMS & ASSEMBLIES

Rocker Studs

Rocker studs are either threaded or pressed in place. Threaded studs are removed by locking 2 nuts on the stud. Unscrew the stud by turning the jam nut. Coat the stud threads with Loctite and install. Tighten to specification.

Pressed in stud can be removed using a stud puller. Ream the stud bore to proper specification and press in a new oversize stud. Pressed in studs are often replaced by cutting threads in the stud bore to accept a threaded stud.

Rocker Arms & Shafts

Mark rocker arms for location. Remove rocker arm retaining bolts. Remove rocker arms. Inspect rocker arms, shafts, bushings and pivot balls (if equipped) for excessive wear. Inspect rocker arms for wear in valve stem contact area. Measure rocker arm bushing I.D. Replace bushings if excessively worn.

The rocker arm valve stem contact point can be reground, using special fixture for valve grinding machine. Remove minimum amount of material as possible. Ensure all oil passages are clear. Install rocker arms in original locations. Ensure rocker arm is properly seated in push rod. Tighten bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

Pushrods

Remove rocker arms. Mark push rods for location. Remove push rods. Push rods can be steel or aluminum, solid or hollow. Hollow pushrods must be internally cleaned to ensure oil passage to the rocker arms is cleaned. Check the pushrod for damage, such as loose ends on steel tipped aluminum types.

Check push rod for straightness. Roll push rod on a flat surface. Using feeler gauge, check clearance at center. Replace push rod if bent. The push rod can also be supported at each end and rotated. A dial indicator is used to detect bends in the push rod.

Lubricate ends of push rod and install push rod in original location. Ensure push rod is properly seated in lifter. Install rocker arm. Tighten bolts to specification. Adjust valves if required. See VALVE ADJUSTMENT in this article.

LIFTERS

Hydraulic Lifters

Before replacing a hydraulic lifter for noisy operation, ensure noise is not caused by worn rocker arms or valve tips. Hydraulic lifter assemblies must be installed in original locations. Remove the rocker arm assembly and push rod. Mark components for location. Some applications require intake manifold, or lifter cover removal. Remove lifter retainer plate (if used). To remove lifters, use a hydraulic lifter remover or magnet. Different type lifters are used. See Fig. 13.

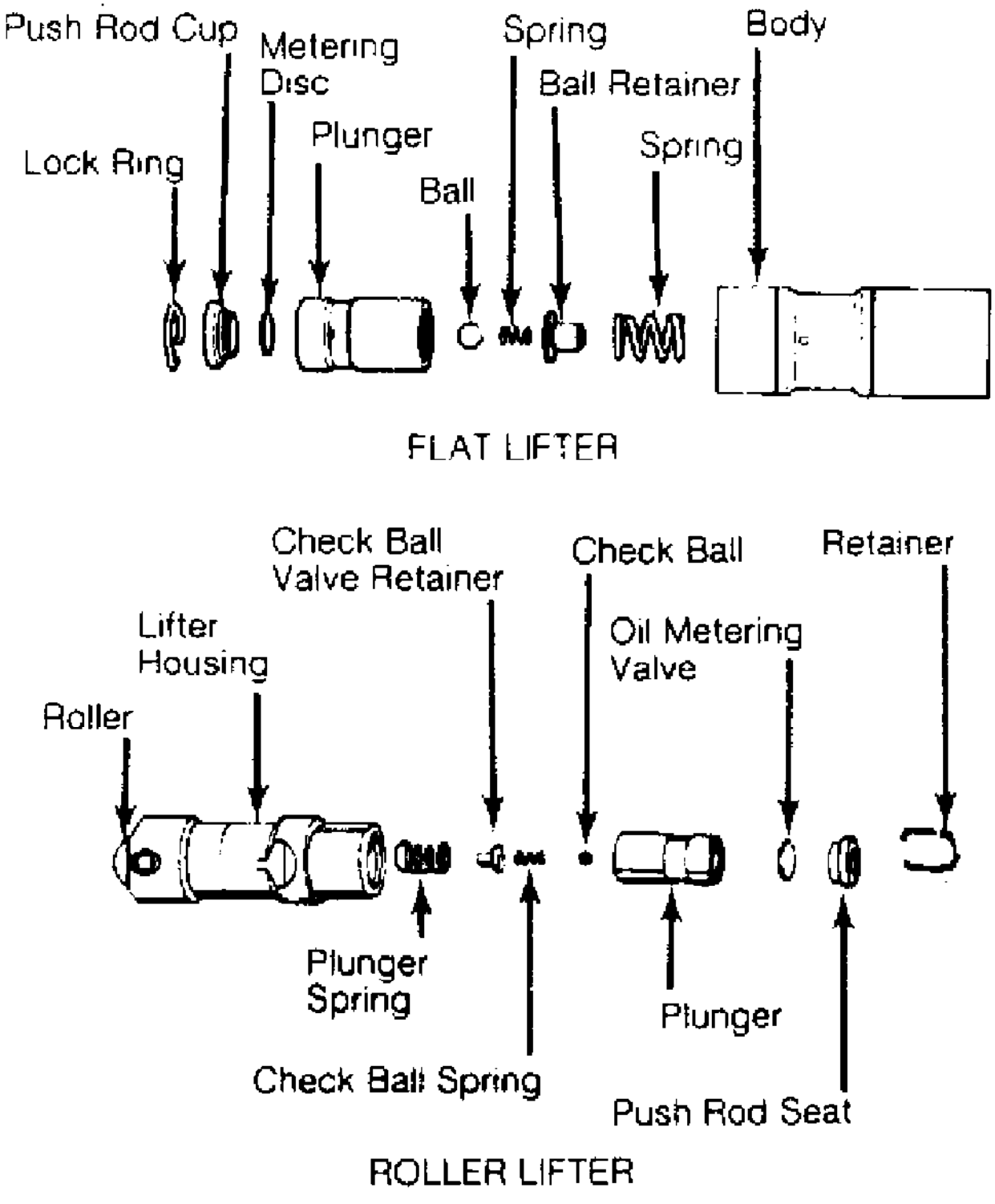

Fig. 13: Typical Hydraulic Valve Lifter Assemblies - Typical
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On sticking lifters, disassemble and clean lifter. DO NOT mix lifter components or positions. Parts are select-fitted and are not

interchangeable. Inspect all components for wear. Note amount of wear in lifter body-to-camshaft contact area. Surface must have smooth and convex contact face. If wear is apparent, carefully inspect cam lobe.

Inspect push rod contact area and lifter body for scoring or signs of wear. If body is scored, inspect lifter bore for damage and lack of lubrication. On roller type lifters, inspect roller for flaking, pitting, loss of needle bearings and roughness during rotation.

Measure lifter body O.D. in several areas. Measure lifter bore I.D. of cylinder block. Some models offer oversized lifters. Replace lifter if damaged.

If lifter check valve is not operating, obstructions may be preventing it from closing or valve spring may be broken. Clean or replace components as necessary.

Check plunger operation. Plunger should drop to bottom of the body by its own weight when assembled dry. If plunger is not free, soak lifter in solvent to dissolve deposits.

Lifter leak-down test can be performed on lifter. Lifter must be filled with special test oil. New lifters contain special test oil. Using lifter leak-down tester, perform leak-down test following manufacturer's instructions. If leak-down time is not within specifications, replace lifter assembly.

Lifters should be soaked in clean engine oil several hours prior to installation. Coat lifter base, roller (if equipped) and lifter body with ample amount of Molykote or camshaft lubricant. See Fig. 13. Install lifter in original location. Install remaining components. Valve lash adjustment is not required on most hydraulic lifters. Preload of hydraulic lifter is automatic. Some models may require adjustment.

Mechanical Lifters

Lifter assemblies must be installed in original locations. Remove rocker arm assembly and push rod. Mark components for location. Some applications require intake manifold or lifter cover removal. Remove lifter retainer plate (if used). To remove lifters, use lifter remover or magnet.

Inspect push rod contact area and lifter body for scoring or signs of wear. If body is scored, inspect lifter bore for damage and lack of lubrication. Note amount of wear in lifter body-to-camshaft contact area. Surface must have smooth and convex contact face. If wear is apparent, carefully inspect cam lobe.

Coat lifter base, roller (if equipped) and lifter body with ample amount of Molykote or camshaft lubricant. Install lifter in original location. Install remaining components. Tighten bolts to specification. Adjust valves. See VALVE ADJUSTMENT in this article.

PISTONS, CONNECTING RODS & BEARINGS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

RIDGE REMOVAL

Ridge in cylinder wall must be removed prior to piston removal. Failure to remove ridge prior to removing pistons will cause piston damage in piston ring locations.

With the piston at bottom dead center, place a rag in the bore to trap metal chips. Install ridge reamer in cylinder bore. Adjust ridge reamer using manufacturer's instructions. Remove ridge

using ridge reamer. DO NOT remove an excessive amount of material. Ensure ridge is completely removed.

PISTON & CONNECTING ROD REMOVAL

Note top of piston. Some pistons may contain a notch, arrow or be marked "FRONT". Piston must be installed in proper direction to prevent damage with valve operation.

Check that connecting rod and cap are numbered for cylinder location and which side of cylinder block the number faces. Proper cap and connecting rod must be installed together. Connecting rod cap must be installed on connecting rod in proper direction to ensure bearing lock procedure. Mark connecting rod and cap if necessary. Pistons must be installed in original location.

Remove cap retaining nuts or bolts. Remove bearing cap. Install stud protectors on connecting rod bolts. This protects cylinder walls from scoring during removal. Ensure proper removal of ridge. Push piston and connecting rod from cylinder. Connecting rod boss can be tapped with a wooden dowel or hammer handle to aid in removal.

PISTON & CONNECTING ROD

Disassembly

Using ring expander, remove piston rings. Remove piston pin retaining rings (if equipped). On pressed type piston pins, special fixtures and procedures according to manufacturer must be used to remove piston pins. Follow manufacturer’s recommendations to avoid piston distortion or breakage.

Cleaning

Remove all carbon and varnish from piston. Pistons and connecting rods may be cleaned in cold type chemical tank. Using ring groove cleaner, clean all deposits from ring grooves. Ensure all deposits are cleaned from ring grooves to prevent ring breakage or sticking. DO NOT attempt to clean pistons using wire brush.

Inspection

Inspect pistons for nicks, scoring, cracks or damage in ring areas. Connecting rod should be checked for cracks using Magnaflux procedure. Piston diameter must be measured in manufacturers specified area.

Using telescopic gauge and micrometer, measure piston pin bore of piston in 2 areas, 90 degrees apart. This is done to check diameter and out-of-round.

Install proper bearing cap on connecting rod. Ensure bearing cap is installed in proper location. Tighten bolts or nuts to specification. Using inside micrometer, measure inside diameter in 2 areas, 90 degrees apart.

Connecting rod I.D. and out-of-round must be within specification. Measure piston pin bore I.D. and piston pin O.D. All components must be within specification. Subtract piston pin diameter from piston pin bore in piston and connecting rod to determine proper fit.

Connecting rod length must be measured from center of crankshaft journal inside diameter to center of piston pin bushing using proper caliper. Connecting rods must be the same length. Connecting rods should be checked on an alignment fixture for bent or twisted condition. Replace all components which are damaged or not within specification.

PISTON & CYLINDER BORE FIT

Ensure cylinder is checked for taper, out-of-round and properly honed prior to checking piston and cylinder bore fit. See CYLINDER BLOCK in this article. Using dial bore gauge, measure cylinder bore. Measure piston at right angle to piston pin in center of piston skirt area. Subtract piston diameter from cylinder bore diameter. The difference is piston-to-cylinder clearance. Clearance must be within specification. Mark piston for proper cylinder location.

ASSEMBLING PISTON & CONNECTING ROD

Install proper fitted piston on connecting rod for proper cylinder. Ensure piston marking on top of piston marked is in correspondence with connecting rod and cap number. See Fig. 14.

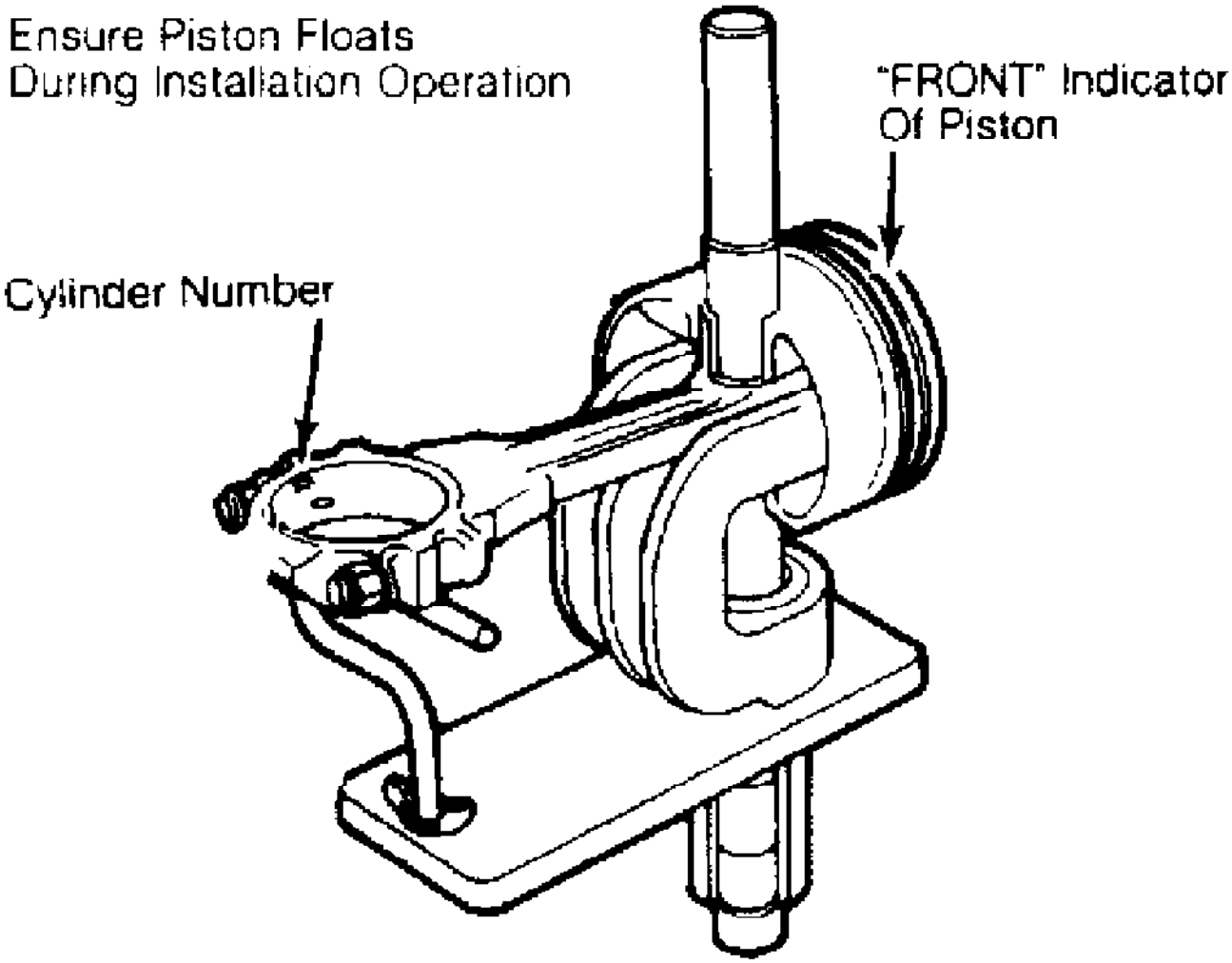

Fig. 14: Piston Pin Installation - Typical
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Lubricate piston pin and install in connecting rod. Ensure piston pin retainers are fully seated (if equipped). On pressed type piston pins, follow manufacturer's recommended procedure to avoid distortion or breakage.

CHECKING PISTON RING CLEARANCES

Piston rings must be checked for side clearance and end gap. To check end gap, install piston ring in cylinder which it is to be installed. Using an inverted piston, push ring to bottom of cylinder in smallest cylinder diameter.

Using feeler gauge, check ring end gap. See Fig. 15. Piston ring end gap must be within specification. Ring breakage will occur with insufficient ring end gap.

On some manufacturers, insufficient ring end gap may be corrected by using a fine file while other manufacturers recommend using another ring set. Mark rings for proper cylinder installation after checking end gap.

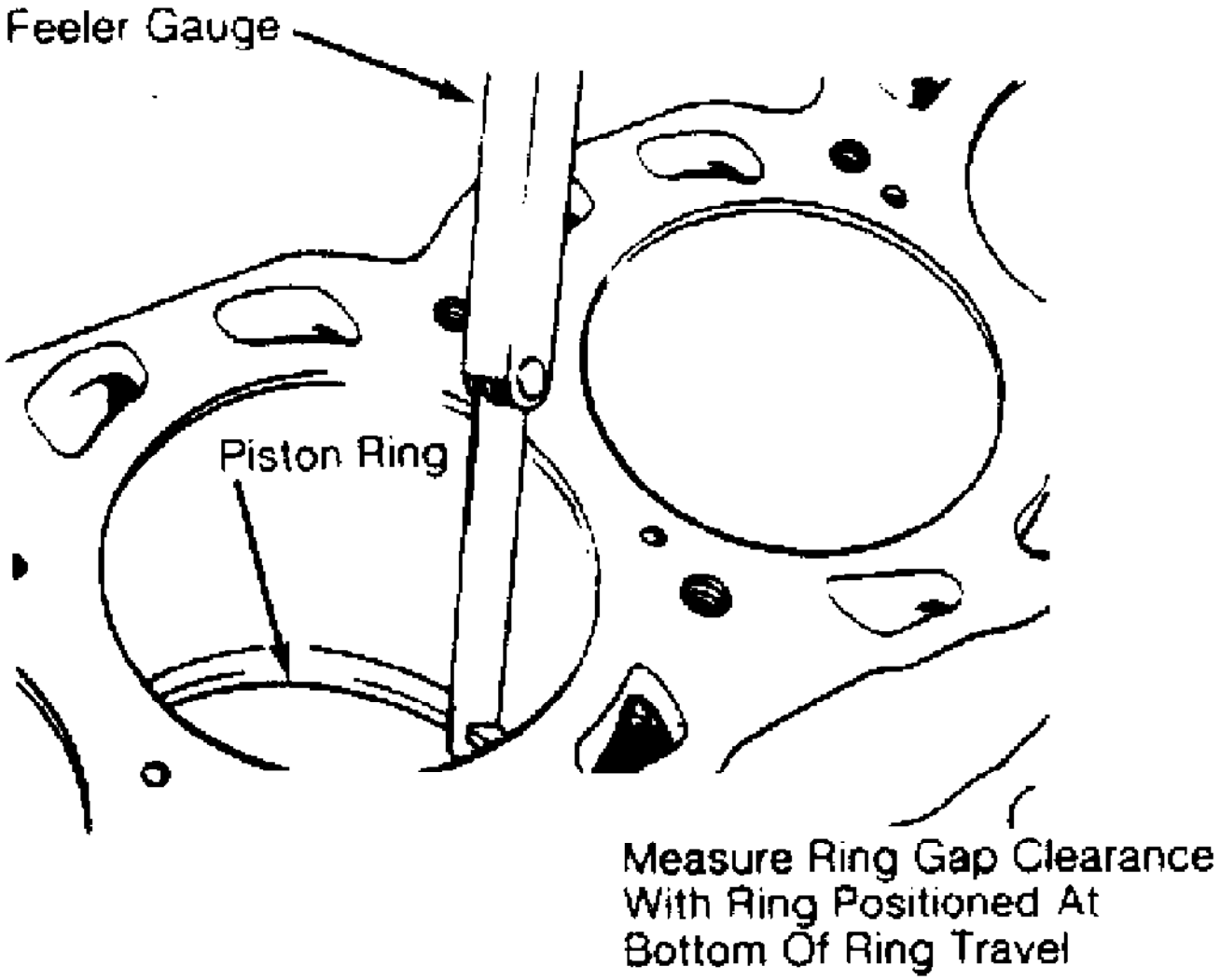

Fig. 15: Checking Piston Ring End Gap - Typical
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For checking side clearance, install rings on piston. Using feeler gauge, measure clearance between piston ring and piston ring land. Check side clearance in several areas around piston. Side clearance must be within specification.

If side clearance is excessive, piston ring grooves can be machined to accept oversized piston rings (if available). Normal practice is to replace piston.

PISTON & CONNECTING ROD INSTALLATION

Cylinders must be honed prior to piston installation. See CYLINDER HONING under CYLINDER BLOCK in this article.

Install upper connecting rod bearings. Lubricate upper bearings with engine oil. Install lower bearings in rod caps. Ensure bearing tabs are properly seated. Position piston ring gaps according to manufacturers recommendations. See Fig. 16. Lubricate pistons, rings and cylinder walls.

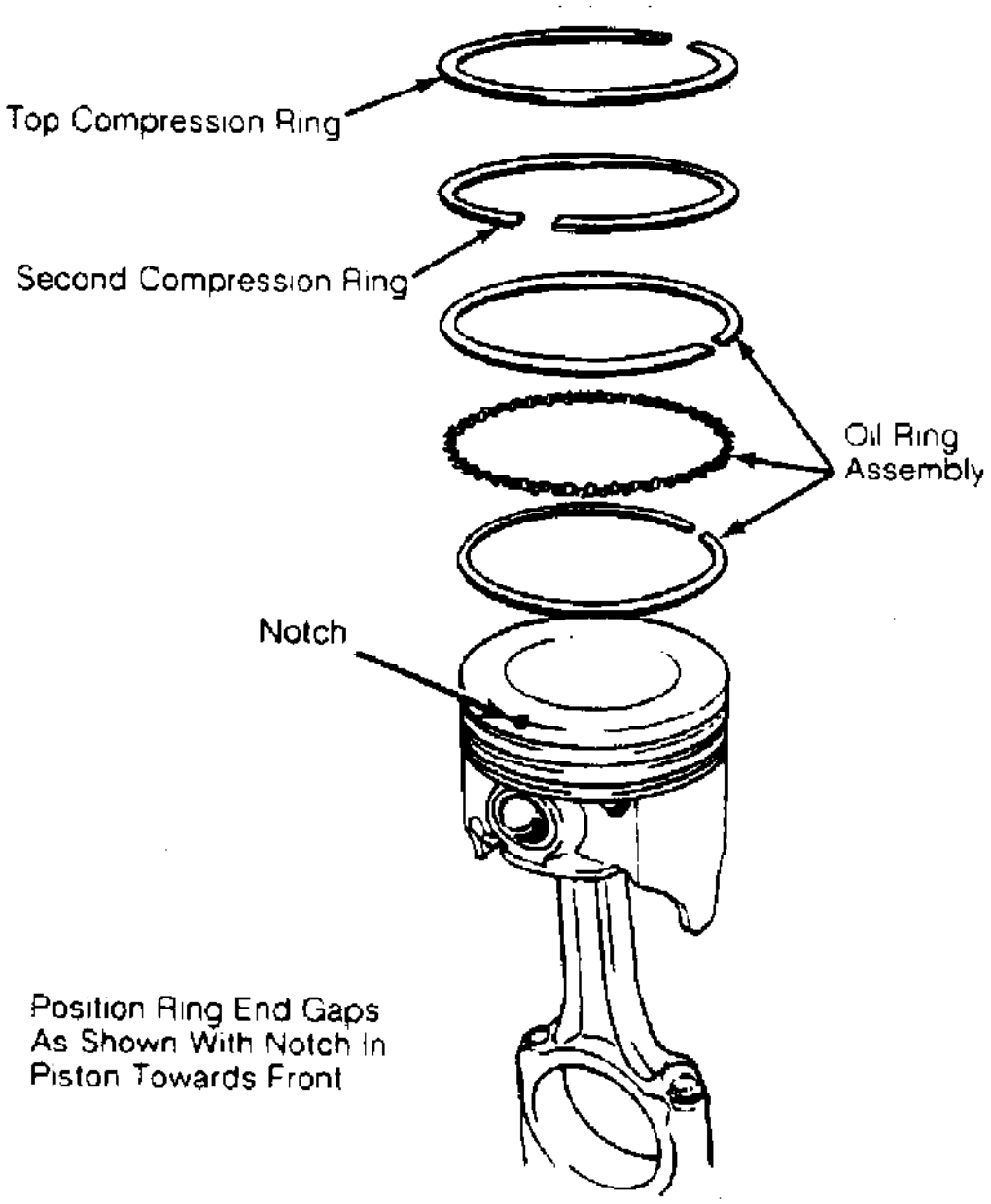

Fig. 16: Typical Piston Ring End Gap Positioning - Typical This Graphic For General Information Only

Install ring compressor. Use care not to rotate piston rings. Compress rings with ring compressor. Install plastic tubing protectors

over connecting rod bolts. Install piston and connecting rod assembly. Ensure piston notch, arrow or "FRONT" mark is toward front of engine. See Fig. 17.

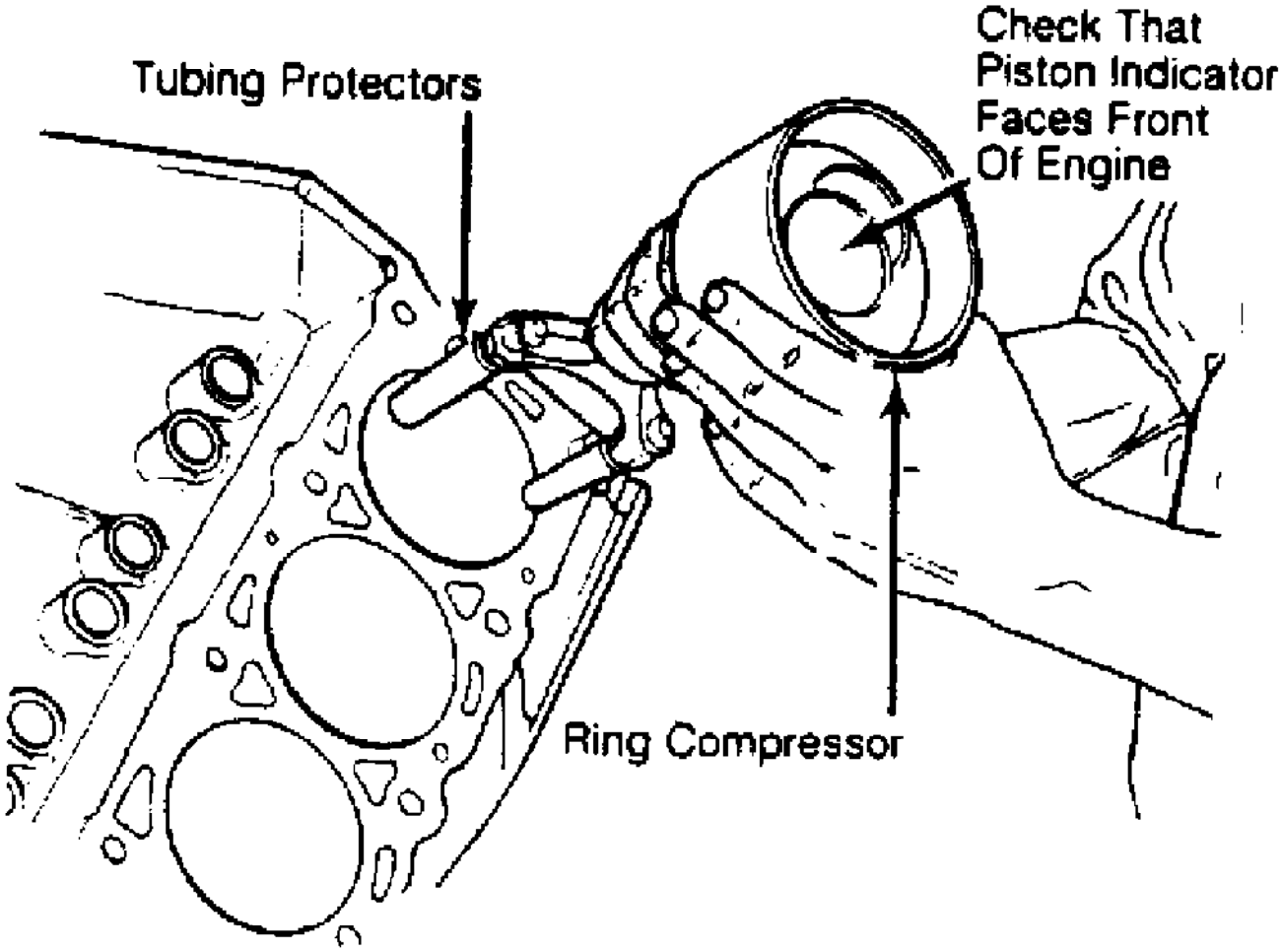

Fig. 17: Installing Piston & Connecting Rod Assembly - Typical This Graphic For General Information Only

Carefully tap piston into cylinder until rod bearing is seated on crankshaft journal. Remove protectors. Install rod cap and bearing. Lightly tighten connecting rod bolts. Repeat procedure for remaining cylinders. Check bearing clearance. See MAIN & CONNECTING ROD BEARING CLEARANCE in this article.

Once clearance is checked, lubricate journals and bearings. Install bearing caps. Ensure marks are aligned on connecting rod and cap. Tighten rod nuts or bolts to specification. Ensure rod moves freely on crankshaft. Check connecting rod side clearance. See CONNECTING ROD SIDE CLEARANCE in this article.

CONNECTING ROD SIDE CLEARANCE

Position connecting rod toward one side of crankshaft as far as possible. Using feeler gauge, measure clearance between side of connecting rod and crankshaft. See Fig. 18. Clearance must be within specifications.

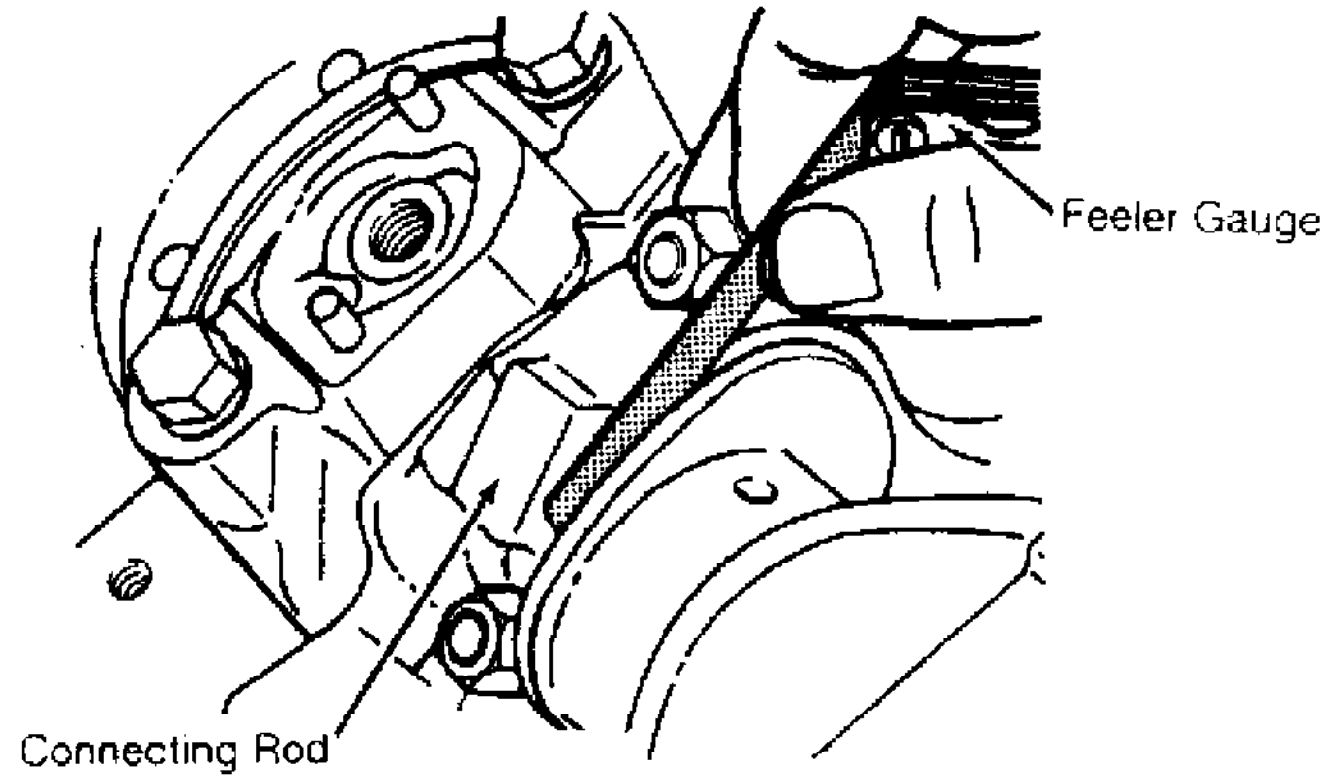

Fig. 18: Measuring Connecting Rod Side Clearance - Typical
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Check for improper bearing installation, wrong bearing cap or insufficient bearing clearance if side clearance is insufficient. Connecting rod may require machining to obtain proper clearance. Excessive clearance usually indicates excessive wear at crankshaft. Crankshaft must be repaired or replaced.

MAIN & CONNECTING ROD BEARING CLEARANCE

Plastigage Method

Plastigage method may be used to determine bearing clearance. Plastigage can be used with an engine in service or during reassembly. Plastigage material is oil soluble.

Ensure journals and bearings are free of oil or solvent. Oil or solvent will dissolve material and false reading will be obtained. Install small piece of Plastigage along full length of bearing journal. Install bearing cap in original location. Tighten bolts to specification.

CAUTION: DO NOT rotate crankshaft while Plastigage is installed. Bearing clearance will not be obtained if crankshaft is rotated.

Remove bearing cap. Compare Plastigage width with scale on Plastigage container to determine bearing clearance. See Fig. 19. Rotate crankshaft 90 degrees. Repeat procedure. this is done to check journal eccentricity. This procedure can be used to check oil clearance on both connecting rod and main bearings.

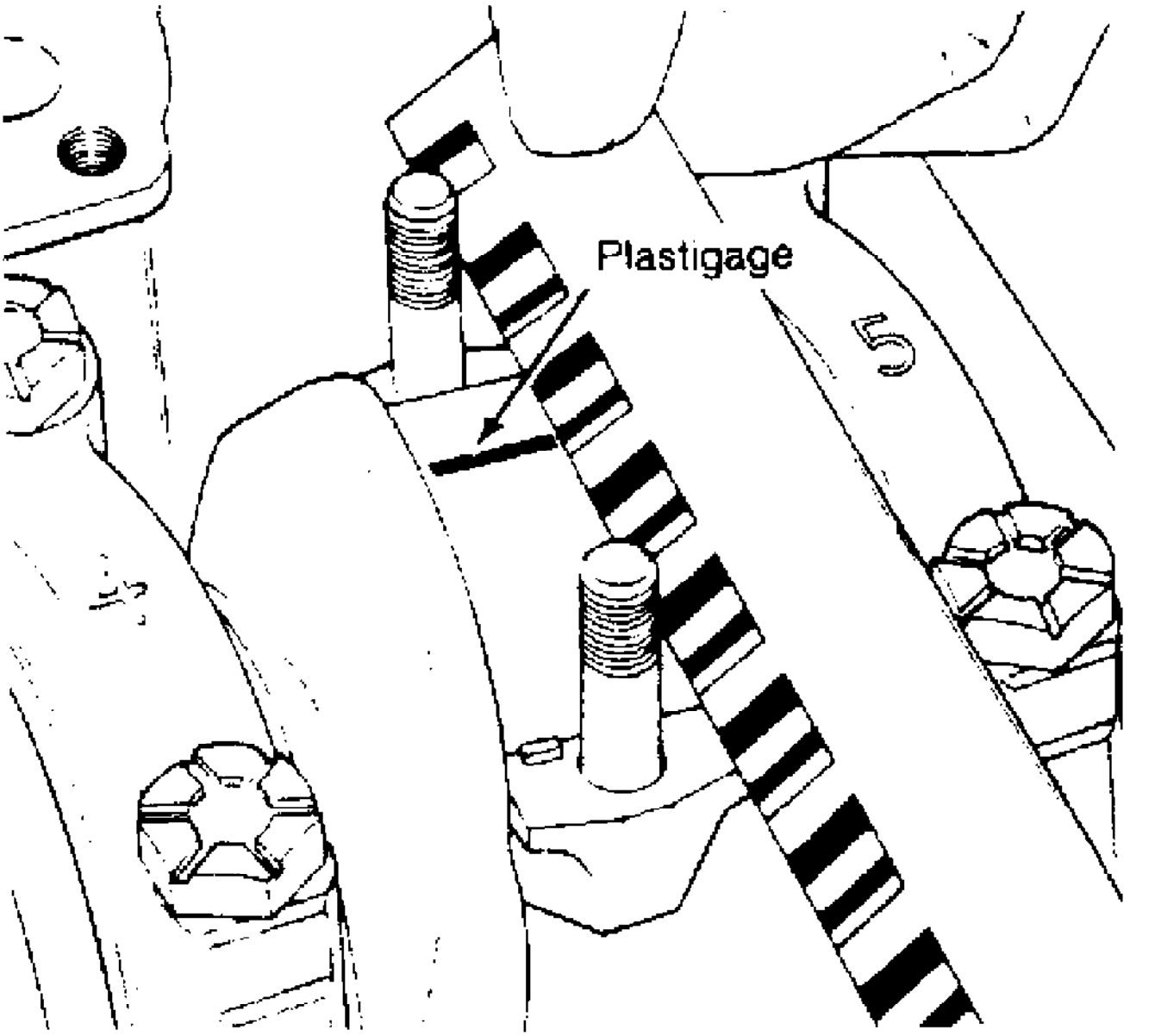

Fig. 19: Measuring Bearing Clearance - Typical
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Micrometer & Telescopic Gauge Method

A micrometer is used to determine journal diameter, taper and out-of-round dimensions of the crankshaft. See CLEANING & INSPECTION under CRANKSHAFT & MAIN BEARINGS in this article.

With crankshaft removed, install bearings and caps in original location on cylinder block. Tighten bolts to specification. On connecting rods, install bearings and caps on connecting rods. Install proper connecting rod cap on corresponding rod. Ensure bearing cap is installed in original location. Tighten bolts to specification.

Using a telescopic gauge and micrometer or inside micrometer measure inside diameter of connecting rod and main bearings bores. Subtract each crankshaft journal diameter from the corresponding inside bore diameter. This is the bearing clearance.

CRANKSHAFT & MAIN BEARINGS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

REMOVAL

Ensure all main bearing caps are marked for location on cylinder block. Some main bearing caps have an arrow stamped on it which must face front of engine. Remove main bearing cap bolts. Remove main bearing caps. Carefully remove crankshaft. Use care not to bind crankshaft in cylinder block during removal.

CLEANING & INSPECTION

Thoroughly clean crankshaft using solvent. Dry with compressed air. Ensure all oil passages are clear and free of sludge, rust, dirt, and metal chips.

Inspect crankshaft for scoring and nicks. Inspect crankshaft for cracks using Magnaflux procedure. Inspect rear seal area for grooving or damage. Inspect bolt hole threads for damage. If pilot bearing or bushing is used, check pilot bearing or bushing fit in crankshaft. Inspect crankshaft gear for damaged or cracked teeth. Replace gear if damaged. Check that oil passage plugs are tight (if equipped).

Using micrometer, measure all journals in 4 areas to determine journal taper, out-of-round and undersize. See Fig. 20. Some crankshafts can be reground to the next largest undersize, depending on the amount of wear or damage. Crankshafts with rolled fillet cannot be reground and must be replaced.

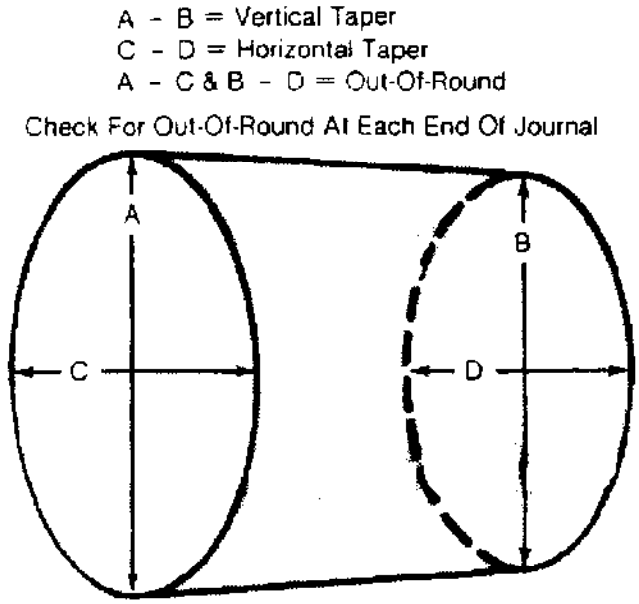

Fig. 20: Measuring Crankshaft Journal - Typical
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Crankshaft journal runout should be checked. Install crankshaft in "V" blocks or bench center. Position dial indicator

with tip resting on the main bearing journal area. See Fig. 21. Rotate crankshaft and note reading. Journal runout must not exceed specification. Repeat procedure on all main bearing journals. Crankshaft must be replaced if runout exceeds specification.

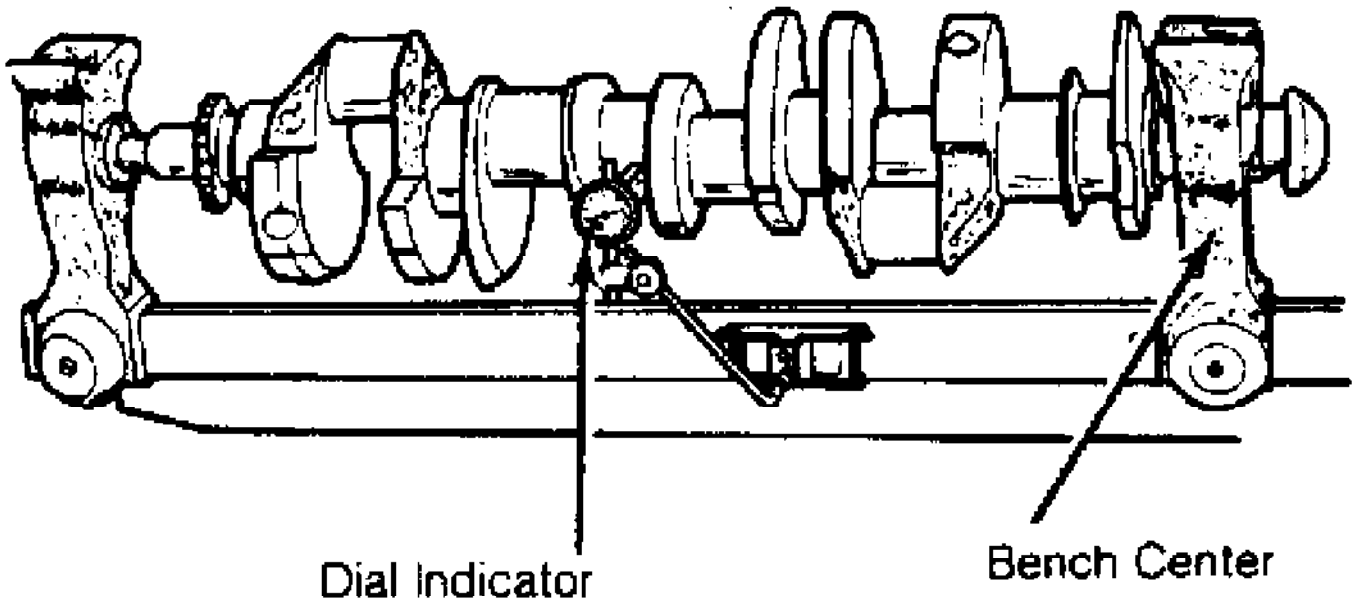

Fig. 21: Measuring Crankshaft Main Bearing Journal Runout - Typical This Graphic For General Information Only

INSTALLATION

Install upper main bearing in cylinder block. Ensure lock tab is properly located in cylinder block. Install bearings in main bearing caps. Ensure all oil passages are aligned. Install rear seal (if removed).

Ensure crankshaft journals are clean. Lubricate upper main bearings with clean engine oil. Carefully install crankshaft. Check each main bearing clearance using Plastigage method. See MAIN & CONNECTING ROD BEARING CLEARANCE in this article.

Once clearance is checked, lubricate lower main bearing and journals. Install main bearing caps in original location. Install rear seal in rear main bearing cap (if removed). Some rear main bearing caps require sealant to be applied in corners to prevent oil leakage.

Install and tighten all bolts except thrust bearing cap to specification. Tighten thrust bearing cap bolts finger tight only. Thrust bearing must be aligned. On most applications, crankshaft must be moved rearward then forward. Procedure may vary with manufacturer. Thrust bearing cap is then tighten to specification. Ensure crankshaft rotates freely. Crankshaft end play should be checked. See CRANKSHAFT END PLAY in this article.

CRANKSHAFT END PLAY

Dial Indicator Method

Crankshaft end play can be checked using dial indicator. Mount dial indicator on rear of cylinder block. Position dial indicator tip against rear of crankshaft. Ensure tip is resting against flat surface.

Pry crankshaft rearward. Adjust dial indicator to zero.

Pry crankshaft forward and note reading. Crankshaft end play must be within specification. If end play is not within specification, check for faulty thrust bearing installation or worn crankshaft. Some applications offer oversized thrust bearings.

Feeler Gauge Method

Crankshaft end play can be checked using feeler gauge. Pry crankshaft rearward. Pry crankshaft forward. Using feeler gauge, measure clearance between crankshaft and thrust bearing surface. See Fig. 22.

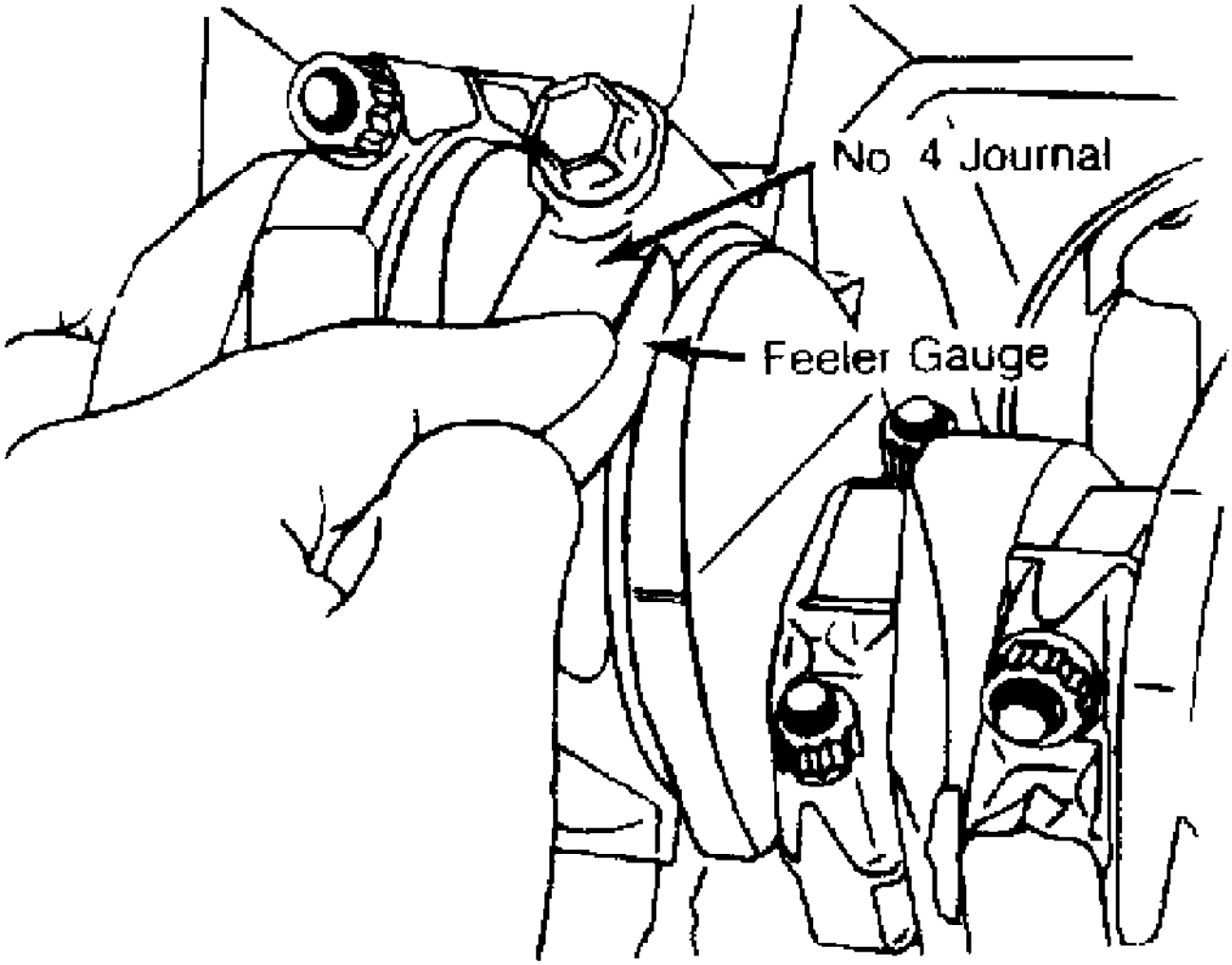

Fig. 22: Checking Crankshaft End Play - Typical
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Crankshaft end play must be within specification. If end play is not within specification, check for faulty thrust bearing installation or worn crankshaft. Some applications offer oversized thrust bearings.

CYLINDER BLOCK

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

BLOCK CLEANING

Only cast cylinder blocks should be hot tank cleaned. Aluminum cylinder blocks should be cleaned using cold tank method. Cylinder block is cleaned in order to remove carbon deposits, gasket residue and water jacket scale. Remove oil galley plugs, freeze plugs and cam bearings prior to block cleaning.

BLOCK INSPECTION

Visually inspect the block. Check suspected areas for cracks using the Dye Penetrant inspection method. Block may be checked for cracks using the Magnaflux method.

Cracks are most commonly found at the bottom of the cylinders, the main bearing saddles, near expansion plugs and between the cylinders and water jackets. Inspect lifter bores for damage. Inspect all head bolt holes for damaged threads. Threads should be cleaned using tap to ensure proper head bolt torque. Consult machine shop concerning possible welding and machining (if required).

CYLINDER BORE INSPECTION

Inspect the bore for scuffing or roughness. Cylinder bore is dimensionally checked for out-of-round and taper using dial bore gauge. For determining out-of-round, measure cylinder parallel and perpendicular to the block centerline. Difference in the 2 readings is the bore out-of-round. Cylinder bore must be checked at top, middle and bottom of piston travel area.

Bore taper is obtained by measuring bore at the top and bottom. If wear has exceeded allowable limits, block must be honed or bored to next available oversize piston dimension.

CYLINDER HONING

Cylinder must be properly honed to allow new piston rings to properly seat. Cross-hatching at correct angle and depth is critical to lubrication of cylinder walls and pistons.

A flexible drive hone and power drill are commonly used. Drive hone must be lubricated during operation. Mix equal parts of kerosene and SAE 20w engine oil for lubrication.

Apply lubrication to cylinder wall. Operate cylinder hone from top to bottom of cylinder using even strokes to produce 45 degree cross-hatch pattern on the cylinder wall. DO NOT allow cylinder hone to extend below cylinder during operation.

Recheck bore dimension after final honing. Wash cylinder wall with hot soapy water to remove abrasive particles. Blow dry with compressed air. Coat cleaned cylinder walls with lubricating oil.

DECK WARPAGE

Check deck for damage or warped head sealing surface. Place a straightedge across gasket surface of the deck. Using feeler gauge, measure clearance at center of straightedge. Measure across width and

length of cylinder block at several points.

If warpage exceeds specifications, deck must be resurfaced. If warpage exceeds manufacturer's maximum tolerance for material removal, replace block.

DECK HEIGHT

Distance from the crankshaft centerline to the block deck is termed the deck height. Measure and record front and rear main journals of crankshaft. To compute this distance, install crankshaft and retain with center main bearing and cap only. Measure distance from the crankshaft journal to the block deck, parallel to the cylinder centerline.

Add one half of the main bearing journal diameter to distance from crankshaft journal to block deck. This dimension should be checked at front and rear of cylinder block. Both readings should be the same.

If difference exceeds specifications, cylinder block must be repaired or replaced. Deck height and warpage should be corrected at the same time.

MAIN BEARING BORE & ALIGNMENT

For checking main bearing bore, remove all bearings from cylinder block and main bearing caps. Install main bearing caps in original location. Tighten bolts to specification. Using inside micrometer, measure main bearing bore in 2 areas 90 degrees apart. Determine bore size and out-of-round. If diameter is not within specification, block must be align-bored.

For checking alignment, place a straightedge along centerline of main bearing saddles. Check for clearance between straightedge and main bearing saddles. Block must be align-bored if clearance is present.

EXPANSION PLUG REMOVAL & INSTALLATION

Removal

Drill a hole in the center of expansion plug. Remove with screwdriver or punch. Use care not to damage sealing surface.

Installation

Ensure sealing surface is free of burrs. Coat expansion plug with sealer. Use a wooden dowel or pipe of slightly smaller diameter, install expansion plug. Ensure expansion plug is evenly located.

OIL GALLERY PLUG REMOVAL & INSTALLATION

Removal

Remove threaded oil gallery plugs using the appropriate wrench. Soft, press-in plugs are removed by drilling into plug and installing a sheet metal screw. Remove plug with slide hammer or pliers.

Installation

Ensure threads or sealing surface is clean. Coat threaded oil gallery plugs with sealer and install. Replacement soft press-in plugs are driven in place with a hammer and drift.

CAMSHAFT

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

CLEANING & INSPECTION

Clean camshaft with solvent. Ensure all oil passages are clear. Inspect cam lobes and bearing journals for pitting, flaking or scoring. Using micrometer, measure bearing journal O.D.

Support camshaft at each end with "V" blocks. Position dial indicator with tip resting on center bearing journal. Rotate camshaft and note reading. If reading exceeds specification, replace camshaft.

Check cam lobe lift by measuring base circle of camshaft using micrometer. Measure again at 90 degrees to tip of cam lobe. Cam lift can be determined by subtracting base circle diameter from tip of cam lobe measurement.

Different lift dimensions are given for intake and exhaust cam lobes. Reading must be within specifications. Replace camshaft if cam lobes or bearing journals are not within specifications.

Inspect camshaft gear for chipped, eroded or damaged teeth. Replace gear if damaged. On camshafts using thrust plate, measure distance between thrust plate and camshaft shoulder. Replace thrust plate if not within specification.

CAMSHAFT BEARINGS

Removal & Installation

Remove the camshaft rear plug. The camshaft bearing remover is assembled with its shoulder resting on the bearing to be removed according to manufacturer's instructions. Tighten puller nut until bearing is removed. Remove remaining bearings, leaving front and rear bearings until last. These bearings act as guide for camshaft bearing remover.

To install new bearings, puller is rearranged to pull bearings toward the center of block. Ensure all lubrication passages of bearing are aligned with cylinder block. Coat new camshaft rear plug with sealant. Install camshaft rear plug. Ensure plug is even in cylinder block.

CAMSHAFT INSTALLATION

Lubricate bearing surfaces and cam lobes with ample amount of Molykote or camshaft lubricant. Carefully install camshaft. Use care not to damage bearing journals during installation. Install thrust plate retaining bolts (if equipped). Tighten bolts to specification. On overhead camshafts, install bearing caps in original location. Tighten bolts to specification. Check end play.

CAMSHAFT END PLAY

Using dial indicator, check end play. Position dial indicator on front of engine block. Position indicator tip against camshaft. Push camshaft toward rear of engine and adjust indicator to zero.

Move camshaft forward and note reading. Camshaft end play must be within specification. End play may be adjusted by relocating gear, shimming thrust plate or replacing thrust plate depending on manufacturer.

TIMING CHAINS & BELTS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

TIMING CHAINS

Timing chains will stretch during operation. Limits are placed upon amount of stretch before replacement is required. Timing chain stretch will alter ignition timing and valve timing.

To check timing chain stretch, rotate crankshaft to eliminate slack from one side of timing chain. Mark reference point on cylinder block. Rotate crankshaft in opposite direction to eliminate slack from remaining side of timing chain. Force other side of chain outward and measure distance between reference point and timing chain. See Fig. 23. Replace timing chain and gears if not within specification.

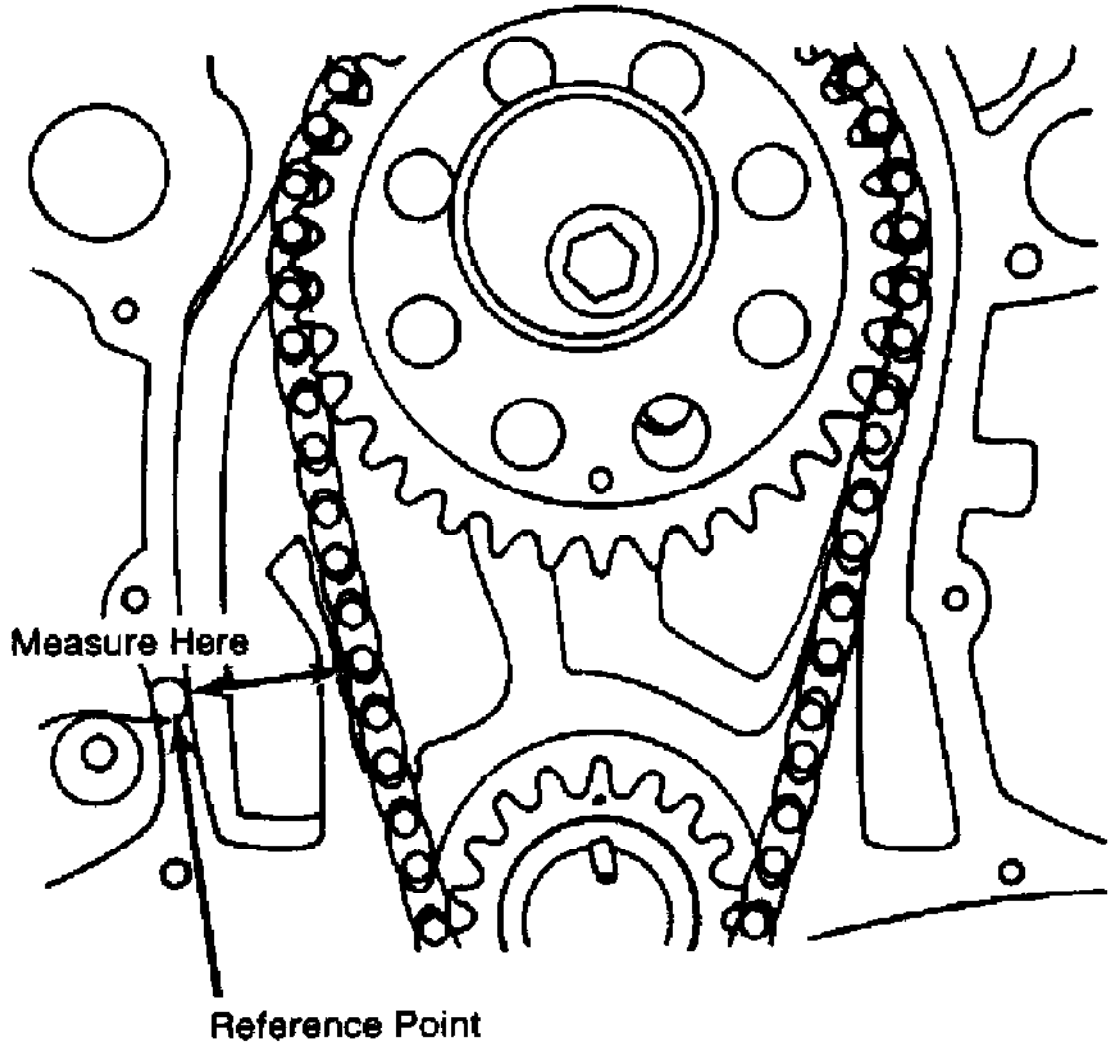

Fig. 23: Measuring Timing Chain Stretch - Typical
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Timing chains must be installed so that timing marks on camshaft gear and crankshaft gear are aligned according to

manufacturer. See Fig. 24.

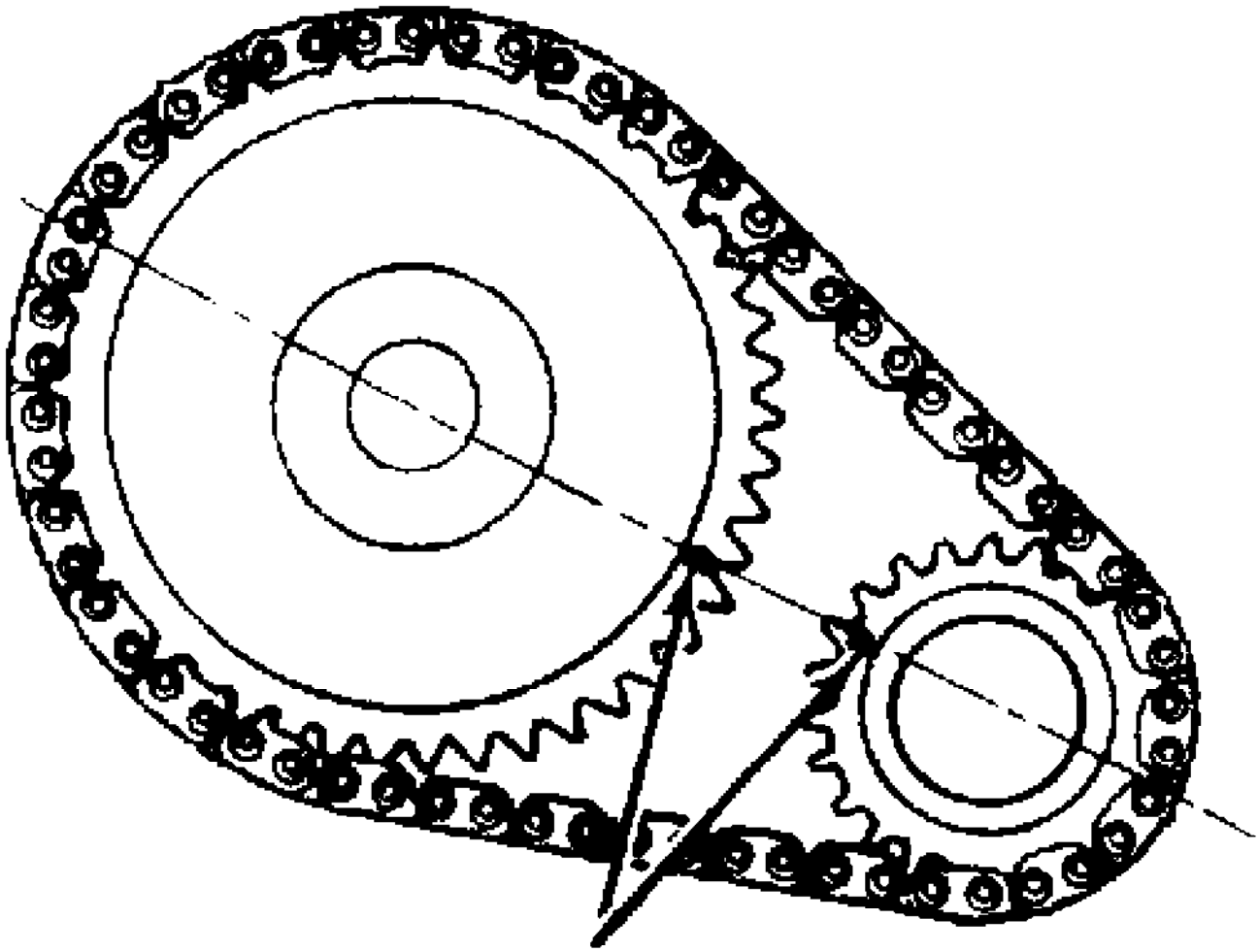

Fig. 24: Timing Gear Mark Alignment - Typical
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TIMING BELTS

Cogged tooth belts are commonly used on overhead cam engines. Inspect belt teeth for rounded corners or cracking. Replace belt if cracked, damaged, missing teeth or oil soaked.

Used timing belt must be installed in original direction of rotation. Inspect all sprocket teeth for wear. Replace all worn sprockets. Sprockets are marked for timing purposes. Engine is positioned so that crankshaft sprocket mark will be upward. Camshaft sprocket is aligned with reference mark on cylinder head and timing belt is installed. See Fig. 25.

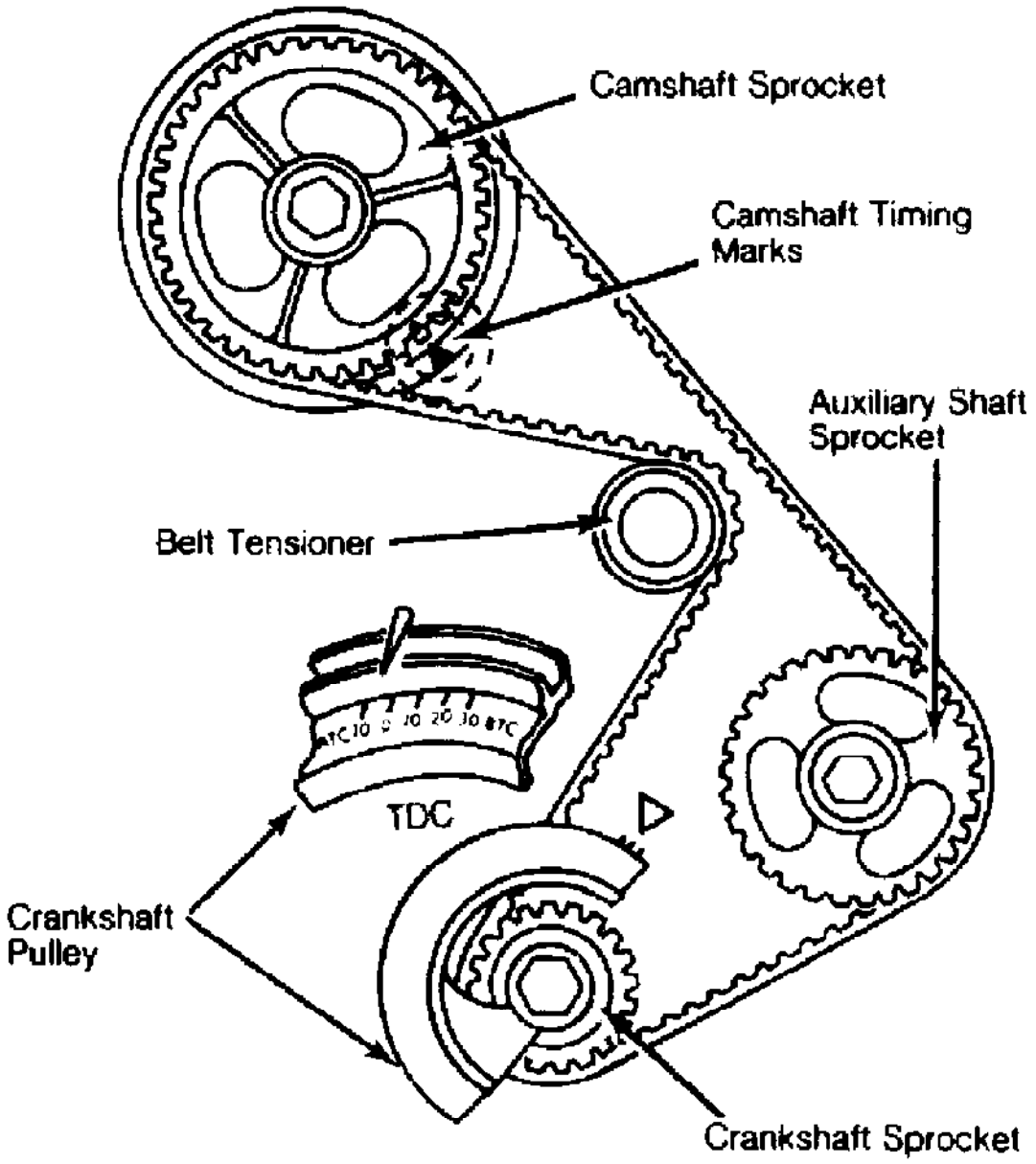

Fig. 25: Timing Belt Sprocket Alignment - Typical
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TENSION ADJUSTMENTS

If guide rails are used with spring loaded tensioners, ensure at least half of original rail thickness remains. Spring loaded tensioner should be inspected for damage.

Ensure all timing marks are aligned. Adjust belt tension using manufacturer's recommendations. Belt tension may require checking using tension gauge. See Fig. 26.

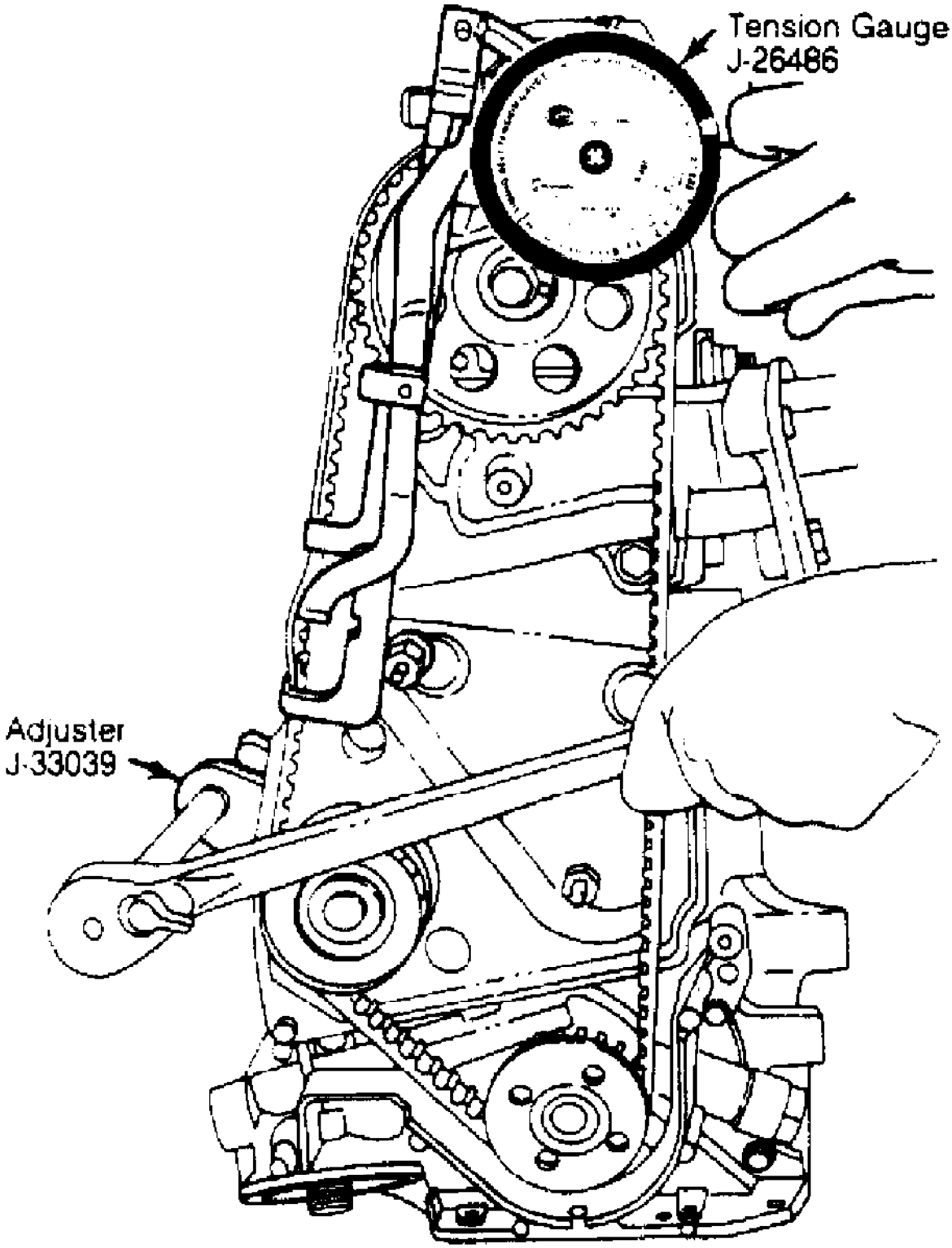

Fig. 26: Timing Belt Tension Adjustment - Typical
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TIMING GEARS

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

TIMING GEAR BACKLASH & RUNOUT

On engines where camshaft gear operates directly on crankshaft gear, gear backlash and runout must be checked. To check backlash, install dial indicator with tip resting on tooth of camshaft gear. Rotate camshaft gear as far as possible. Adjust indicator to zero. Rotate camshaft gear in opposite direction as far as possible and note reading.

To determine timing gear runout, mount dial indicator with tip resting on face edge of camshaft gear. Adjust indicator to zero. Rotate camshaft gear 360 degrees and note reading. If backlash or runout exceed specifications, replace camshaft and/or crankshaft gear.

REAR MAIN OIL SEAL

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

INSTALLATION

One-Piece Type Seal

For one-piece type oil seal installation, coat block contact surface of seal with sealer if seal is not factory coated. Ensure seal surface is free of burrs. Lubricate seal lip with engine oil and press seal into place using proper oil seal installer. See Fig. 27.

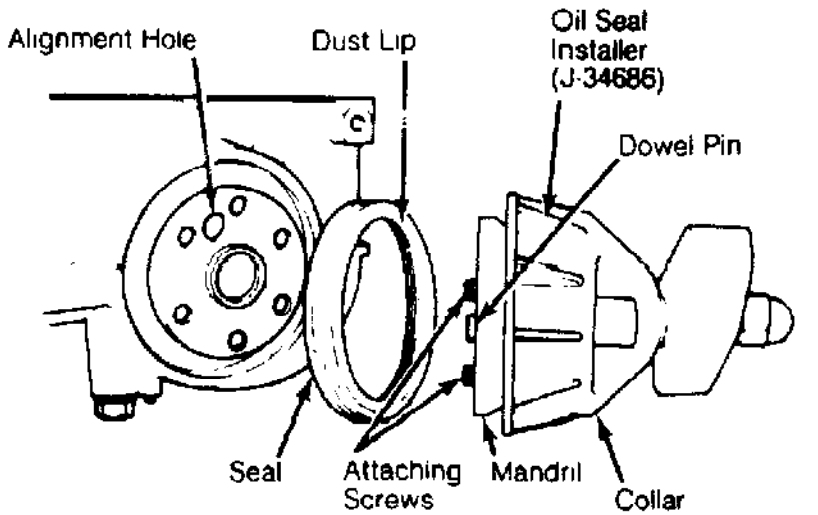

Fig. 27: Installing Typical One-Piece Oil Seal
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Rope Type Seal

For rope type rear main oil seal installation, press seal

lightly into its seat. Using seal installer, fully seat seal in bearing cap or cylinder block.

Trim seal ends even with block parting surface. Some applications require sealer to be applied on main bearing cap prior to installation. See Fig. 28.

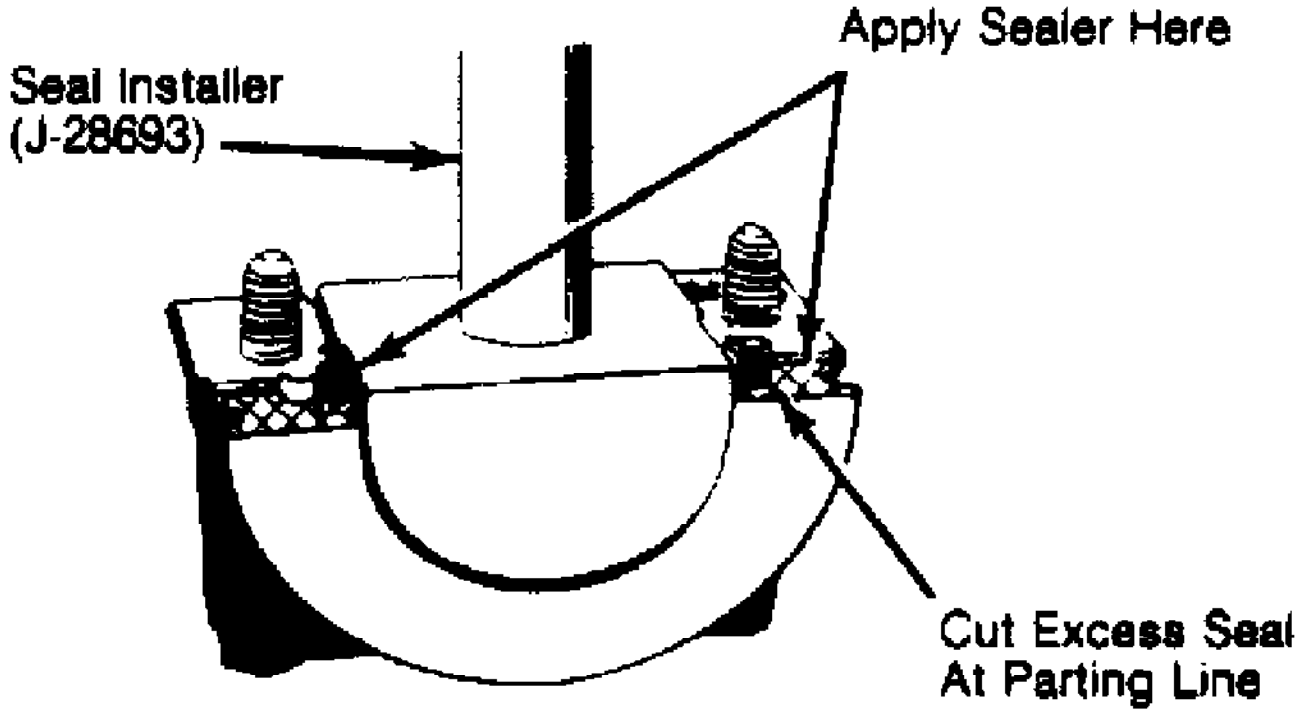

Fig. 28: Typical Rope Seal Installation
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Split-Rubber Type Seal

Follow manufacturers procedures when installing split-rubber type rear main oil seals. Installation procedures vary with engine type. See appropriate ENGINE article in this section. See Fig. 29.

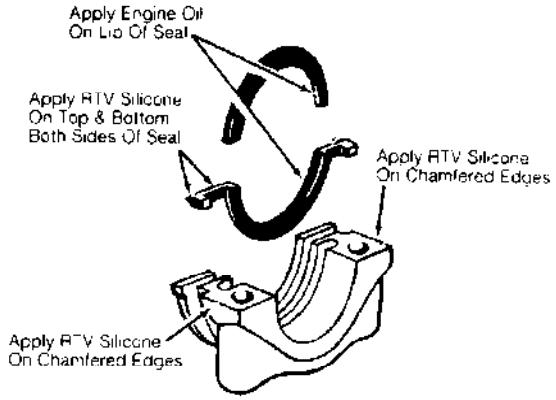

Fig. 29: Typical Split-Rubber Seal Installation
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OIL PUMP

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

ROTOR-TYPE

Oil pump rotors must be marked for location prior to removal. See Fig. 30. Remove outer rotor and measure thickness and diameter. Measure inner rotor thickness. Inspect shaft for scoring or wear. Inspect rotors for pitting or damage. Inspect cover for grooving or wear. Replace components if worn or damaged.

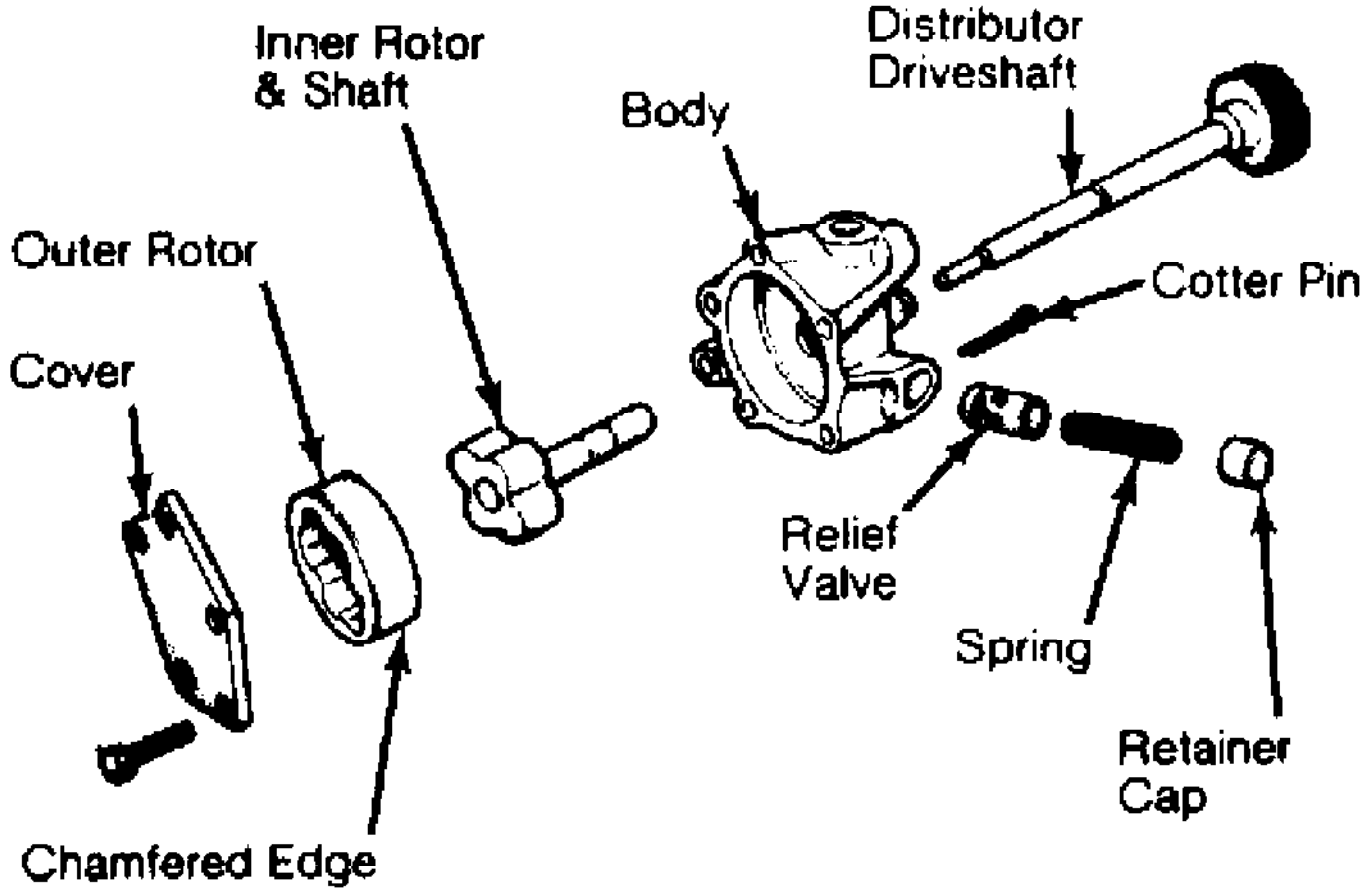

Fig. 30: Typical Rotor Type Oil Pump
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Measure outer rotor-to-body clearance. Replace pump assembly if clearance exceeds specification. Measure clearance between rotors. See Fig. 31. Replace shaft and both rotors if clearance exceeds specifications.

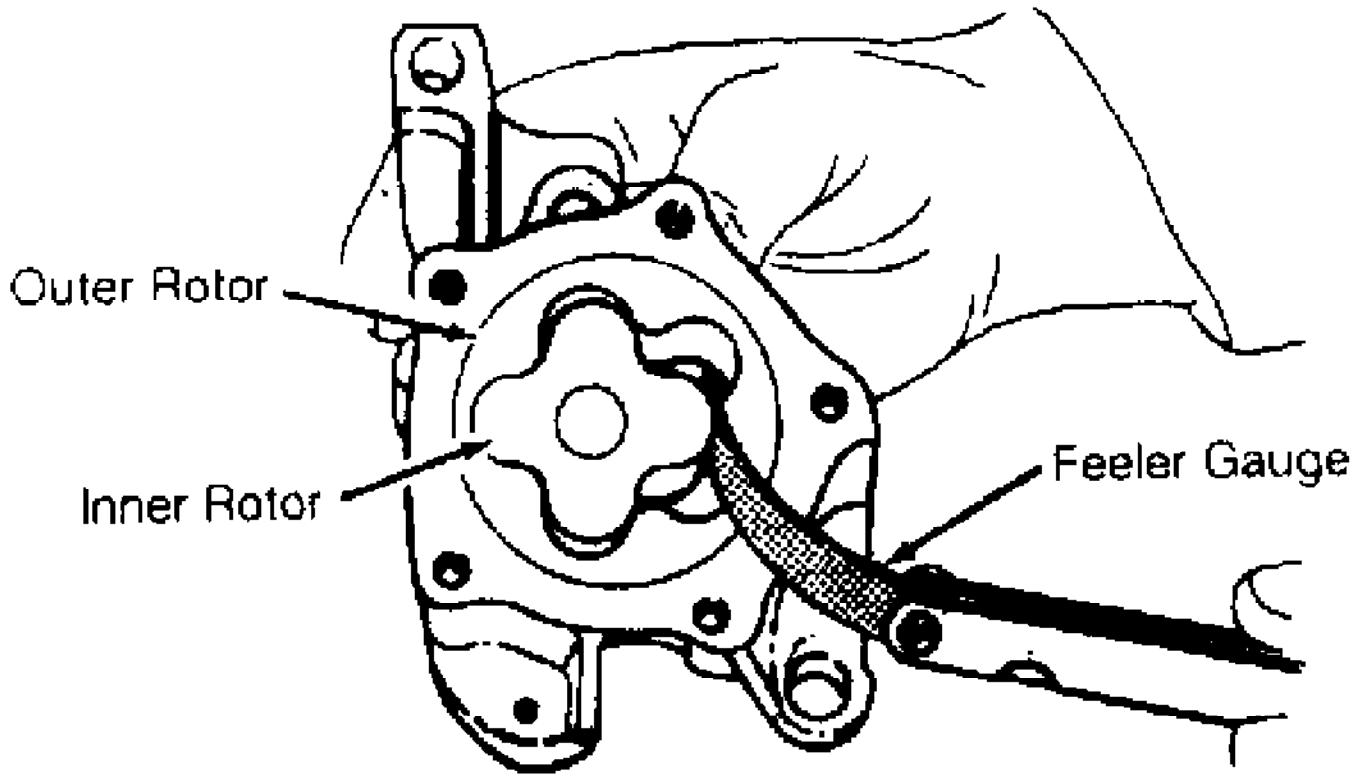

Fig. 31: Measuring Rotor Clearance - Typical
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Install rotors in pump body. Position straightedge across pump body. Using feeler gauge, measure clearance between rotors and straightedge. Pump cover wear is measured using a straightedge and feeler gauge. Replace pump if clearance exceeds specification.

GEAR TYPE

Oil pump gears must be marked for location prior to removal. See Fig. 32. Remove gears from pump body. Inspect gears for pitting or damage. Inspect cover for grooving or wear.

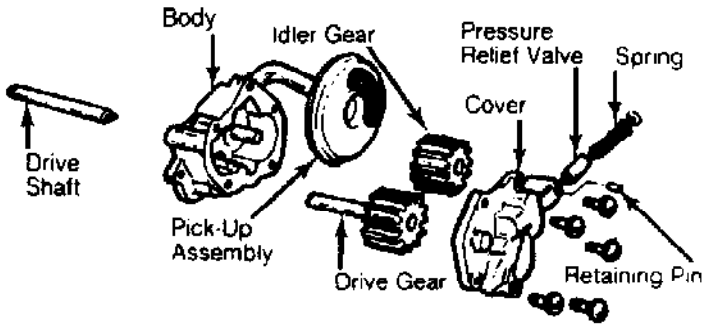

Fig. 32: Typical Gear Type Oil Pump
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Measure gear diameter and length. Measure gear housing cavity depth and diameter. See Fig. 33. Replace components if worn or

damaged.

Pump cover wear is measured using a straightedge and feeler gauge. Pump is to be replaced if warpage or wear exceeds specifications or mating surface of pump cover is scratched or grooved.

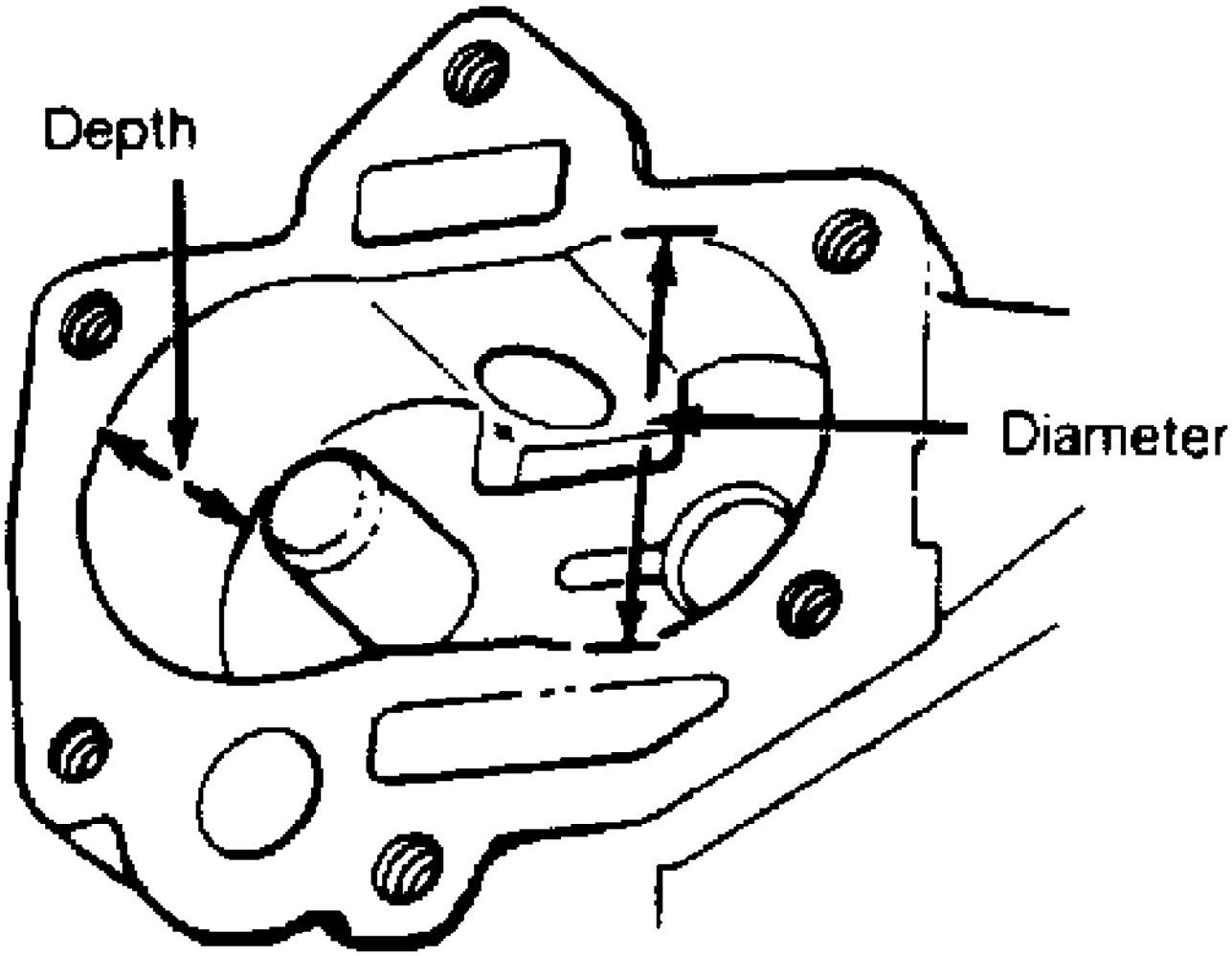

Fig. 33: Measuring Oil Pump Gear Cavity - Typical
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BREAK-IN-PROCEDURE

* PLEASE READ THIS FIRST *

NOTE: Always refer to appropriate engine overhaul article in the ENGINES section for complete overhaul procedures and specifications for the vehicle being repaired.

ENGINE PRE-OILING

Engine pre-oiling should be done prior to operation to prevent engine damage. A lightly oiled pump will cavitate unless oil pump cavities are filled with engine oil or petroleum jelly.

Engine pre-oiling can be done using pressure oiler (if available). Connect pressure oiler to cylinder block oil passage such as oil pressure sending unit. Operate pressure oiler long enough to ensure correct amount of oil has filled crankcase. Check oil level while pre-oiling.

If pressure oiler is not available, disconnect ignition system. Remove oil pressure sending unit and replace with oil pressure test gauge. Using starter motor, rotate engine starter until gauge shows normal oil pressure for several seconds. DO NOT crank engine for more than 30 seconds to avoid starter motor damage.

Ensure oil pressure has reached the most distant point from the oil pump. Reinstall oil pressure sending unit. Reconnect ignition system.

INITIAL START-UP

Start the engine and operate engine at low speed while checking for coolant, fuel and oil leaks. Stop engine. Recheck coolant and oil level. Adjust if necessary.

CAMSHAFT

Break-in procedure is required when a new or reground camshaft has been installed. Operate and maintain engine speed between 1500-2500 RPM for approximately 30 minutes. Procedure may vary due to manufacturers recommendations.

PISTON RINGS

Piston rings require a break-in procedure to ensure seating of rings to cylinder walls. Serious damage may occur to rings if correct procedures are not followed.

Extremely high piston ring temperatures are produced obtained during break-in process. If rings are exposed to excessively high RPM or high cylinder pressures, ring damage can occur. Follow piston ring manufacturer’s recommended break-in procedure.

FINAL ADJUSTMENTS

Check or adjust ignition timing and dwell (if applicable). Adjust valves (if necessary). Adjust carburetion or injection idle speed and mixture. Retighten cylinder heads (if required). If cylinder head or block is aluminum, retighten bolts when engine is cold. Follow the engine manufacturer’s recommended break-in procedure and maintenance schedule for new engines.

NOTE: Some manufacturer’s require that head bolts be retightened after specified amount of operation. This must be done to prevent head gasket failure.

* EXHAUST SYSTEM UNIFORM INSPECTION GUIDELINES *

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Exhaust Systems Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW OF MOTORIST ASSURANCE PROGRAM

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt (1) a Pledge of Assurance to their Customers and (2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication

Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS AND SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer’s best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer’s recommended service interval and must be documented.

Some conditions indicate that service or part replacement is

required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement
A - Part no longer performs intended purpose
B - Part does not meet a design specification (regardless of performance)
C - Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

EXHAUST

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

WARNING: Federal EPA rules prohibit altering an exhaust system in any way that defeats the emission reduction components of a vehicle. Be sure to review and adhere to EPA policy on removing and replacing catalytic converters. Where state or local laws are stricter, they take precedence over these guidelines.

NOTE: Some exhaust systems are of a welded design. It is not required that the entire system be replaced. Determine the need to replace individual components based on conditions of component.

CATALYTIC CONVERTERS

CAUTION: Before working on an exhaust system, review EPA regulations on removing and replacing catalytic converters.

NOTE: Any time a converter has failed, further diagnosis is required to determine the reason(s) for converter failure.

CATALYTIC CONVERTER INSPECTION

Condition	Code	Procedure
Air injection tube broken	A ...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube burnt	A ...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube leaking	A ...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube		

loose	A	...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube restricted	A	...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube threads damaged	A	...	Require repair or replacement of injection tube or replacement of catalytic converter.
Air injection tube threads stripped (threads missing)	A	...	Require repair or replacement of injection tube or replacement of catalytic converter.
Body cracked	B	..	Require repair or replacement.
Converter empty	A	..	Require repair or replacement.
Converter fill plug missing	C	..	Require repair or replacement.
Converter missing	C	.....	Require replacement.
Exhaust gases leaking	A	..	Require repair or replacement.
Flanges leaking	A	...	Require repair or replacement of flanges.
Inlet pipes cracked	B	..	Require repair or replacement.
Internal rattle (except pellet-type)	2	.....	(1) Further inspection required.
Mounting brackets that are part of converter broken	A	..	Require repair or replacement.
Obvious overheating	..	.....	(2) Require testing of converter.
Outlet pipes cracked	B	..	Require repair or replacement.
Pieces of catalyst material found downstream	1	.....	Suggest replacement.
Plugged	A	.....	(3) Require replacement.
Testing has determined that existing converter has been lead-poisoned, contaminated, or failed testing	A	..	Require repair or replacement.

(1) - If the converter is breaking up, suggest converter replacement. If an object has fallen into the converter, remove the object.
(2) - Overheating is caused by something other than the converter. Further diagnosis is required to determine the cause of the overheating.
(3) - Determine cause and correct to ensure that new converter will not become plugged.

EXHAUST AND TAIL PIPES

NOTE: For pipes with resonators, also see MUFFLERS AND RESONATORS.

EXHAUST AND TAIL PIPE INSPECTION

Condition	Code	Procedure
Bracket broken	A	Require repair or replacement.
Pipe bent out of position	B	Require repair or replacement.
Pipe broken	A	Require repair or replacement.
Pipe cracked	B	Require repair or replacement.
Pipe leaking	A	Require replacement.
Pipe missing	C	Require replacement.
Pipe plugged	A	Require replacement.
Pipe weak due to corrosion, but no leaks present	1	Suggest replacement.
Weld broken	A	Require repair or replacement.

EXHAUST CONNECTIONS

EXHAUST CONNECTION INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	B	Require replacement of hardware.
Clamp broken	A	Require replacement.
Clamp loose	A	Require repair or replacement.
Clamp missing	C	Require replacement.
Corroded, affecting structural integrity	1	Suggest replacement.
Incorrect type (i.e. flange, ball & socket etc.)	B	Require replacement.
Leaking	A	Require repair.
Loose	A	Require repair.

HANGERS

HANGER INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Corroded, affecting structural integrity	1	Suggest replacement.
Incorrect type	B	Require replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.
Out of position	B	Require repair or replacement.
Rubber deteriorated	1	Suggest replacement.

HEAT RISERS (MECHANICAL EFE DEVICES)

HEAT RISER (MECHANICAL EFE DEVICE) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement of affected parts.
Diaphragm inoperative	A	(1) Require replacement.

Leaking	A	Require repair or replacement.
Noisy	2	Suggest repair or replacement of affected parts.
Seized	A	Require repair or replacement of affected parts.
Spring broken	B	Require replacement of spring(s).
Spring inoperative	A	Require replacement of spring(s).

(1) - If the inoperative diaphragm is separate from the heat riser, then require replacement of the inoperative diaphragm. If the inoperative diaphragm is part of the heat riser, then replace the heat riser.

HEAT SHIELDS

HEAT SHIELD INSPECTION

Condition	Code	Procedure
Bent	B	Require repair or replacement.
Broken	A	Require replacement.
Corroded, affecting structural integrity	1	Suggest replacement.
Loose	A	Require repair or replacement.
Missing	C	Require replacement.

MANIFOLDS (CAST AND TUBE TYPE)

MANIFOLD (CAST AND TUBE TYPE) INSPECTION

Condition	Code	Procedure
Air injection tube in manifold broken	A	Require repair or replacement of injection tube or replacement of manifold.
Air injection tube in manifold corroded, affecting structural integrity	1	Suggest replacement of injection tube or manifold.
Air injection tube in manifold leaking	A	Require repair or replacement of injection tube or replacement of manifold.
Air injection tube in manifold loose	A	Require repair.
Air injection tube in manifold restricted	A	Require replacement of injection tube or manifold.
Air injection tube in manifold threads damaged	A	Require repair of injection tube or manifold.
Air injection tube in manifold threads stripped (threads missing)	A	Require replacement of injection tube or manifold.
Bolt broken	A	Require replacement of bolts.

Bolt loose	A	.....	Require tightening or replacement of bolts.
Bolt missing	C	...	Require replacement of bolts.
Corroded, affecting sealability	A	..	Require repair or replacement.
Cylinder head threads stripped	A	...	Require repair or replacement of cylinder head.
Gasket leaking	A	.....	Require tightening or replacement of gasket.
Heat stove bent	B	.....	(1) Require repair or replacement of stove.
Heat stove broken	A	.....	(1) Require replacement of stove.
Heat stove corroded, affecting structural integrity	1	.....	(1) Suggest replacement of stove.
Heat stove missing	C	.....	(1) Require replacement of stove.
Manifold broken	A	..	Require repair or replacement.
Manifold cracked	B	..	Require repair or replacement.
Manifold warped	A	..	Require repair or replacement.
Out of specification	B	..	Require repair or replacement.
Stud broken	A	....	Require replacement of stud.
Stud missing	C	....	Require replacement of stud.
Stud threads damaged	A	...	Require repair or replacement of stud.
Stud threads stripped (threads missing)	A	....	Require replacement of stud.

(1) - Stove may not be available separately; this may require replacement of manifold.

MECHANICAL EFE DEVICES

See HEAT RISERS (MECHANICAL EFE DEVICES).

MUFFLERS AND RESONATORS

MUFFLER AND RESONATOR INSPECTION

Condition	Code		Procedure
Body shell distorted, affecting performance or structural integrity	A	.....	Require replacement.
Corrosion hole	A	.....	Require replacement.
Missing	C	.....	Require replacement.
Mounting bracket broken	A	..	Require repair or replacement.
Mounting bracket cracked	B	..	Require repair or replacement.
Nipple cracked	A	..	Require repair or replacement.
Nipple loose	B	.....	Require replacement.
Outer wrap peeling (exhaust not leaking)	1	.....	Suggest replacement.
Plugged	A	.....	Require replacement.
Puncture (other than a drain hole)	A	.....	Require replacement.
Rattling or knocking noise from inside muffler	B	.....	Require replacement.
Seam open (exhaust			

leaking)	A	.....	Require replacement.
Sound quality unsatisfactory	2	..	Suggest replacement to address customer need and/or request.
Split (exhaust leaking) .	A	.....	Require replacement.
Weak due to corrosion, but no leaks present	1	.....	Suggest replacement.

GEAR TOOTH CONTACT PATTERNS

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Gear Tooth Contact Patterns

*** PLEASE READ THIS FIRST ***

The following article is for GENERAL INFORMATION purposes only. Information does not SPECIFICALLY apply to all years, makes and models, but is to be used as a general reference guide.

INSPECTION

PRELIMINARY INSPECTION

Wipe lubricant from internal parts. Rotate gears and inspect for wear or damage. Mount dial indicator to housing, and check backlash at several points around ring gear. Backlash must be within specifications at all points. If no defects are found, check gear tooth contact pattern.

GEAR TOOTH CONTACT PATTERN

NOTE: Drive pattern should be well centered on ring gear teeth. Coast pattern should be centered, but may be slightly toward toe of ring gear teeth.

1) Paint ring gear teeth with marking compound. Wrap cloth or rope around drive pinion flange to act as brake. Rotate ring gear until clear tooth contact pattern is obtained.

2) Contact pattern will indicate whether correct pinion bearing mounting shim has been installed and if drive gear backlash has been set properly. Backlash between drive gear and pinion must be maintained within specified limits, until correct tooth pattern is obtained.

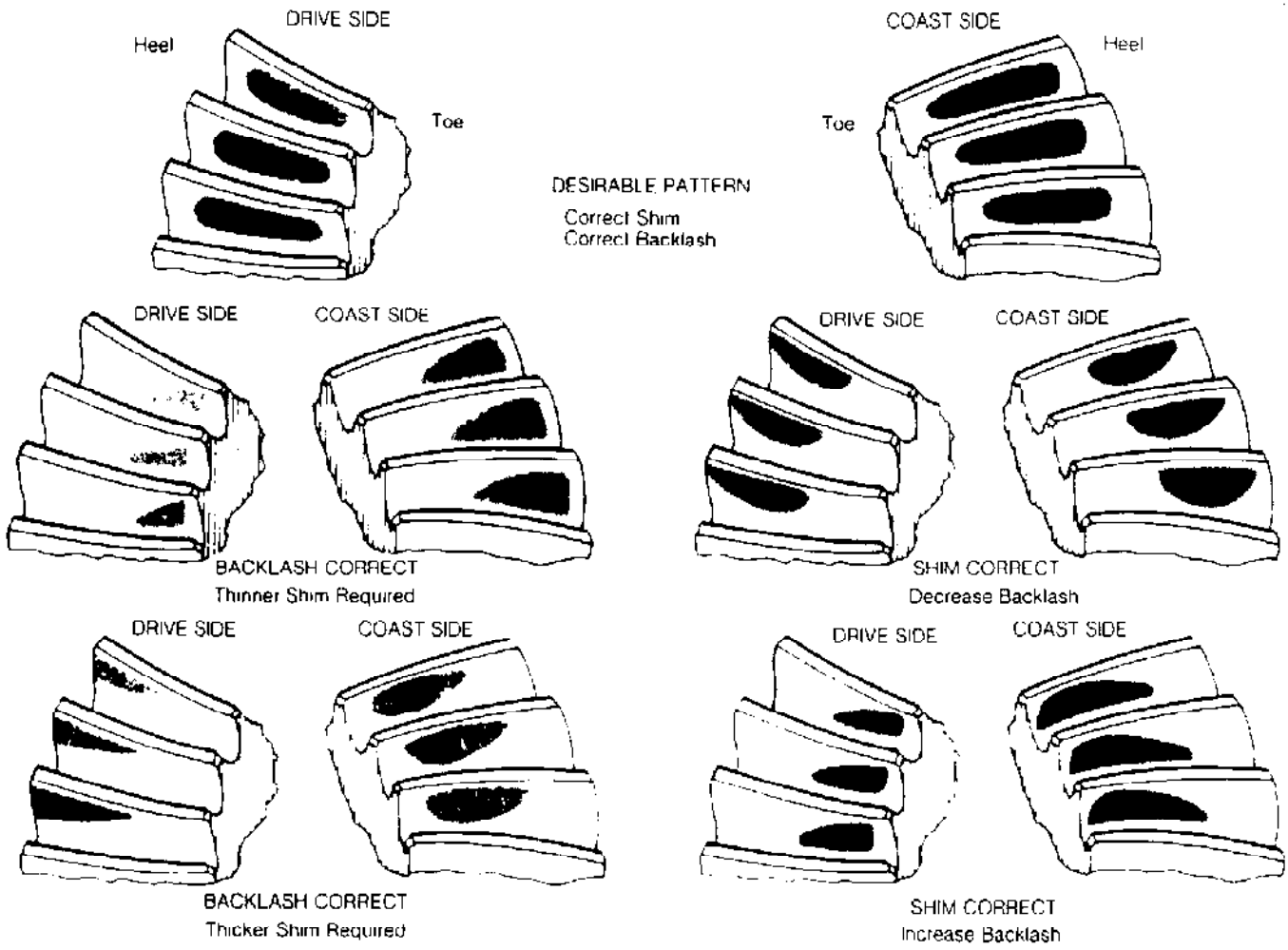

Fig. 1: Drive Axle Gear Tooth Patterns

ADJUSTMENTS

GEAR BACKLASH & PINION SHIM CHANGES

NOTE: Backlash is adjusted by either moving shims from one side of differential case to the other or by turning adjusting nuts on which side bearing races ride. Changing of pinion shims alters the distance from face of pinion of centerline of ring gear.

1) With no change in backlash, moving pinion further from ring gear moves drive pattern toward heel and top of tooth, and moves coast pattern toward toe and top of tooth.

2) With no change in backlash, moving pinion closer to ring gear moves drive pattern toward toe and bottom of tooth, and moves coast pattern toward heel and bottom of tooth.

3) With no change in pinion shim thickness, an increase in backlash moves ring gear further from pinion. Drive pattern moves toward heel and top of tooth, and coast pattern moves toward heel and top of tooth.

4) With no change in pinion shim thickness, decrease in

backlash moves ring gear closer to pinion gear. Drive pattern moves toward toe and bottom of tooth, and coast pattern moves toward toe and bottom of tooth.

GENERAL COOLING SYSTEM SERVICING

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
General Cooling System Servicing

* PLEASE READ THIS FIRST *

The following article is for general information only. Information may not apply to all years, makes and models. See specific article in the ENGINE COOLING section.

DESCRIPTION

The basic liquid cooling system consists of a radiator, water pump, thermostat, electric or belt-driven cooling fan, pressure cap, heater, and various connecting hoses and cooling passages in the block and cylinder head.

MAINTENANCE

DRAINING

Remove radiator cap and open heater control valve to maximum heat position. Open drain cocks or remove plugs in bottom of radiator and engine block. In-line engines usually have one plug or drain cock, while "V" type engines will have 2, one in each bank of cylinders.

CLEANING

A good cleaning compound removes most rust and scale. Follow manufacturer's instructions in the use of cleaner. If considerable rust and scale has to be removed, cooling system should be flushed. Clean radiator air passages with compressed air.

FLUSHING

CAUTION: Some manufacturers use an aluminum and plastic radiator. Flushing solution must be compatible with aluminum.

Back Flushing
Back flushing is an effective means of removing cooling system rust and scale. The radiator, engine and heater core should be flushed separately.

Radiator
To flush radiator, connect flushing gun to water outlet of radiator and disconnect water inlet hose. To prevent flooding engine, use a hose connected to radiator inlet. Use air in short bursts to prevent damage to radiator. Continue flushing until water runs clear.

Engine
To flush engine, remove thermostat and replace housing. Connect flushing gun to water outlet of engine. Flush using short air bursts until water runs clean.

Heater Core
Flush heater core as described for radiator. Ensure heater control valve is set to maximum heat position before flushing heater.

REFILLING

To prevent air from being trapped in engine block, engine should be running when refilling cooling system. After system is full, continue running engine until thermostat is open, then recheck fill level. Do not overfill system.

TESTING

THERMOSTAT

1) Visually inspect thermostat for corrosion and proper sealing of valve and seat. If okay, suspend thermostat and thermometer in a 50/50 mixture of coolant and water. See Fig. 1. Do not allow thermostat or thermometer to touch bottom of container. Heat water until thermostat just begins to open.

2) Read temperature on thermometer. This is the initial opening temperature and should be within specification. Continue heating water until thermostat is fully open and note temperature. This is the fully opened temperature. If either reading is not to specification, replace thermostat.

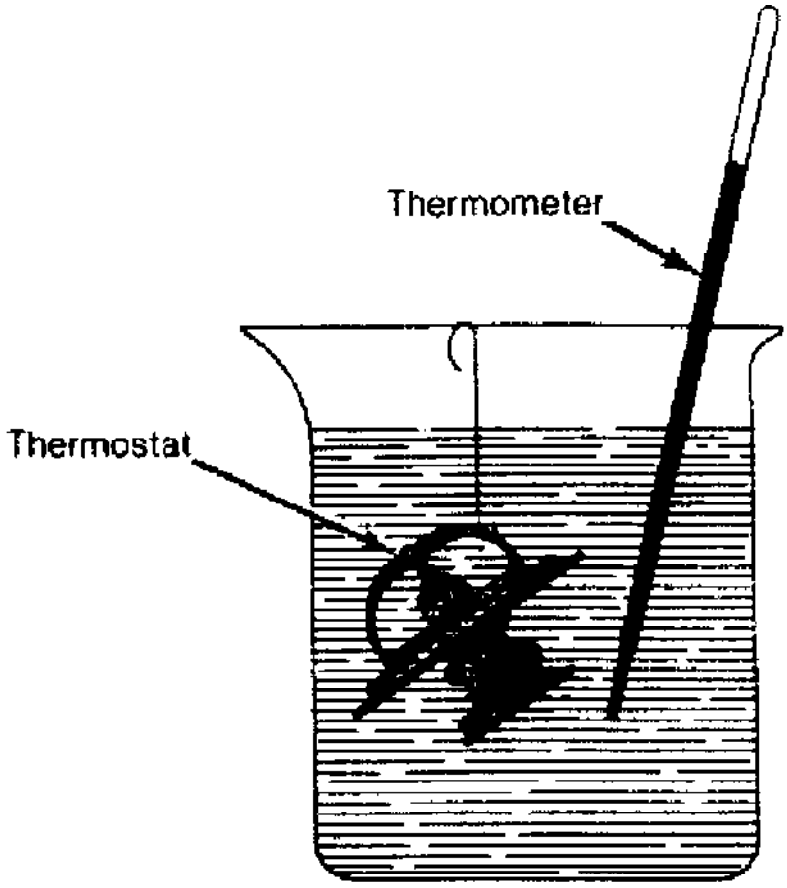

Fig. 1: Testing Thermostat in Anti-Freeze/Water Solution

PRESSURE TESTING

A pressure tester is used to check both radiator cap and

complete cooling system. Test components as follows, following tool manufacturer's instructions.

Radiator Cap

Visually inspect radiator cap, then dip cap into water and connect to tester. Pump tester to bring pressure to upper limit of cap specification. If cap fails to hold pressure, replace cap.

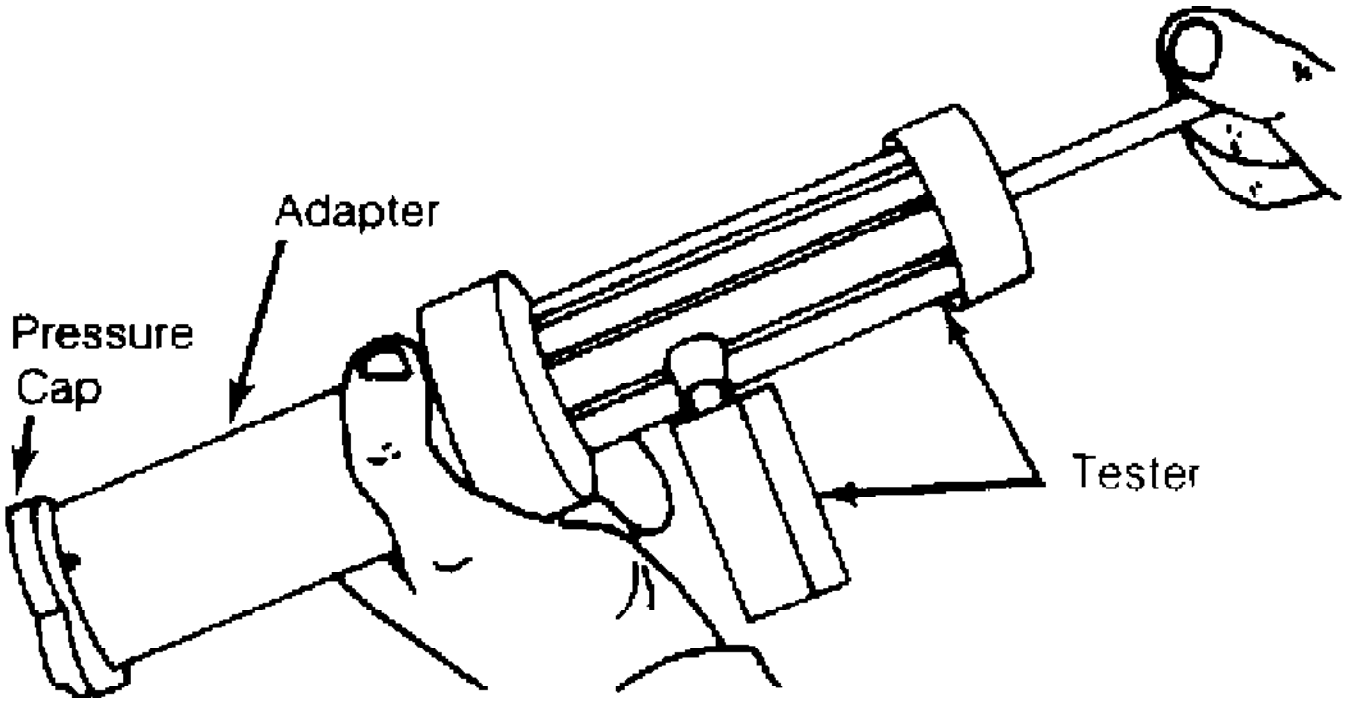

Fig. 2: Testing Radiator Pressure Cap

Cooling System

1) With engine off, wipe radiator filler neck seat clean. Fill radiator to correct level. Attach tester to radiator and pump until pressure is at upper level of radiator rating.

2) If pressure drops, inspect for external leaks. If no leaks are apparent, detach tester and run engine until normal operating temperature is reached. Reattach tester and observe. If pressure builds up immediately, a possible leak exists from a faulty head gasket or crack in head or block.

NOTE: Pressure may build up quickly. Release any excess pressure or cooling system damage may result.

3) If there is no immediate pressure build up, pump tester to within system pressure range (on radiator cap). Vibration of gauge pointer indicates compression or combustion leak into cooling system. Isolate leak by shorting each spark plug wire to cylinder block. Gauge pointer should stop or decrease vibration when leaking cylinder is shorted.

GENERATOR & REGULATOR

1997-99 Mitsubishi Montero Sport

1997-99 STARTING & CHARGING SYSTEMS
Mitsubishi - Generator & Regulator

Montero Sport

DESCRIPTION & OPERATION

Mitsubishi alternators are conventional 3-phase, self-rectifying type units containing 6 diodes (3 positive and 3 negative) which are used to rectify current. All models use a case-mounted Integrated Circuit (IC) voltage regulator.

Alternator relay or resistor with diode is used to ensure charging of battery even if charging indicator light is defective.

ADJUSTMENTS

BELT TENSION

For belt tension, see DRIVE BELT ADJUSTMENT table.

DRIVE BELT ADJUSTMENT TABLE

Application	Deflection (1) New Belt In. (mm)	Deflection (1) Used Belt In. (mm)
2.4L (2)	.22-.29 (5.5-7.5)	.30-.33 (7.5-8.5)
3.0L (2) & 3.5L (2)	.22-.29 (5.5-7.5)	.31-.35 (8.0-9.0)

(1) - With 22 lbs. (10 kg) pressure midway on belt run.
(2) - Measure between water pump and generator pulleys.

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING - BASIC PROCEDURES article in GENERAL INFORMATION.

ON-VEHICLE TESTING

ALTERNATOR TO BATTERY CONTINUITY TEST

NOTE: Check alternator wiring harness connections and drive belt tension and ensure battery is fully charged before performing test.

1) Turn ignition off. Disconnect negative battery cable. Remove output lead from alternator terminal "B". See Fig. 1. Install a 100-amp or 130-amp ammeter in series with terminal "B" and disconnected output lead. Install positive lead of ammeter to terminal "B" and negative lead to disconnected output wire.

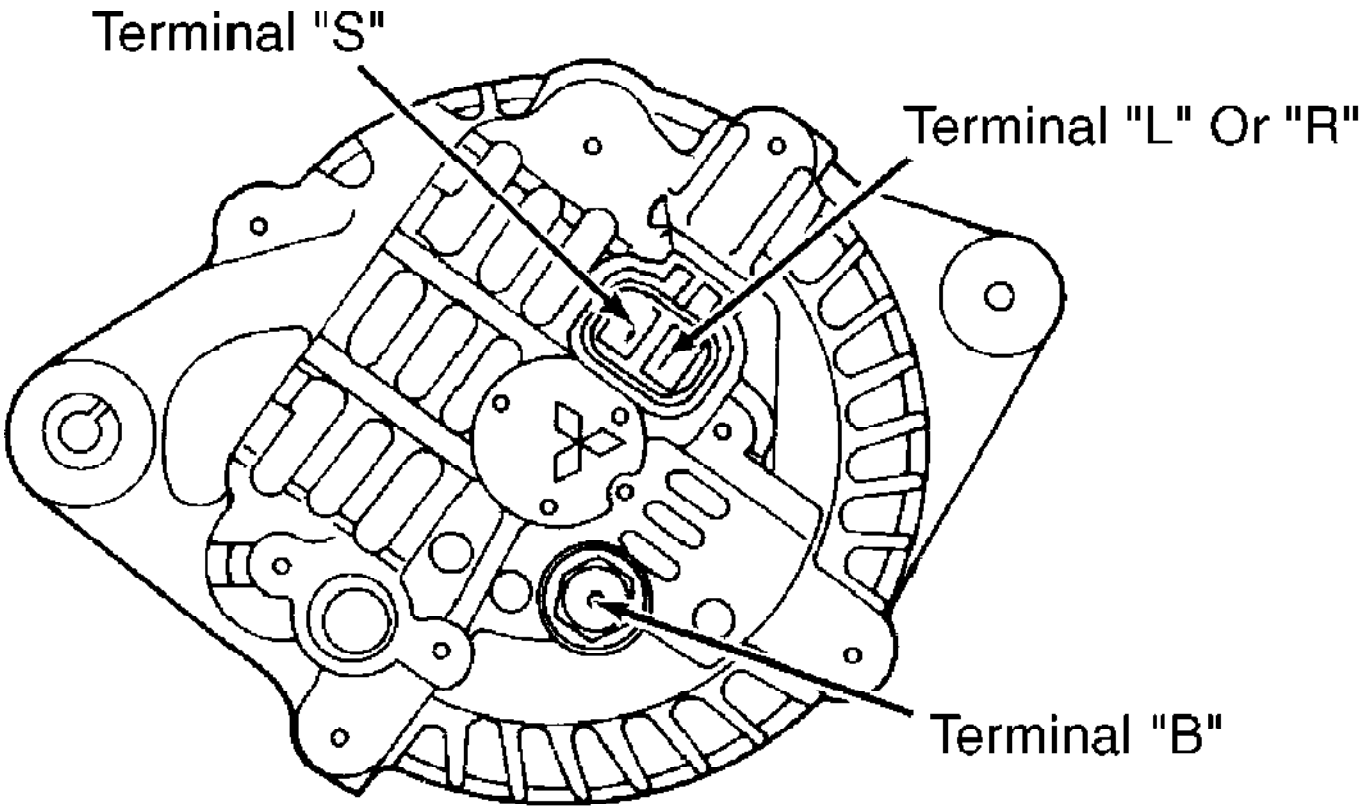

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Fig. 1: Identifying Alternator Terminals (Typical)
Courtesy of Mitsubishi Motor Sales of America.

2) Install a digital voltmeter between alternator terminal "B" and positive battery terminal. Install positive voltmeter lead to terminal "B" and negative lead to positive battery terminal. Reconnect negative battery cable.

3) Start and operate engine at 2500 RPM. Turn accessories on and adjust engine speed until ammeter indicate slightly greater than 30 amps, and note voltmeter reading. If voltmeter indicates .3 volt or less, system is okay.

4) If voltage is greater than .3 volt, check wiring between alternator terminal "B", fusible link and positive battery terminal. If terminal is not sufficiently tight or if harness is discolored due to overheating, repair as necessary and retest.

ALTERNATOR OUTPUT TEST

NOTE: A slightly discharged battery should be used as a fully charged battery may not allow full alternator output.

1) Turn ignition off. Disconnect negative battery cable. Disconnect alternator output wire from terminal "B". Connect positive lead of 100-amp ammeter to terminal "B" and negative lead to disconnected output lead.

CAUTION: Tighten each connection securely as heavy current flow will exist. DO NOT use clips on ammeter. An inductive-type ammeter is recommended.

2) Connect positive voltmeter lead (0-20 volts) to alternator terminal "B" and negative lead to ground. Install tachometer, and reconnect negative battery cable.

3) Ensure voltmeter indicates battery voltage. If voltage is not present, check for open circuit in wire between alternator terminal "B" and negative battery terminal. Check grounds and fusible link.

4) Start engine and turn headlights on. Set headlights at high beam and heater blower switch on HIGH. Increase engine speed to 2500 RPM and note alternator output current on ammeter. Minimum output should be within specification. See ALTERNATOR MINIMUM OUTPUT SPECIFICATIONS table.

NOTE: Output voltage changes with electrical load and temperature. Ensure proper electrical load is applied while checking output. Nominal output may not be obtained if alternator or ambient temperature is excessive. Allow alternator or temperature to cool, and recheck output. Alternator output is stamped on metal plate attached to alternator case.

5) If minimum output is not obtained and alternator wiring is okay, repair alternator. Operate engine at idle speed after the test.

ALTERNATOR MINIMUM OUTPUT SPECIFICATIONS TABLE

Application	Amps
Montero	85

REGULATED VOLTAGE TEST

NOTE: Ensure battery is fully charged and proper drive belt tension exists.

1) Turn ignition switch off. Disconnect negative battery cable. Connect positive voltmeter lead to terminal "S" of alternator. See Fig. 1. Connect negative voltmeter lead to ground.

2) Disconnect alternator output wire from terminal "B". Install a 100-amp ammeter in series with terminal "B" and disconnected output lead. Connect positive lead of ammeter to terminal "B" and negative lead to disconnected output wire. Install a tachometer, and reconnect negative battery cable.

3) Turn ignition switch on and ensure voltmeter indicates battery voltage. If voltage is not present, check for open in wire between alternator terminal "S" and positive battery terminal or fusible link is blown.

4) Start engine. Ensure all lights and accessories are off. Operate engine at 2500 RPM and read voltmeter when alternator output current drops to 10 amps or less. Voltage regulator is okay if voltage output is within specification. See REGULATOR VOLTAGE SPECIFICATIONS table.

REGULATOR VOLTAGE SPECIFICATIONS TABLE

Ambient Temperature	Voltage
-4°F (-20°C)	14.2-15.4
68°F (20°C)	13.9-14.9
140°F (60°C)	13.4-14.6
176°F (80°C)	13.1-14.5

BENCH TESTING

RECTIFIER ASSEMBLY

1) Using ohmmeter, check for continuity between diodes and stator coil lead connection. See Fig. 2. Reverse leads. If continuity is present in both directions, diode is shorted. Replace rectifier assembly.

2) To check entire diode assembly, use an ohmmeter to check for continuity between both ends of each diode. See Fig. 2. Switch ohmmeter leads. Continuity should be present in one direction only. If continuity is not present in both directions, diode is defective. Replace rectifier assembly.

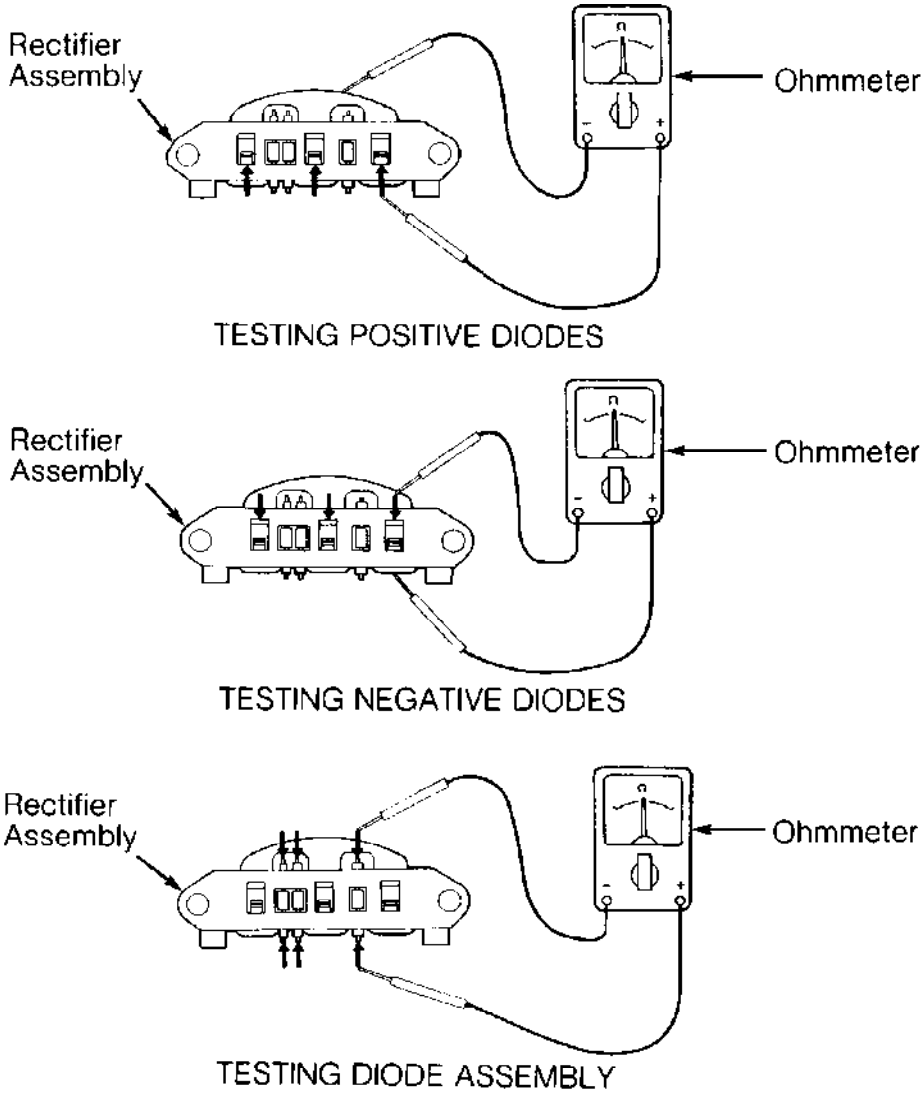

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Fig. 2: Testing Rectifier Assembly
Courtesy of Mitsubishi Motor Sales of America.

ROTOR

1) Check continuity across rotor slip rings. Resistance should be 3-5 ohms. Replace rotor if continuity is not present or resistance is not within specification.

2) Check continuity between individual slip rings and rotor shaft. If continuity is present, rotor coil or slip ring is grounded. Replace rotor.

STATOR

Ensure continuity is not present between stator coil leads and stator core. Check continuity between leads of stator coil. If continuity is not present between coil leads, replace stator.

OVERHAUL

Replace brushes if worn to limit line. Limit line is line closest to rotor contact end of brush. Brushes can be retained in brush holder while installing rotor by inserting wire into back of rear housing. See Fig. 3.

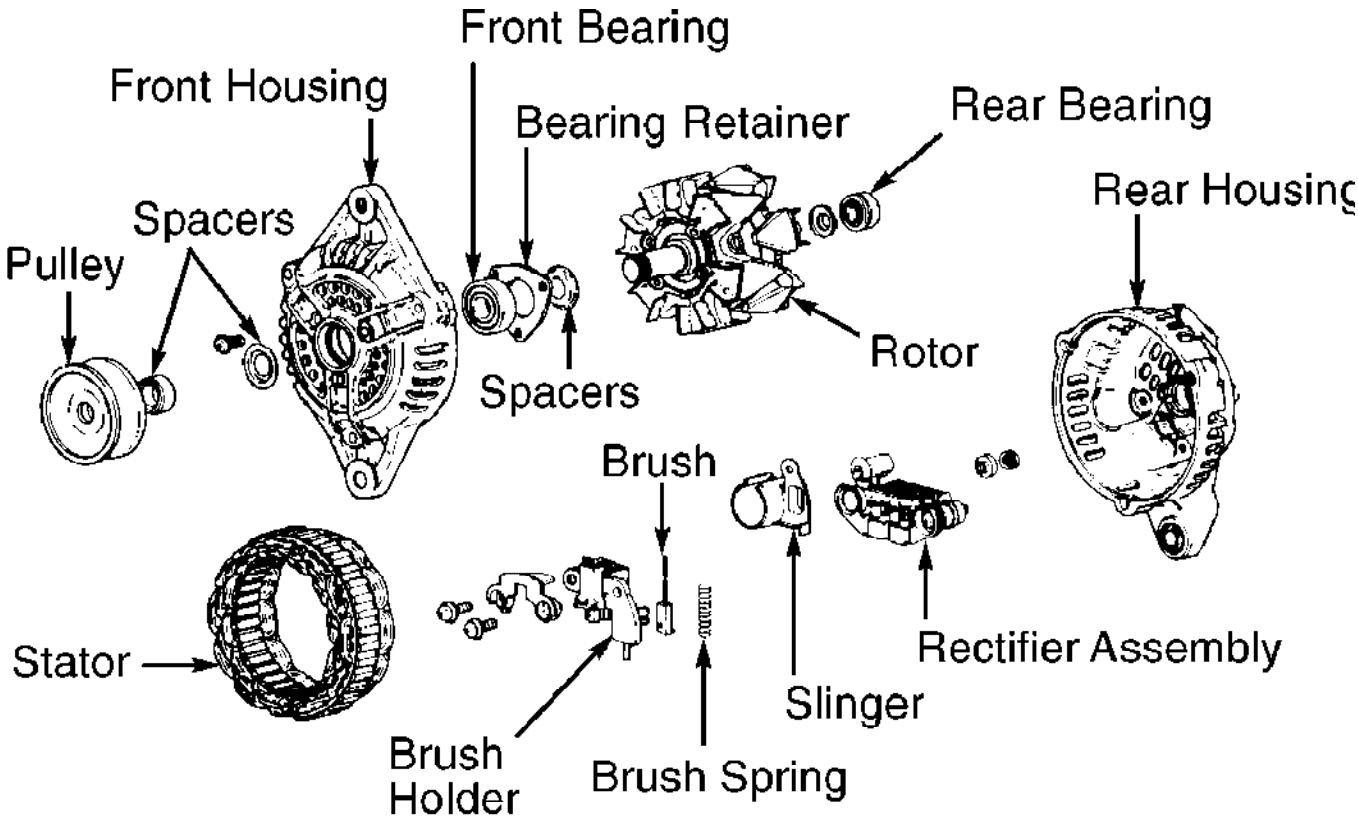

Fig. 3: Exploded View Of Mitsubishi Alternator (Typical)
Courtesy of Mitsubishi Motor Sales of America.

WIRING DIAGRAMS

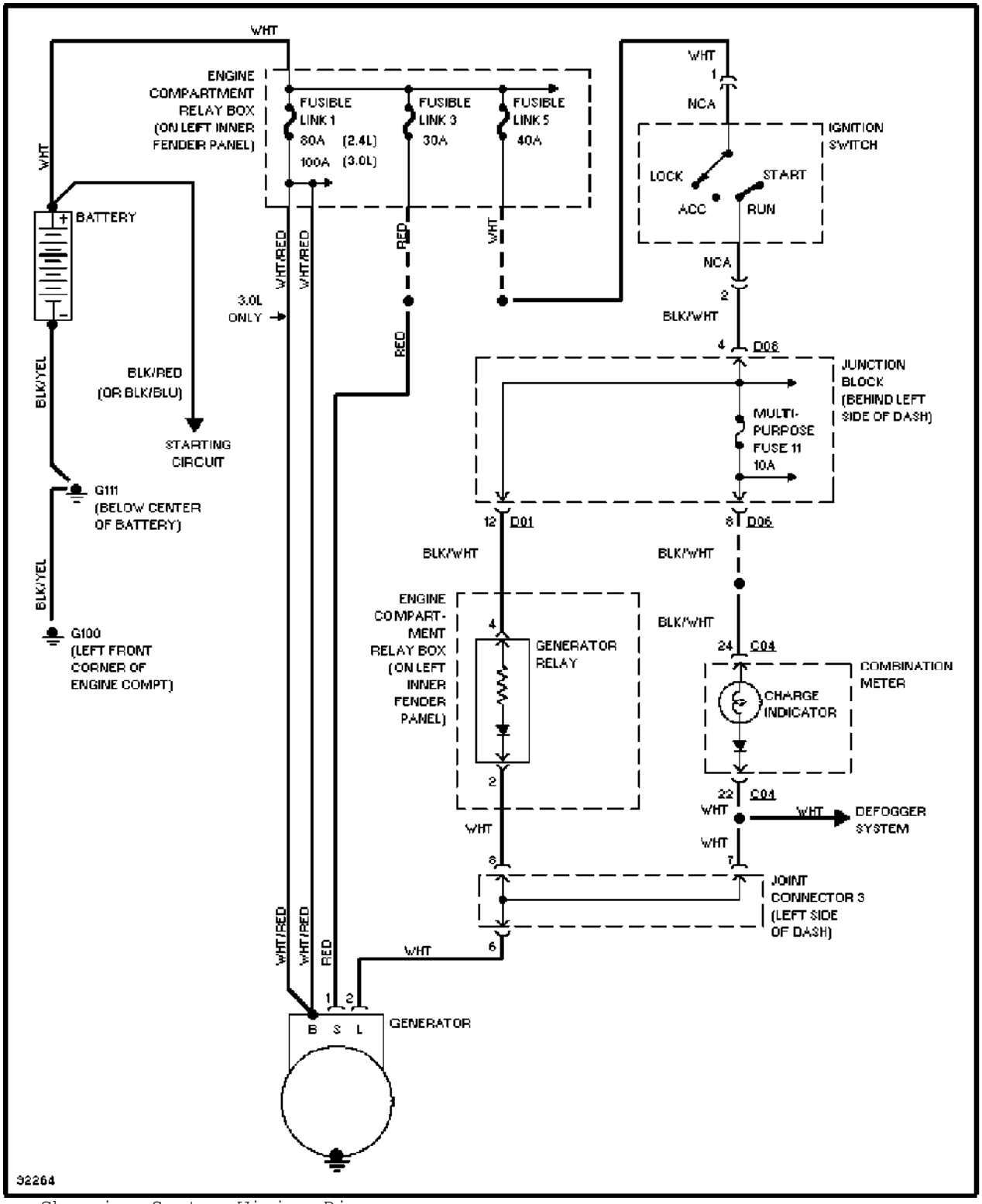

Fig. 4: Charging System Wiring Diagram

HEATER SYSTEM

1997-99 Mitsubishi Montero Sport

1997-99 A/C-HEATER SYSTEMS
Mitsubishi - Heater Systems

Montero Sport

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

DESCRIPTION

Heater assembly is located in passenger compartment. A heater control valve is used to regulate coolant flow and heat output. Heater assembly contains heater core, heater control valve, air ducts, blower motor and intake ducts. See Fig. 1. Heater systems are blend-air type. Sport also has rear heater unit. See Fig. 2.

OPERATION

Heater and fresh air operations are controlled by control knobs and/or levers, which regulate airflow source, temperature setting, airflow direction and blower speed.

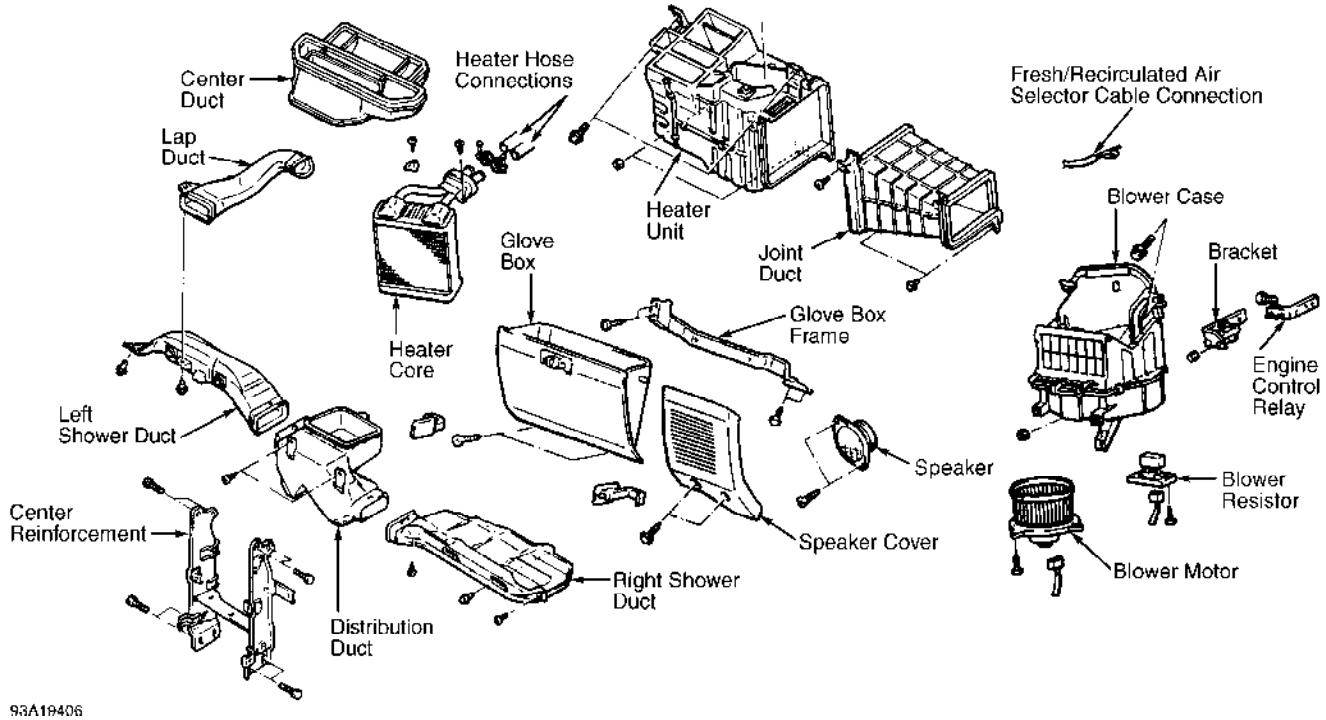

Fig. 1: Exploded View Of Front Heater System Components (Typical)
Courtesy of Mitsubishi Motor Sales of America.

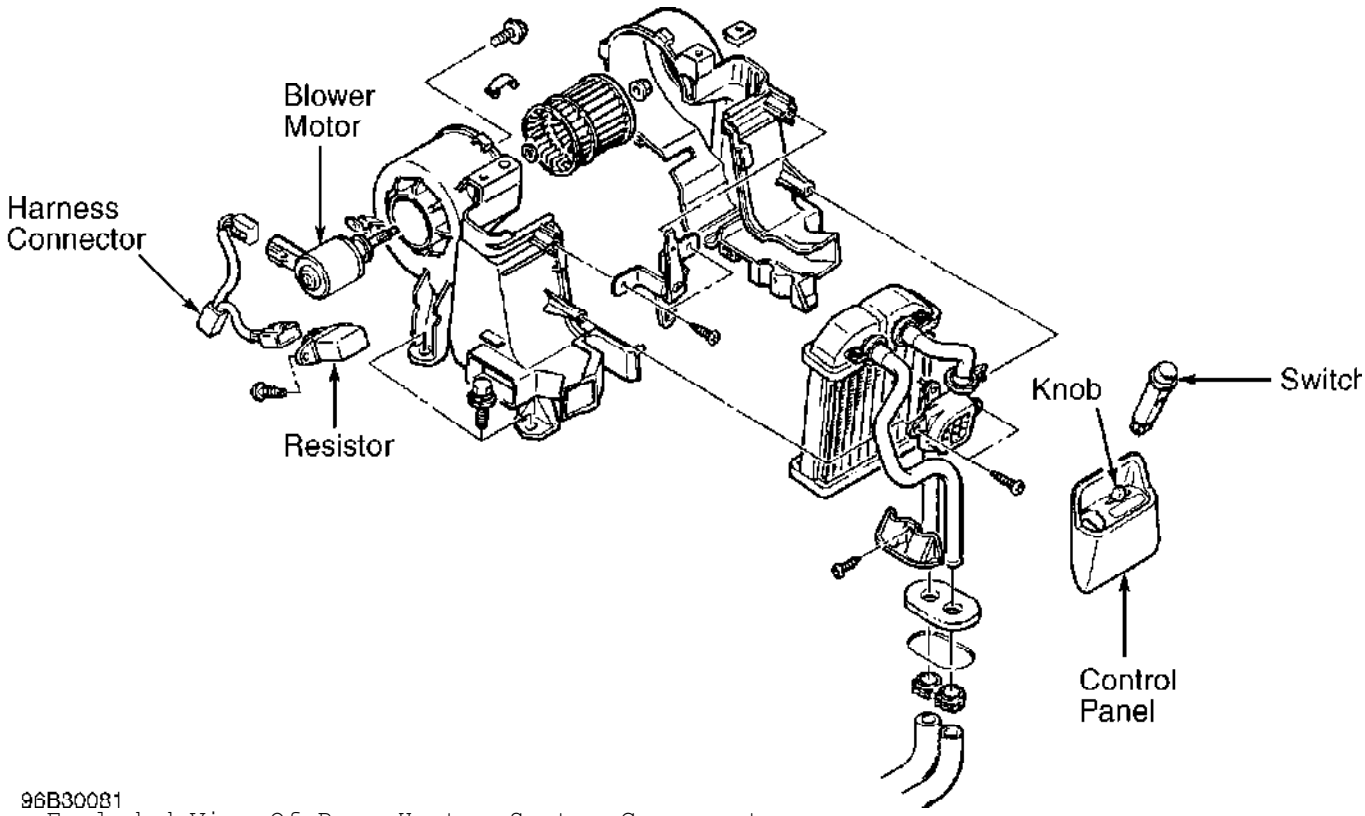

Fig. 2: Exploded View Of Rear Heater System Components
Courtesy of Mitsubishi Motor Sales of America.

FRONT AIR SELECTOR LEVER

This lever is used to select source of airflow. With lever at fresh air setting, outside air is allowed to enter and/or pass through heater. With lever at recirculated air setting, air is recirculated inside passenger compartment.

FRONT BLOWER SWITCH

The front blower switch controls fan speeds to regulate amount of airflow. Fan speed increases as switch is turned/moved to the right.

REAR BLOWER SWITCH

The rear blower switch controls fan speeds to regulate amount of airflow. Blower switch has 3 positions, OFF, ON and HIGH.

FRONT MODE SELECTOR KNOB/LEVER

Depending on position selected, airflow can be directed to different areas of passenger compartment. Airflow selection capabilities include individual areas or a combination of windshield, upper body, knee and/or foot area.

TEMPERATURE CONTROL KNOB/LEVER

Temperature level is selected by moving lever or turning knob left or right. The temperature control cable opens and closes heater

control valve, which determines heat output. Highest heat setting is attained when lever/knob is at right most position. With temperature lever/knob at cool setting, ambient air is used for ventilating.

ADJUSTMENTS

FRONT FRESH/RECIRCULATED AIR SELECTOR CABLE

Place air selector knob at fresh air setting. Set damper lever to fresh air position. See Fig. 3. Connect inner wire of fresh/recirculated air selector cable to damper lever. Move outer cable to remove slack, and secure with clip.

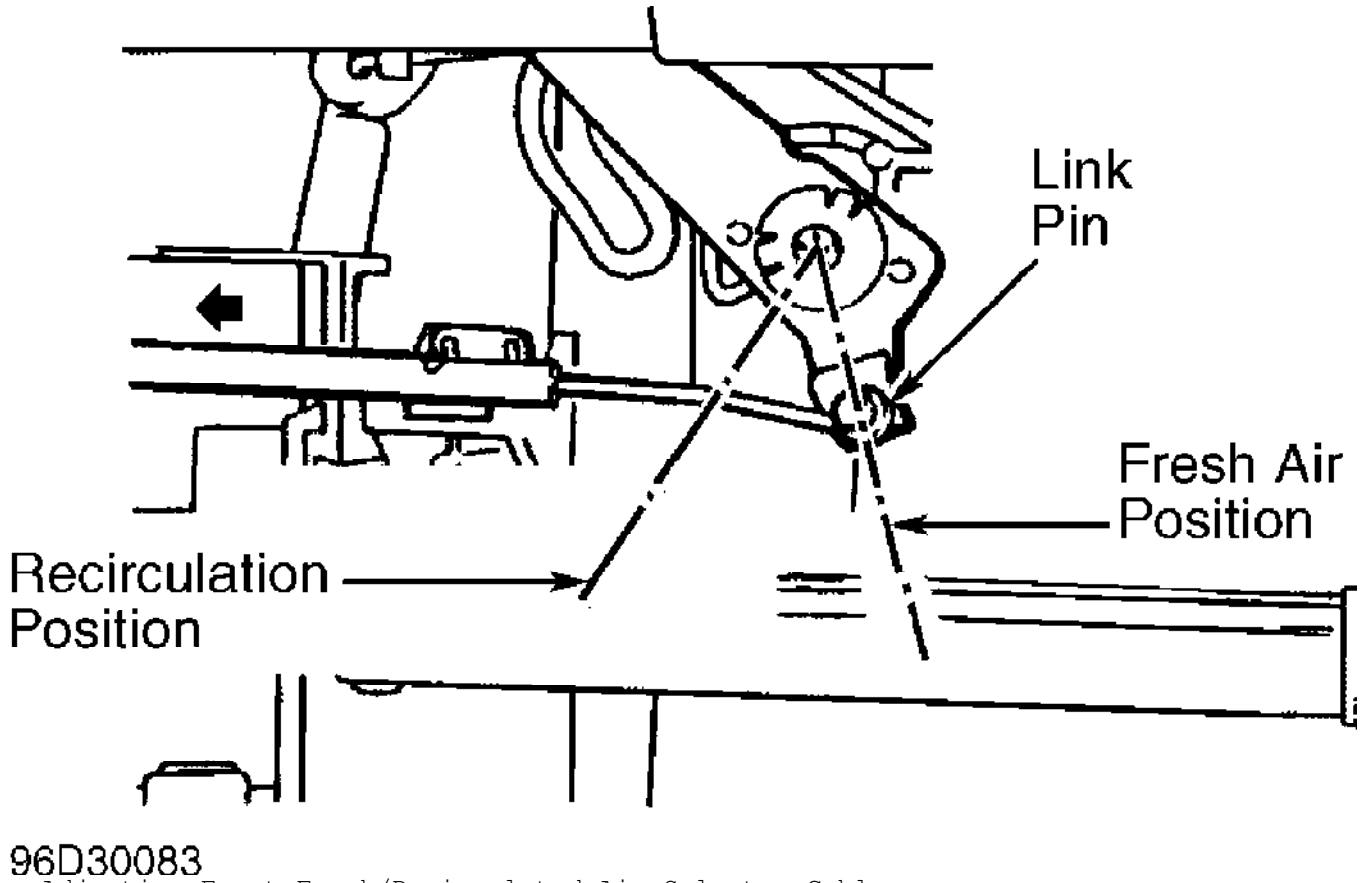

Fig. 3: Adjusting Front Fresh/Recirculated Air Selector Cable
Courtesy of Mitsubishi Motor Sales of America.

FRONT MODE SELECTOR CABLE

Place front mode selector knob at defrost setting. Press damper lever to defrost position. See Fig. 4. Connect inner wire of mode selector cable to damper lever. Move outer cable to remove slack, and secure with clip.

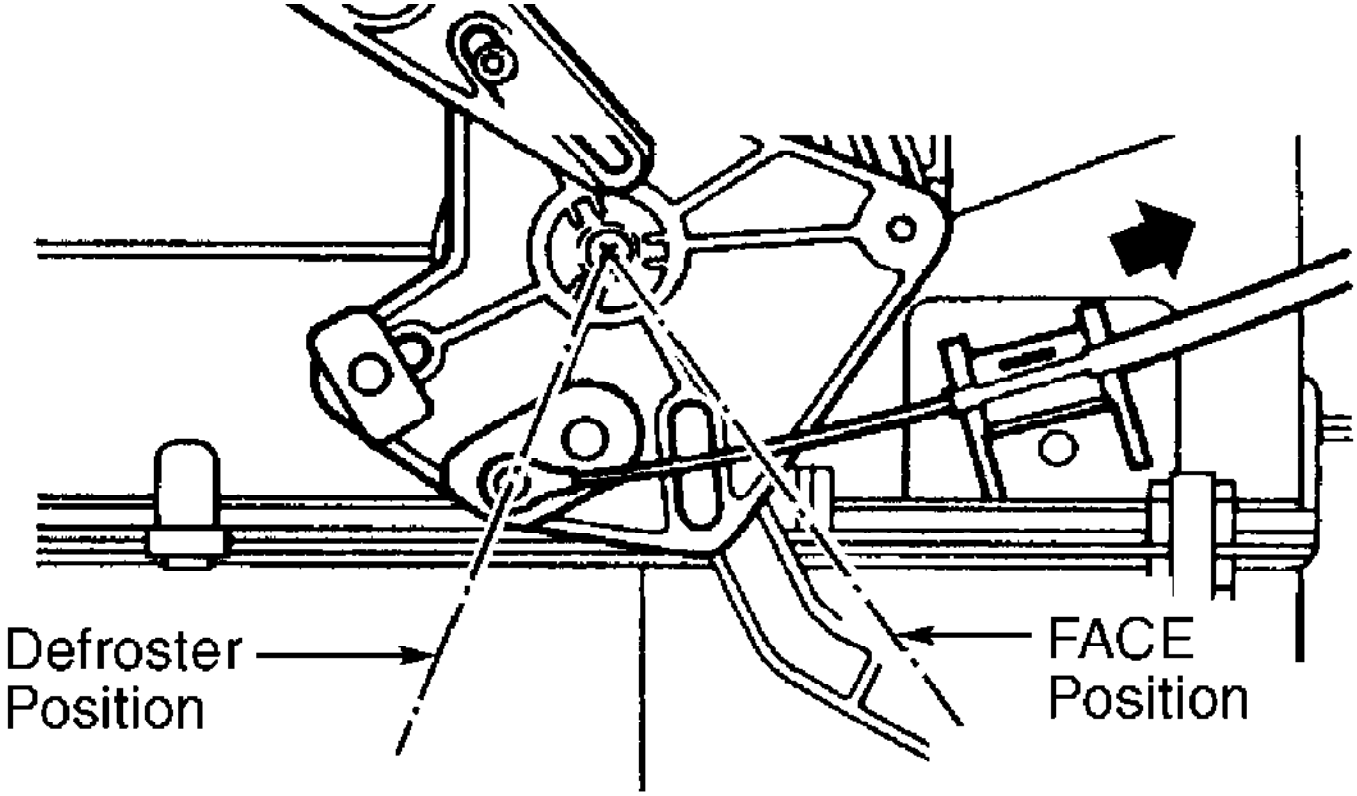

Fig. 4: Adjusting Front Mode Selector Cable
Courtesy of Mitsubishi Motor Sales of America.

FRONT TEMPERATURE CONTROL CABLE

Move front temperature control knob to the extreme right (HOT) position. Push blend air lever to maximum hot position. See Fig. 5. Connect inner wire of temperature control cable to blend air lever. Move outer cable to remove slack, and secure with clip.

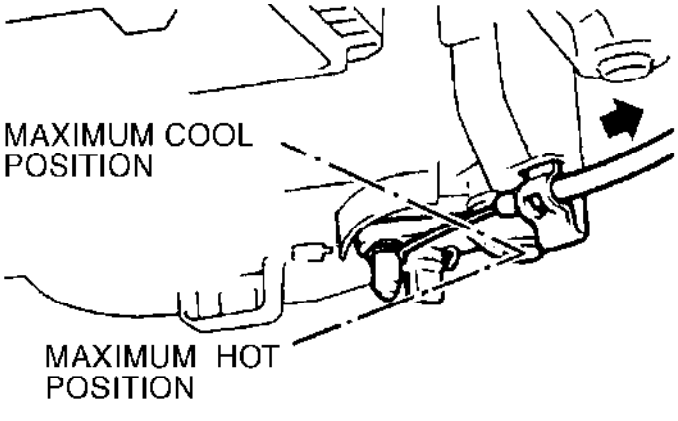

Fig. 5: Adjusting Front Temperature Control Cable
Courtesy of Mitsubishi Motor Sales of America.

TROUBLE SHOOTING

BLOWER MOTOR

If the blower motor will only run at high speed, check blower motor resistor.

INSUFFICIENT HEAT

Obstructed floor outlets or heater hoses. Bound or improperly adjusted dampers. Improperly adjusted control cable. Plugged heater core.

NO FRONT VENTILATION

Improper damper adjustment. Incorrect mode selector cable installation. Improper duct connection, or duct damage.

TESTING

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

FRONT BLOWER SWITCH

Disconnect switch, and check continuity between indicated terminals using ohmmeter. See FRONT BLOWER SWITCH CONTINUITY table. See Fig. 6.

FRONT BLOWER SWITCH CONTINUITY TABLE

Switch Position	Continuity Between Terminal No.
Low	1 & 8; 3 & 5
Medium-Low	1 & 8; 5 & 6
Medium-High	1 & 4; 1 & 8; 2 & 5
High	1 & 4; 1 & 8; 5 & 7

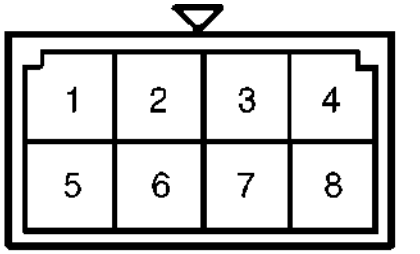

Fig. 6: Identifying Front Blower Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

REAR BLOWER SWITCH

Disconnect switch, and check continuity between indicated terminals using ohmmeter. See REAR BLOWER SWITCH CONTINUITY table. See Fig. 7.

REAR BLOWER SWITCH CONTINUITY TABLE

Switch Position	Continuity Between Terminal No.
Low	2, 4 & 5; 3 & 6
High	2, 4 & 5; 3 & 6

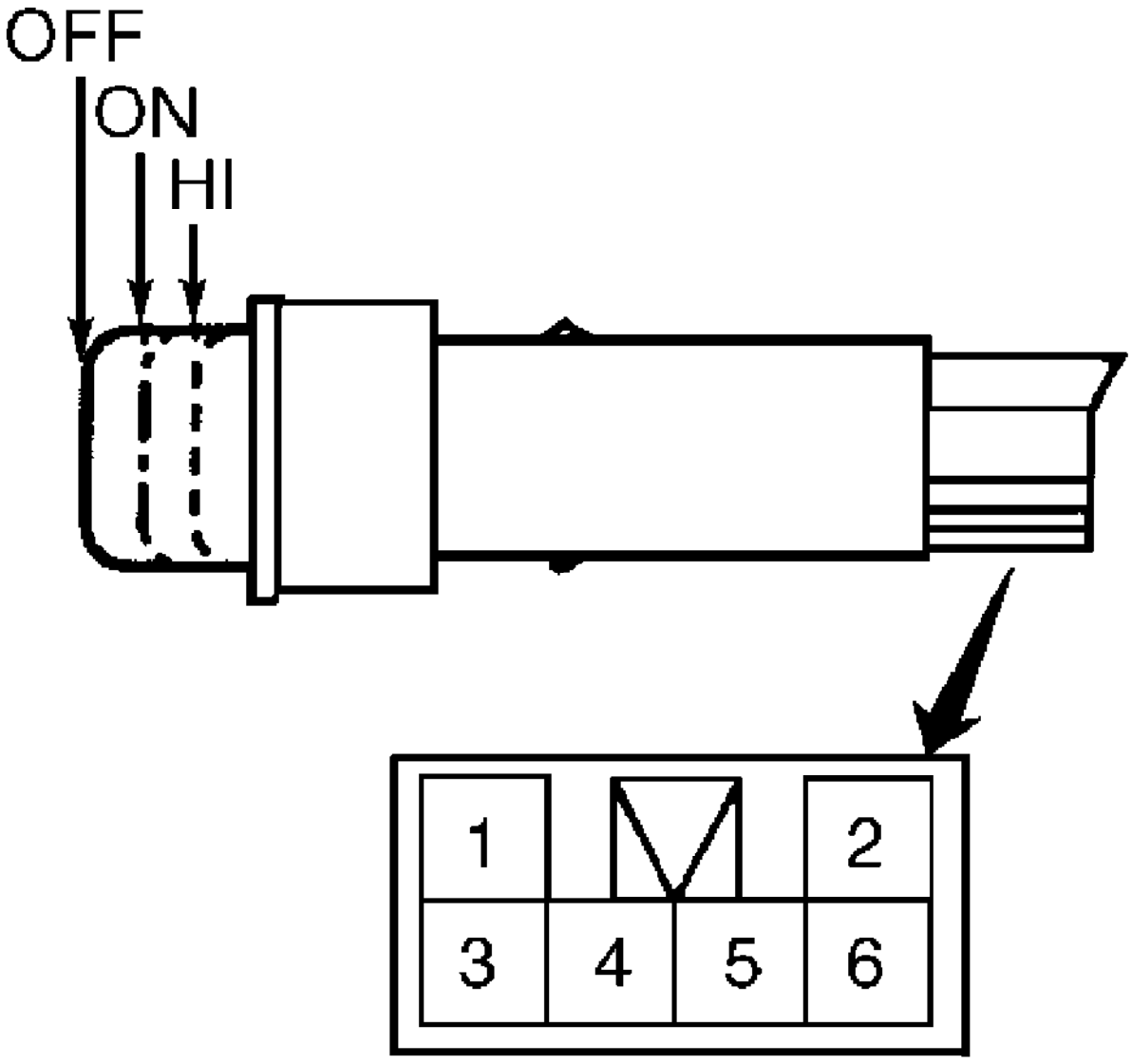

Fig. 7: Identifying Rear Blower Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

FRONT BLOWER MOTOR

Disconnect blower motor connector. Connect battery directly to blower motor terminals. Ensure blower motor operates smoothly. Reverse polarity, and ensure blower motor operates smoothly in the reverse direction. Replace blower motor if it does not function as specified.

REAR BLOWER MOTOR

Disconnect blower motor connector. Connect battery positive directly to blower motor terminal No. 1. Ground terminal No. 3 to check LOW speed operation. Ground terminal No. 4 to check HIGH speed operation. Ensure blower motor operates smoothly. Replace blower motor if it does not function as specified. See Fig. 8.

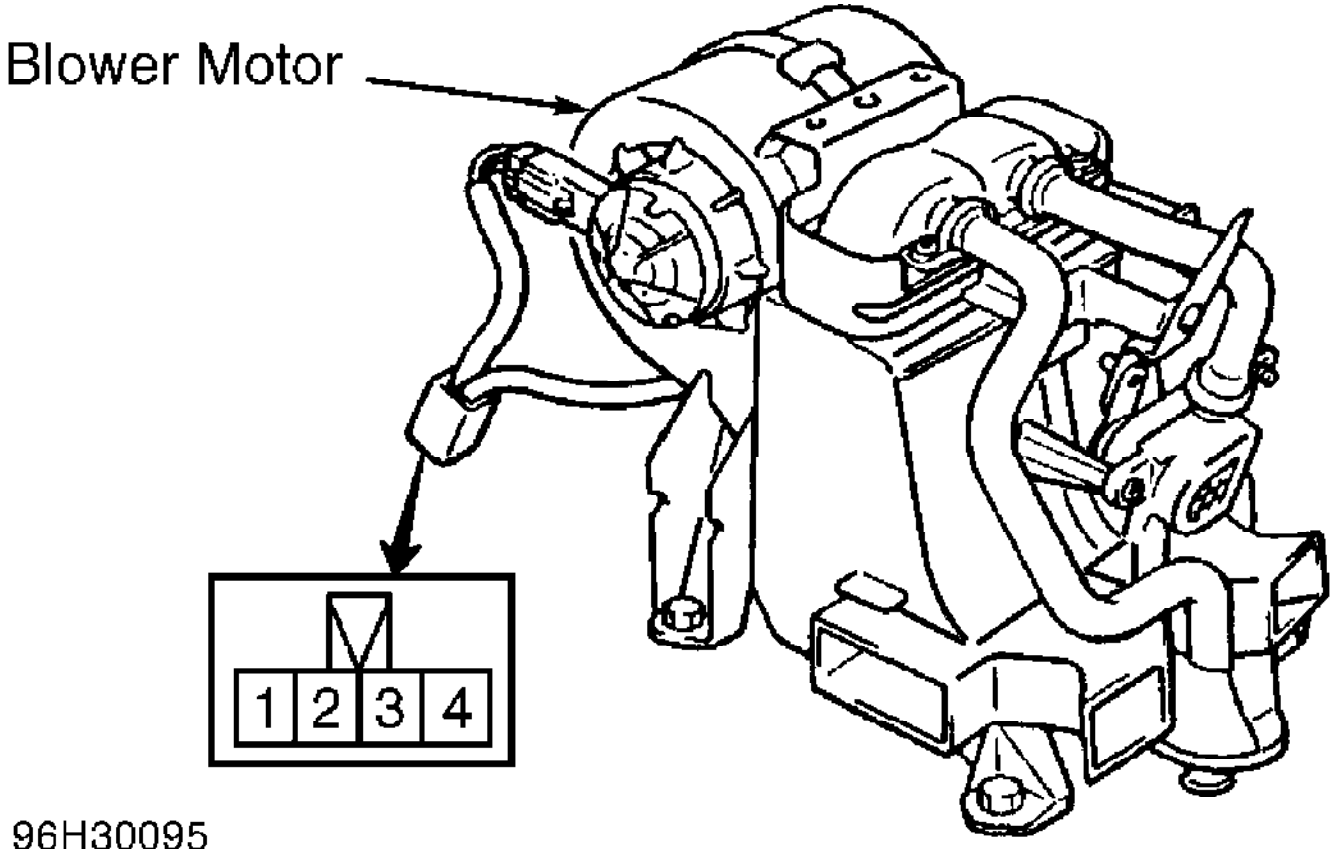

Fig. 8: Identifying Rear Heater Terminals
Courtesy of Mitsubishi Motor Sales of America.

FRONT BLOWER MOTOR RELAY

1) Remove blower motor relay from junction block, located under hood on driver's side fenderwell. Using ohmmeter, check continuity between terminals No. 4 and No. 5. See Fig. 9. Continuity should not exist.

2) Check continuity between terminals No. 1 and 3. Ensure continuity is present. Connect 12-volt battery to terminals No. 1 and 3. See Fig. 9. Ensure continuity exists between terminals No. 4 and 5 with voltage applied. If continuity is not as specified, replace relay.

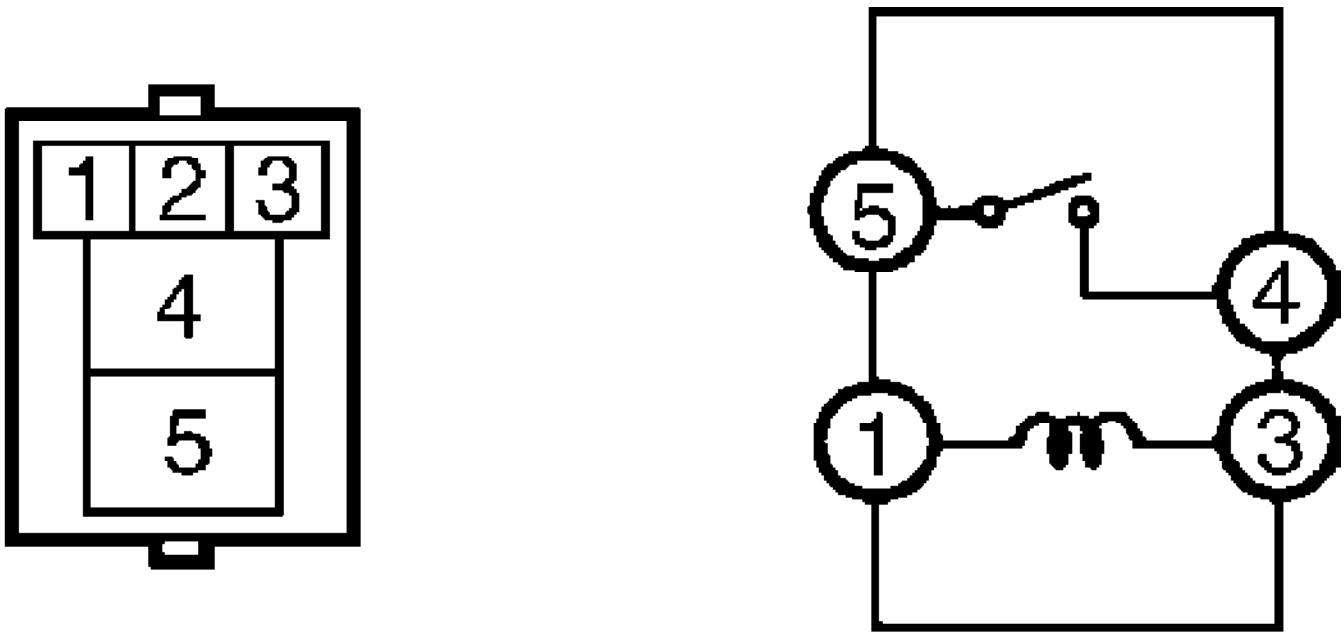

Fig. 9: Identifying Blower Relay Terminals
Courtesy of Mitsubishi Motor Sales of America.

FRONT BLOWER MOTOR RESISTOR

Disconnect harness connector from resistor, located in blower assembly. See Fig. 1. Using ohmmeter, check resistance between indicated terminals. See FRONT BLOWER MOTOR RESISTOR RESISTANCE table. See Fig. 10. If resistance is not as specified, replace resistor.

BLOWER MOTOR RESISTOR RESISTANCE TABLE

Terminal No.	Ohms
1 & 3	0.68
2 & 3	2.00
3 & 4	1.10

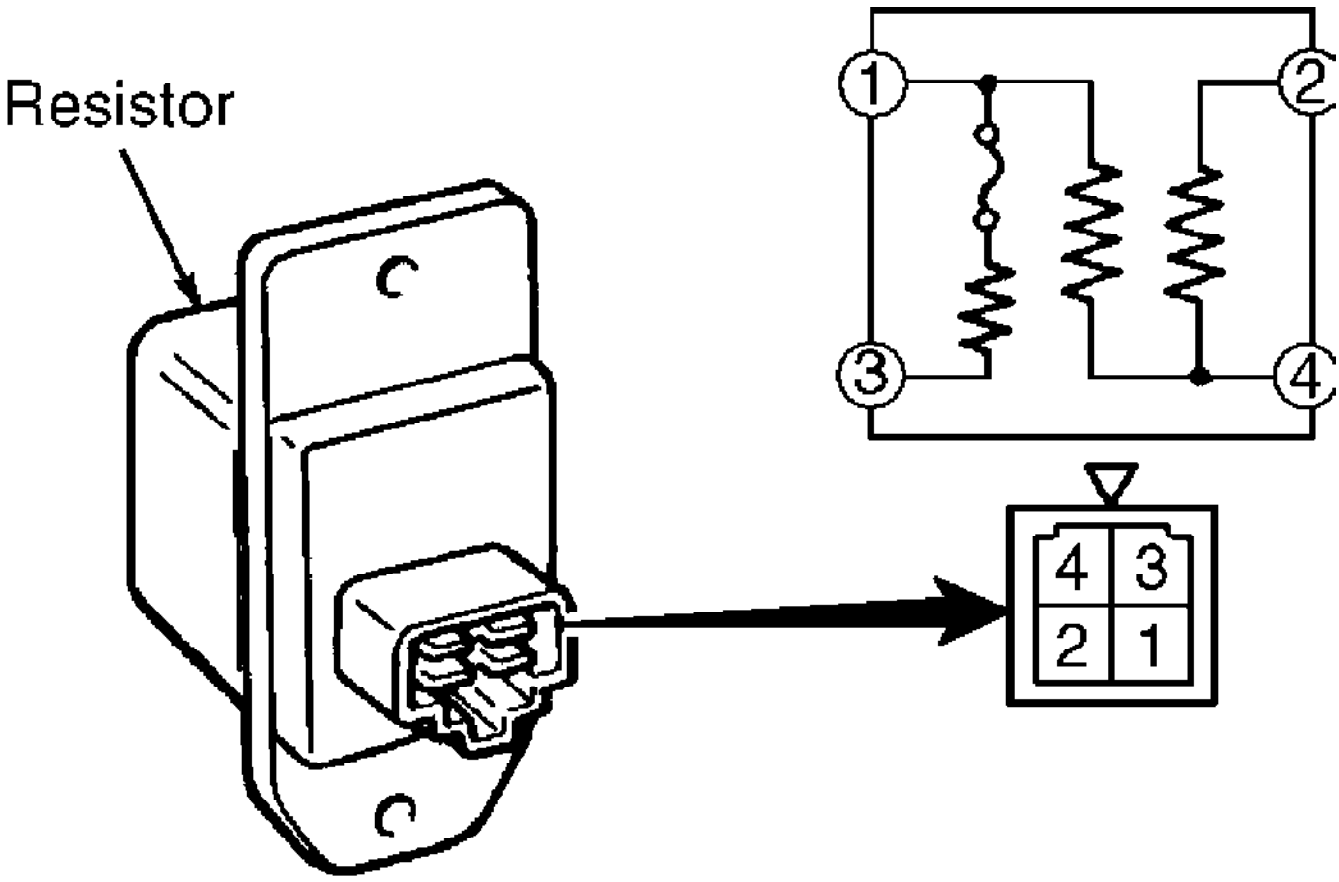

Fig. 10: Identifying Blower Motor Resistor Terminals
Courtesy of Mitsubishi Motor Sales of America.

REAR BLOWER MOTOR RESISTOR

Disconnect harness connector. See Fig. 2. Using ohmmeter, check resistance between terminals No. 3 and 4. See Fig. 8. If resistance is not 39 ohms, replace resistor.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: To avoid injury from accidental air bag deployment, read and follow all SERVICE PRECAUTIONS and DISABLING & ACTIVATING AIR BAG SYSTEM procedures in AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

CAUTION: When removing or installing floor console, DO NOT allow any impact or shock to Supplemental Restraint System Electronic Control Unit (SRS-ECU).

FRONT HEATER UNIT & HEATER CORE

Removal

1) Deactivate air bag system. See the AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section. Remove front and rear floor consoles. Remove hood release handle. Remove fuel door release handle. Remove knee protector and support brackets. Remove speaker covers.

NOTE: On A/T models, when removing front floor console, set A/T selector lever in "L" position.

2) Remove glove box door stop, glove box and glove box frame. Remove passenger-side air bag module. Remove heater control panel cover. Remove heater control panel and radio. Remove plug from instrument cluster cover. Remove instrument cluster cover and instrument cluster.

3) Remove steering column cover. Remove clock or plug. Remove side defroster covers. Remove side mirror control switch. Remove front speakers.

4) Remove rheostat, rear wiper/washer switch, and door lock switch. Remove steering column bolts and instrument panel. Drain coolant and disconnect heater hoses from heater unit.

5) Remove shower ducts, lap duct, joint duct and center duct. See Fig. 1. Remove center reinforcement. Remove heater unit. Remove distribution duct. Remove heater core.

Installation

Install heater core, distribution duct, heater unit and center reinforcement. Install remaining ducts in reverse order of removal. Install instrument panel. Tighten steering column bolts to 16 ft. lbs. (22 N.m). Install and adjust ventilation control cable. See ADJUSTMENTS. To complete installation, reverse removal procedure. Fill cooling system and check for leaks.

REAR HEATER UNIT & HEATER CORE

Removal

Drain coolant. Remove rear floor console. Remove resistor. See Fig. 2. Disconnect heater hoses. Remove heater core assembly. Remove heater core.

Installation

To install, reverse removal procedure. Fill coolant and check for leaks.

FRONT HEATER CONTROL PANEL

Removal & Installation

1) Remove right side foot shower duct. Remove glove box door stops. Disconnect fresh/recirculated air selector cable and temperature control cable. Remove knee protector. Remove lap duct and left shower duct. See Fig. 1. Disconnect mode selector wire.

2) Remove heater control panel cover and panel. Remove heater control panel bezel and knobs. Remove blower switch. Using a screwdriver, remove wire clips. Remove heater control cables from heater control panel. To install, reverse removal procedure. Adjust heater control cables. See ADJUSTMENTS.

REAR HEATER CONTROL PANEL

Removal & Installation

Remove knob. See Fig. 2. Remove rear heater control panel. Disconnect wiring. To install, reverse removal procedure.

FRONT BLOWER ASSEMBLY

Removal & Installation

Remove glove box, speaker cover and speaker or corner cover. See Fig. 1. Remove glove box frame. Disconnect right shower duct. Remove engine control relay and bracket. Disconnect fresh/recirculated air selector cable and joint duct. Remove blower assembly. To install, reverse removal procedure. Adjust air selector cable. See ADJUSTMENTS.

REAR BLOWER ASSEMBLY

Removal

Drain coolant. Remove rear floor console. Remove resistor. Disconnect heater hoses at rear heater. Remove heater core assembly. Remove blower motor. See Fig. 2.

Installation

To install, reverse removal procedure. Fill coolant and check for leaks.

WIRING DIAGRAMS

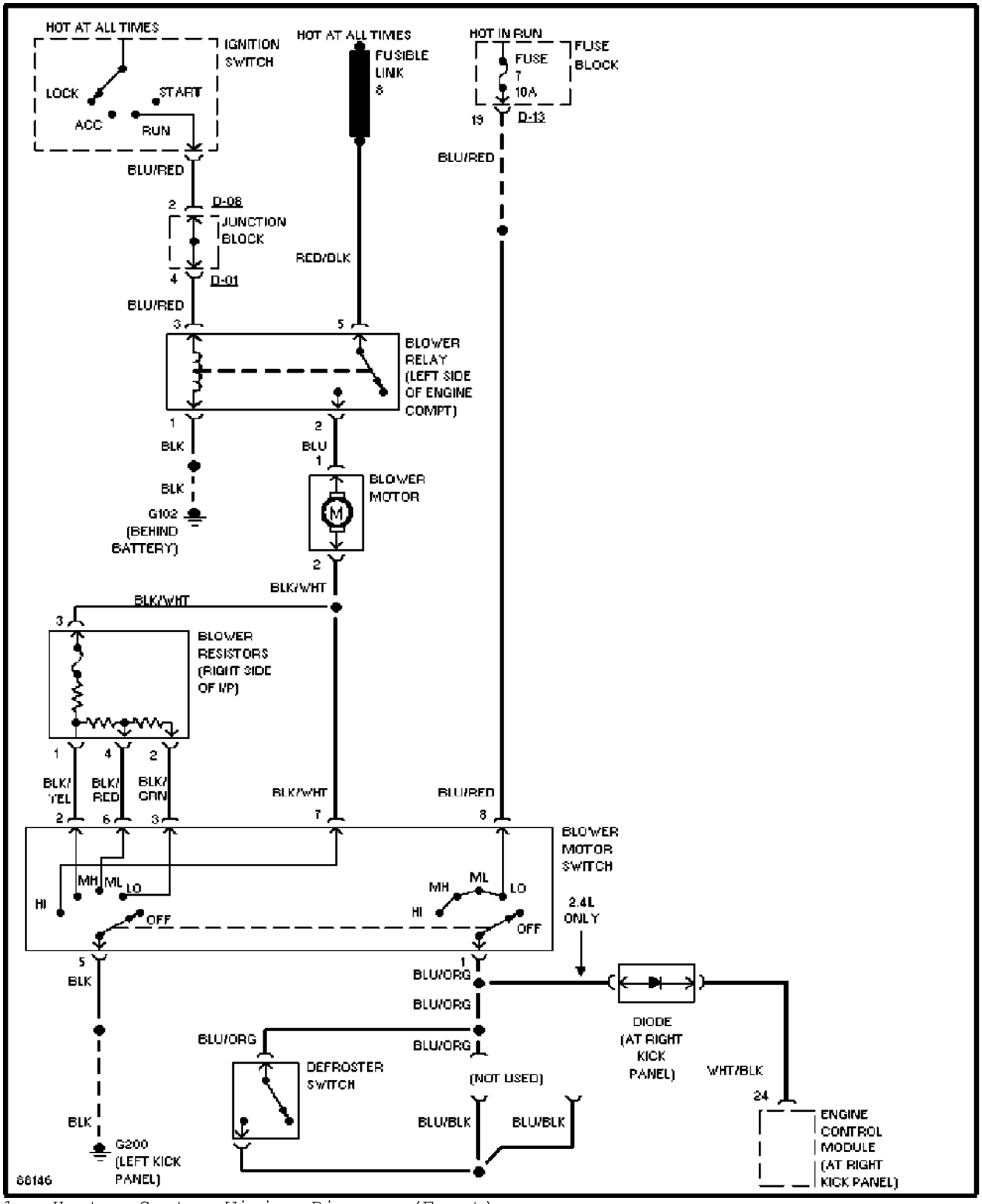

Fig. 11: Heater System Wiring Diagram (Front)

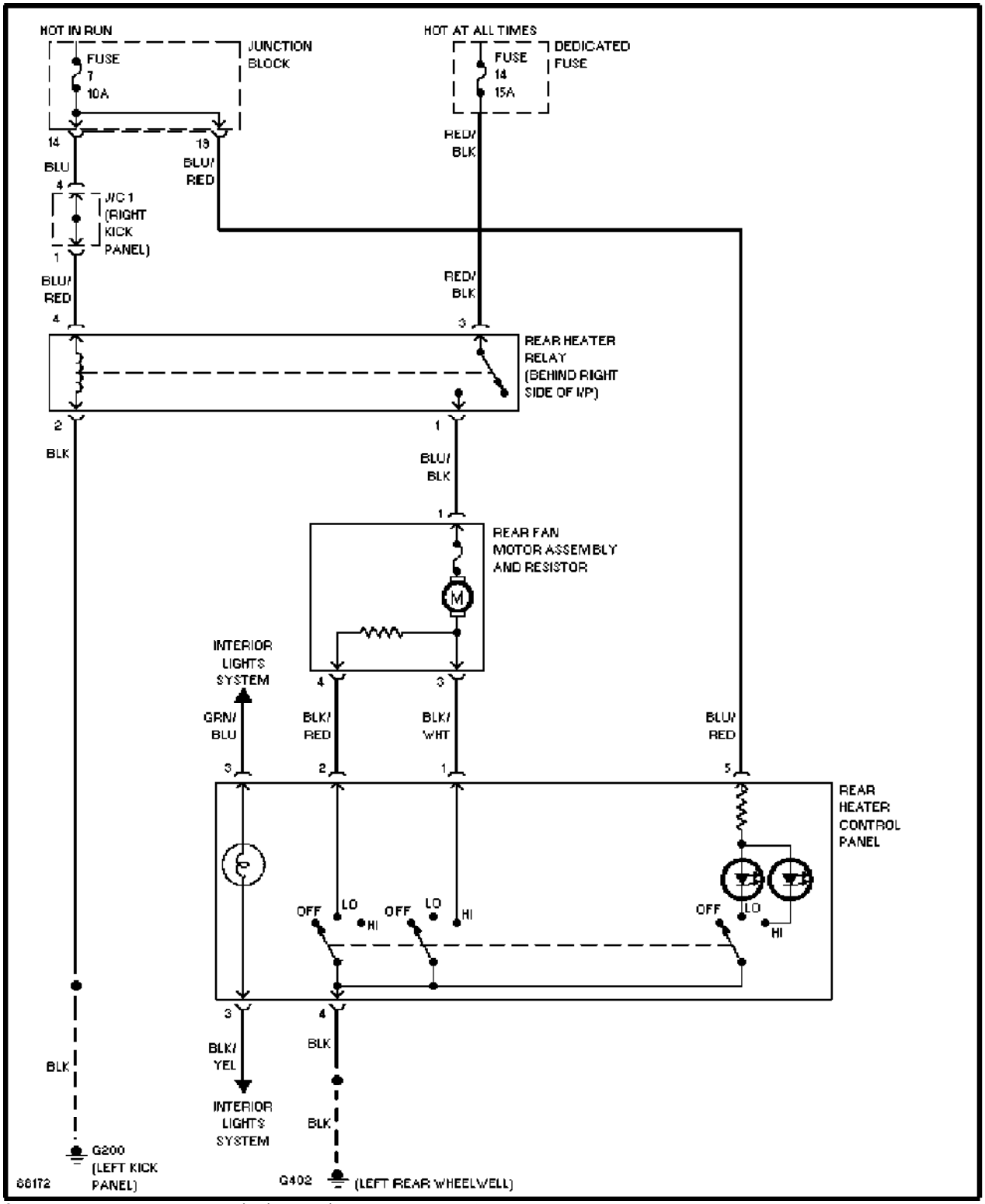

Fig. 12: Heater System Wiring Diagram (Rear)

HOW TO USE SYSTEM WIRING DIAGRAMS

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Using Wiring Diagrams

All Models

INTRODUCTION

This CD obtains wiring diagrams and technical service bulletins, containing wiring diagram changes from the domestic and import manufacturers. These are checked for accuracy and are all redrawn into a consistent format for easy use.

In the past, when cars were simpler, diagrams were simpler. All components were connected by wires and diagrams seldom exceeded 4 pages in length. Today, some wiring diagrams require more than 16 pages. It would be impractical to expect a service technician to trace a wire from page 1 across every page to page 16.

Removing some of the wiring maze reduces eyestrain and time wasted searching across several pages. Today the majority of these diagrams follow a much improved format, which permits space for internal switch details.

Wiring diagrams are drawn in a "top-down" format. The diagrams are drawn with the power source at the top of the diagram and the ground point at the bottom of the diagram. Components locations are identified on the wiring diagrams. Any wires that don't connect directly to a component are identified on the diagram to indicate where they go.

COLOR ABBREVIATIONS

COLOR ABBREVIATIONS TABLE

Color	Normal	Optional
Black	BLK	BK
Blue	BLU	BU
Brown	BRN	BN
Clear	CLR	CR
Dark Blue	DK BLU	DK BU
Dark Green	DK GRN	DK GN
Green	GRN	GN
Gray	GRY	GY
Light Blue	LT BLU	LT BU
Light Green	LT GRN	LT GN
Orange	ORG	OG
Pink	PNK	PK
Purple	PPL	PL
Red	RED	RD
Tan	TAN	TN
Violet	VIO	VI
White	WHT	WT
Yellow	YEL	YL

IDENTIFYING WIRING DIAGRAM ABBREVIATIONS

NOTE: Abbreviations used on these diagrams are normally self-explanatory. If necessary see ABBREVIATIONS

article in GENERAL INFORMATION.

IDENTIFYING WIRING DIAGRAM SYMBOLS

NOTE: Standard wiring symbol are used in these diagrams. The illustration below will help clarify any symbols that are not easily understood at a glance. Most components are labeled "Motor", "Switch" or "Relay" in addition to being drawn with the standard symbol.

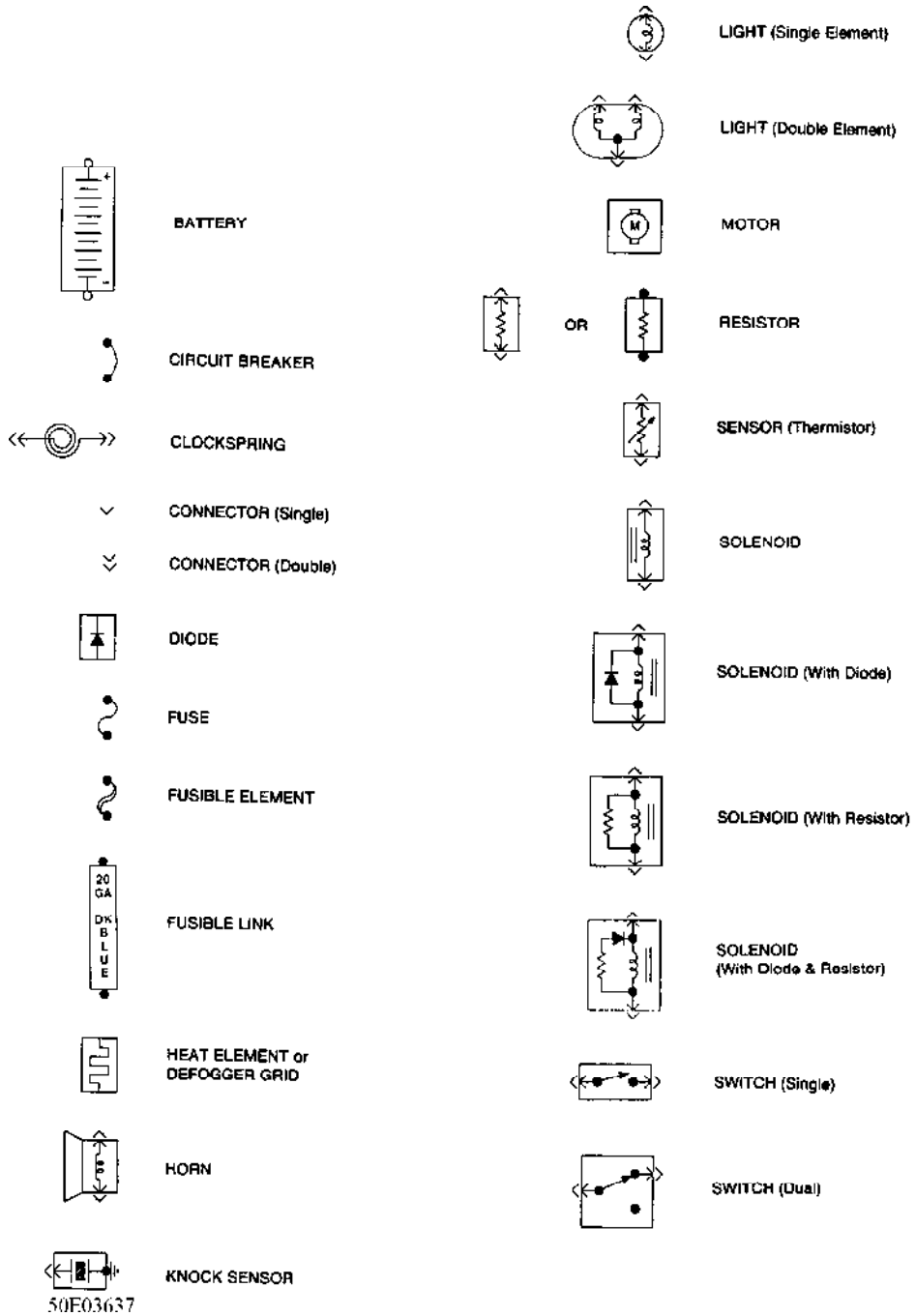

Fig. 1: Identifying Wiring Diagram Symbols

WIRING DIAGRAM COMPONENT LOCATIONS

When trying to locate a component in a wiring diagram and you don't know the specific system where it is located, use this handy component locator to find the system wiring diagram in which the component is located. Then, go to that system and locate the component within the wiring diagram.

For example, if you don't know the specific system in which the ignition switch is located, look up ignition switch in the wiring diagram component location tables and go to the appropriate wiring diagram(s) which contain either full or partial views of the ignition switch. The full view of the ignition switch is located in Power Distribution.

The first listing for the component will be the full or most complete view of the component. Additional listings will be partial views of the component. Not all components are used on all models.

All components will have a partial view in Ground Distribution and Power Distribution. Data Link Connectors show connecting circuits between modules. Alternate names for components may be listed in wiring diagram component locations tables.

WIRING DIAGRAM COMPONENT LOCATIONS TABLE

Component	Wiring Diagram
ABS Electronic Control Unit	Anti-Lock Brakes
	Data Link Connectors
ABS Hydraulic Unit	Anti-Lock Brakes
Acceleration Sensor	Anti-Lock Brakes
Accessory Delay Relay	Power Windows
A/C Compressor Clutch Relay	Engine Performance
A/C Sensor	Engine Performance
A/C Pressure Switch	Engine Performance
Adaptive Lamp Control Module	Exterior Lights
Air Bag(s)	Air Bag Restraint System
Air Bag Module	Air Bag Restraint System
Air Bag Sensor(s)	Air Bag Restraint System
Air Injection Pump Relay	Engine Performance
Air Temperature Sensor	Overhead Console
Alternator (Generator)	Generators & Regulators
Anti-Theft Control Module	Anti-Theft System
	Starters
Autolamp Control Relay	Headlight Systems
	Daytime Running Lights
Automatic Shutdown (ASD) Relay	Engine Performance
	Generators & Regulators
Autostick Switch	Engine Performance
Auxiliary Battery Relay	Generators & Regulators
Back-Up Lights	Back-Up Lights
	Exterior Lights
Barometric (BARO) Pressure Sensor	Engine Performance
Battery	Power Distribution
Battery Temperature Sensor	Engine Performance
Body Control Module	Body Control Computer
	Anti-Theft System
	Daytime Running Lights
	Engine Performance
	Headlight Systems
	Warning Systems
Boost Control Solenoid	Engine Performance
Boost Sensor	Engine Performance
Brake Fluid Level Switch	Analog Instrument Panels

Brake On/Off (BOO) Switch ..... Cruise Control Systems
Engine Performance
Shift Interlock Systems
Buzzer Module ..... Warning Systems
Camshaft Position (CMP) Sensor ..... Engine Performance
Central Control Module ..... Anti-Theft System
Clockspring ..... Air Bag Restraint System
Cruise Control Systems
Steering Column Switches
Clutch Pedal Position Switch ..... Starters
Clutch Start Switch ..... Starters
Combination Meter ..... Analog Instrument Panels
Constant Control Relay Module (CCRM) ..... Engine Performance
Electric Cooling Fans
Convenience Center ..... Power Distribution
Illumination/Interior Lights
Convertible Top Motor ..... Power Convertible Top
Convertible Top Switch ..... Power Convertible Top
Crankshaft Position (CKP) Sensor ..... Engine Performance
Cruise Control Module ..... Cruise Control Systems
Cruise Control Switch ..... Cruise Control Systems
Condenser Fan Relay(s) ..... Electric Cooling Fans
Data Link Connector (DLC) ..... Engine Performance
Daytime Running Lights Module ..... Daytime Running Lights
Exterior Lights
Defogger Relay ..... Rear Window Defogger
Diagnostic Energy Reserve Module (DERM) ... Air Bag Restraint System
Discriminating Sensor (Air Bag) ..... Air Bag Restraint System
Distributor ..... Engine Performance
Door Lock Actuators ..... Power Door Locks
Remote Keyless Entry
Door Lock Relay(s) ..... Power Door Locks
Electrochromic Mirror ..... Power Mirrors
Electronic Level Control (ELC)
Height Sensor ..... Electronic Suspension
Electronic Level Control (ELC) Module ..... Electronic Suspension
Engine Coolant Temperature (ECT)
Sending Unit ..... Analog Instrument Panels
Engine Coolant Temperature (ECT) Sensor ..... Engine Performance
Engine Control Module ..... Engine Performance
Generators & Regulators
Starters
ETACS ECU ..... Warning Systems
Power Windows
Remote Keyless Entry
Evaporative (EVAP) Emissions Canister ..... Engine Performance
EVAP Canister Purge Solenoid ..... Engine Performance
EVAP Canister Vent Solenoid ..... Engine Performance
Exhaust Gas Recirculation (EGR) Valve ..... Engine Performance
Fuel Tank Vacuum Sensor ..... Engine Performance
Fog Lights ..... Headlight Systems
Daytime Running Lights
Fog Light Relay ..... Headlight Systems
Daytime Running Lights
Fuel Door Release Solenoid ..... Power Fuel Door Release
Fuel Gauge Sending Unit ..... Analog Instrument Panels
Fuel Injectors ..... Engine Performance
Fuel Pump ..... Engine Performance
Fuel Pump Relay ..... Engine Performance
Power Distribution
Fuse/Relay Block ..... Power Distribution
Fusible Links ..... Power Distribution
Generators & Regulators

Starters
Generator ..... Generators & Regulators
Engine Performance
Power Distribution
Generic Electronic Module (GEM) ..... Body Control Modules
Electronic Suspension
Glow Plug Relay ..... Engine Performance
Glow Plugs ..... Engine Performance
Grounds ..... Ground Distribution
Headlight Door Module ..... Headlight Doors
Headlight Relay ..... Headlight Systems
Daytime Running Lights
Headlights ..... Headlight Systems
Daytime Running Lights
Heated Oxygen Sensor(s) (HO2S) ..... Engine Performance
Heated Windshield Control Module ..... Heated Windshields
Height Sensor ..... Electronic Suspension
Horns ..... Steering Column Switches
Horn Relay ..... Steering Column Switches
Idle Air Control (IAC) Motor/Valve ..... Engine Performance
Ignition Coil(s) ..... Engine Performance
Ignition Key Lock Cylinder ..... Anti-Theft System
Ignition Module ..... Engine Performance
Ignition Switch ..... Power Distribution
Engine Performance
Generators & Regulators
Starters
Illuminated Entry Module ..... Illumination/Interior Lights
Illumination Lights ..... Illumination/Interior Lights
Impact Sensor ..... Air Bag Restraint System
Inertia Fuel Shutoff Switch ..... Engine Performance
Inhibit Relay ..... Starters
Instrument Cluster ..... Analog Instrument Panels
Intake Air Temperature (IAT) Sensor ..... Engine Performance
Interior Lights ..... Illumination/Interior Lights
Interlock Switch ..... Starters
Junction Block ..... Power Distribution
Keyless Entry Receiver ..... Remote Keyless Entry
Key Reminder Switch ..... Starters
Knock Sensor ..... Engine Performance
Lamp Control Module ..... Exterior Lights
License Plate Lamp ..... Exterior Lights
Lighting Control Module ..... Lighting Control Modules
Anti-Theft System
Daytime Running Lights
Headlight Systems
Lower Relay ..... Power Convertible Top
Malfunction Indicator Light (MIL) ..... Engine Performance
Instrument Panels
Manifold Absolute Pressure (MAP) Sensor ..... Engine Performance
Mass Airflow (MAF) Sensor ..... Engine Performance
Mega Fuse ..... Generators & Regulators
Memory Seat/Mirror Module ..... Memory Systems
Mirror Defogger ..... Rear Window Defogger
Moon Roof Motor ..... Power Moon Roof
Moon Roof Relay ..... Power Moon Roof
Multi-Function Control Module ..... Warning Systems
Neutral Safety Switch ..... Starters
Oil Level Switch ..... Engine Performance
Oil Pressure Switch/Sending Unit ..... Analog Instrument Panels
Engine Performance
Overhead Console ..... Overhead Console
Oxygen Sensor(s) (O2S) ..... Engine Performance

Parking Brake Switch ..... Analog Instrument Panels
Park Lights ..... Exterior Lights
Park/Neutral Position Switch ..... Starters
Engine Performance
Anti-Theft System
Body Control Module
Perimeter Lighting Control Relay ..... Exterior Lights
Power Amplifier ..... Power Antennas
Power Antenna Module ..... Power Antennas
Power Antenna Motor ..... Power Antennas
Power Distribution Center ..... Power Distribution
Generators & Regulators
Starters
Power Door Lock Motors ..... Power Door Locks
Power Mirror Motors ..... Power Mirrors
Memory Systems
Power Sliding Door Controller ..... Power Sliding Side Door
Power Seat Motors ..... Power Seats
Memory Systems
Power Steering Pressure Switch ..... Engine Performance
Power Top Motor ..... Power Convertible Top
Power Top Relay(s) ..... Power Convertible Top
Powertrain Control Module ..... Engine Performance
Analog Instrument Panels
Cruise Control Systems
Data Link Connectors
Generators & Regulators
Starters
Power Window Motors ..... Power Windows
Power Window Relay(s) ..... Power Windows
Radiator Fan Motor(s) ..... Electric Cooling Fans
Radiator Fan Relay(s) ..... Engine Performance
Electric Cooling Fans
Rainsense Module ..... Wiper/Washer Systems
Raise Relay ..... Power Convertible Top
Remote Anti-Theft Personality (RAP) Module ..... Anti-Theft System
Starters
Warning Systems
Seat Belt Pretensioners ..... Air Bag Restraint System
Seat Belt Retractor Solenoid ..... Passive Restraints
Seat Belt Switch ..... Air Bag Restraint System
Passive Restraints
Shift Interlock Solenoid ..... Shift Interlock Systems
Shift Lock Actuator ..... Shift Interlock Systems
Side Marker Lights ..... Exterior Lights
SIR Coil Assembly (Clockspring) ..... Air Bag Restraint System
Slip Ring (Clockspring) ..... Air Bag Restraint System
Steering Column Switches
SRS Control Module ..... Air Bag Restraint System
Starter Motor ..... Starters
Starter Interrupt Relay ..... Starters
Starter Solenoid ..... Starters
Starter Relay ..... Starters
Steering Wheel Position Sensor ..... Anti-Lock Brakes
Stoplights ..... Exterior Lights
Stoplight Switch ..... Engine Performance
Cruise Control Systems
Anti-Lock Brakes
Sun Roof ECU ..... Power Sun Roof
Sun Roof Motor ..... Power Sun Roof
Sun Roof Position Sensor ..... Power Sun Roof
Taillights ..... Exterior Lights
Throttle Position (TP) Sensor ..... Engine Performance

Torque Converter Clutch Solenoid/Switch ..... Engine Performance
Traction Control Switch ..... Anti-Lock Brakes
Trailer Tow Connector ..... Exterior Lights
Trailer Tow Relay ..... Exterior Lights
Transmission/Transaxle ..... Engine Performance
Transmission Control Module (TCM) ..... Engine Performance
Starters
Transmission Range Sensor ..... Starters
Back-Up Lights
Engine Performance
Transmission Range Switch ..... Back-Up Lights
Engine Performance
Anti-Theft System
Turn Signal Flasher ..... Exterior Lights
Turn Signal Lights ..... Exterior Lights
Twilight Sentinel Switch ..... Headlight Systems
Daytime Running Lights
Vapor Canister Leak Detection Pump ..... Engine Performance
Vehicle Control Module (VCM) ..... Engine Performance
Vehicle Dynamic Module ..... Electronic Suspension
Vehicle Speed Control Servo ..... Cruise Control Systems
Vehicle Speed Sensor ..... Data Link Connectors
Analog Instrument Panels
Cruise Control Systems
Electronic Suspension
Voltage Regulator ..... Generators & Regulators
Water-In-Fuel Sensor ..... Engine Performance
Analog Instrument Panels
Wheel Speed Sensors ..... Anti-Lock Brakes
Window Timer Module ..... Power Convertible Top
Windshield Intermittent Wiper Relay ..... Wiper/Washer Systems
Windshield Washer Motor ..... Wiper/Washer Systems
Wiper Motor ..... Wiper/Washer Systems

INSTRUMENT PANEL

1997-99 Mitsubishi Montero Sport

1997-99 ACCESSORIES & EQUIPMENT
Mitsubishi - Instrument Panel

Montero Sport

DESCRIPTION & OPERATION

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEM article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

Instrument cluster includes speedometer, fuel gauge and temperature gauge. Fuel gauge has a built-in voltage limiter to keep voltage supply to gauges at 7 volts. Some models may also have an ammeter, oil pressure gauge, tachometer, voltmeter and/or turbo boost pressure gauge. Oil pressure gauge uses full battery voltage. The tachometer operates by pulse feed.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Coolant Temperature Sensor	On Thermostat Housing
Vehicle Speed Sensor	On Transmission Tailshaft

TROUBLE SHOOTING

FUEL/TEMPERATURE GAUGE NOT WORKING

Check for blown fuse, faulty voltage limiter and faulty relay. Ensure sending unit connections are clean and tight. Test sending unit for correct operation. Tighten connections in instrument cluster.

SPEEDOMETER NOT WORKING

Check for faulty vehicle speed sensor or faulty circuit. For testing, see SPEEDOMETER TEST under COMPONENT TESTS. Repair or replace as necessary.

TACHOMETER NOT WORKING

Tachometer is serviced as an assembly. If wiring harness is okay, replace tachometer assembly.

WARNING LIGHTS NOT WORKING

Test for defective sending unit, burned-out bulb and broken printed circuit. Ensure all connections are clean and tight.

COMPONENT TESTS

FUEL TANK SENDING UNIT

Resistance Test

Remove fuel tank sending unit from fuel tank. Check resistance between appropriate terminals with fuel float in FULL and EMPTY positions. See Fig. 1. Compare resistance reading to FUEL TANK SENDING UNIT RESISTANCE SPECIFICATIONS table. If resistance is not as specified, replace fuel tank sending unit.

FUEL TANK SENDING UNIT RESISTANCE SPECIFICATIONS TABLE

Application	Empty	Full
Montero Sport	103-117	1-5

FUEL GAUGE

CAUTION: Gauge coils can be damaged if wire is grounded too long. Perform test as quickly as possible.

Simple Test

1) Disconnect fuel gauge sending unit connector wire in luggage compartment, in cargo space or at tank unit. Connect a 12-volt, 3.4-watt bulb to harness side of connector, between appropriate terminals. See Fig. 1.

2) Turn ignition switch to ON position. Ensure test bulb flashes, or stays on, and fuel gauge needle moves. If bulb or gauge needle does not function as described, check and repair fuel gauge circuit.

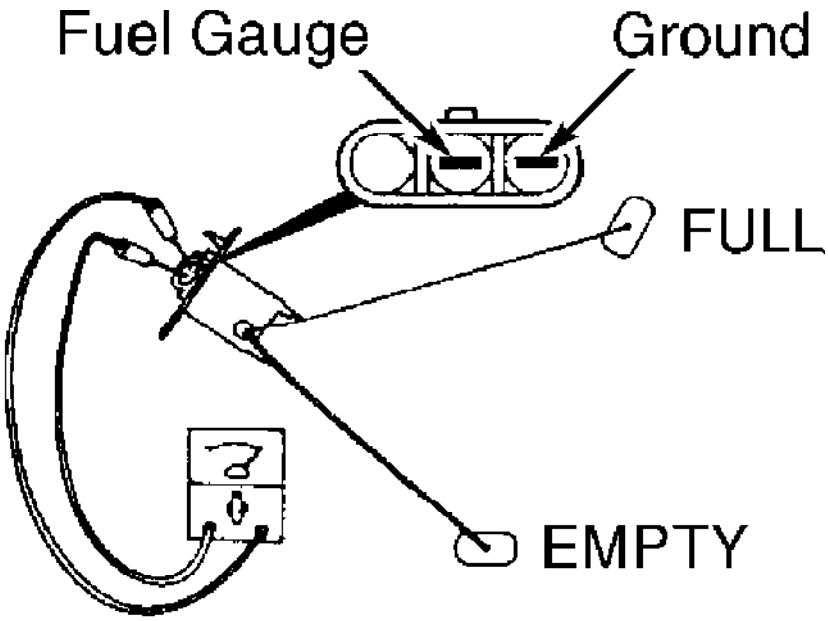

Fig. 1: Identifying Fuel Gauge Test Connections
Courtesy of Mitsubishi Motor Sales of America.

NOTE: Fuel gauge resistance test must be completed with instrument panel cluster removed. Use ohmmeter for all measurements. If

resistance is extremely low, a short may exist in coil. If resistance is extremely high, a broken wire or similar problem may exist in gauge.

Resistance Test

1) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION.

2) Check resistance between appropriate terminals of instrument cluster or combination gauges. See Fig. 2. See FUEL GAUGE RESISTANCE SPECIFICATIONS table. If resistance readings are not as specified, replace fuel gauge.

FUEL GAUGE RESISTANCE SPECIFICATIONS TABLE

Terminals	Ohms
"A" & "B"	85
"A" & "C"	107
"B" & "C"	192

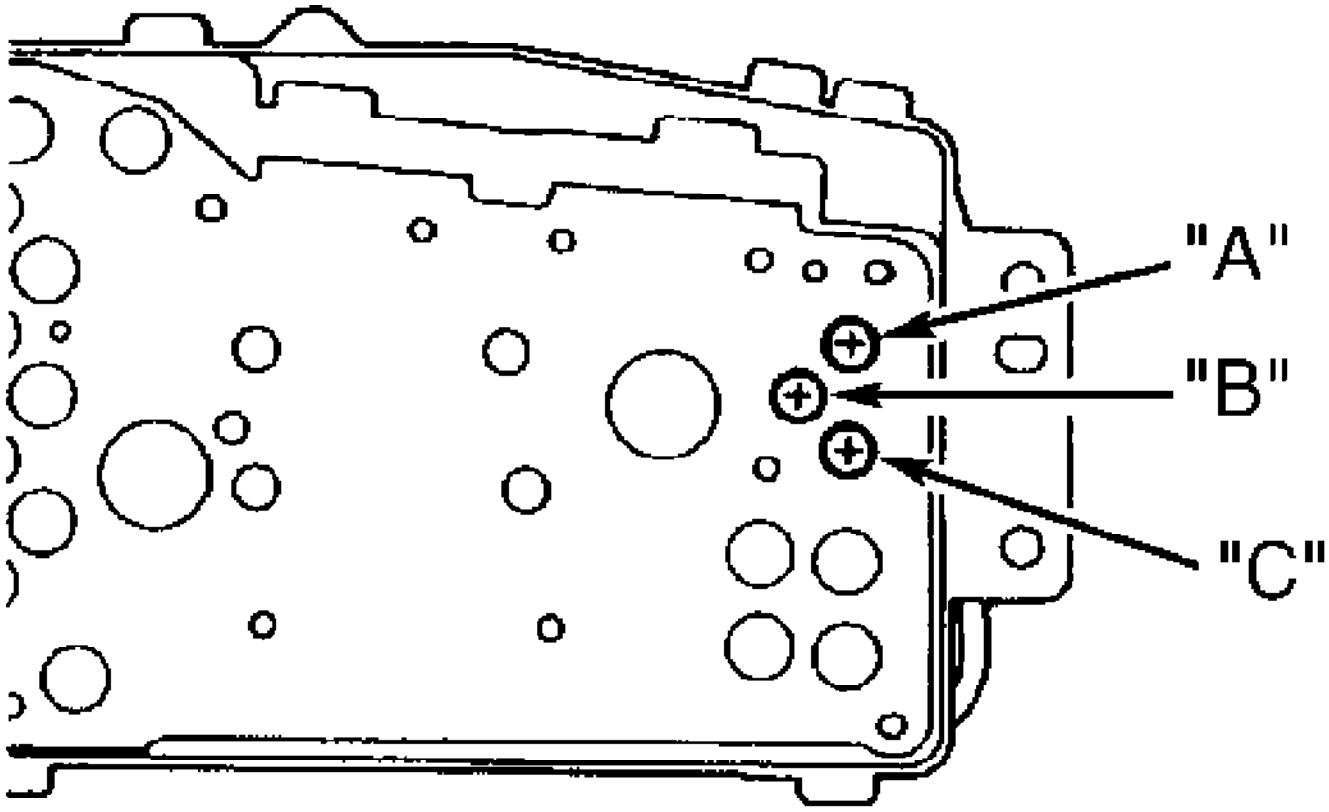

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Fig. 2: Instrument Panel Fuel Gauge Resistance Check Terminals
Courtesy of Mitsubishi Motor Sales of America.

Circuit Test

1) Disconnect harness connector from oil pressure sending unit. Turn ignition on. Check voltage between ground and sending unit harness-side connector. If battery voltage is present, problem is intermittent. If battery voltage is not present, go to next step.

2) Repair sending unit harness connector. If connector is okay, check circuit (Yellow wire) between oil pressure gauge and oil pressure sending unit. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

3) Remove multi-meter assembly. Check voltage between ground and harness-side connector terminal No. 10 (Red/Black wire). See WIRING DIAGRAMS. If battery voltage is present, problem is intermittent. If battery voltage is not present, go to next step.

4) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check circuit between multi-meter harness connector and fusible link. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

5) Turn ignition on. Check voltage between ground and multi-meter harness-side connector terminal No. 11 (Black/White wire). See WIRING DIAGRAMS. Repair as necessary. If battery voltage is present, problem is intermittent. If battery voltage is not present, go to next step.

6) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check circuit between multi-meter assembly harness connector and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

7) Turn ignition off. Check continuity between ground and multi-meter assembly harness-side connector terminal No. 3 (Black wire). If continuity is present, problem is intermittent. If continuity is not present, go to next step.

8) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check circuit (Black wire) between multi-meter assembly harness connector and ground. See WIRING DIAGRAMS . Repair as necessary. If circuit is okay, problem is intermittent.

Gauge Sending Unit Resistance Test

Disconnect harness connector to oil pressure sending unit. Start and idle engine. Check resistance between oil pressure gauge sending unit terminal and engine block. Resistance should be about 2 ohms. Replace sending unit if resistance is not as specified.

SPEEDOMETER TEST

Calibration Test

Adjust tire pressure to standard value. Using a calibrated, reliable speedometer tester, compare reading of vehicle speedometer to speedometer tester. See SPEEDOMETER ALLOWABLE VARIATION table. Replace speedometer if necessary.

SPEEDOMETER ALLOWABLE VARIATION TABLE

MPH (km/h)	Allowable Variation MPH (km/h)
20 (32)	19-22 (31-35)
40 (64)	38-44 (61-71)
60 (97)	57-66 (92-106)
80 (129)	76-88 (122-142)
100 (161)	94-110 (151-177)

Circuit Test

1) Disconnect vehicle speed sensor harness connector. Check vehicle speed sensor. See VEHICLE SPEED SENSOR under COMPONENT TESTS. Replace sensor as necessary. If sensor is okay, go to next step.

2) Turn ignition on. Check voltage between ground and vehicle speed sensor harness-side connector terminal No. 3 (Yellow/White wire). See WIRING DIAGRAMS. If voltage reading is 4.5 volts, problem is intermittent. If voltage reading is not 4.5 volts, go to next step.

3) Check vehicle speed sensor harness connector. Repair as necessary. If connector is okay, check circuit between vehicle speed sensor and instrument cluster. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

4) Check voltage between ground and vehicle speed sensor harness-side connector terminal No. 1 (Black/White wire). See WIRING DIAGRAMS. Battery voltage should be present. If voltage reading is as specified, problem is intermittent. If battery voltage is not present, go to next step.

5) Check harness connectors to vehicle speed sensor and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, check circuit between vehicle speed sensor and ignition switch. Repair as necessary. If circuit is okay, go to next step.

6) Turn ignition off. Check resistance between ground and vehicle speed sensor harness-side connector terminal No. 2 (Black wire). See WIRING DIAGRAMS. Continuity should be present. If continuity is present, problem is intermittent. If continuity is not present, check circuit between sensor harness-side connector terminal No. 2 and ground. Repair as necessary. If circuit is okay, go to next step.

7) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Check voltage between ground and instrument cluster harness-side connector terminal No. 53 (Red/Black wire). See WIRING DIAGRAMS. Battery voltage should be present. If battery voltage is present, go to step 9). If battery voltage is not present, go to next step.

8) Check harness connector to instrument cluster. Repair as necessary. If connector is okay, check circuit between instrument cluster harness connector and fusible link. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

9) Check voltage between ground and instrument cluster harness-side connector terminal No. 24 (Black/White wire). See WIRING DIAGRAMS. Battery voltage should be present. If battery voltage is present, problem is intermittent. If battery voltage is not present, check harness connector. Repair as necessary.

TACHOMETER

NOTE: DO NOT reverse polarity when installing tachometer; diode and transistor may be damaged.

Calibration Test

Connect a calibrated, reliable tachometer to vehicle ignition system. Operate engine at various speeds (RPM). See TACHOMETER ALLOWABLE VARIATION table. If comparison between tach-dwell meter and vehicle tachometer readings are not within permissible variation, replace vehicle tachometer.

TACHOMETER ALLOWABLE VARIATION TABLE

Engine Speed (RPM)	Allowable Variation (RPM)
700	600-800
3000	2850-3150
5000	4750-5250
6000	5700-6300

Circuit Test

1) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Disconnect instrument cluster harness connector. Connect voltmeter between ground and instrument cluster

harness-side connector terminal No. 14 (White wire). Start and idle engine. Voltmeter should read about 5 volts. If voltage is as specified, problem is intermittent. If voltage is not as specified, go to next step.

2) Check instrument cluster harness connector. Repair as necessary. If connector is okay, go to next step on 2.4L engines or step 7) on 3.0L engines.

3) Check noise filter harness connector (located behind instrument cluster). Repair as necessary. If connector is okay, go to next step.

4) Check circuit between instrument cluster harness connector and noise filter connector. Repair as necessary. If connectors are okay, go to next step.

5) Remove noise filter (located near throttle position sensor harness). Check resistance between noise filter terminals. Resistance should be 1760-2640 ohms. If resistance is not as specified, replace noise filter. If resistance is not as specified, go to next step.

6) Check joint connector behind right side of dash. Repair as necessary. If connector is okay, check circuit between joint connector and instrument cluster harness connector. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

7) Check voltage between ground and instrument cluster harness-side connector terminal No. 24 (Black/White wire). If battery voltage is present, problem is intermittent. If battery voltage is not present, go to next step.

8) Check harness connector to instrument cluster. Repair as necessary. If connector is okay, check circuit between instrument cluster and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

9) Check circuit between ground and instrument cluster harness-side connector terminal No. 13 (Black wire). If continuity is present, problem is intermittent. If continuity is not present, check harness connector to instrument cluster and to chassis ground. See WIRING DIAGRAMS. Repair as necessary. If connectors are okay, problem is intermittent.

TEMPERATURE GAUGE

CAUTION: DO NOT connect sender wire directly to ground during test.

Circuit Test

1) Disconnect temperature sender wire from sending unit. Connect a 12-volt, 3.4-watt test light between connector terminal and ground. Turn ignition switch to ON position.

2) If test light flashes and temperature gauge needle moves, go to SENSOR RESISTANCE TEST. If test light does not flash or gauge needle does not move, repair wiring to sending unit.

Sensor Resistance Test

1) Remove Coolant Temperature Sensor (CTS) from engine. See COMPONENT LOCATIONS. Place sending unit in 158°F (70°C) water. Check sensor resistance using ohmmeter.

2) CTS resistance should be 90-117 ohms. If CTS resistance is okay, go to GAUGE RESISTANCE TEST. Replace CTS if resistance is not as specified.

Gauge Resistance Test

1) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION.

2) Check resistance between temperature gauge terminals at rear of cluster or combination gauges. See TEMPERATURE GAUGE RESISTANCE SPECIFICATIONS table. See Fig. 3

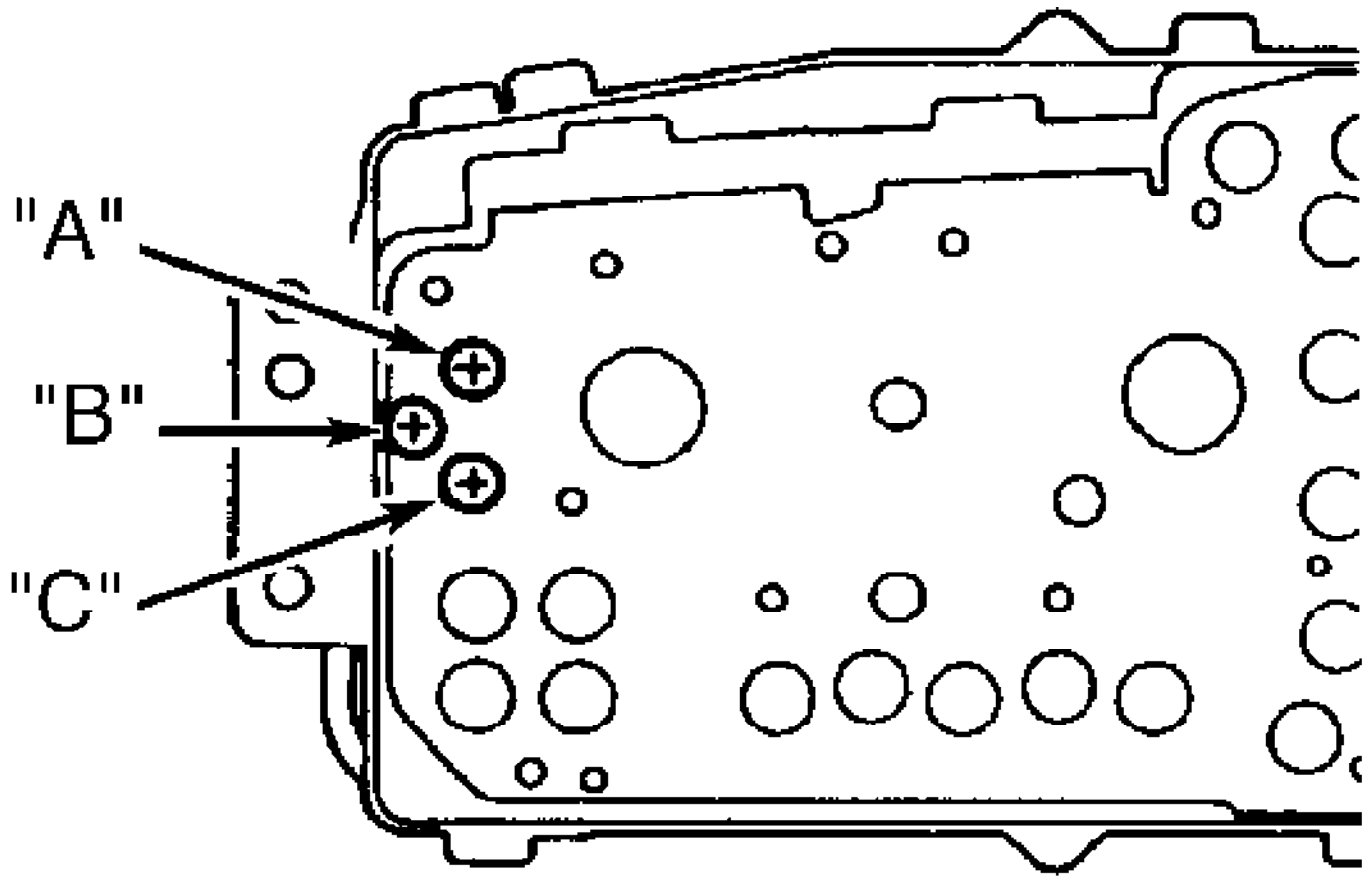

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Fig. 3: Temperature Gauge Resistance Test Terminals
Courtesy of Mitsubishi Motor Sales of America.

TEMPERATURE GAUGE RESISTANCE SPECIFICATIONS TABLE

Terminals (1)	Ohms
"A" & "B"	88
"A" & "C"	103
"B" & "C"	191

(1) - See Fig. 3.

VEHICLE SPEED SENSOR

Circuit Test

1) Disconnect vehicle speed sensor harness connector. Check circuit between instrument cluster harness connector and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

2) Remove instrument cluster. See INSTRUMENT CLUSTER under REMOVAL & INSTALLATION. Check continuity between ground and instrument cluster harness-side terminal No. 31 (Black wire). See WIRING DIAGRAMS . If continuity is present, problem is intermittent. If continuity is not present, go to next step.

3) Check circuit between instrument cluster and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace speedometer assembly.

Sensor Test

1) Remove vehicle speed sensor from transaxle. Jumper a 3000-10,000 ohm resistor between sensor terminals No. 1 and 3. Connect battery positive to sensor terminal No. 1 and battery negative to sensor terminal No. 2. See Fig. 4.

2) Connect a voltmeter between sensor terminals No. 2 and 3. Manually turn speed sensor shaft. Voltage should pulse 4 times each revolution. Replace vehicle speed sensor if operation is not correct.

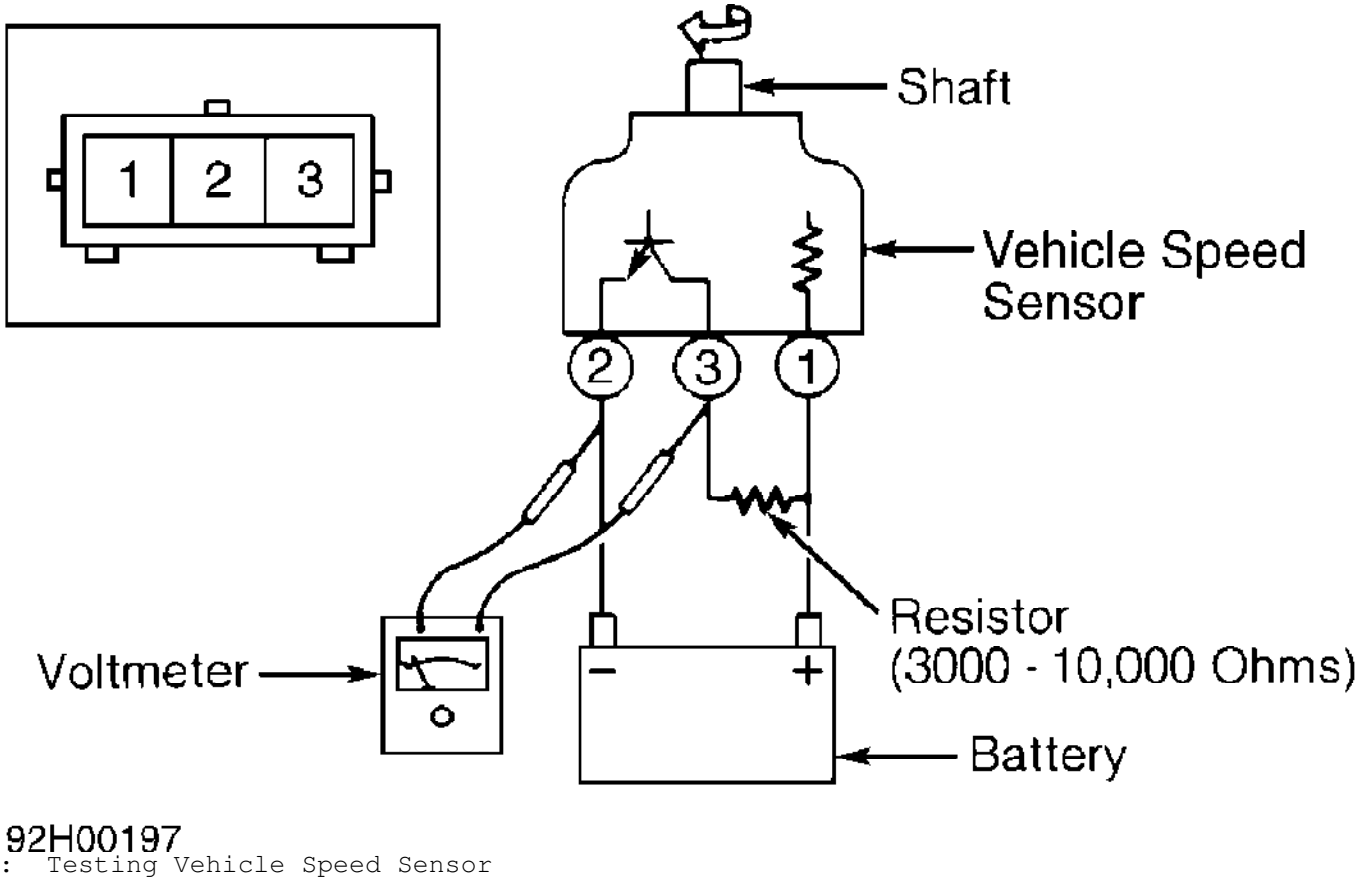


Fig. 4: Testing Vehicle Speed Sensor
Courtesy of Mitsubishi Motor Sales of America.

VOLTMETER

Circuit Test

1) Remove multi-meter assembly from top of dashboard. Check voltage between ground and multi-meter harness-side connector terminal No. 10 (Brown wire). If voltage reading is about 12 volts, go to step 4). If voltage reading is not about 12 volts, go to next step.

2) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check circuit between multi-meter harness connector and fusible link No. 6. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

3) Turn ignition on. Check voltage between ground and multi-meter harness-side connector terminal No. 11 (Black/White wire). See WIRING DIAGRAMS. If voltage reading is about 12 volts, problem is intermittent. If voltage reading is not about 12 volts, go to next

step.

4) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check circuit between multi-meter assembly harness connector and ignition switch. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, go to next step.

5) Turn ignition off. Check continuity between ground and multi-meter assembly harness-side connector terminal No. 3 (Black wire). If continuity is present, problem is intermittent. If continuity is not present, go to next step.

6) Check harness connector to multi-meter assembly. Repair as necessary. If connector is okay, check multi-meter assembly harness connector ground circuit. See WIRING DIAGRAMS. Repair as necessary. If circuit is okay, replace multi-meter assembly.

REMOVAL & INSTALLATION

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEM article. Do not apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

INSTRUMENT CLUSTER

Removal & Installation

Disconnect negative battery cable. Remove instrument cluster cover. Remove screws from instrument cluster. Disconnect all connectors attaching cluster. Remove cluster. To install, reverse removal procedure. See Fig. 6.

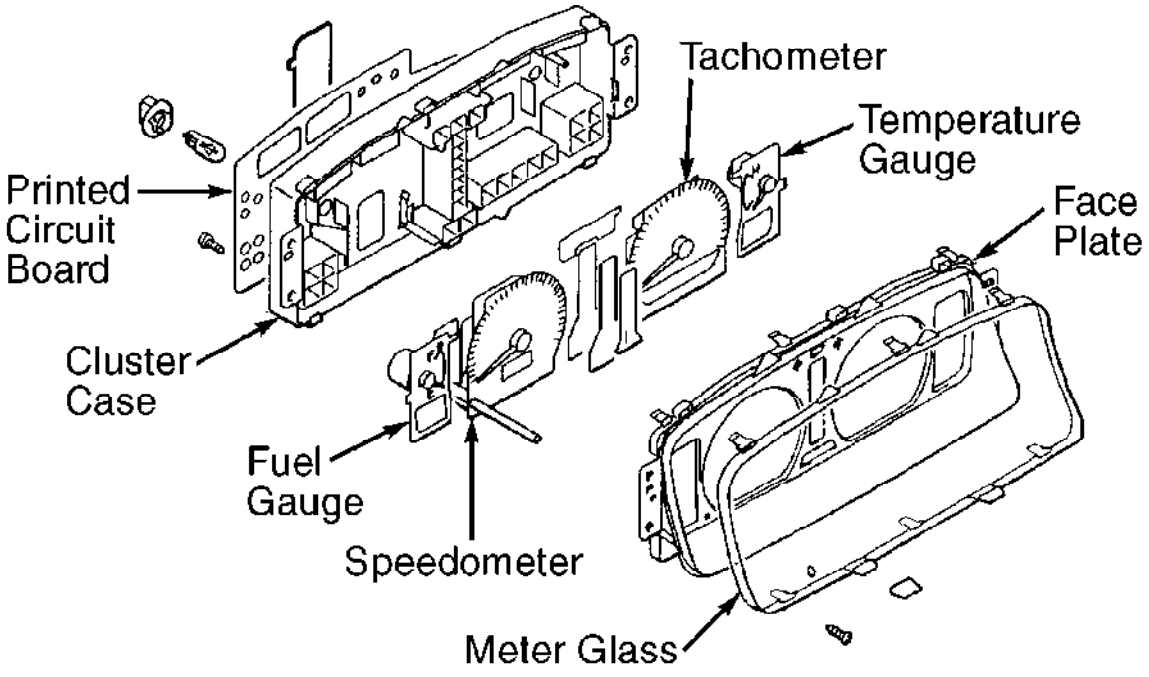


Fig. 5: Identifying Instrument Cluster Components
Courtesy of Mitsubishi Motor Sales of America.

WIRING DIAGRAMS

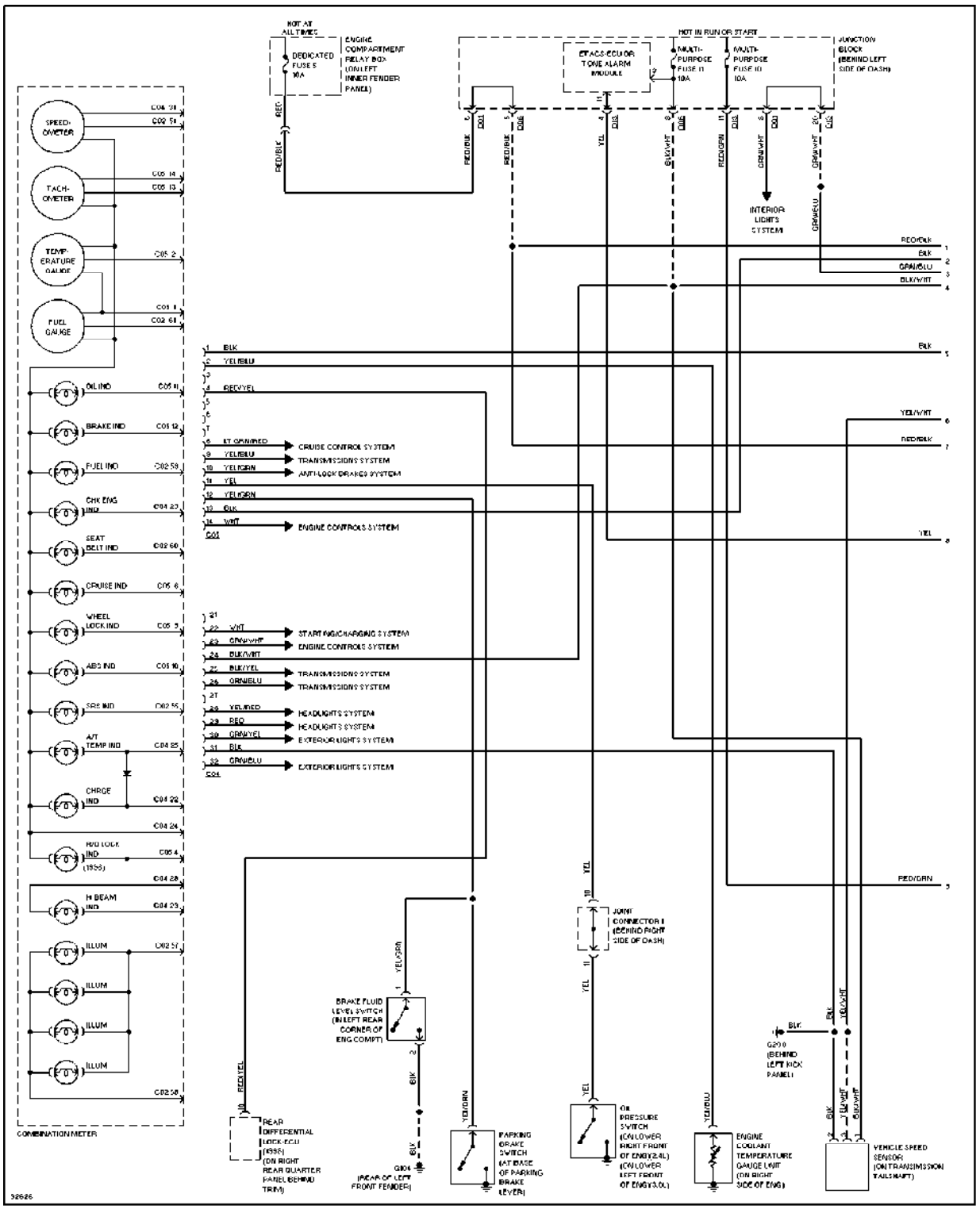


Fig. 6: Instrument Cluster Wiring Diagram (1 Of 2)

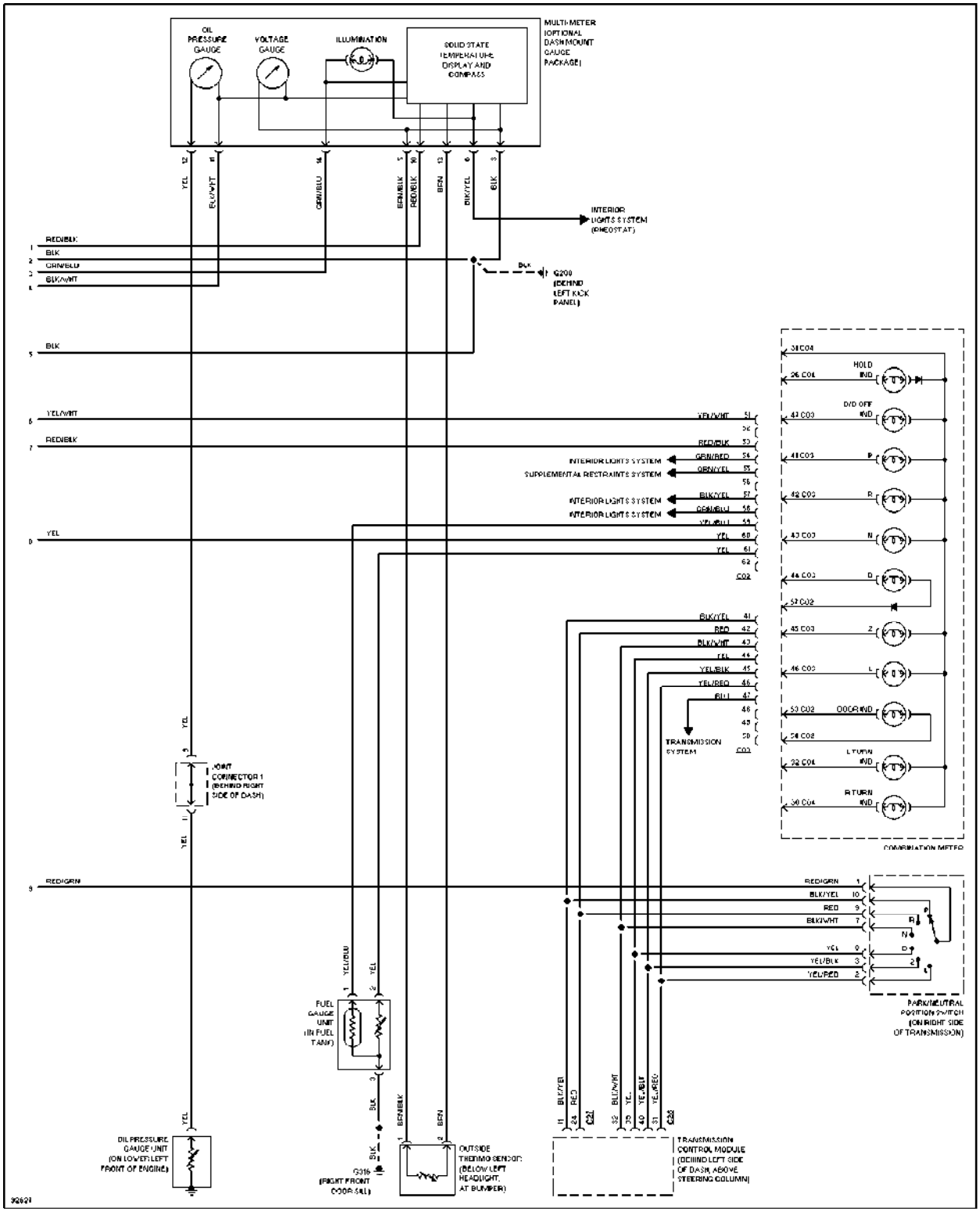


Fig. 7: Instrument Cluster Wiring Diagram (2 Of 2)

LOCKING HUBS

1997-99 Mitsubishi Montero Sport

1997-99 DRIVE AXLES
Mitsubishi Locking Hubs

Montero, Montero Sport

DESCRIPTION

Vehicles are equipped with an automatic locking clutch. Locking clutch engages, providing full time AWD operation, when 4WD (4H) is selected at transfer case, at speeds up to 62 MPH. Selecting center differential lock position (4HLc or 4HLLc), while in AWD at 4 MPH or less, provides 4WD operation. Center differential lock disengages when 4H or 2H is selected. Locking clutch disengages when 2H is selected.

REMOVAL & INSTALLATION

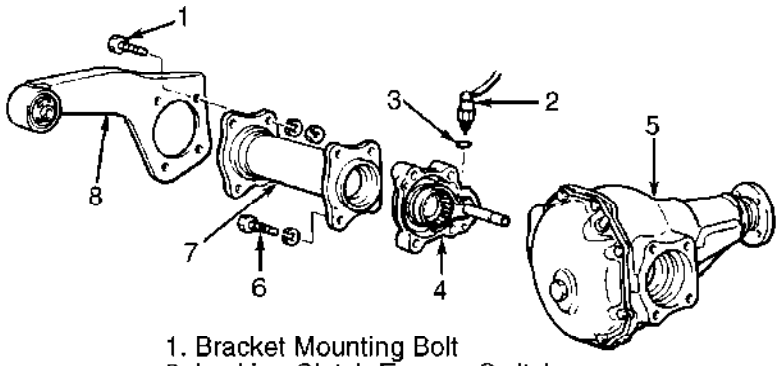
AUTOMATIC LOCKING HUBS

Removal & Installation

1) Remove right side inner shaft for automatic locking clutch removal. See INNER SHAFT & BEARING in DIFFERENTIAL & AXLE SHAFTS - FRONT article. With inner shaft removed, remove locking clutch engage switch. See Fig. 1.

2) Remove 4 inner shaft tube-to-differential mounting bracket bolts. Pivot differential mounting bracket. Remove 4 inner shaft tube-to-differential carrier assembly mounting bolts. Pull inner shaft tube and automatic locking clutch out of differential carrier assembly.

3) To install, reverse removal procedure. Tighten inner shaft tube bolts to 65 ft. lbs. (90 N.m) and locking clutch engage switch to 26 ft. lbs.(36 N.m).



1. Bracket Mounting Bolt
2. Locking Clutch Engage Switch
3. Gasket
4. Locking Clutch Assembly
5. Carrier Assembly
6. Carrier Assembly Mounting Bolt
7. Inner Shaft Tube
8. Differential Mounting Bracket

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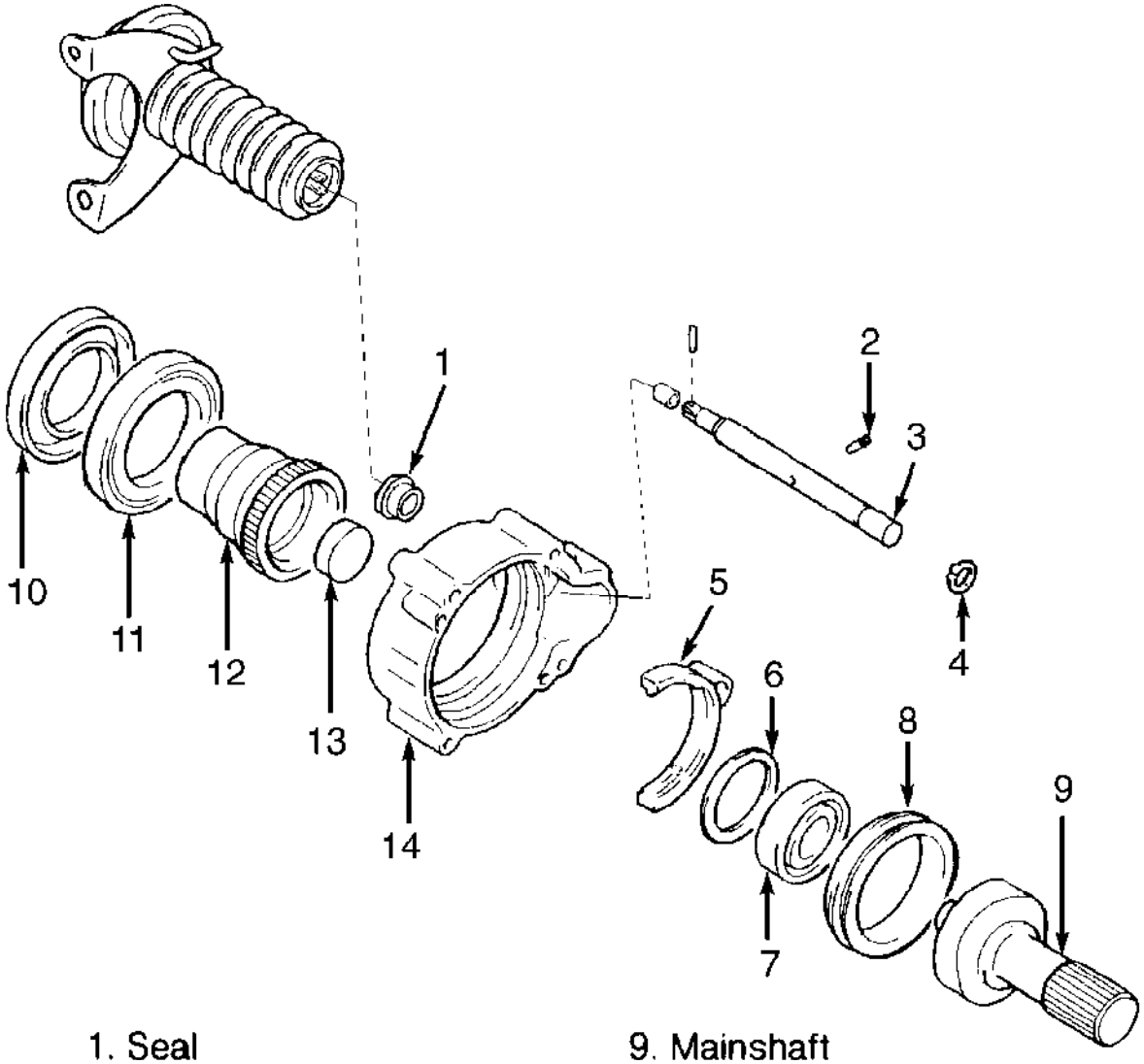
Fig. 1: Identifying Automatic Locking Clutch Components
Courtesy of Mitsubishi Motor Sales of America.

OVERHAUL

NOTE: Locking clutch overhaul procedure is not available from manufacturer. Use illustration for exploded view of locking clutch. See Fig. 2.



1. Seal
2. Spring Pin
3. Shift Rod
4. Snap Ring
5. Shift Fork
6. Spacer
7. Bearing
8. Clutch Sleeve
9. Mainshaft
10. Seal
11. Bearing
12. Clutch Gear
13. Cap (1995 Montero Only)
14. Locking Clutch Housing

97B07064

Fig. 2: Exploded View Of Locking Clutch
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Hub Cover	13-25 (18-34)
Locking Hub Bolts	36-43 (49-58)
Wheel Lug Nut	
Montero	72-87 (98-118)
Montero Sport	
Aluminum Wheel	73-86 (99-117)
Steel Wheel	87-101 (118-137)

MAINTENANCE INFORMATION

1997-99 Mitsubishi Montero Sport

1997-99 MAINTENANCE
Mitsubishi Maintenance Information

Montero Sport

*** PLEASE READ THIS FIRST ***

NOTE: For scheduled maintenance intervals and the related fluid capacities, fluid specifications and labor times for major service intervals, see SCHEDULED SERVICES article below:

* SCHEDULED SERVICES

Warranty information and specifications for fluid capacities, lubrication specifications, wheel and tire size, and battery type are covered in this article.

MODEL IDENTIFICATION

VIN LOCATION

The Vehicle Identification Number (VIN) is located on the left side of the dash panel at the base of the windshield. The VIN chart explains the code characters.

VIN CODE ID EXPLANATION

Numbers preceding the explanations in the legend below refer to the sequence of characters as listed on VIN identification label. See VIN example below.

(VIN)	J	A	4	F	J	4	3	E	1	H	J	0	0	0	0	0	1
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

1 - Manufacturing Country
J * Japan

2 - Manufacturer
A * Mitsubishi Motor Corp.

3 - Vehicle Type
4 * Multi-Purpose Vehicle

4 - GVW & Brake Type
M * 5001-6000 Lbs., Hydraulic Brakes

5 - Vehicle Line
R * Montero

6 - Vehicle Series
4 * High
5 * Premium

7 - Body Type
1 * 5-Door Wagon

8 - Engine Type
  M * 3.5L V6

9 - VIN Check Digit
     * 1 Through 9 Or X

10 - Vehicle Model Year
  V * 1997
  W * 1998

11 - Assembly Plant
  J * Nagoya, Japan

12-17 - Serial Number
     * Sequential Production Number

MAINTENANCE SERVICE INFORMATION

SEVERE & NORMAL SERVICE DEFINITIONS

Service is recommended at mileage intervals based on vehicle operation. Service schedules are based on the following primary operating conditions.

Normal Service

* Driven More Than 10 Miles Daily
* No Operating Conditions From Severe Service Schedule

Severe Service (Unique Driving Conditions)

NOTE: Use the Severe Service schedule if the vehicle to be serviced is operated under ANY (one or more) of these conditions:

* Driving In Dusty Conditions
* Towing A Trailer, Police, Taxi, Or Commercial Type Operation
* Extensive Idling, Driving In Stop And Go Traffic
* Short-Trip Operation At Freezing Temperatures (Engine Not Thoroughly Warmed Up)
* Driving In Sandy Areas
* Driving In Salty Areas
* More Than 50% Operation In Heavy City Traffic Or At Sustained High Speeds During Hot Weather Above 90°F (32°C)
* Driving On Off-Road

CAMSHAFT TIMING BELT

Replace the camshaft timing belt every 60,000 miles. It is recommended that the timing belt be inspected every 30,000 miles after replacement.

CAUTION: Failure to replace a faulty camshaft timing belt may result in serious engine damage.

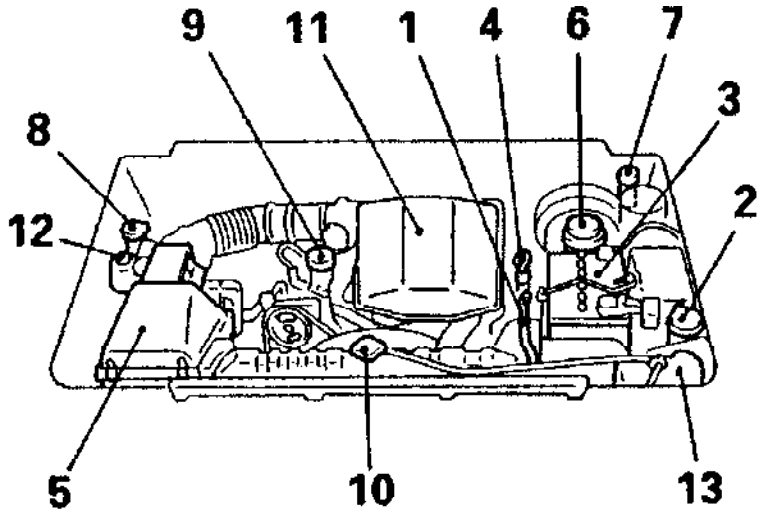
The condition of camshaft drive belts should always be checked on vehicles which have more than 50,000 miles. Although some manufacturers do not recommend belt replacement at a specified mileage, others require it at 60,000-100,000 miles. A camshaft drive belt failure may cause extensive damage to internal engine components on most engines, although some designs do not allow piston-to-valve contact. These designs are often called "Free Wheeling".
Many manufacturers changed their maintenance and warranty

schedules in the mid-1980's to reflect timing belt inspection and/or replacement at 50,000-60,000 miles. Most service interval schedules in this manual reflect these changes.

Belts or components should be inspected and replaced if any of the following conditions exist:

* Cracks Or Tears In Belt Surface
* Missing, Damaged, Cracked Or Rounded Teeth
* Oil Contamination
* Damaged Or Faulty Tensioners
* Incorrect Tension Adjustment

SERVICE POINT LOCATIONS



1 – Engine oil level dipstick
2 – Windshield washer reservoir
3 – Battery
4 – Automatic transmission fluid level dipstick (vehicles with an automatic transmission)
5 – Air cleaner filter
6 – Brake fluid reservoir
7 – Clutch fluid reservoir (vehicles with a manual transmission)
8 – Headlight washer reservoir (if so equipped)
9 – Engine oil filler cap
10 – Radiator cap
11 – Spark plug
12 – Power steering fluid reservoir
13 – Engine coolant reservoir

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Fig. 1: Service Point Locations
Courtesy of Mitsubishi Motor Sales of America.

INFORMATION LABEL LOCATIONS

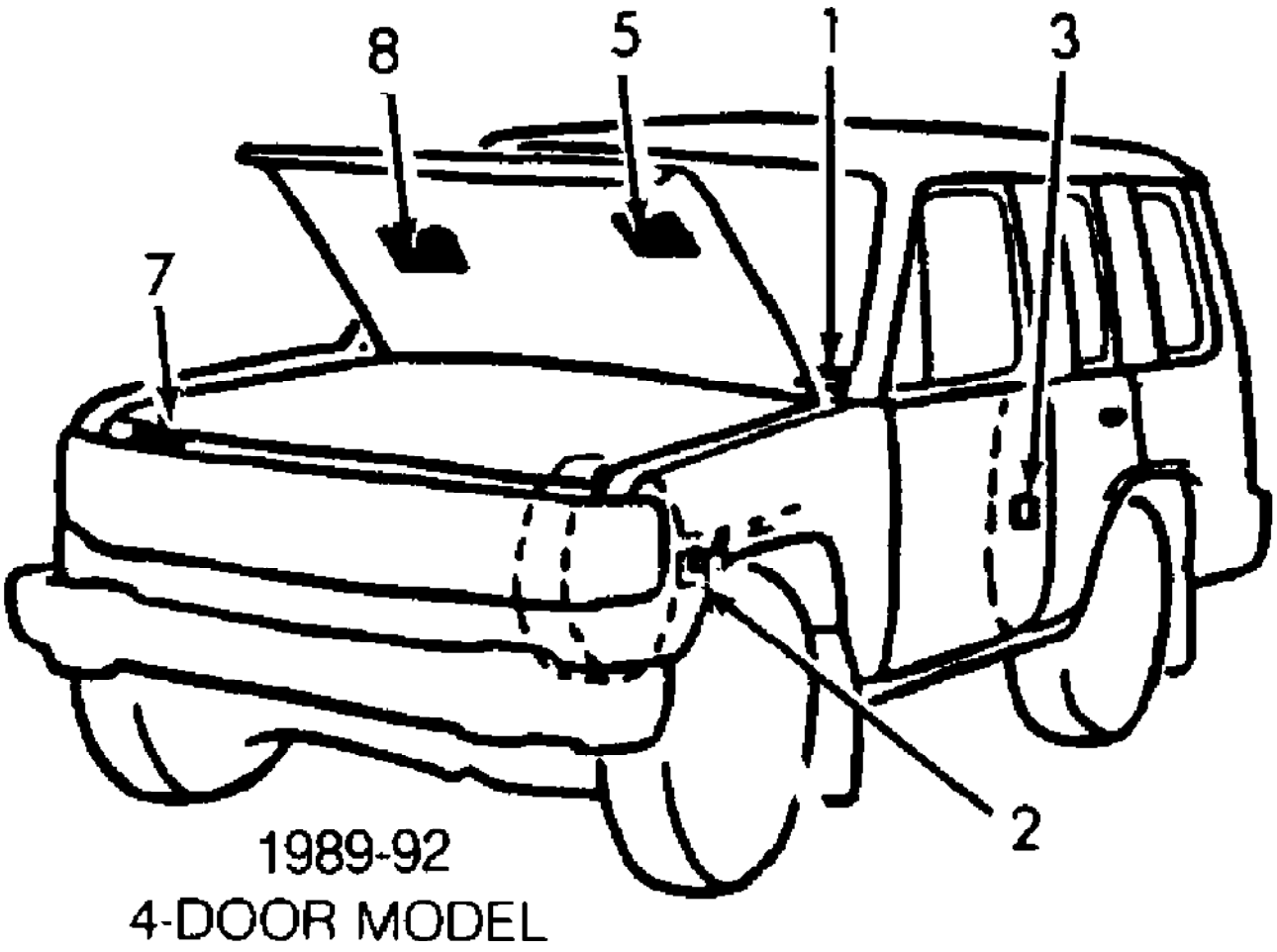


Fig. 2: Information Label Locations
Courtesy of Mitsubishi Motor Sales of America.

LUBRICATION SPECIFICATIONS

LUBRICATION SPECIFICATIONS TABLE

Material	Condition	Specification

Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Power Steering Fluid	All	Automatic Transmission Fluid DEXRON II
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Transfer Case	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Front Axle	All	API Classification GL-5 Or Higher (2)
Clutch Fluid	All	DOT 3 Or DOT 4
Hook Lock Catch, Door Lock Strikers Seat Adjust-ers, Backdoor Lock, Parking Brake Cable Mechanism	All	Multipurpose Grease NLGI Grade 2
Front Wheel Bearings	All	Multipurpose Grease NLGI Grade 2 Or Equivalent
Door Hinges, Back Door Hinges	All	Engine Oil
A/C Refrigerant	All	HFC-134a
Manual Transmission	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Automatic Transmission	All	"ATF DEXRON II" Or Equivalent
Brake Fluid	All	DOT 3 Or DOT 4
Rear Axle	All	API Classification GL-5 Or Higher (2)

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).
(2) - SAE90, 85W-90, 80W-90 may be used in temperatures above -10° F (-23° C). SAE 80W, 80W-90 may be used in temperatures from -30° F (-34° C) to -10° F (-23° C). SAE 75W may be used in temperatures below -30° F (-34° C).

FLUID CAPACITIES

FLUID CAPACITIES TABLE (1)

Item	Condition	Specification
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)
Power Steering	Drained	1.1 Qts. (1.0L)
Automatic Transmission	Drained	8.9 Qts. (8.5L)
Manual Transmission	Drained	3.3 Qts. (3.2L)
Transfer Case	Drained	2.6 Qts. (2.5L)
Front Axle	Drained	1.3 Qts. (1.2L)
Rear Axle	Drained	3.3 Qts. (3.2L)
A/C Refrigerant	Drained	27 oz (760 g)
Fuel Tank	Capacity	24 gal (92L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

WHEEL & TIRE SPECIFICATIONS

Tire specifications are imprinted on the tire side wall. The recommended cold tire inflation pressures are listed on a label attached to the rear face of the driver's door. These pressures provide the best combination of ride comfort, tire wear and stability under normal conditions.

CAUTION: DO NOT mix tires of different design such as radial ply with bias or bias-belted tires. Mixing tire types will adversely affect road handling and may lead to loss of vehicle control. When using snow tires, they must be used in set of four for maneuverability and safety. DO NOT use tire chains on front wheels.

TIRE & WHEEL SPECIFICATIONS TABLE

Wheel Size	Tire Size
15 x 6JJ (Steel or Aluminum)	P235/75R15
15 X 7JJ (Aluminum)	P265/70R15

WHEEL TIGHTENING

Tighten wheel lug nuts to 72-87 ft. lbs. (100-120 N.m).

BATTERY SPECIFICATIONS

CAUTION: When battery is disconnected, vehicles equipped with computers may lose memory data. When battery power is restored, driveability problems may exist on some vehicles. These vehicles may require a relearn procedure. See COMPUTER RELEARN PROCEDURES article in the GENERAL INFORMATION Section.

Battery is maintenance-free and does not normally require additional water. However, under severe conditions it is advisable to check battery fluid periodically. Use only distilled water to fill battery cell should it become necessary to add water. Charge condition can be checked by a visual test indicator on top of battery.

CAUTIONS & WARNINGS

SUPPLEMENTAL RESTRAINT SYSTEM (AIR BAG)

NOTE: See the AIR BAGS article in the ACCESSORIES/SAFETY EQUIPMENT Section.

Modifications or improper maintenance, including incorrect removal and installation of the Supplemental Restraint System (SRS), can adversely affect system performance. DO NOT cover, obstruct or change the steering wheel horn pad in any way, as such action could cause improper function of the system. Use only plain water when cleaning the horn pad. Solvents or cleaners could adversely affect the air bag cover and cause improper deployment of the system.

WARNING: Service on or around Air Bag System Components or Wiring must be preformed only by an authorized Suzuki dealer. Please observe all WARNINGS and SERVICE PRECAUTIONS.

WARNING: Technical service work must be started at least 90 seconds after the ignition switch is turned to the LOCK position and the cable is disconnected from the battery.

WARNING: Never attempt to disassemble or repair the passenger air bag (inflator) module. If any abnormality is found, be sure to replace it with new one as an assembly.

WARNING: To avoid injury from accidental air bag deployment, read and carefully follow all warnings and service precautions. See appropriate AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

CAUTION: Disconnect negative battery cable before servicing any air bag system, steering column or passenger side dash component. After any repair, turn ignition key to the ON position from passenger's side of vehicle in case of accidental air bag inflation

AIR CONDITIONING SERVICING

WARNING: Avoid breathing R-134a refrigerant and PAG lubricant vapors, exposure may irritate eyes, nose and throat. To remove R-134a from system use R-134a recycling equipment that meets

SAE J2210 specifications. If accidental system discharge occurs, ventilate work area before resuming service.

WARNING: R-134a service equipment or vehicle A/C systems SHOULD NOT be pressure tested or leak tested with compressed air. Some mixtures of air/R134a have shown to be combustible at elevated pressures. These mixtures are dangerous and may cause fire and/or explosions. See AIR CONDITIONING SERVICE article in GENERAL INFORMATION section.

AIR CLEANER FILTER

WARNING: Operating the engine with the air cleaner off can cause you or others to be burned. The air cleaner not only cleans the air, it stops flame if the engine backfires. Do not drive with it off, and be careful working on the engine with the air cleaner off.

ANTI-LOCK BRAKE SYSTEM

The anti-lock brake system contains electronic equipment that can be susceptible to interference caused by improperly installed or high output radio transmitting equipment. Since this interference could cause the possible loss of the anti-lock braking capability, such equipment should be installed by qualified professionals.

On models equipped with anti-lock brake systems, ALWAYS observe the following cautions:

* DO NOT attempt to bleed hydraulic system without first referring to the appropriate ANTI-LOCK BRAKE SYSTEM article in the BRAKES Section.
* DO NOT mix tire sizes. As long as tires remain close to the original diameter, increasing the width is acceptable. Rolling diameter must be identical for all 4 tires. Some manufacturers recommend tires of the same brand, style and type. Failure to follow this precaution may cause inaccurate wheel speed readings.
* Use ONLY recommended brake fluids. DO NOT use silicone brake fluids in an ABS-equipped vehicle.

AUTOMATIC TRANSAXLE SERVICE

WARNING: Make certain that no fluid is spilled when the transaxle fluid is inspected, or when fluid is added soon after driving (since the engine is hot). If the fluid spills onto the exhaust manifold, there is danger of fire.

BATTERY SERVICE

WARNING: When battery is disconnected, vehicles equipped with computers may lose memory data. When battery power is restored, driveability problems may exist on some vehicles. These vehicles may require a relearn procedure. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION section.

WARNING: Batteries produce flammable hydrogen gas. Keep flames and sparks away from the battery or and explosion may occur. Never smoke when working in the vicinity of the battery.

WARNING: When checking or servicing the battery, disconnect the negative cable. Be careful not to cause a short circuit by

allowing metal objects to contact the battery posts and the vehicle at the same time.

CAUTION: Never disconnect the battery while the engine is running; doing so could damage the car's electrical components.

REPLACING BLOWN FUSES

Before replacing a blown fuse, remove ignition key, turn off all lights and accessories to avoid damaging the electrical system. Be sure to use fuse with the correct indicated amperage rating. The use of an incorrect amperage rating fuse may result in a dangerous electrical system overload.

BRAKE PAD WEAR INDICATOR

Indicator will cause a squealing or scraping noise, warning that brake pads need replacement.

BRAKE FLUID

WARNING: DO NOT use reclaimed fluid or fluid that has been stored in old or open containers. It is essential that foreign particles and other liquids are kept out of the brake fluid reservoir.

CATALYTIC CONVERTER

Continued operation of vehicle with a severe malfunction could cause converter to overheat, resulting in possible damage to converter and vehicle.

ENGINE COOLANT SERVICE

WARNING: To avoid the danger of being scalded never change the coolant when the engine is hot.

WARNING: Never remove the radiator cap when the engine is hot Serious burns could be caused by high pressure fluid escaping from the radiator.

CAUTION: When adding or replacing engine coolant, use a high quality ethylene glycol antifreeze diluted with 50% distilled water. When putting the cap on the reserve tank, line up the arrow on the cap and the arrow on the tank, or coolant can leak out

ENGINE DRIVE BELT SERVICE

WARNING: Be sure the ignition key is OFF. The engine could rotate unexpectedly.

ENGINE OIL

WARNING: The engine oil may be high enough to burn your fingers when the drain plug is loosened. Wait until the drain plug is cool enough to touch with you bare hands.

WARNING: Continuous contact with used engine oil has been found to cause skin cancer in laboratory animals. Brief contact with used engine oil may irritate skin. To minimize your exposure to used oil, wear a long sleeve shirt and moisture-proof gloves when changing oil. If oil contacts your skin, wash

thoroughly with soap and water.

CAUTION: Never use non-detergent or straight mineral oil.

FUEL SYSTEM SERVICE

WARNING: Relieve fuel system pressure prior to servicing any fuel system component (fuel injection models).

HALOGEN BULBS

Halogen bulbs contain pressurized gas which may explode if overheated. DO NOT touch glass portion of bulb with bare hands. Eye protection should be worn when handling or working around halogen bulbs.

RADIATOR CAP

CAUTION: Always disconnect the fan motor when working near the radiator fan. The fan is temperature controlled and could start at any time even when the ignition key is in the OFF position. DO NOT loosen or remove radiator cap when cooling system is hot.

RADIATOR FAN

WARNING: Keep hands away from radiator fan. Fan is controlled by a thermostatic switch which may come on or run for up to 15 minutes even after engine is turned off.

WARRANTY INFORMATION

CAUTION: Due to the different warranties offered in various regions and the variety of after-market extended warranties available, please refer to the warranty package that came with the vehicle to verify all warranty options.

FUSES & CIRCUIT BREAKERS

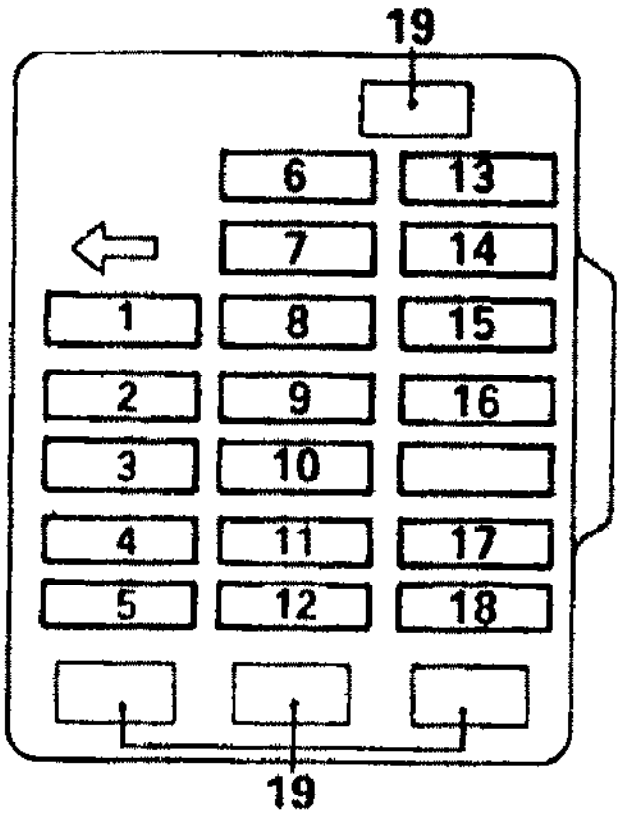
FUSE PANEL LOCATION

The electrical system is protected against shorts by fuses that are designed to fail, to prevent damage to the wire harness. The fuse block is located under the instrument panel on the driver's side. If a fuse is blown, locate the cause before replacing the fuse. Spare fuses are contained in the fuse block.

FUSE PANEL IDENTIFICATION

Fuse & Circuit Breaker Identification

PASSENGER COMPARTMENT



Passenger compartment

1 –	15A	Cigarette lighter
2 –	10A	(Radio)
3 –	10A	Heater relay
4 –	10A	4A/T (vehicles with an automatic transmission only)
5 –	20A	(Front and rear air conditioner)

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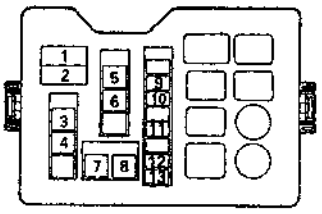
Fig. 3: Passenger Compartment Fuse Box
Courtesy of Mitsubishi Motor Sales of America.

1 - 15 Amp (Light Blue)
Cigarette Lighter

2 - 10 Amp (Red)
Radio
3 - 10 Amp (Red)
Heater Relay
4 - 10 Amp (Red)
4A/T
5 - 20 Amp (Yellow)
Front & Rear Air Conditioner
6 - 10 Amp (Red)
Turn Signals
7 - 10 Amp (Red)
Meters
8 - 10 Amp (Red)
Horn
9 - 15 Amp (Light Blue)
Wiper
10 - 10 Amp (Red)
Power Window Control
11 - 10 Amp (Red)
Four Wheel Drive System, Overdrive Control (Vehicles With Automatic Transmission Only)
12 - 15 Amp (Light Blue)
Power Door Locks
13 - 10 Amp (Red)
Doom Light, Clock
14 - 15 Amp (Light Blue)
Backup Lights
15 - 15 Amp (Light Blue)
Stoplights
16 - 25 Amp
Heater
17 - 15 Amp (Light Blue)
Accessory Socket
18 - 10 Amp (Red)
Rear Heater
19 - Spare Fuse

ENGINE COMPARTMENT



Fusible Links
1 - 60A Battery
2 - 100A Alternator
3 - 20A Multi-point injection
4 - 40A Ignition switch
5 - 30A Rear window defogger
6 - 30A Power window control
7 - 30A (Air conditioner)
8 - 40A Lights

Fuses
9 - 10A (Aircon compressor)
10 - 25A Condenser fan
11 - 10A Tail lights
12 - 10A Headlight upper beam
13 - 10A Hazard warning flashers
( ): indicates optional equipment

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Fig. 4: Engine Compartment Fusible Links
Courtesy of Mitsubishi Motor Sales of America.

1 - 60 Amp
Battery
2 - 100 Amp
Alternator
3 - 20 Amp (Yellow)
Multipoint Injection
4 - 40 Amp
Ignition Switch
5 - 30 Amp (Green)
Rear Window Defogger
6 - 30 Amp (Green)
Power Window Control
7 - 30 Amp (Green)
Air Conditioner
8 - 40 Amp
Lights
9 - 10 Amp (Red)
AIR CONDITIONING & HEAT Compressor
10 - 25 Amp
Condenser Fan
11 - 10 Amp (Red)
Tail Lights
12 - 10 Amp (Red)
Headlight Upper Beam
13 - 10 Amp (Red)
Hazard Warning Flashers

MIRRORS - POWER

1997-99 Mitsubishi Montero Sport

1997-99 ACCESSORIES & EQUIPMENT
Mitsubishi - Mirrors - Power

Montero Sport

DESCRIPTION & OPERATION

Electric remote control mirrors are controlled by a dual-control switch mounted on driver's door, dash or center console depending on model. Left/right switch directs current to desired mirror. Horizontal/vertical switch directs current to electric motor in mirror assembly, controlling up/down and left/right adjustment. Heated mirrors are controlled by defogger relay.

TROUBLE SHOOTING

POWER MIRRORS INOPERATIVE

Check for faulty fuse no. 8, faulty power mirror switch or faulty power mirror motor.

COMPONENT TESTS

POWER MIRROR MOTOR TEST

Connect 12-volt power source to mirror connector terminals. See Fig. 1. Replace mirror as necessary.

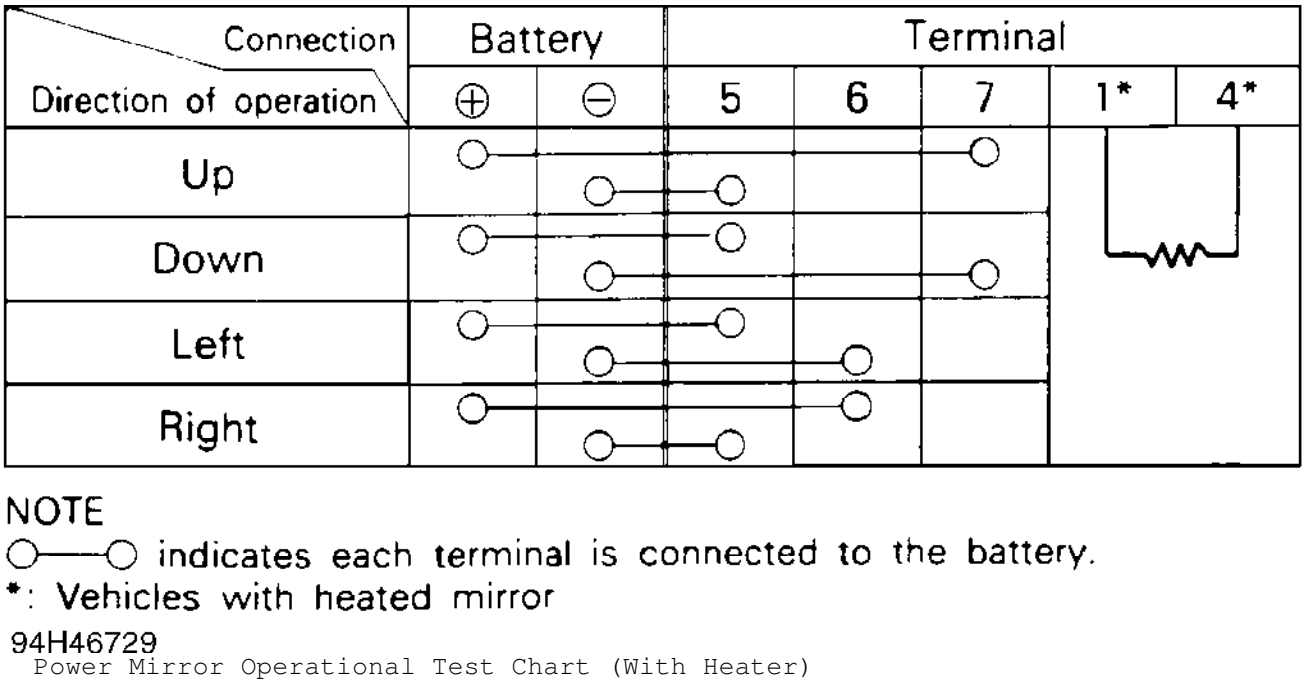

Fig. 1: Power Mirror Operational Test Chart (With Heater)
Courtesy of Chrysler Corp.

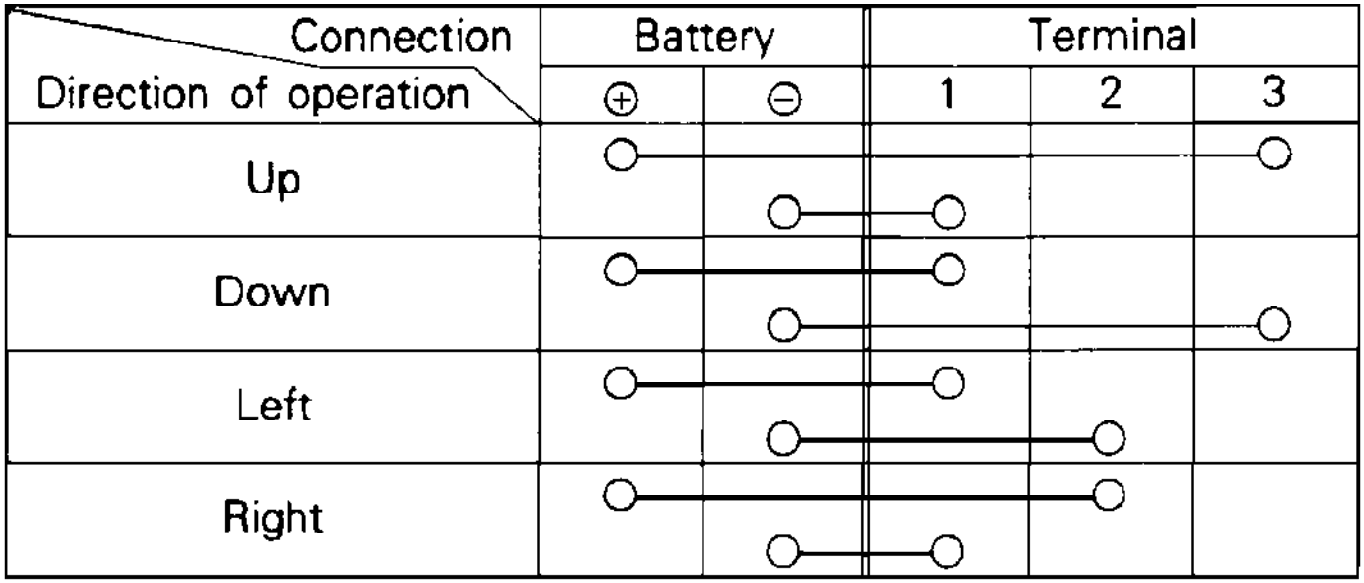

Fig. 2: Power Mirror Operational Test Chart (Without Heater)
Courtesy of Chrysler Corp.

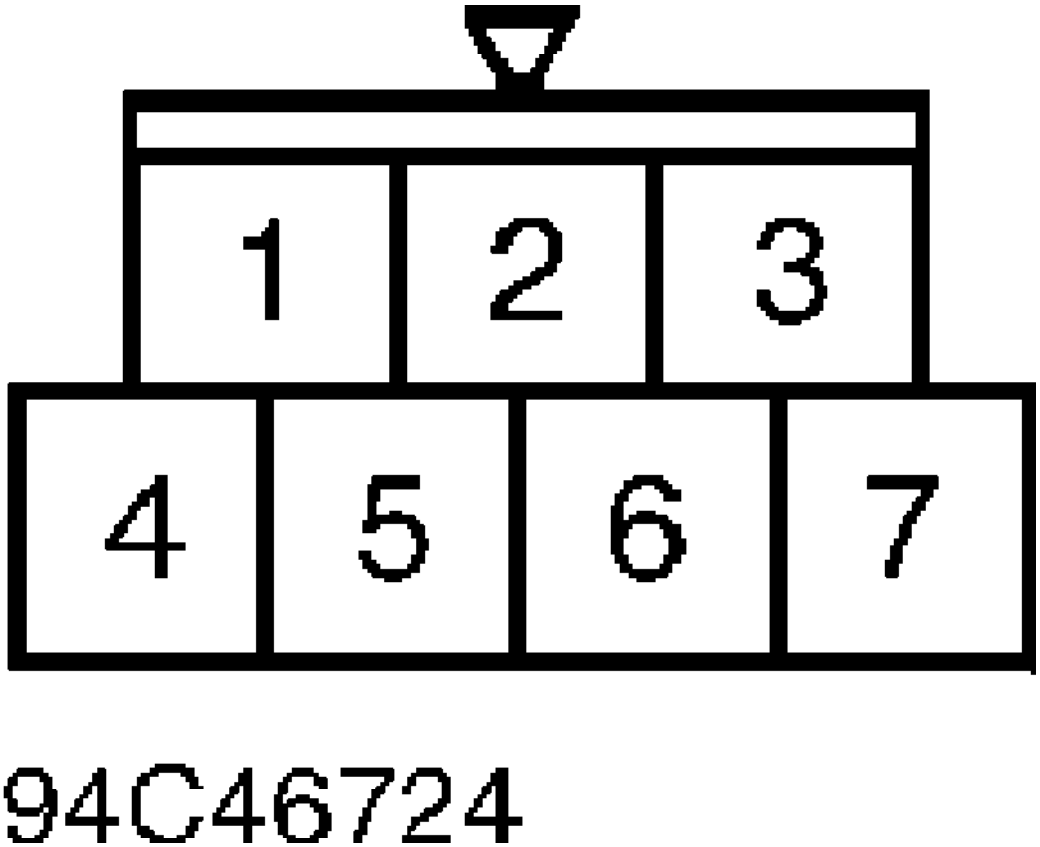

Fig. 3: Power Mirror Connector (With Heater)
Courtesy of Chrysler Corp.

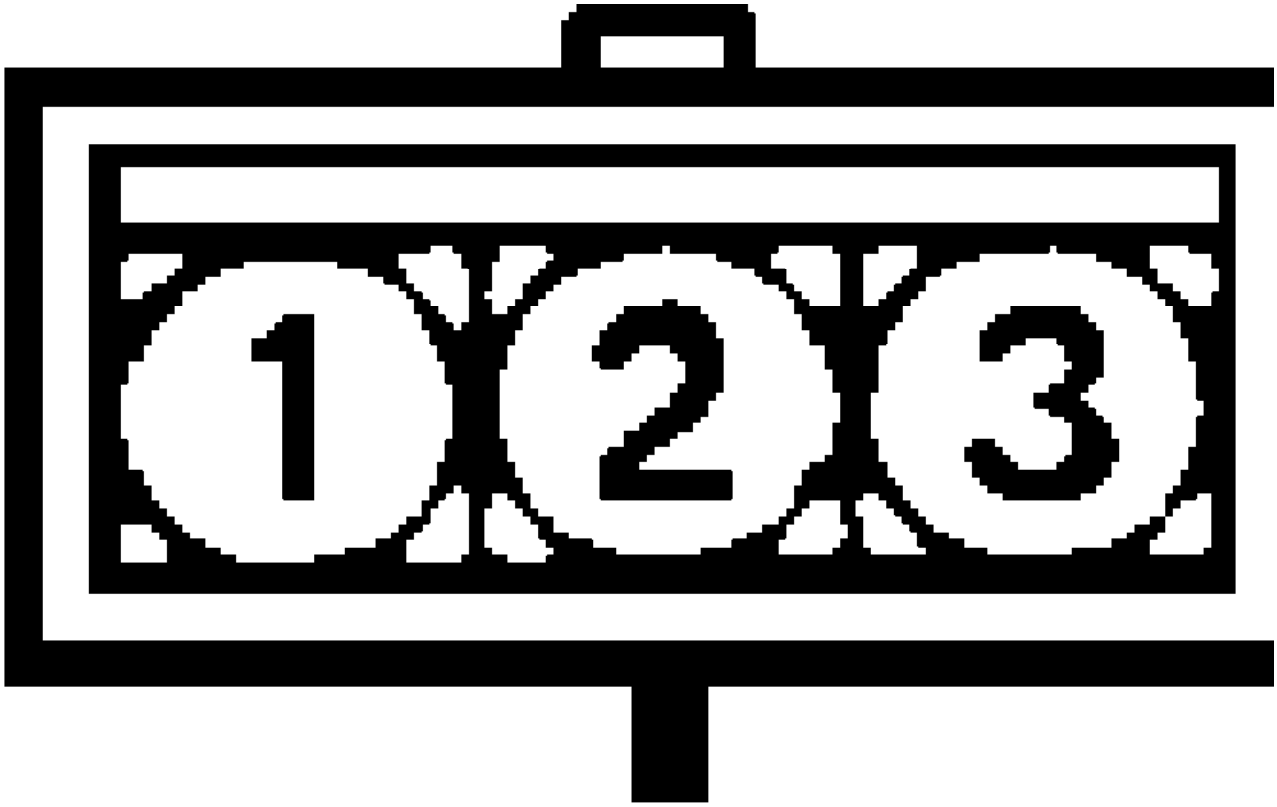

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Fig. 4: Power Mirror Connector (Without Heater)
Courtesy of Chrysler Corp.

POWER MIRROR SWITCH TEST

Remove mirror switch. Using ohmmeter, check continuity of switch. See POWER MIRROR SWITCH CONTINUITY CHART. See Fig. 3. Replace switch if switch continuity is not as specified.

POWER MIRROR SWITCH CONTINUITY CHART

Switch Position	(1) Check Continuity Between Pin No.
Left Side	
UP	4 & 8; 6 & 7
DOWN	4 & 7; 6 & 8
LEFT	3 & 6; 4 & 7
RIGHT	3 & 4; 6 & 7
Right Side	
UP	2 & 4; 6 & 7
DOWN	2 & 6; 4 & 7
LEFT	4 & 7; 6 & 9
RIGHT	4 & 9; 6 & 7

(1) - See Fig. 3.

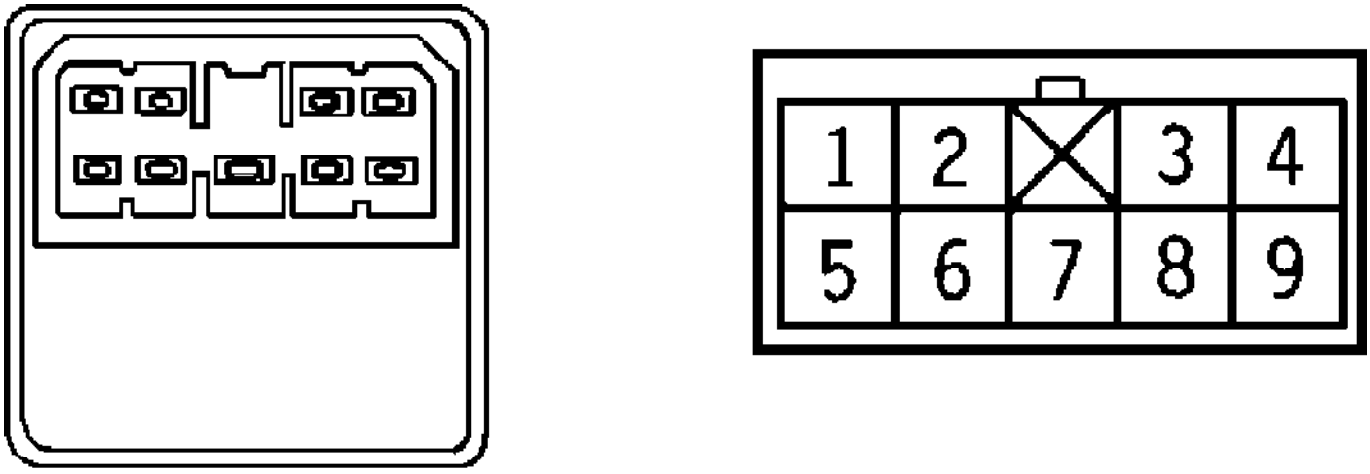


Fig. 5: Identifying Power Mirror Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

POWER MIRROR ASSEMBLY

Removal & Installation
Remove delta cover (trim cover), screws and electrical connector. Remove mirror assembly. To install, reverse removal procedure.

WIRING DIAGRAMS

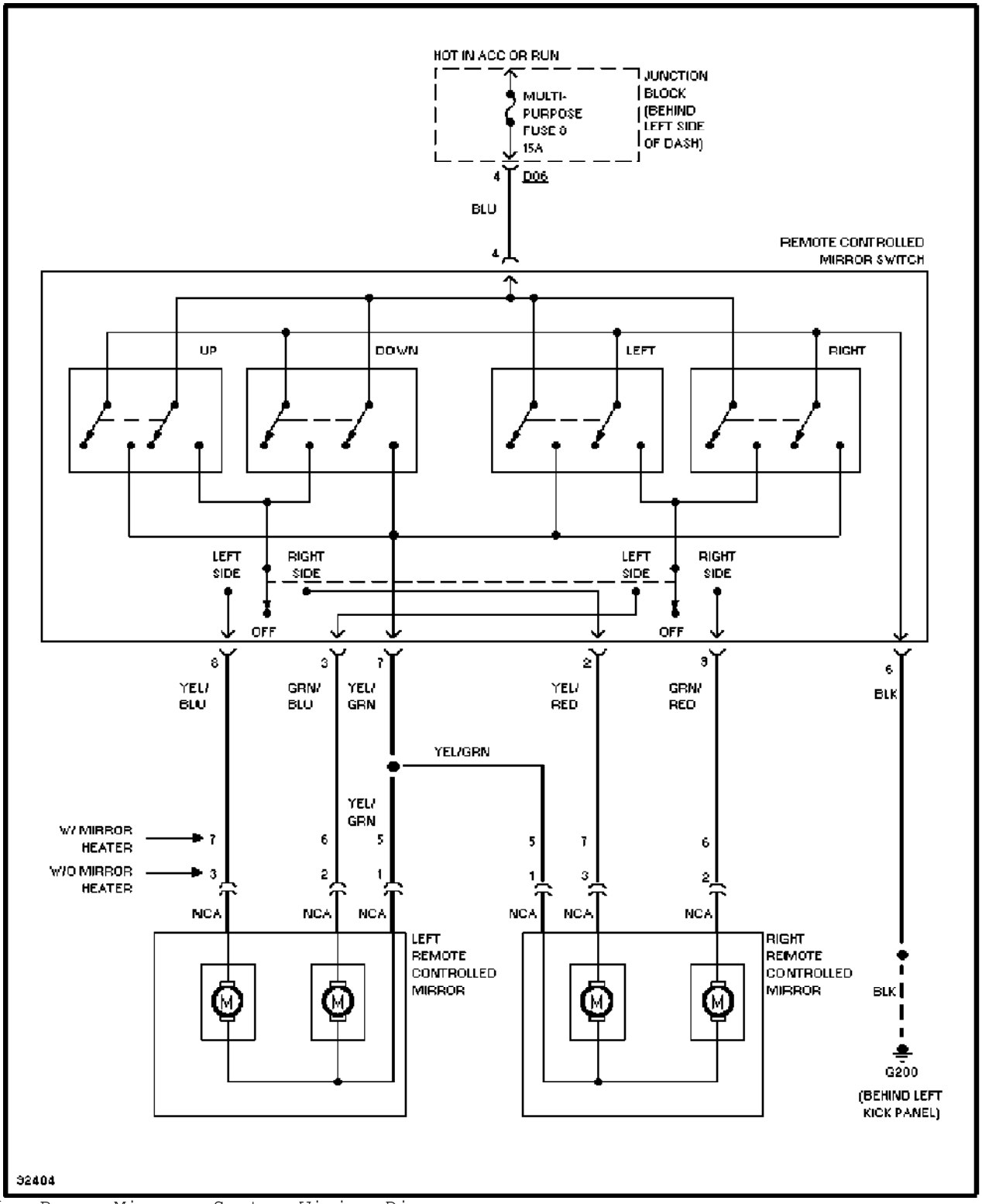


Fig. 6: Power Mirrors System Wiring Diagram

PARASITIC LOAD EXPLANATION & TEST PROCEDURES

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Parasitic Load Explanation & Test Procedures

*** PLEASE READ THIS FIRST ***

This article is provided for general information only. Not all procedures apply to all makes and models.

GENERAL INFORMATION

The term Parasitic Load refers to electrical devices that continue to use or draw current after the ignition switch is turned to OFF position. This small amount of continuous battery draw is expressed in milliamps (mA). On Ford Motor Co. and General Motors vehicles produced after 1980, a typical Parasitic Load should be no more than 50 milliamps (0.050 amps).

Vehicles produced since 1980 have memory devices that draw current with ignition off for as long as 20 minutes before shutting down the Parasitic Drain. When Parasitic Load exceeds normal specifications, the vehicle may exhibit dead battery and no-start condition.

Follow test procedure for checking Parasitic Loads to completion. A brief overview of a suggested test procedure is included along with some typical Parasitic Load specifications. Refer to the GENERAL MOTORS PARASITIC LOAD TABLE chart.

TESTING FOR PARASITIC LOAD

INTRODUCTION

CAUTION: Always turn ignition off when connecting or disconnecting battery cables, battery chargers or jumper cables. DO NOT turn test switch to OFF position (which causes current to run through ammeter or vehicle electrical system).

NOTE: Memory functions of various accessories must be reset after the battery is reconnected.

The battery circuit must be opened to connect test switch (shunt) and ammeter into the circuit. When a battery cable is removed, timer circuits within the vehicle computer are interrupted and immediately begin to discharge. If in doubt about the condition of the ammeter fuse, test it with an ohmmeter prior to beginning test. An open fuse will show the same reading (00.00) as no parasitic drain. Begin test sequence with the meter installed and on the 10-amp scale. Select lower scale to read parasitic draw.

TEST PROCEDURE USING TEST SWITCH

1) Turn ignition off. Remove negative battery terminal cable. Install Disconnect Tool (J-38758) test switch male end to negative battery cable. Turn test switch knob to OFF position (current through meter). Install negative battery cable to the female end of test switch.

2) Turn test switch knob to ON position (current through switch). Road test vehicle with vehicle accessories on (radio, air conditioner, etc.). After road test, turn ignition switch to LOCKED position and remove key. Connect ammeter terminals to test switch

terminals. See Fig. 1. Select 10-amp scale.

3) Turn off all electrical accessories. Turn off interior lights, underhood lamp, trunk light, illuminated entry, etc. To avoid damaging ammeter or obtaining a false meter reading, all accessories must be off before turning test switch knob to OFF position.

4) Turn test switch knob to OFF position to allow current to flow through ammeter. If meter reads wrong polarity, turn test switch to ON position and reverse leads. Turn test switch to OFF position. Observe current reading. If reading is less than 2 amps, turn test switch to ON position to keep electrical circuits powered-up.

5) Select low amp scale. Switch lead to the correct meter position. Turn test switch to OFF position and compare results to normal current draw. See the GENERAL MOTORS PARASITIC LOAD TABLE. If current draw is unusually high for the vehicle's overall electrical system, remove system fuses one at a time until current draw returns to normal.

6) Turn test switch to ON position each time door is opened or fuse is removed. Turn switch to OFF position to read current draw value through meter. When the cause of excessive current drain has been located and repaired, remove test switch and reconnect negative battery cable to the negative battery terminal.

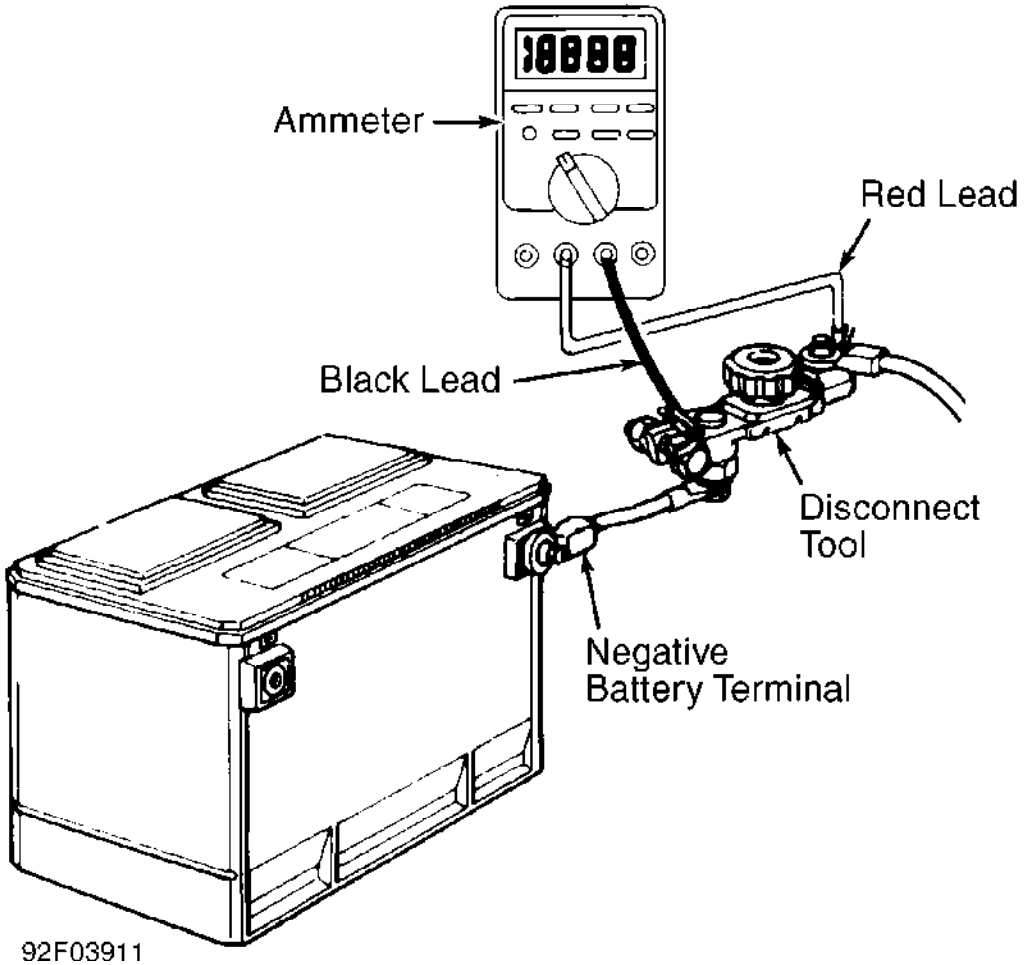


Fig. 1: Connecting Kent-Moore Disconnect Tool (J-38758)
Courtesy of General Motors Corp.

GENERAL MOTORS PARASITIC LOAD TABLE (MILLIAMPS)

Component	Normal Draw	Maximum Draw	Time-Out (Minutes)
Anti-Theft System	0.4	1.0	...
Auto Door Lock	1.0	1.0	...
Body Control Module	3.6	12.4	20
Central Processing System	1.6	2.7	20
Electronic Control Module	5.6	10.0	...
Electronic Level Control	2.0	3.3	20
Heated Windshield Module	0.3	0.4	...
HVAC Power Module	1.0	1.0	...
Illuminated Entry	1.0	1.0	1
Light Control Module	0.5	1.0	...
Oil Level Module	0.1	0.1	...
Multi-Function Chime	1.0	1.0	...
Pass Key Decoder Module	0.75	1.0	...
Power Control Module	5.0	7.0	...
Retained Accessory Power	3.8	3.8	...
Radio	7.0	8.0	15
Twilight Sentinel Module	1.0	1.0	...
Voltage Regulator	1.4	2.0	...

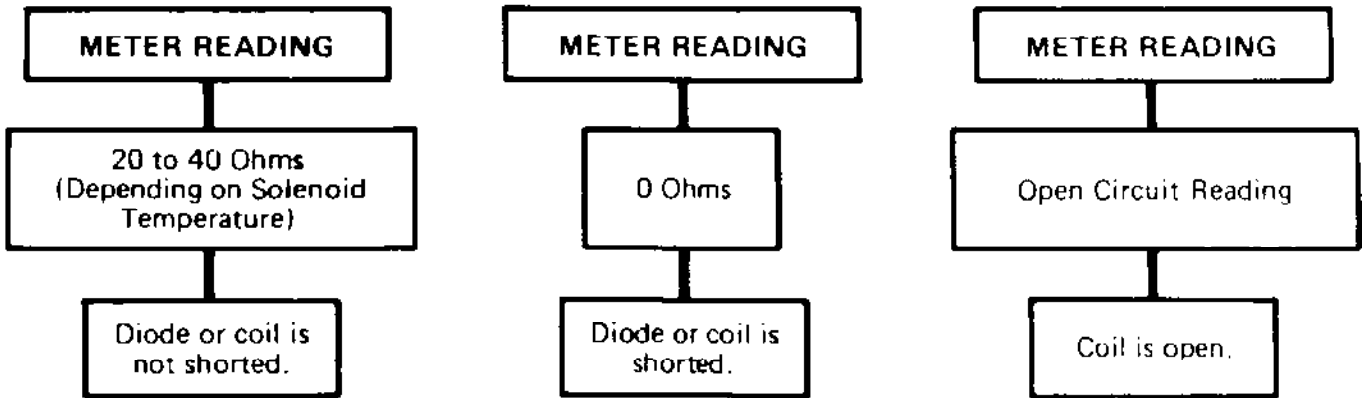
INTERMITTENT PARASITIC LOAD PROBLEMS

Intermittent parasitic lad can occur because of a memory device that does not power down with ignition off. With an intermittent parasitic load, battery draw can be greater than 1.0 amp. To find and intermittent problem requires that an ammeter and Disconnect Tool (J-38758) test switch be connected and left in the circuit. See Fig. 1. Road test vehicle. After road test, turn ignition off and remove key.

Monitor the milliamps scale for 15-20 minutes after ignition is turned off. This allows monitoring memory devices to determine if they time out and stop drawing memory current. The test switch is needed to protect ammeter when the vehicles is started.

DIODE CHECK & SOLENOID TEST (GENERAL MOTORS)

Step 1) Select the X1 SCALE and zero the needle.
Step 2) Attach the POSITIVE SOLENOID LEAD (Red lead) to the POSITIVE METER LEAD and the NEGATIVE SOLENOID LEAD (Black lead) to the NEGATIVE METER LEAD.



Step 3) Reverse the solenoid lead attachments.

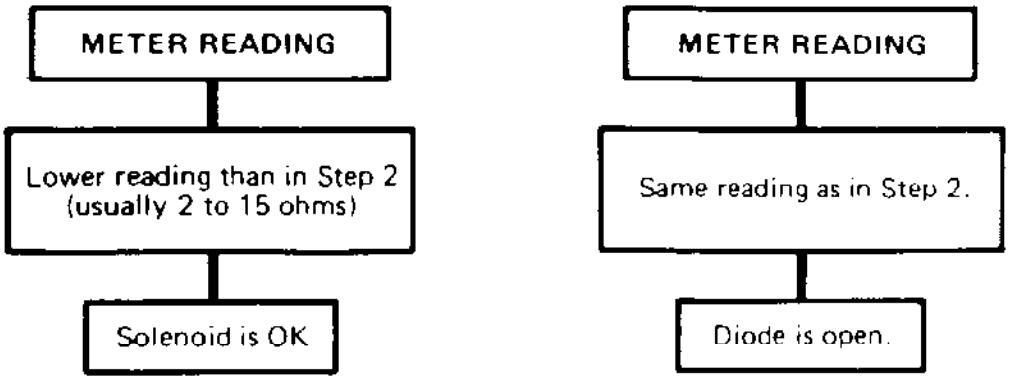


Fig. 2: Diode Check & Solenoid Test (General Motors)
Courtesy of General Motors Corp.

QUAD DRIVER TEST (GENERAL MOTORS)

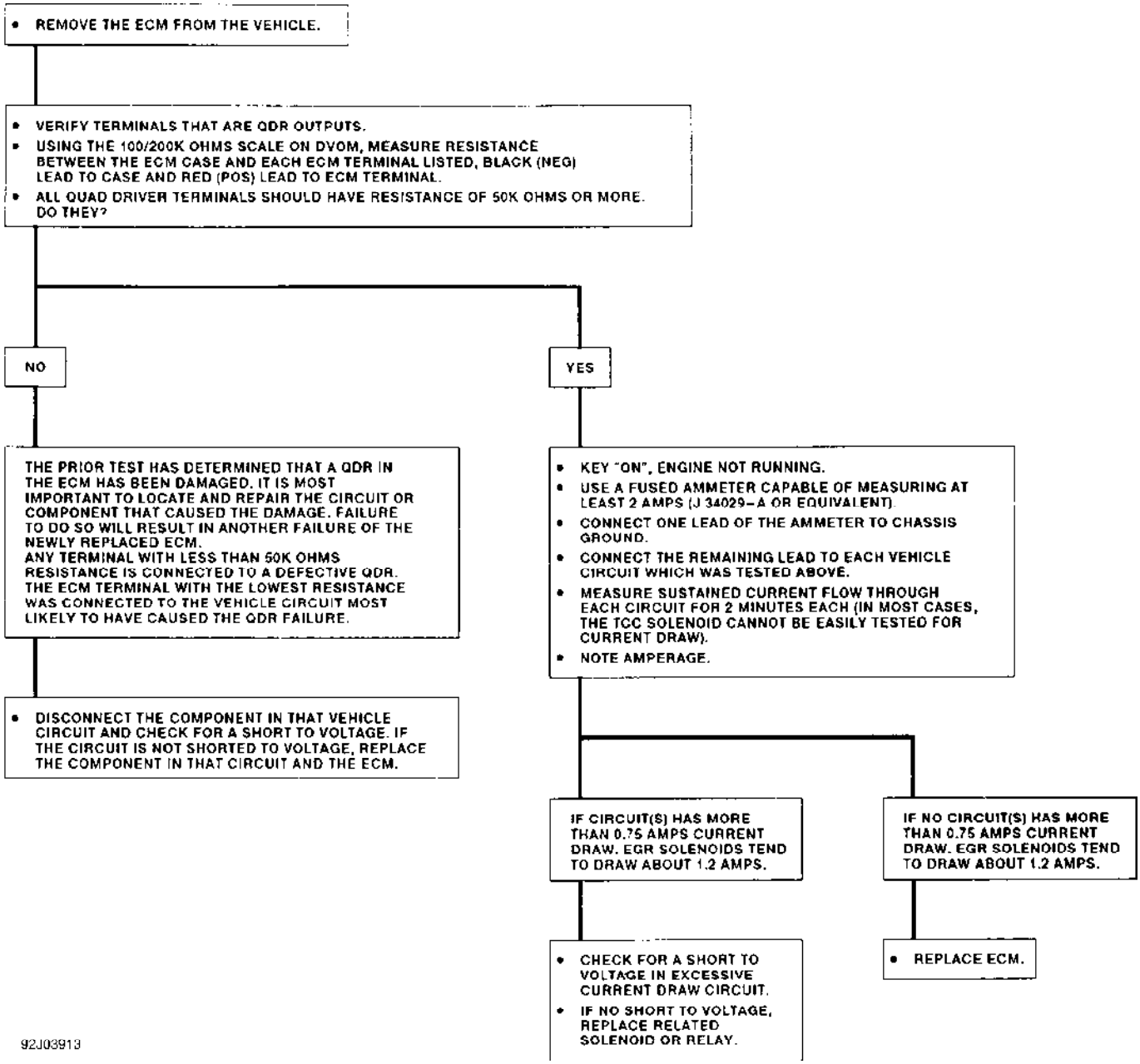


Fig. 3: Quad Driver Test (General Motors)
Courtesy of General Motors Corp.

PASSIVE RESTRAINT SYSTEM INSPECTION

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Passive Restraint System Inspection - Asian

*** PLEASE READ THIS FIRST ***

Follow all manufacturers servicing precautions when working with air bag systems. See SERVICE PRECAUTIONS in the appropriate AIR BAG RESTRAINT SYSTEM article in the ACCESSORIES/SAFETY EQUIPMENT section.

INTRODUCTION

When a vehicle equipped with passive restraint system has been involved in a collision, certain systems and components must be inspected and or replaced regardless of whether or not the air bag has deployed. Follow the manufacturer's guidelines provided in this article.

ACURA (1988-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - ACURA (1988-98)

Model	Year	(1) Location
Integra	1994-98	D/P
Legend	1991-95	D/P
	1988-90	DS
NSX	1993-98	D/P
	1991-92	DS
Vigor	1993-94	D/P
	1992	DS
2.2CL	1997	D/P
2.3CL	1998	D/P
2.5TL	1995-98	D/P
3.0CL	1997-98	D/P
3.2TL	1996-98	D/P
3.5RL	1996-98	D/P
SLX	1996-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - ACURA (1988-98 EXCEPT SLX)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Seat Belt Tensioners (If Equipped) * SRS Control Unit
Inspect & If Damaged, Replace Component	* Cable Reel * Dash or Impact Sensors (If Equipped) * Seat Belts

(Even If Air Bag Did Not Deploy)	* SRS Control Unit * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness. * After vehicle is repaired, ensure AIR BAG warning light is functioning properly.

INSPECTION PROCEDURES TABLE - ACURA (1996-98 SLX)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolsters & Mounting Points * Steering Column * SRS Coil Assembly * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

HONDA (1991-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - HONDA (1991-98)

Model	Year	(1) Location
Accord	1993-98	D/P
	1991-92	DS
Civic	1994-98	D/P
	1992-93	DS
Civic del Sol	1994-97	D/P
	1993	DS
CR-V	1997-98	D/P
Odyssey	1995-98	D/P
Prelude	1994-98	D/P
SI 4WS	1992-93	D/P
Except SI 4WS	1992-93	DS
Passport	1995 1/2-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - HONDA (1991-98 EXCEPT PASSPORT)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Seat Belt Tensioners (If Equipped) * SRS Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Cable Reel * Dash Sensors (1991-94) * Seat Belts * SRS Control Unit * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness. * After vehicle is repaired, ensure AIR BAG warning light is functioning properly.

INSPECTION PROCEDURES TABLE - HONDA (1995 1/2-98 PASSPORT)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolsters & Mounting Points * Steering Column * SRS Coil Assembly * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

HYUNDAI (1994-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - HYUNDAI (1994-98)

Model	Year	(1) Location
Accent	1995-98	D/P
Elantra	1996-98	D/P
	1994-95	DS
Sonata	1995-98	D/P
Tiburon	1997-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - HYUNDAI (1994-98)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Module * Steering Column Clockspring
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Any Seat Belt In Use At Time Of Collision * Steering Column * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness.

INFINITI (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - INFINITI (1990-98)

Model	Year	(1) Location	Inspection Table
G20	1993-96	D/P	INFINITI-2
I30	1998	D/P, SI	INFINITI-1
	1997	D/P	INFINITI-1
	1996	D/P	INFINITI-2
J30	1997	D/P	INFINITI-1
	1994-96	D/P	INFINITI-2
	1993	D/P	INFINITI-3
M30	1990-92	DS	INFINITI-3
Q45	1998	D/P, SI	INFINITI-1
	1997	D/P	INFINITI-1
	1994-96	D/P	INFINITI-2
	1990-93	DS	INFINITI-3
QX4	1997-98	D/P	INFINITI-1

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - INFINITI-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Satellite Sensor (1) * Seat Belt Pretensioners (2)

	* Side Air Bag Module (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Pillar Inner (1) * Instrument Panel * Seat (1) * Seat Belt Pretensioners (2) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* Inspect all SRS components for dents, deformities or rust. * After repairs are completed, check AIR BAG warning light to ensure system is functioning properly.
(1) - On side of impact. (2) - Except I30 and QX4.	

INSPECTION PROCEDURES TABLE - INFINITI-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Instrument Panel * Seat Belt Pretensioners (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors (2) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* Inspect all SRS components for dents, deformities or rust. * After repairs are completed, check AIR BAG warning light to ensure system is functioning properly.
(1) - Except I30. (2) - Except 1996 I30, 1995-96 J30 and 1995-96 Q45.	

INSPECTION PROCEDURES TABLE - INFINITI-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Sensors In Affected Collision Area
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* Inspect all SRS components for dents, deformities or rust.

	* After repairs are completed, check AIR BAG warning light to ensure system is functioning properly.

ISUZU (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - ISUZU (1990-98)

Model	Year	(1) Location	Inspection Table
Hombre	1996-97	DS	ISUZU-1
Impulse	1990-92	DS	ISUZU-5
Oasis	1996-98	D/P	ISUZU-2
Rodeo	1996-98	D/P	ISUZU-3
	1995 1/2	D/P	ISUZU-3
Stylus	1991-93	DS	ISUZU-5
Trooper	1996-98	D/P	ISUZU-3
	1995	D/P	ISUZU-4

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - ISUZU-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensors In Area Of Accident Damage
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolster * Sensors In Area Of Accident Damage * SRS Coil Assembly
Comments	* Any sensor which the Diagnostic Energy Reserve Module (DERM) indicates as bad must be replaced. * If any components are damaged or bent, they must be replaced. * SRS wiring can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - ISUZU-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Seat Belt Tensioners (If Equipped) * SRS Control Unit
Inspect & If Damaged, Replace	* Cable Reel * Dash Sensors (1991-94)

Component (Even If Air Bag Did Not Deploy)	* Seat Belts * SRS Control Unit * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring repairs. If SRS wiring or harness connectors are faulty, replace faulty wiring harness. * After vehicle is repaired, ensure AIR BAG warning light is functioning properly.

INSPECTION PROCEDURES TABLE - ISUZU-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel Braces * Instrument Panel Steering Column Reinforcement Plate * Seat Belts & Mounting Points * Knee Bolsters & Mounting Points * Steering Column * SRS Coil Assembly * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

INSPECTION PROCEDURES TABLE - ISUZU-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * All Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* SRS Coil Assembly * Instrument Panel Steering Column Reinforcement Panel * Instrument Panel Braces * Knee Bolsters * Seat Belts Mounting Points * Sensors In Area of Accident Damage * Steering Column
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace harness.

INSPECTION PROCEDURES TABLE - ISUZU-5

Action	Component or System
Replace After	* Air Bag Module

Deployment	
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Arming Sensor * Coil Assembly * Diagnostic Energy Reserve Module (DERM) * Forward Sensor * Instrument Panel-To-Steering Column Reinforcement * Knee Pad * Passenger Compartment Sensor * Steering Column * Wiring Harness & Brackets
Comments	* If any components are damaged or bent, they must be replaced.

KIA (1995-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - KIA (1995-98)

Model	Year	(1) Location
Sephia	1996-98	D/P
	1995 1/2	D/P
Sportage	1996-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - KIA (1995-98)

Action	Component or System
Replace After Deployment	* Air Bag Module(s)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Air Bag Diagnosis Control Unit * Clockspring * Impact Sensors Sensor Mountings (1) * Steering Column * Steering Wheel * Wiring Harness
Comments	* After repairs a completed, ensure Warning Light is functioning properly.
(1) - 1995 1/2 Sephia only.	

LEXUS (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - LEXUS (1990-98)

Model	Year	(1) Location	Inspection Table
ES250	1990-91	DS	LEXUS-6
ES300	1998	D/P, SI	LEXUS-3
	1997	D/P	LEXUS-1
	1994-96	D/P	LEXUS-4
	1992-93	DS	LEXUS-5
GS300	1998	D/P, SI	LEXUS-3
	1993-97	D/P	LEXUS-4
GS400	1998	D/P, SI	LEXUS-3
LS400	1997-98	D/P, SI	LEXUS-3
	1995-96	D/P	LEXUS-1
	1993-94	D/P	LEXUS-4
	1990-92	DS	LEXUS-6
LX450	1996-97	D/P	LEXUS-1
LX470	1998	D/P	LEXUS-2
SC300	1996-98	D/P	LEXUS-1
	1993-95	D/P	LEXUS-4
	1992	DS	LEXUS-5
SC400	1996-98	D/P	LEXUS-1
	1993-95	D/P	LEXUS-4
	1992	DS	LEXUS-5

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - LEXUS-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Seat Belt Pretensioners (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Glove Compartment Door (2) * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced.

(1) - 1995 LS400 only.
(2) - 1997 ES300, 1996 LS400 and 1996-97 LX450 only.

INSPECTION PROCEDURES TABLE - LEXUS-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensors * Seat Belt Pretensioner
Inspect & If Damaged, Replace Component	* Instrument Panel * Instrument Panel Reinforcement * Seat Belt Pretensioner

(Even If Air Bag Did Not Deploy)	* Spiral Cable Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.

INSPECTION PROCEDURES TABLE - LEXUS-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Seat Belt Pretensioner (1) * Side Air Bag Modules * Side Air Bag Sensor Assembly
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Glove Compartment Door (2) * Instrument Panel Instrument Panel Reinforcement * Seat Belt Pretensioner (1) * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.
(1) - Except 1997 LS400. (2) - 1997 LS400 only.	

INSPECTION PROCEDURES TABLE - LEXUS-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Front Air Bag Sensors * Front Seat Belt Tensioners (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Glove Compartment Door (2) * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.
(1) - 1993-95 GS300 and 1993-94 LS400. (2) - Except 1994-95 SC300 and SC400.	

INSPECTION PROCEDURES TABLE - LEXUS-5

Action	Component or System
Replace After Deployment	* Air Bag Module * Center Air Bag Sensor Assembly * Front Air Bag Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - LEXUS-6

Action	Component or System
Replace After Deployment	* Air Bag Module * Front Air Bag Sensors
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Air Bag Sensor Assembly * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

MAZDA (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - MAZDA (1990-98)

Model	Year	(1) Location	Inspection Table
Miata	1995-97	D/P	MAZDA-1
	1994	D/P	MAZDA-2
	1990-93	DS	MAZDA-2
Millenia	1995-98	D/P	MAZDA-1
MPV	1996-98	D/P	MAZDA-1
	1995	DS	MAZDA-1
	1994	DS	MAZDA-2
MX-3	1994-95	D/P	MAZDA-2
MX-6	1995-98	D/P	MAZDA-1
	1994	D/P	MAZDA-2
	1993	DS	MAZDA-2

Pickup	1996-98	D/P	MAZDA-2
	1995-96	DS	MAZDA-2
Protege	1995-98	D/P	MAZDA-1
RX7	1994-95	D/P	MAZDA-2
	1990-93	DS	MAZDA-2
626	1995-98	D/P	MAZDA-1
	1994	D/P	MAZDA-2
	1993	DS	MAZDA-2
929	1992-95	D/P	MAZDA-2

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - MAZDA-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Impact Sensors & Sensors Mountings * Steering Column * Steering Wheel * Wiring Harness
Comments	* DO NOT attempt wiring harness repairs. Replace entire wiring harness. * Impact sensors must always be installed with arrow on sensor facing front of vehicle.

INSPECTION PROCEDURES TABLE - MAZDA-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Diagnosis Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Impact Sensors & Sensors Mountings * Steering Column Steering Wheel Wiring Harness
Comments	* DO NOT attempt wiring harness repairs. Replace entire wiring harness. * Impact sensors must always be installed with arrow on sensor facing front of vehicle.

MITSUBISHI (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - MITSUBISHI (1990-98)

Model	Year	(1) Location	Inspection Table
Diamante	1997-98	D/P	MITSUBISHI-1
	1994-96	D/P	MITSUBISHI-2
	1992-93	DS	MITSUBISHI-2
Eclipse	1996-98	D/P	MITSUBISHI-1
	1995	D/P	MITSUBISHI-3
Expo	1994-95	DS	MITSUBISHI-1
Galant	1997-98	D/P	MITSUBISHI-1
	1994-96	D/P	MITSUBISHI-2
Mirage	1997-98	D/P	MITSUBISHI-1
	1995-96	D/P	MITSUBISHI-4
	1994	DS	MITSUBISHI-4
Montero	1996-98	D/P	MITSUBISHI-2
	1994-95	DS	MITSUBISHI-2
Montero Sport	1997-98	D/P	MITSUBISHI-2
Sigma	1990	DS	MITSUBISHI-3
3000GT	1997-98	D/P	MITSUBISHI-1
	1994-96	D/P	MITSUBISHI-2
	1991-93	DS	MITSUBISHI-2

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - MITSUBISHI-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * SRS Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Steering Column & Intermediate Joint * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - MITSUBISHI-2

Action	Component or System
Replace After Deployment	* Air BagModule(s) * Front Impact Sensors * SRS Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Steering Column & Intermediate Joint * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - MITSUBISHI-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Clockspring * Front Impact Sensors * SRS Control Unit * Steering Column & Intermediate Joint * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - MITSUBISHI-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Control Unit
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Clockspring * Steering Column * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

NISSAN (1989-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - NISSAN (1989-98)

Model	Year	(1) Location	Inspection Table
Altima	1998	D/P	NISSAN-3
	1995-97	D/P	NISSAN-4
	1994	D/P	NISSAN-6
	1993	DS	NISSAN-6
Frontier	1998	D/P	NISSAN-1
Maxima	1998	D/P, SI	NISSAN-2
	1997	D/P	NISSAN-3
	1995-96	D/P	NISSAN-4
	1994	D/P	NISSAN-5
	1992-93	DS	NISSAN-6
NX Coupe	1991-93	DS	NISSAN-6
Pathfinder	1996-98	D/P	NISSAN-5

Pickup	1996-97	DS		NISSAN-5
Pulsar NX	1989-90	DS		NISSAN-6
Quest	1997-98	D/P		NISSAN-3
	1996	D/P		NISSAN-4
	1994-95	DS		NISSAN-5
Sentra	1997-98	D/P		NISSAN-3
	1995-96	D/P		NISSAN-4
	1994	DS		NISSAN-5
	1993	DS		NISSAN-6
200SX	1997-98	D/P		NISSAN-3
	1995-96	D/P		NISSAN-4
240SX	1997-98	D/P		NISSAN-3
	1995-96	D/P		NISSAN-4
300ZX	1994-96	D/P		NISSAN-4
	1991-93	DS		NISSAN-6

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - NISSAN-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Crash Zone Sensor (1) * Instrument Panel * Passenger Deactivation Switch * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.
(1) - 4WD only.	

INSPECTION PROCEDURES TABLE - NISSAN-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Side Air Bag Module (1) * Satellite Sensor (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Pillar Inner (1) * Instrument Panel * Seat (1) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced.

	* DO NOT attempt SRS wiring harness repairs.
(1) - On side of impact.	

INSPECTION PROCEDURES TABLE - NISSAN-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.

INSPECTION PROCEDURES TABLE - NISSAN-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors (1) * Instrument Panel * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.
(1) - 300ZX Only.	

INSPECTION PROCEDURES TABLE - NISSAN-5

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors (1) * Crash Zone Sensor (2) * Instrument Panel (3) * Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. DO NOT attempt SRS wiring harness repairs.

(1) - Except Pathfinder and Pickup.
(2) - 4WD Pickup only.
(3) - Pathfinder only.

INSPECTION PROCEDURES TABLE - NISSAN-6

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Control Unit, Diagnosis * Sensors In Affected Collision Area
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* All Sensors Spiral Cable * Steering Wheel * Wiring Harnesses
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt SRS wiring harness repairs.

SUBARU (1992-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - SUBARU (1992-98)

Model	Year	(1) Location
Forester	1998	D/P
Impreza	1994-98	D/P
	1993	DS
Legacy	1995-98	D/P
	1992-94	DS
SVX	1994-97	D/P
	1992-93	DS

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - SUBARU (1992-98)

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Control Module * Front Impact Sensors (1) * Side Air Bag Sensors (2)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Air Bag Control Module * Combination Switch & Clockspring * Front Impact Sensors

Comments	* DO NOT attempt SRS wiring repairs. * If any components are damaged or bent, they must be replaced.

(1) - If Equipped.
(2) - 1998 Legacy, on side of deployment.

SUZUKI (1995-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - SUZUKI (1995-98)

Model	Year	(1) Location
Esteem	1995-98	D/P
Sidekick	1996-98	D/P
Swift	1995-98	D/P
X90	1996-98	D/P

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - SUZUKI (1995-98)

Action	Component or System
Replace After Deployment	* Air BagModule(s) * Sensing & Diagnostic Module (SDM)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Air Bag Warning Light * Combination Switch Assembly * Contact Coil * Forward Discriminating Sensor (1) * Instrument Panel Reinforcement * Knee Bolsters * Seat Belts & Mounting Points * SDM Bracket * Steering Column Bracket * Steering Column & Shaft Joints * Steering Wheel * Wiring Harness
Comments	* If any components are damaged or bent, they must be replaced.

(1) - Swift Only

TOYOTA (1990-98)

AIR BAG APPLICATION

AIR BAG APPLICATION TABLE - TOYOTA (1990-98)

Model	Year	(1) Location	Inspection Table
Avalon	1998	D/P, SI	TOYOTA-1
	1996-97	D/P	TOYOTA-3
	1995	D/P	TOYOTA-4
Camry	1998	D/P, SI	TOYOTA-1
	1997	D/P	TOYOTA-3
	1996	D/P	TOYOTA-5
	1994-95	D/P	TOYOTA-6
	1992-93	DS	TOYOTA-9
Celica	1998	D/P	TOYOTA-2
	1996-97	D/P	TOYOTA-5
	1994-95	D/P	TOYOTA-7
	1990-93	DS	TOYOTA-10
Corolla	1998	D/P, SI	TOYOTA-1
	1996-97	D/P	TOYOTA-3
	1994-95	D/P	TOYOTA-6
	1993	DS	TOYOTA-9
Land Cruiser	1998	D/P	TOYOTA-2
	1995-97	D/P	TOYOTA-4
MR2	1994-95	D/P	TOYOTA-5
	1991-93	DS	TOYOTA-10
Paseo	1996-97	D/P	TOYOTA-3
	1993-95	DS	TOYOTA-9
Previa	1996-97	D/P	TOYOTA-3
	1994-95	D/P	TOYOTA-6
	1992-93	DS	TOYOTA-9
RAV4	1996-98	D/P	TOYOTA-3
Sienna	1998	D/P	TOYOTA-1
Supra	1997-98	D/P	TOYOTA-3
	1993-96	D/P	TOYOTA-5
	1990-92	DS	TOYOTA-10
Tercel	1998	D/P	TOYOTA-2
	1996-97	D/P	TOYOTA-3
	1995	D/P	TOYOTA-8
	1993-94	DS	TOYOTA-9
Tacoma	1998	D/P	TOYOTA-3
	1996-97	DS	TOYOTA-3
T100	1994-98	DS	TOYOTA-9
4Runner	1996-98	D/P	TOYOTA-4

(1) - Location Definitions: D/P = Driver's & Passenger's Side, DS = Driver's Side Only, SI = Side Impact.

INSPECTION PROCEDURES

INSPECTION PROCEDURES TABLE - TOYOTA-1

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensors (1) * Seat Belt Pretensioner (2) * Seatback Assembly (2) (3) * Side Air Bag Modules (If Equipped) (2) * Side Air Bag Sensor Assembly (If equipped) (1)

Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel * Instrument Panel Reinforcement * Seatback Assembly (2) * Seat Belt Pretensioner (2) * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.
(1) - Corolla and Sienna only. Replace both sensors. (2) - On side of impact. (3) - Avalon only.	

INSPECTION PROCEDURES TABLE - TOYOTA-2

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensors * Seat Belt Pretensioner (1)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Instrument Panel * Instrument Panel Reinforcement * Seat Belt Pretensioner (1) * Spiral Cable * Steering Wheel * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * DO NOT attempt wiring harness repairs. Replace entire wiring harness.
(1) - Land Cruiser and Tercel only.	

INSPECTION PROCEDURES TABLE - TOYOTA-3

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Front Air Bag Sensor (1) * Instrument Panel (2) * Instrument Panel Reinforcement (2) * Spiral Cable (3) * Steering Wheel (3)
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Spiral Cable (4) * Steering Wheel (4) * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they

	must be replaced.

(1) - 1998 RAV4 only.
(2) - Except 1996-97 Tacoma and 1998 Supra.
(3) - Except 1998 Tacoma.
(4) - 1998 Tacoma.

INSPECTION PROCEDURES TABLE - TOYOTA-4

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Glove Compartment Door * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - TOYOTA-5

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Front Air Bag Sensors * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-6

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly

	* Front Air Bag Sensors * Glove Compartment * Glove Compartment Door * Instrument Panel * Instrument Panel Reinforcement * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-7

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Center Console Bracket Support * Front Air Bag Sensors * Instrument Panel * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-8

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Air Bag Sensor Assembly * Center Console Bracket Support * Instrument Panel Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not	* Wiring Harness & Connectors

Deploy)	
Comments	* If any components are damaged or bent, they must be replaced.

INSPECTION PROCEDURES TABLE - TOYOTA-9

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Center Air Bag Sensor Assembly * Front Air Bag Sensors * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

INSPECTION PROCEDURES TABLE - TOYOTA-10

Action	Component or System
Replace After Deployment	* Air Bag Module(s) * Front Air Bag Sensors * Spiral Cable * Steering Wheel
Inspect & If Damaged, Replace Component (Even If Air Bag Did Not Deploy)	* Center Air Bag Sensor Assembly * Wiring Harness & Connectors
Comments	* If any components are damaged or bent, they must be replaced. * Wiring for Front Air Bag Sensors can be repaired following manufacturer's instructions.

J - PIN VOLTAGE CHARTS - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Pin Voltage Charts

Montero Sport - 2.4L

INTRODUCTION

NOTE: Unless stated otherwise in testing procedures, perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance. Voltage readings may vary slightly due to battery condition or charging rate.

Pin voltage charts are supplied to reduce diagnostic time. Checking pin voltages at the PCM connector determines whether it is receiving and transmitting proper voltage signals. Diagnostic charts may also help determine if PCM harness is shorted or open.

TEST PROCEDURE

CAUTION: Shorting positive DVOM lead between connector terminal and ground could damage vehicle wiring, sensor and PCM.

1) If necessary, remove PCM to access harness connector. For PCM location, see PCM LOCATION table. Leave PCM connectors connected. Using DVOM, backprobe terminals with positive lead. Connect negative lead to PCM ground terminal. See appropriate chart for identification of ground terminal. See Figs. 1-4.

2) All measurements are applicable to vehicle at normal operating temperature at sea level. Unless otherwise noted, engine is idling when specification requires engine running. Ensure transmission shift selector is in Neutral or Park (as applicable). If DVOM displays measurement that is not within specification, see appropriate G - TESTS W/CODES - 2.4L article.

PCM LOCATION TABLE

Application	Location
Montero Sport	Behind Right Side Of Instrument Panel (Glove Box)

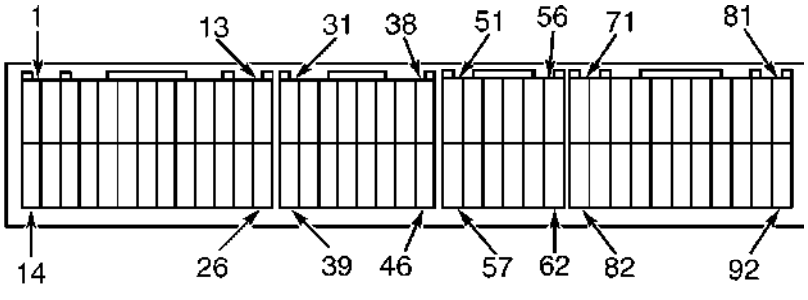


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Fig. 1: Identifying PCM Terminals
Courtesy of Mitsubishi Motor Sales of America.

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Yellow/Green [1]	1	Injector No. 1	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Yellow/Green [3]	2	Injector No. 3	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Lt. Green/White	3	Injector No. 5 (3.0L)	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Blue [4]	4	Idle Air Control Motor A1	B+/0-3 Volts (Pulse) After Hot Start
White [5]	5	Idle Air Control Motor B1	B+/0-3 Volts (Pulse) After Hot Start
Brown [6]	6	EGR Solenoid (Fed.)	B+ With KOEO [7] B+ & Momentary Drop @ WOT With KOER [2]
Yellow/Blue	7	Transaxle (3.0L)	[8]
White/Red	8	MFI Pump Relay (2.4L)	B+ With KOEO [7], 0-3 Volts With KOER [2]
White/Red	8	MFI Relay Module (3.0L)	0-5 Volts With KOEO [7], 4-6 Volts (Cranking)
Black/Yellow	9	EVAP Emission Purge Solenoid (2.4L.)	B+ With KOEO [7], 0-3 Volts With KOER [2]
White	10	Ignition Power Transistor "A"	0.3-3.0 Volts @ 3000 RPM
Blue	11	Ignition Power Transistor "C" (3.0L)	0.3-3.0 Volts @ 3000 RPM
Red [9]	12	Power Supply	B+ With KOEO [7]
Black	13	Ground Circuit	Not Applicable
Yellow/Black [6]	14	Injector No. 2	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Yellow/Black	15	Injector No. 4	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Yellow/Green	16	Injector No. 6 (3.0L)	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Yellow [9]	17	Idle Air Control Motor A2	B+/0-3 Volts (Pulse) After Hot Start
Green [10]	18	Idle Air Control Motor B2	B+/0-3 Volts (Pulse) After Hot Start
Yellow/White [11]	19	Volume Airflow Sensor Reset Signal	0-1 Volt With KOER [2], 6-9 Volts @ 3000 RPM
Green/Yellow [12]	22	A/C Compressor Clutch Relay	6 Volts Or More With KOER [2] 0-3 Volts With Clutch Cycling
Black/Yellow	23	Ignition Power Transistor "B" (3.0L)	0.3-3.0 Volts @ 3000 RPM
White/Black	24	Defogger System (2.4)	[8]
Red [9]	25	Power Supply	B+ With KOEO [7]
Black	26	Ground Circuit	Not Applicable
White/Black	31	Spark Check Signal (2.4L)	2-6 Volts @ 3000 RPM
Blue/White	32	EVAP Emission Purge Solenoid (3.0L)	B+ With KOEO [7], 0-3 Volts With KOER [2]
Lt. Green/Red	34	Front Heated Oxygen Sensor Heater (3.0L - Fed.)	0-3 Volts With KOER [2], B+ @ 5000 RPM
Black/White	34	LF Heated Oxygen Sensor Heater (3.0L - Calif.)	0-3 Volts With KOER [2], B+ @ 5000 RPM

[1] - Wire color is Yellow/Blue on 3.0L.
[2] - KOER - Key On, Engine Running.
[3] - Wire color is Yellow/White on 3.0L.
[4] - Wire color is Green/Black on 3.0L.
[5] - Wire color is Green on 3.0L.
[6] - Wire color is Yellow/Red on 3.0L.
[7] - KOEO - Key On, Engine Off.
[8] - Information is not available from manufacturer.
[9] - Wire color is Black/Red on 3.0L.
[10] - Wire color is Green/Red on 3.0L.
[11] - Wire color is Green/Black on 3.0L.
[12] - Wire color is Black/White on 3.0L.

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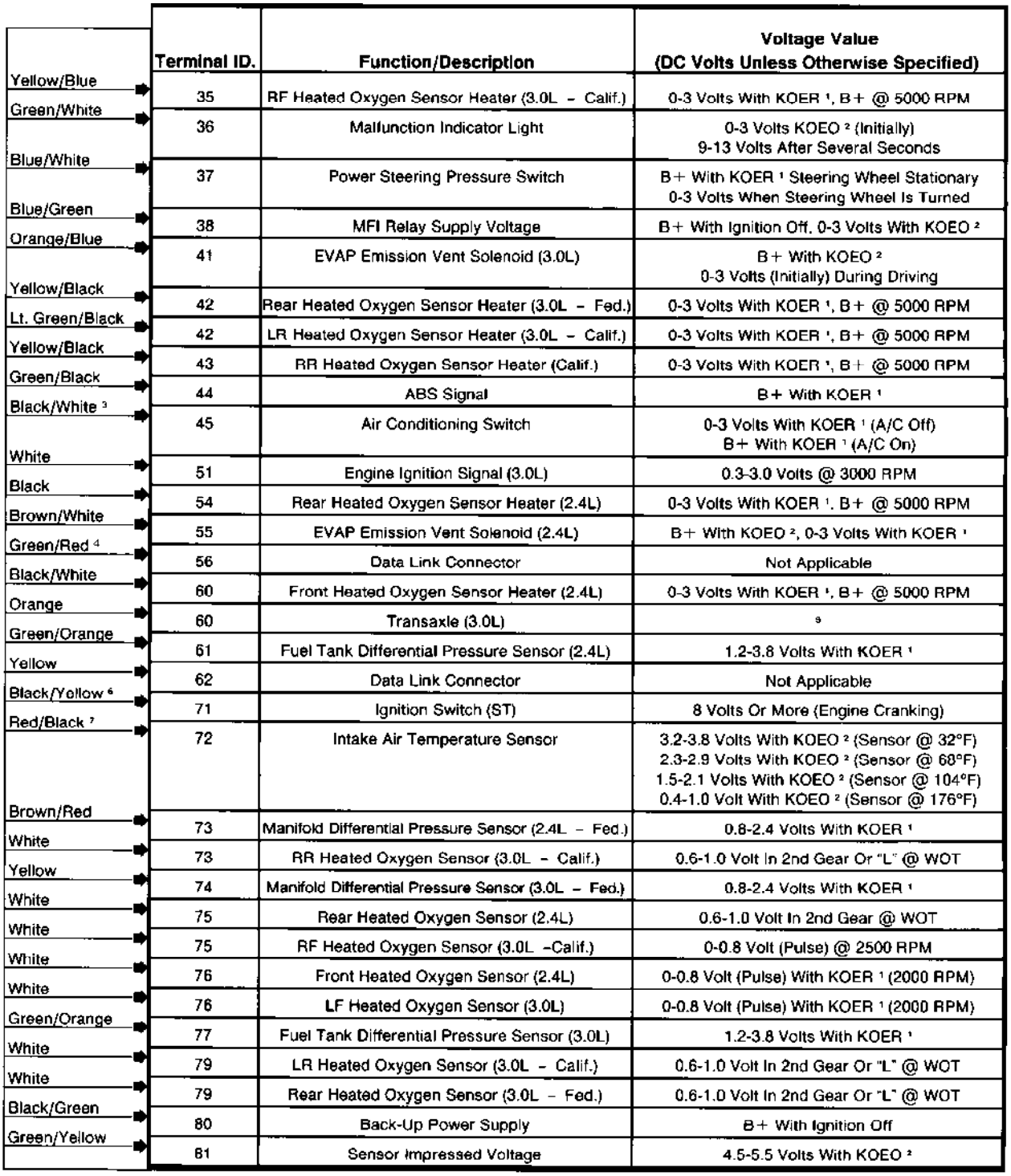
Fig. 2: Pin Voltage Chart (1 Of 3)



Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
35	RF Heated Oxygen Sensor Heater (3.0L - Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
36	Malfunction Indicator Light	0-3 Volts KOEO [2] (Initially) 9-13 Volts After Several Seconds
37	Power Steering Pressure Switch	B+ With KOER [1] Steering Wheel Stationary 0-3 Volts When Steering Wheel Is Turned
38	MFI Relay Supply Voltage	B+ With Ignition Off. 0-3 Volts With KOEO [2]
41	EVAP Emission Vent Solenoid (3.0L)	B+ With KOEO [2] 0-3 Volts (Initially) During Driving
42	Rear Heated Oxygen Sensor Heater (3.0L - Fed.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
42	LR Heated Oxygen Sensor Heater (3.0L - Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
43	RR Heated Oxygen Sensor Heater (Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
44	ABS Signal	B+ With KOER [1]
45	Air Conditioning Switch	0-3 Volts With KOER [1] (A/C Off) B+ With KOER [1] (A/C On)
51	Engine Ignition Signal (3.0L)	0.3-3.0 Volts @ 3000 RPM
54	Rear Heated Oxygen Sensor Heater (2.4L)	0-3 Volts With KOER [1], B+ @ 5000 RPM
55	EVAP Emission Vent Solenoid (2.4L)	B+ With KOEO [2], 0-3 Volts With KOER [1]
56	Data Link Connector	Not Applicable
60	Front Heated Oxygen Sensor Heater (2.4L)	0-3 Volts With KOER [1], B+ @ 5000 RPM
60	Transaxle (3.0L)	[5]
61	Fuel Tank Differential Pressure Sensor (2.4L)	1.2-3.8 Volts With KOER [1]
62	Data Link Connector	Not Applicable
71	Ignition Switch (ST)	8 Volts Or More (Engine Cranking)
72	Intake Air Temperature Sensor	3.2-3.8 Volts With KOEO [2] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [2] (Sensor @ 68°F) 1.5-2.1 Volts With KOEO [2] (Sensor @ 104°F) 0.4-1.0 Volt With KOEO [2] (Sensor @ 176°F)
73	Manifold Differential Pressure Sensor (2.4L - Fed.)	0.8-2.4 Volts With KOER [1]
73	RR Heated Oxygen Sensor (3.0L - Calif.)	0.6-1.0 Volt In 2nd Gear Or "L" @ WOT
74	Manifold Differential Pressure Sensor (3.0L - Fed.)	0.8-2.4 Volts With KOER [1]
75	Rear Heated Oxygen Sensor (2.4L)	0.6-1.0 Volt In 2nd Gear @ WOT
75	RF Heated Oxygen Sensor (3.0L -Calif.)	0-0.8 Volt (Pulse) @ 2500 RPM
76	Front Heated Oxygen Sensor (2.4L)	0-0.8 Volt (Pulse) With KOER [1] (2000 RPM)
76	LF Heated Oxygen Sensor (3.0L)	0-0.8 Volt (Pulse) With KOER [1] (2000 RPM)
77	Fuel Tank Differential Pressure Sensor (3.0L)	1.2-3.8 Volts With KOER [1]
79	LR Heated Oxygen Sensor (3.0L - Calif.)	0.6-1.0 Volt In 2nd Gear Or "L" @ WOT
79	Rear Heated Oxygen Sensor (3.0L - Fed.)	0.6-1.0 Volt In 2nd Gear Or "L" @ WOT
80	Back-Up Power Supply	B+ With Ignition Off
81	Sensor Impressed Voltage	4.5-5.5 Volts With KOEO [2]

[1] - KOER - Key On, Engine Running.
[2] - KOEO - Key On, Engine Off.
[3] - Wire color is Green/Yellow on 3.0L.
[4] - Wire color is Gray/Red on 3.0L.
[5] - Information is not available from manufacturer.
[6] - Wire color may also be Black/Blue on 3.0L.
[7] - Wire color is Red/Blue on 3.0L.

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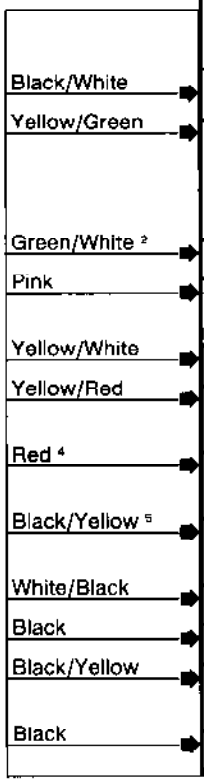
Fig. 3: Pin Voltage Chart (2 Of 3)



Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
82	Ignition Switch (IG)	B+ With KOEO 1
83	Engine Coolant Temperature Sensor	3.2-3.8 Volts With KOEO 1 (Sensor @ 32°F) 2.3-2.9 Volts With KOEO 1 (Sensor @ 68°F) 1.3-1.9 Volts With KOEO 1 (Sensor @ 104°F) 0.3-0.9 Volt With KOEO 1 (Sensor @ 176°F)
84	Throttle Position Sensor	0.3-1.0 Volt With KOEO 1, 4.5-5.5 Volts @ WOT
85	Barometric Pressure Sensor	3.7-4.3 Volts With KOEO 1 (Sea Level) 3.2-3.8 Volts With KOEO 1 (@ 3937 Ft.)
86	Vehicle Speed Sensor	0-5 Volts (Pulse) With KOER 3 (Vehicle Moving)
87	Closed Throttle Position Switch	0-1 Volt With KOEO 1 (Throttle Closed) 4 Volts Or More With KOEO 1 (Throttle Open)
88	Camshaft Position Sensor	0.4-3.0 Volts (Engine Cranking) 0.5-2.0 Volts With KOER 3
89	Crankshaft Position Sensor	0.4-4.0 Volts (Engine Cranking) 1.5-2.5 Volts With KOER 3
90	Volume Airflow Sensor	2.2-3.2 Volts KOER 3 Or @ 2500 RPM
91	Ground Circuit (M/T)	Not applicable
91	Park/Neutral Position Switch (A/T)	0-3 Volts With KOEO 1 (In "P" Or "N") 8-14 Volts KOEO 1 (In "D", "2", "L" Or "R")
92	Ground Circuit	Not Applicable

1 - KOEO - Key On, Engine Off.
2 - Wire color is Green/Blue on 3.0L.
3 - KOER - Key On, Engine Running.
4 - Wire color is Blue/White on 3.0L.
5 - Wire color is Blue on 3.0L.

Fig. 4: Pin Voltage Chart (3 Of 3)

J - PIN VOLTAGE CHARTS - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Pin Voltage Charts

Montero Sport - 3.0L

INTRODUCTION

NOTE: Unless stated otherwise in testing procedures, perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance. Voltage readings may vary slightly due to battery condition or charging rate.

Pin voltage charts are supplied to reduce diagnostic time. Checking pin voltages at the PCM connector determines whether it is receiving and transmitting proper voltage signals. Diagnostic charts may also help determine if PCM harness is shorted or open.

TEST PROCEDURE

CAUTION: Shorting positive DVOM lead between connector terminal and ground could damage vehicle wiring, sensor and PCM.

1) If necessary, remove PCM to access harness connector. For PCM location, see PCM LOCATION table. Leave PCM connectors connected. Using DVOM, backprobe terminals with positive lead. Connect negative lead to PCM ground terminal. See appropriate chart for identification of ground terminal. See Figs. 1-4.

2) All measurements are applicable to vehicle at normal operating temperature at sea level. Unless otherwise noted, engine is idling when specification requires engine running. Ensure transmission shift selector is in Neutral or Park (as applicable). If DVOM displays measurement that is not within specification, see appropriate G - TESTS W/CODES - 3.0L article.

PCM LOCATION TABLE

Application	Location
Montero Sport	Behind Right Side Of Instrument Panel (Glove Box)

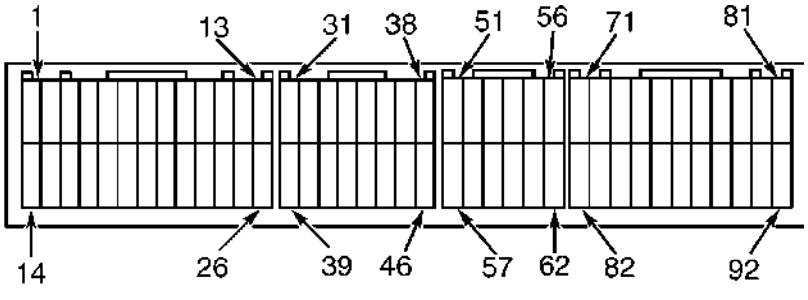


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Fig. 1: Identifying PCM Terminals
Courtesy of Mitsubishi Motor Sales of America.

	Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
Yellow/Green [1]	1	Injector No. 1	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Yellow/Green [3]	2	Injector No. 3	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Lt. Green/White	3	Injector No. 5 (3.0L)	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Blue [4]	4	Idle Air Control Motor A1	B+/0-3 Volts (Pulse) After Hot Start
White [5]	5	Idle Air Control Motor B1	B+/0-3 Volts (Pulse) After Hot Start
Brown [6]	6	EGR Solenoid (Fed.)	B+ With KOEO [7] B+ & Momentary Drop @ WOT With KOER [2]
Yellow/Blue	7	Transaxle (3.0L)	[8]
White/Red	8	MFI Pump Relay (2.4L)	B+ With KOEO [7], 0-3 Volts With KOER [2]
White/Red	8	MFI Relay Module (3.0L)	0-5 Volts With KOEO [7], 4-6 Volts (Cranking)
Black/Yellow	9	EVAP Emission Purge Solenoid (2.4L.)	B+ With KOEO [7], 0-3 Volts With KOER [2]
White	10	Ignition Power Transistor "A"	0.3-3.0 Volts @ 3000 RPM
Blue	11	Ignition Power Transistor "C" (3.0L)	0.3-3.0 Volts @ 3000 RPM
Red [9]	12	Power Supply	B+ With KOEO [7]
Black	13	Ground Circuit	Not Applicable
Yellow/Black [6]	14	Injector No. 2	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Yellow/Black	15	Injector No. 4	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Yellow/Green	16	Injector No. 6 (3.0L)	B+ With KOER [2] B+ & Momentary Drop @ WOT With KOER [2]
Yellow [9]	17	Idle Air Control Motor A2	B+/0-3 Volts (Pulse) After Hot Start
Green [10]	18	Idle Air Control Motor B2	B+/0-3 Volts (Pulse) After Hot Start
Yellow/White [11]	19	Volume Airflow Sensor Reset Signal	0-1 Volt With KOER [2], 6-9 Volts @ 3000 RPM
Green/Yellow [12]	22	A/C Compressor Clutch Relay	6 Volts Or More With KOER [2] 0-3 Volts With Clutch Cycling
Black/Yellow	23	Ignition Power Transistor "B" (3.0L)	0.3-3.0 Volts @ 3000 RPM
White/Black	24	Defogger System (2.4)	[8]
Red [9]	25	Power Supply	B+ With KOEO [7]
Black	26	Ground Circuit	Not Applicable
White/Black	31	Spark Check Signal (2.4L)	2-6 Volts @ 3000 RPM
Blue/White	32	EVAP Emission Purge Solenoid (3.0L)	B+ With KOEO [7], 0-3 Volts With KOER [2]
Lt. Green/Red	34	Front Heated Oxygen Sensor Heater (3.0L - Fed.)	0-3 Volts With KOER [2], B+ @ 5000 RPM
Black/White	34	LF Heated Oxygen Sensor Heater (3.0L - Calif.)	0-3 Volts With KOER [2], B+ @ 5000 RPM

[1] - Wire color is Yellow/Blue on 3.0L.
[2] - KOER - Key On, Engine Running.
[3] - Wire color is Yellow/White on 3.0L.
[4] - Wire color is Green/Black on 3.0L.
[5] - Wire color is Green on 3.0L.
[6] - Wire color is Yellow/Red on 3.0L.
[7] - KOEO - Key On, Engine Off.
[8] - Information is not available from manufacturer.
[9] - Wire color is Black/Red on 3.0L.
[10] - Wire color is Green/Red on 3.0L.
[11] - Wire color is Green/Black on 3.0L.
[12] - Wire color is Black/White on 3.0L.

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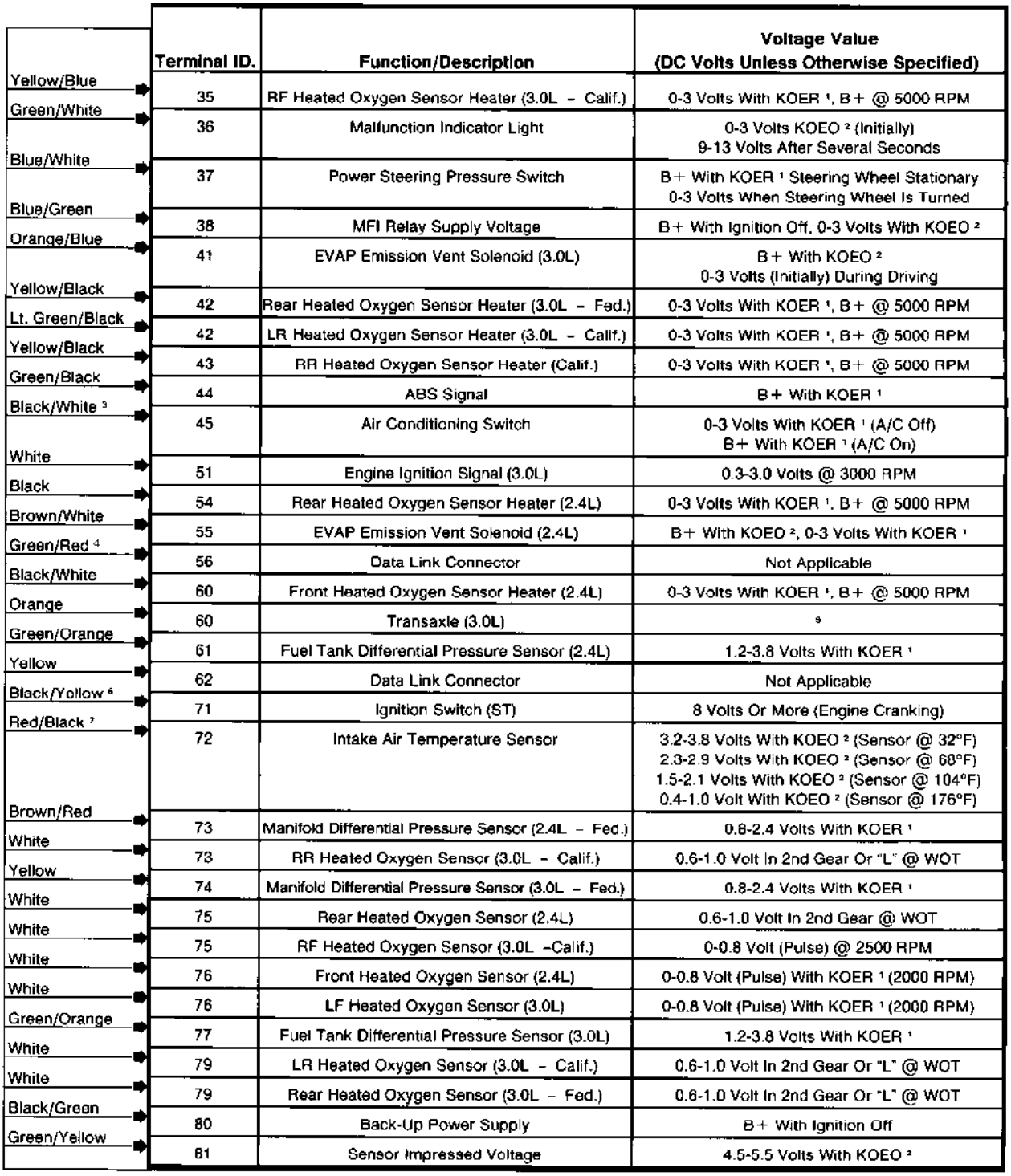
Fig. 2: Pin Voltage Chart (1 Of 3)



Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
35	RF Heated Oxygen Sensor Heater (3.0L - Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
36	Malfunction Indicator Light	0-3 Volts KOEO [2] (Initially) 9-13 Volts After Several Seconds
37	Power Steering Pressure Switch	B+ With KOER [1] Steering Wheel Stationary 0-3 Volts When Steering Wheel Is Turned
38	MFI Relay Supply Voltage	B+ With Ignition Off. 0-3 Volts With KOEO [2]
41	EVAP Emission Vent Solenoid (3.0L)	B+ With KOEO [2] 0-3 Volts (Initially) During Driving
42	Rear Heated Oxygen Sensor Heater (3.0L - Fed.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
42	LR Heated Oxygen Sensor Heater (3.0L - Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
43	RR Heated Oxygen Sensor Heater (Calif.)	0-3 Volts With KOER [1], B+ @ 5000 RPM
44	ABS Signal	B+ With KOER [1]
45	Air Conditioning Switch	0-3 Volts With KOER [1] (A/C Off) B+ With KOER [1] (A/C On)
51	Engine Ignition Signal (3.0L)	0.3-3.0 Volts @ 3000 RPM
54	Rear Heated Oxygen Sensor Heater (2.4L)	0-3 Volts With KOER [1], B+ @ 5000 RPM
55	EVAP Emission Vent Solenoid (2.4L)	B+ With KOEO [2], 0-3 Volts With KOER [1]
56	Data Link Connector	Not Applicable
60	Front Heated Oxygen Sensor Heater (2.4L)	0-3 Volts With KOER [1], B+ @ 5000 RPM
60	Transaxle (3.0L)	[5]
61	Fuel Tank Differential Pressure Sensor (2.4L)	1.2-3.8 Volts With KOER [1]
62	Data Link Connector	Not Applicable
71	Ignition Switch (ST)	8 Volts Or More (Engine Cranking)
72	Intake Air Temperature Sensor	3.2-3.8 Volts With KOEO [2] (Sensor @ 32°F) 2.3-2.9 Volts With KOEO [2] (Sensor @ 68°F) 1.5-2.1 Volts With KOEO [2] (Sensor @ 104°F) 0.4-1.0 Volt With KOEO [2] (Sensor @ 176°F)
73	Manifold Differential Pressure Sensor (2.4L - Fed.)	0.8-2.4 Volts With KOER [1]
73	RR Heated Oxygen Sensor (3.0L - Calif.)	0.6-1.0 Volt In 2nd Gear Or "L" @ WOT
74	Manifold Differential Pressure Sensor (3.0L - Fed.)	0.8-2.4 Volts With KOER [1]
75	Rear Heated Oxygen Sensor (2.4L)	0.6-1.0 Volt In 2nd Gear @ WOT
75	RF Heated Oxygen Sensor (3.0L -Calif.)	0-0.8 Volt (Pulse) @ 2500 RPM
76	Front Heated Oxygen Sensor (2.4L)	0-0.8 Volt (Pulse) With KOER [1] (2000 RPM)
76	LF Heated Oxygen Sensor (3.0L)	0-0.8 Volt (Pulse) With KOER [1] (2000 RPM)
77	Fuel Tank Differential Pressure Sensor (3.0L)	1.2-3.8 Volts With KOER [1]
79	LR Heated Oxygen Sensor (3.0L - Calif.)	0.6-1.0 Volt In 2nd Gear Or "L" @ WOT
79	Rear Heated Oxygen Sensor (3.0L - Fed.)	0.6-1.0 Volt In 2nd Gear Or "L" @ WOT
80	Back-Up Power Supply	B+ With Ignition Off
81	Sensor Impressed Voltage	4.5-5.5 Volts With KOEO [2]

[1] - KOER - Key On, Engine Running.
[2] - KOEO - Key On, Engine Off.
[3] - Wire color is Green/Yellow on 3.0L.
[4] - Wire color is Gray/Red on 3.0L.
[5] - Information is not available from manufacturer.
[6] - Wire color may also be Black/Blue on 3.0L.
[7] - Wire color is Red/Blue on 3.0L.

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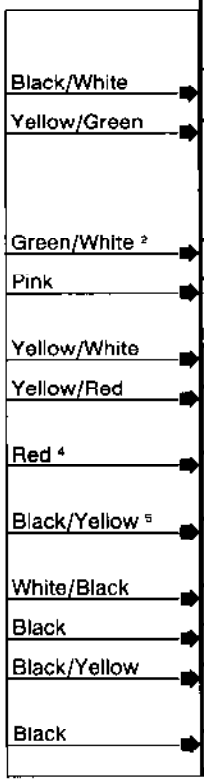
Fig. 3: Pin Voltage Chart (2 Of 3)



Terminal ID.	Function/Description	Voltage Value (DC Volts Unless Otherwise Specified)
82	Ignition Switch (IG)	B+ With KOEO 1
83	Engine Coolant Temperature Sensor	3.2-3.8 Volts With KOEO 1 (Sensor @ 32°F) 2.3-2.9 Volts With KOEO 1 (Sensor @ 68°F) 1.3-1.9 Volts With KOEO 1 (Sensor @ 104°F) 0.3-0.9 Volt With KOEO 1 (Sensor @ 176°F)
84	Throttle Position Sensor	0.3-1.0 Volt With KOEO 1, 4.5-5.5 Volts @ WOT
85	Barometric Pressure Sensor	3.7-4.3 Volts With KOEO 1 (Sea Level) 3.2-3.8 Volts With KOEO 1 (@ 3937 Ft.)
86	Vehicle Speed Sensor	0-5 Volts (Pulse) With KOER 3 (Vehicle Moving)
87	Closed Throttle Position Switch	0-1 Volt With KOEO 1 (Throttle Closed) 4 Volts Or More With KOEO 1 (Throttle Open)
88	Camshaft Position Sensor	0.4-3.0 Volts (Engine Cranking) 0.5-2.0 Volts With KOER 3
89	Crankshaft Position Sensor	0.4-4.0 Volts (Engine Cranking) 1.5-2.5 Volts With KOER 3
90	Volume Airflow Sensor	2.2-3.2 Volts KOER 3 Or @ 2500 RPM
91	Ground Circuit (M/T)	Not applicable
91	Park/Neutral Position Switch (A/T)	0-3 Volts With KOEO 1 (In "P" Or "N") 8-14 Volts KOEO 1 (In "D", "2", "L" Or "R")
92	Ground Circuit	Not Applicable

1 - KOEO - Key On, Engine Off.
2 - Wire color is Green/Blue on 3.0L.
3 - KOER - Key On, Engine Running.
4 - Wire color is Blue/White on 3.0L.
5 - Wire color is Blue on 3.0L.

Fig. 4: Pin Voltage Chart (3 Of 3)

POWER WINDOWS

1997-99 Mitsubishi Montero Sport

1997-99 ACCESSORIES & EQUIPMENT
Mitsubishi - Power Windows

Montero Sport

DESCRIPTION & OPERATION

With ignition switch in RUN position, battery voltage is applied to master power window switch located on driver's door. The master power window switch provides power and ground for all power window switches and motors. The master power window switch offers one-touch operation of driver's window. A solid state control unit, incorporated in master switch, fully lowers driver's window when switch is completely depressed. Master switch also includes lock-out feature to prevent passengers from operating any of the other power window door switches.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Power Window Relay (1)	In Passenger Compartment Fuse/Relay Block

(1) - See Fig. 1.

TROUBLE SHOOTING

POWER WINDOWS INOPERATIVE

Check for faulty fusible link, faulty power window relay or faulty power window switches. See WIRING DIAGRAMS.

ONE WINDOW FAILS TO OPERATE

If one window does not operate, even if both master and passenger side power window switches are pressed, check for faulty master power window switch or power window motor that is inoperative. If one window does not operate, only when either master or passenger side power window switch is pressed, but does operate when both switches are pressed, check power window switch that is inoperative.

ONE-TOUCH SWITCH FUNCTION INOPERATIVE

Replace master power window switch.

COMPONENT TESTS

CIRCUIT BREAKER TEST

Press UP switch to fully close window. Continue to press switch for 10 seconds. Release UP switch and immediately press DOWN switch. If window begins to open within 60 seconds, circuit breaker is

okay. Circuit breaker is part of window motor.

POWER WINDOW RELAY TEST

1) Remove power window relay from fuse/relay block. See Fig. 1. Check continuity between power window relay terminals No. 2 and 4. See Fig. 2. Continuity should be present.

2) Connect positive lead of a 12-volt battery to power window relay terminal No. 2, and negative lead of battery to terminal No. 4. Continuity should be present between terminals No. 1 and 3 with voltage applied. Replace power window relay if continuity is not as specified.

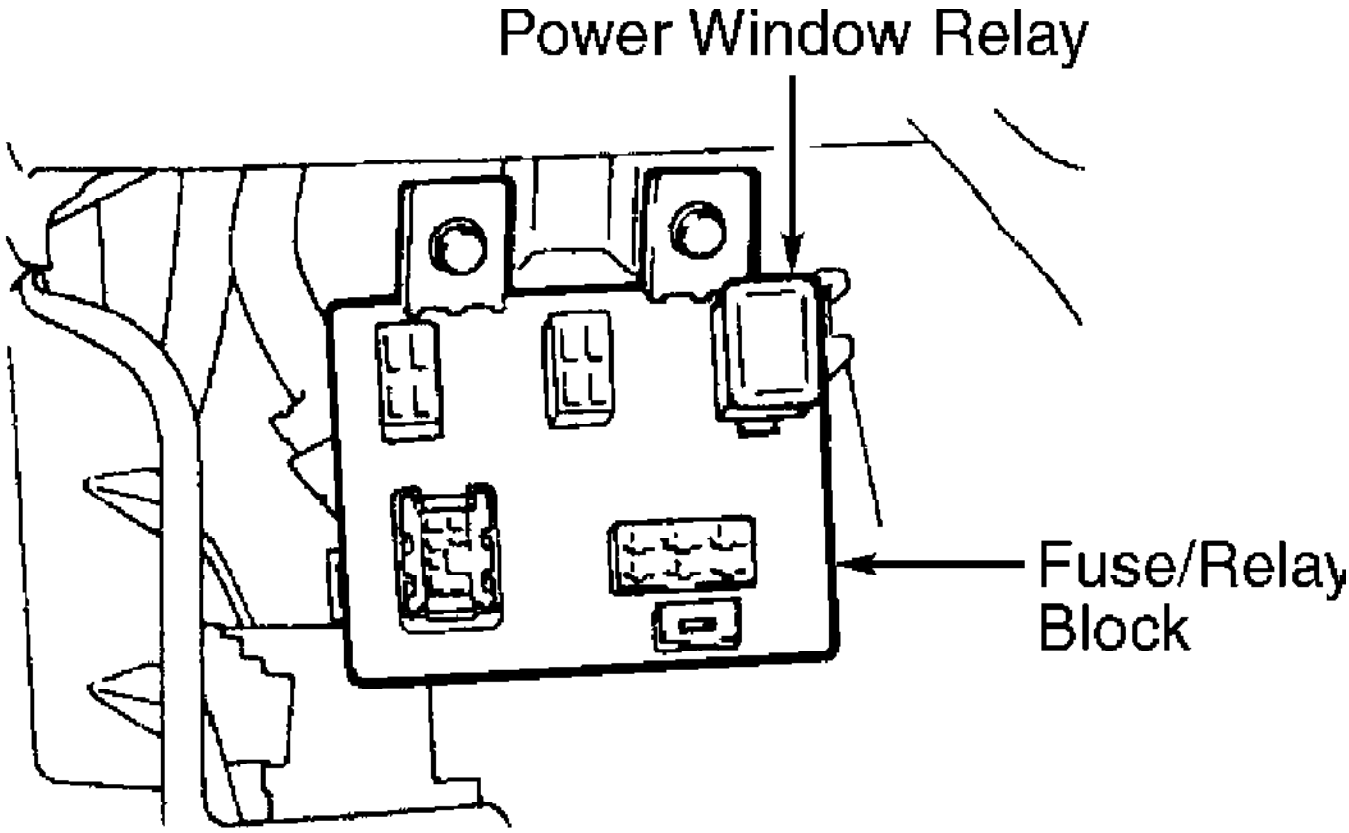


Fig. 1: Locating Power Window Relay
Courtesy of Mitsubishi Motor Sales of America.

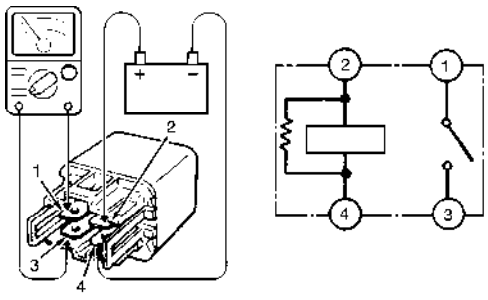


Fig. 2: Identifying Power Window Relay Terminals
Courtesy of Mitsubishi Motor Sales of America.

POWER WINDOW MOTOR TEST

1) Remove appropriate door trim panel. Connect positive lead of a 12-volt test battery to either motor terminal. Connect negative lead of test battery to other motor terminal. Motor should operate, unless motor is at maximum travel.

2) Reverse test battery leads. Motor should operate in opposite direction. If motor does not operate, inspect wiring. If wiring is okay, replace motor. Reverse test battery leads again to complete full function test of motor.

POWER WINDOW SWITCH TEST

Remove control switch from trim panel. Using ohmmeter, check continuity of switch. See appropriate WINDOW SWITCH CONTINUITY table. See Fig. 3 and 4. Replace appropriate switch as necessary if switch continuity is not as specified.

MASTER WINDOW SWITCH CONTINUITY TABLE

Switch Position (1)	Check Continuity Between Pins No.
Normal Position	
Left Front OFF	8, 9 & 12
Left Rear OFF	1, 2 & 12
Left Front UP	8 & 13; 9 & 12
Left Rear UP	1 & 13; 2 & 12
Left Front DOWN	8 & 12; 9 & 13
Left Rear DOWN	1 & 12; 2 & 13
Right Front OFF	3, 11 & 12
Right Rear OFF	6, 12 & 14
Right Front UP	3 & 13; 11 & 12
Right Rear UP	6 & 12; 13 & 14
Right Front DOWN	3 & 12; 11 & 13
Right Rear DOWN	6 & 13; 12 & 14
Lock Position	
Left Front OFF	8, 9 & 12
Left Rear OFF	1 & 2
Left Front UP	8 & 13; 9 & 12
Left Rear UP	1 & 13
Left Front DOWN	8 & 12; 9 & 13
Left Rear DOWN	2 & 13
Right Front OFF	3 & 11
Right Rear OFF	6 & 14
Right Front UP	3 & 13
Right Rear UP	13 & 14
Right Front DOWN	11 & 13
Right Rear DOWN	6 & 13

(1) - Left side of vehicle refers to driver's side.

SUB-SWITCH CONTINUITY TABLE

Switch Position	Check Continuity Between Pins No.
OFF	4 & 7; 6 & 8
UP	5 & 7; 6 & 8
DOWN	4 & 7; 5 & 6

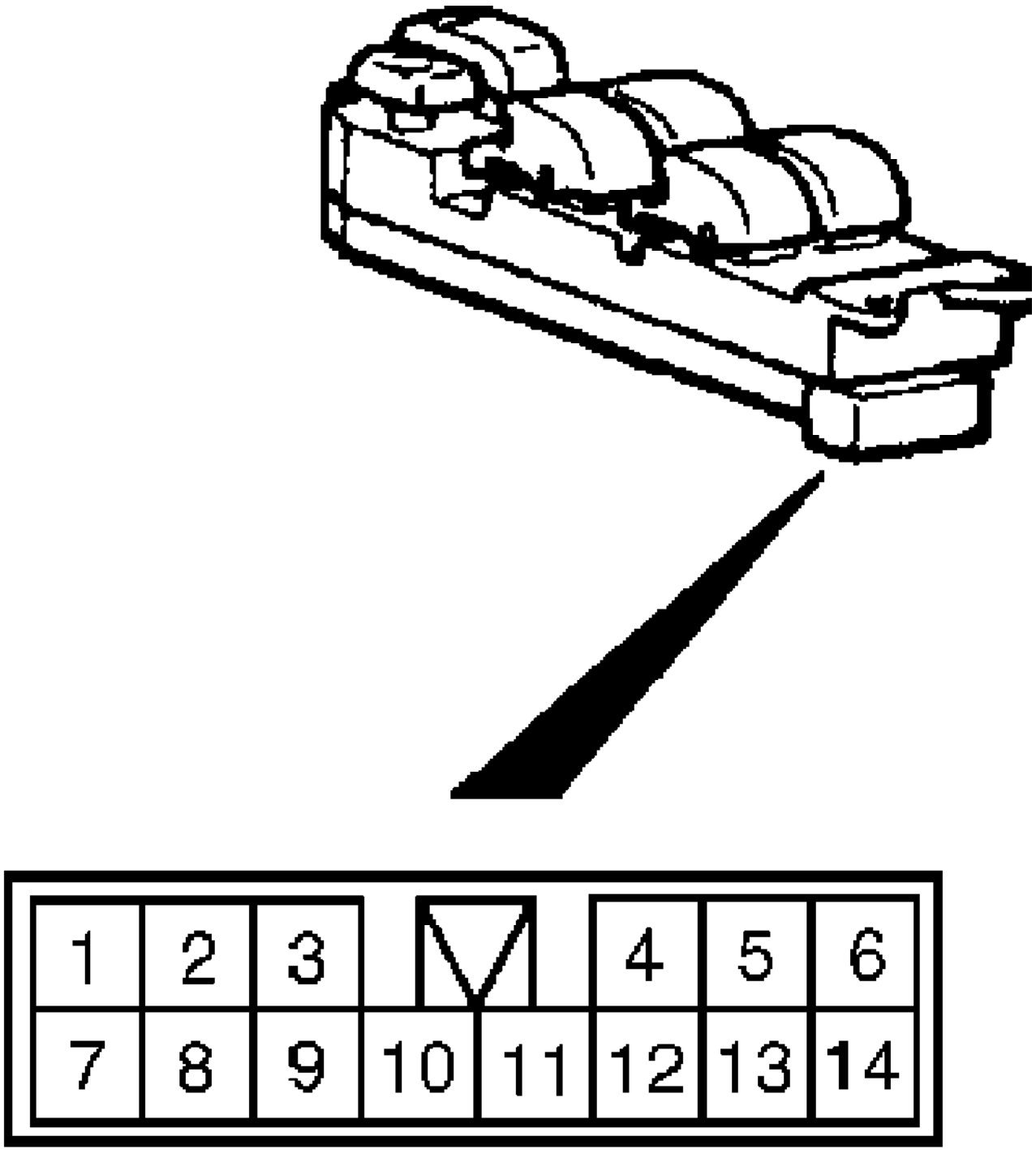


Fig. 3: Power Window Connector Terminals (Main Switch)
Courtesy of Mitsubishi Motor Sales of America.

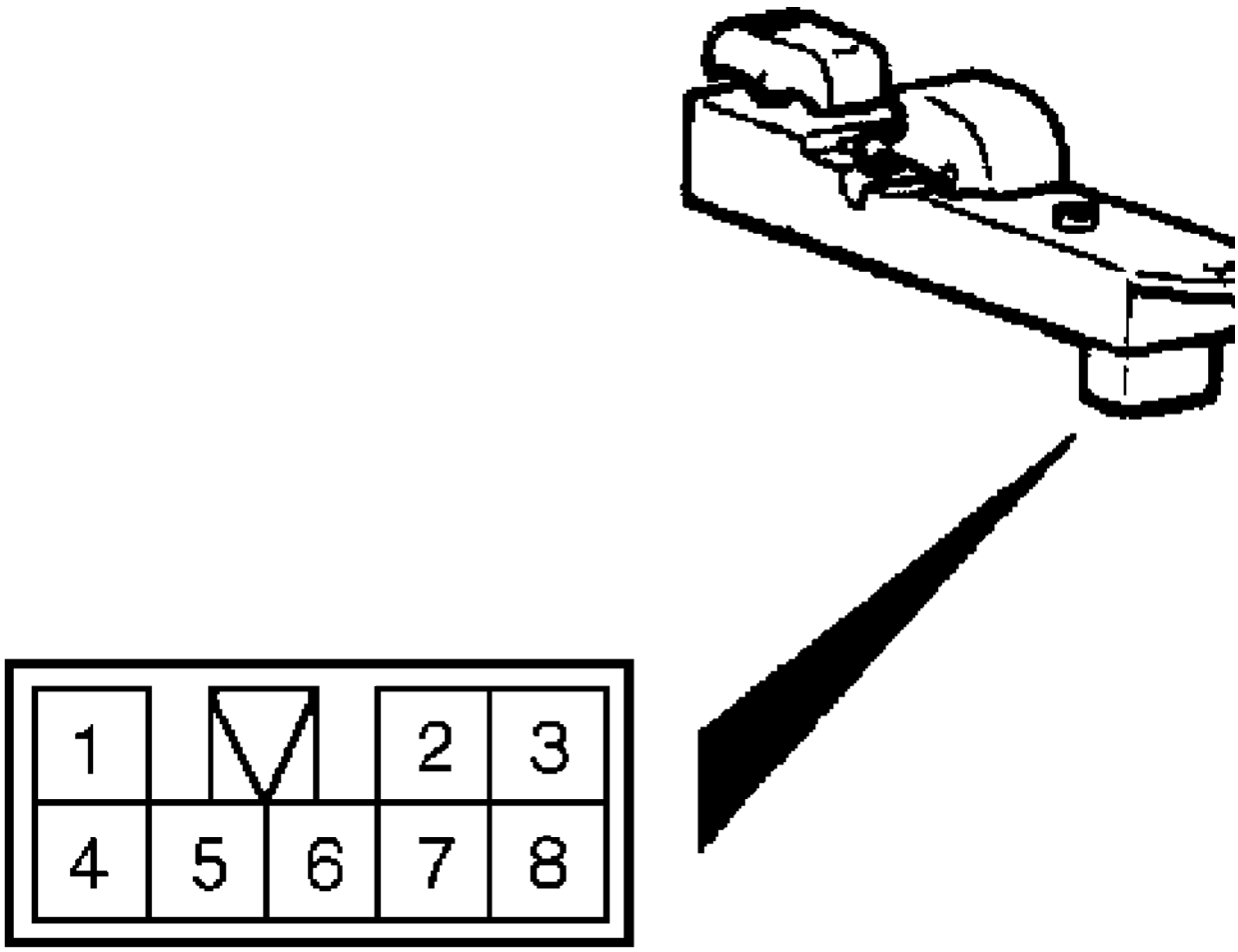


Fig. 4: Power Window Connector Terminals (Sub-Switch)
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

POWER WINDOW MOTOR

Removal & Installation

Remove door trim panel and waterproof shield. Remove glass retaining screws and glass. See Fig. 5. Remove motor and slider assembly retaining bolts. Remove motor and slider assembly from door. To install, reverse removal procedure.

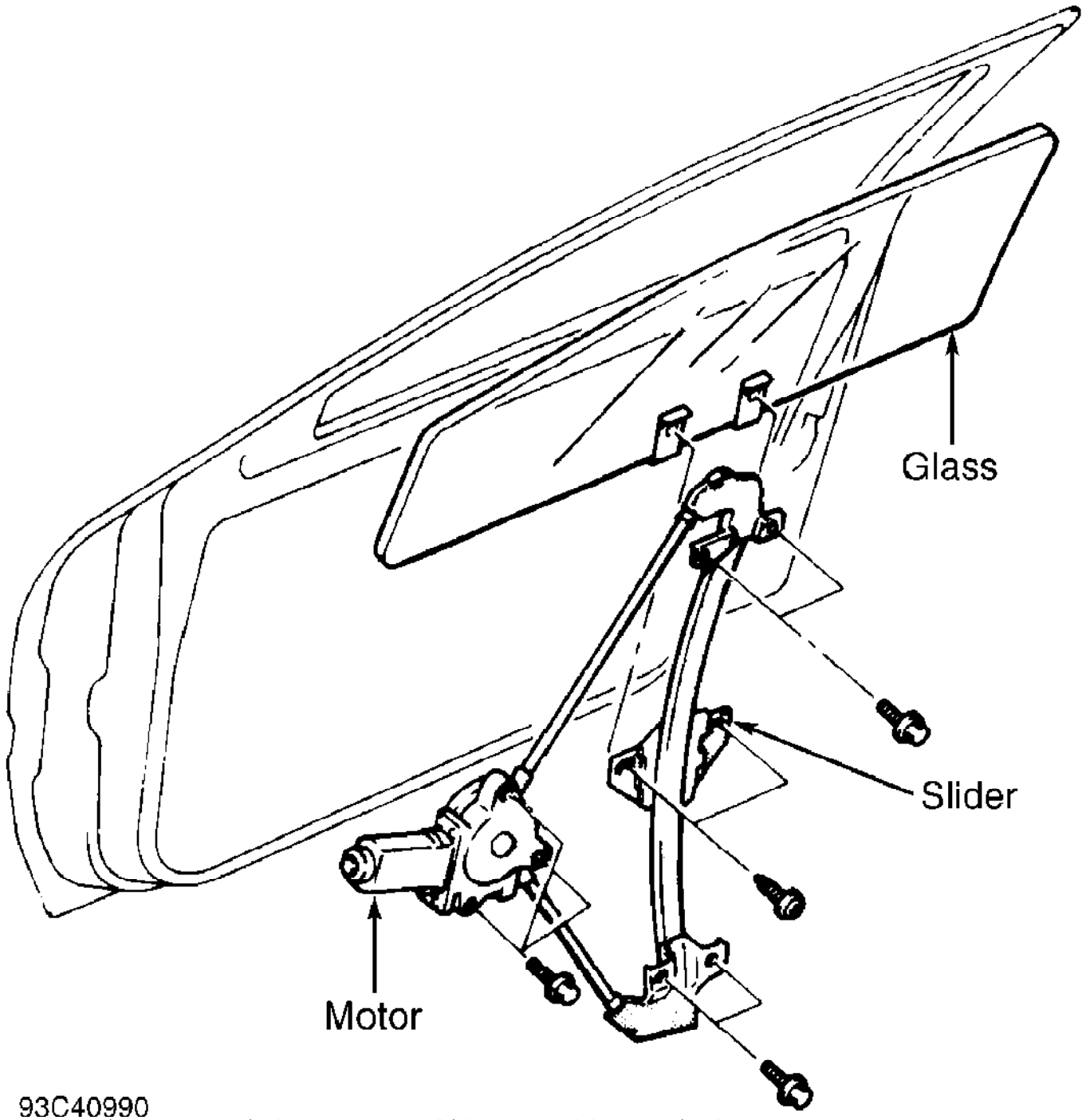


Fig. 5: Removing Power Window Motor & Slider Assembly (Typical)
Courtesy of Mitsubishi Motor Sales of America.

WIRING DIAGRAMS

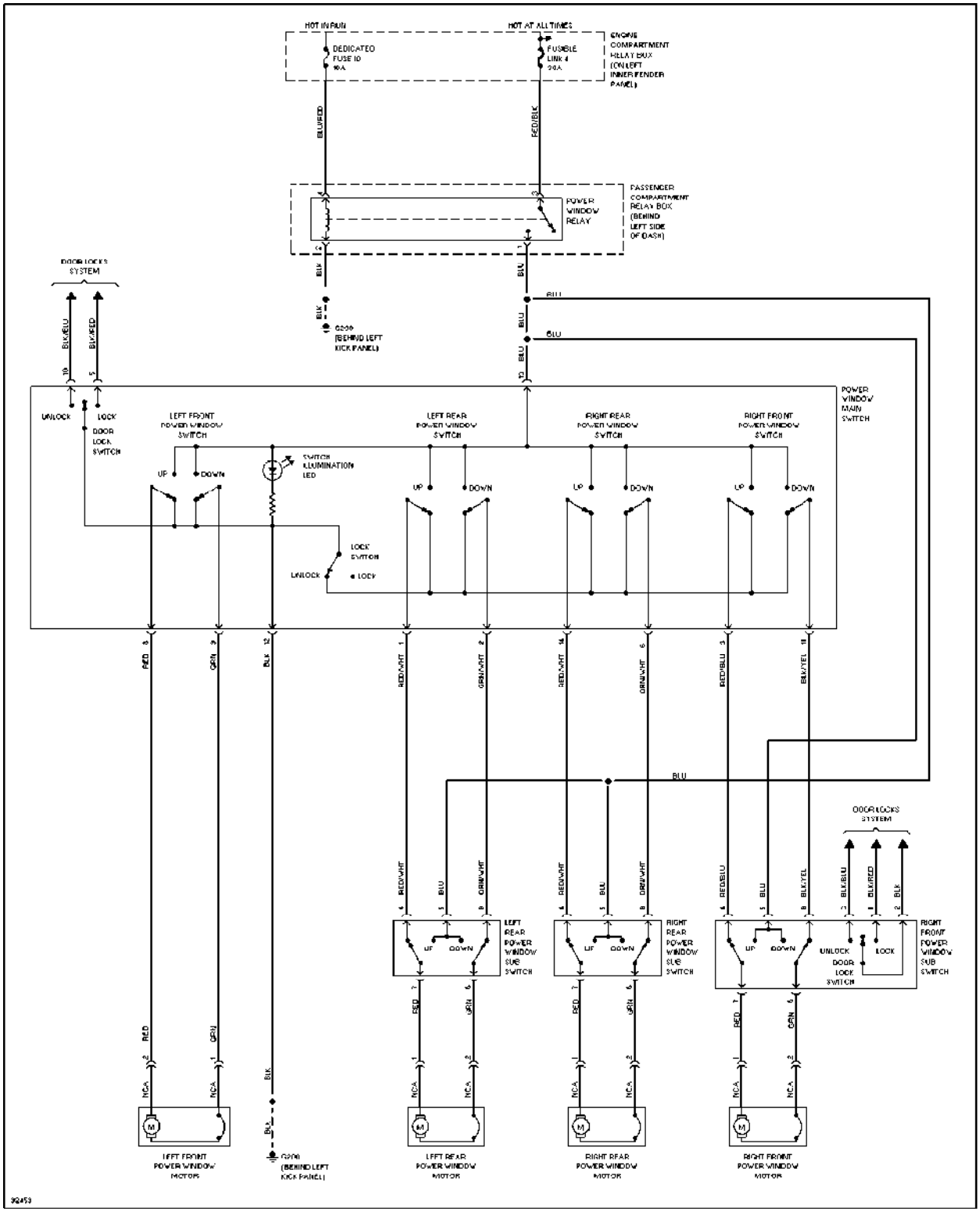


Fig. 6: Power Window System Wiring Diagram

N - REMOVE/INSTALL/OVERHAUL - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Removal, Overhaul & Installation

Montero Sport - 2.4L

INTRODUCTION

Removal, overhaul and installation procedures are covered in this article. If component removal and installation is primarily an unbolt and bolt-on procedure, only a torque specification may be furnished.

IGNITION SYSTEM

DISTRIBUTOR

NOTE: Montero Sport 2.4L uses distributor type ignition systems with non-serviceable distributors on which only the rotor and distributor cap can be changed.

FUEL SYSTEM

WARNING: Always relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

FUEL SYSTEM PRESSURE RELEASE

Relieving Fuel Pressure

1) On Montero Sport, remove cargo compartment carpet, remove access plate and disconnect fuel pump harness connector. On all other models, remove rear seat cushion and remove access plate if required to disconnect fuel pump harness connector.

2) On all models, start engine. Let engine run until it stops. Turn ignition off. Disconnect negative battery cable. Connect fuel pump harness connector. Reinstall rear seat (if necessary.)

FUEL PUMP

Removal & Installation

1) Fuel pump assembly is located inside fuel tank. Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Raise vehicle on hoist. Drain fuel into suitable container. Disconnect electrical connectors and breather/fuel hoses at fuel tank.

2) Remove fuel filler hose from fuel tank. Support fuel tank with transmission jack. Remove nuts securing fuel tank. Remove fuel tank from vehicle. Remove fuel pump assembly. To install, reverse removal procedure. Tighten nuts to specification. See TORQUE SPECIFICATIONS.

FUEL RAILS & INJECTORS

WARNING: Use a rag to cover fuel hose connection before disconnecting high pressure fuel hose at fuel rail. Some residual fuel pressure may still be in system.

CAUTION: DO NOT drop injectors while removing or installing fuel rail.

Removal (Montero Sport 2.4L)

1) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Disconnect negative battery cable. Drain coolant. Remove air intake hose. Remove throttle body and gasket with control cables and vacuum hoses attached.

2) Remove EGR pipe (if equipped). Disconnect power brake hose. Label and disconnect vacuum hoses and wiring harness connectors as necessary. Remove intake plenum brackets and mounting bolts. Remove intake plenum and gasket.

3) Disconnect high pressure fuel hose at fuel rail. Disconnect fuel return hose. Disconnect vacuum hoses. Disconnect injector electrical connectors. Remove fuel rail bolts, and lift fuel rail and injectors from engine. Injectors may be removed after fuel rail is removed from intake manifold.

Installation

To install, reverse removal procedure. Use new insulators and "O" rings when installing injectors. Install injectors into fuel rail with a twisting motion. Ensure injectors rotate smoothly when installing. Refill cooling system.

HEATED OXYGEN SENSOR (HO2S)

Removal & Installation

1) Front HO2S is mounted in exhaust pipe below exhaust header. Rear HO2S is mounted behind catalytic converter. HO2S is equipped with a permanent pigtail which must be protected from damage when HO2S is removed. Ensure HO2S is free of contaminants. Avoid using cleaning solvents of any type.

2) HO2S may be difficult to remove when engine temperature is less than 120°F (48°C). Always use anti-seize compound on threads before installation. Tighten HO2S to specification. See TORQUE SPECIFICATIONS.

THROTTLE BODY

Removal

1) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Drain enough coolant to ensure coolant level is below throttle body. Disconnect air intake hose.

2) Remove accelerator, cruise control and A/T throttle valve cables (if equipped). Disconnect fuel vapor hose, electrical harness connector, vacuum hose and coolant hoses. Remove throttle body retaining bolts.

Disassembly

Remove throttle position sensor. Remove idle air control motor. Remove throttle bracket and connector bracket (if equipped). Remove idle position switch and adjusting nut (if equipped).

CAUTION: DO NOT remove throttle valve. DO NOT use cleaning solvents on throttle position sensor, idle air control motor or idle position switch.

Cleaning

1) Clean all parts except throttle position sensor, idle air control motor and idle position switch in solvent.

WARNING: Safety glasses MUST be worn whenever compressed air is used for parts cleaning.

2) Check vacuum port and passage for clogging. Clean vacuum,

vapor and fuel passages using compressed air.

Reassembly
To reassemble, reverse disassembly procedure.

Installation
To install, reverse removal procedure.

THROTTLE POSITION (TP) SENSOR

Removal & Installation
Throttle Position (TP) sensor is located on throttle body. Disconnect TP sensor electrical connector. Remove TP sensor screws and TP sensor. To install, reverse removal procedure. Tighten TP sensor screws to specification. See TORQUE SPECIFICATIONS. For TP sensor adjustment procedure, see D - ADJUSTMENTS - 2.4L article.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Applications	Ft. Lbs. (N.m)
EGR Valve	16 (22)
Engine Coolant Temperature Sensor	22 (30)
Exhaust Manifold-To-Engine Nuts	18-21 (24-29)
Exhaust Pipe Bolts	21-36 (29-49)
Fuel Filter Line	27 (36)
Fuel Tank Drain Plug	11-18 (15-24)
Fuel Tank Nuts	15-21 (20-29)
Heated Oxygen Sensor	
Front	29-33 (39-44)
Rear	15-29 (20-39)
Intake Manifold Plenum Bolt/Nut	13 (18)
Knock Sensor	15-18 (20-24)
Oil Return Pipe-To-Engine	10-14 (14-19)
Oil Supply Pipe-To-Engine Nut	14 (19)
Plenum-To-Intake Manifold Bolts	11-15 (15-20)
Throttle Body	14 (19)
	INCH Lbs. (N.m)
Camshaft Position Sensor	80 (9)
Crankshaft Position Sensor	80 (9)
Distributor Hold-Down Bolt	106 (12)
Engine Cover	22-40 (2.5-4.5)
Fuel Pressure Regulator	80 (9)
Fuel Pump Nuts	22 (2.5)
Fuel Rail Bolts	80-106 (9.0-12.0)
Heat Protector Bolts	106-133 (12.0-15.0)
TP Sensor Screws	13-22 (1.5-2.5)
Wastegate Actuator Bolts	80-106 (9.0-12.0)

N - REMOVE/INSTALL/OVERHAUL - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Removal, Overhaul & Installation

Montero Sport - 3.0L

INTRODUCTION

Removal, overhaul and installation procedures are covered in this article. If component removal and installation is primarily an unbolt and bolt-on procedure, only a torque specification may be furnished.

IGNITION SYSTEM

DISTRIBUTOR

NOTE: Montero Sport 3.0L uses Distributorless Ignition System (DIS).

FUEL SYSTEM

WARNING: Always relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

FUEL SYSTEM PRESSURE RELEASE

Relieving Fuel Pressure

1) On Montero Sport, remove cargo compartment carpet, remove access plate and disconnect fuel pump harness connector. On all other models, remove rear seat cushion and remove access plate if required to disconnect fuel pump harness connector.

2) On all models, start engine. Let engine run until it stops. Turn ignition off. Disconnect negative battery cable. Connect fuel pump harness connector. Reinstall rear seat (if necessary.)

FUEL PUMP

Removal & Installation

1) Fuel pump assembly is located inside fuel tank. Release fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Raise vehicle on hoist. Drain fuel into suitable container. Disconnect electrical connectors and breather/fuel hoses at fuel tank.

2) Remove fuel filler hose from fuel tank. Support fuel tank with transmission jack. Remove nuts securing fuel tank. Remove fuel tank from vehicle. Remove fuel pump assembly. To install, reverse removal procedure. Tighten nuts to specification. See TORQUE SPECIFICATIONS.

FUEL RAILS & INJECTORS

WARNING: Use a rag to cover fuel hose connection before disconnecting high pressure fuel hose at fuel rail. Some residual fuel pressure may still be in system.

CAUTION: DO NOT drop injectors while removing or installing fuel rail.

Removal

1) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Disconnect negative battery cable. Disconnect PCV hose and breather hoses. Disconnect high pressure fuel hose at fuel rail. Disconnect fuel return hose and vacuum hoses.

2) Disconnect injector electrical connectors. Remove fuel rail bolts, and lift fuel rail and injectors from engine. Injectors may be removed after fuel rail is removed from intake manifold.

Installation

To install, reverse removal procedure. Use new insulators and "O" rings when installing injectors. Use lubricant on "O" rings. Install injectors into fuel rail with a twisting motion. Ensure injectors rotate smoothly when installing.

HEATED OXYGEN SENSOR (HO2S)

Removal & Installation

1) Front HO2S is mounted in exhaust pipe below exhaust header. Rear HO2S is mounted behind catalytic converter. HO2S is equipped with a permanent pigtail which must be protected from damage when HO2S is removed. Ensure HO2S is free of contaminants. Avoid using cleaning solvents of any type.

2) HO2S may be difficult to remove when engine temperature is less than 120°F (48°C). Always use anti-seize compound on threads before installation. Tighten HO2S to specification. See TORQUE SPECIFICATIONS.

THROTTLE BODY

Removal

1) Relieve fuel pressure. See FUEL SYSTEM PRESSURE RELEASE. Drain enough coolant to ensure coolant level is below throttle body. Disconnect air intake hose.

2) Remove accelerator, cruise control and A/T throttle valve cables (if equipped). Disconnect fuel vapor hose, electrical harness connector, vacuum hose and coolant hoses. Remove throttle body retaining bolts.

Disassembly

Remove throttle position sensor. Remove idle air control motor. Remove throttle bracket and connector bracket (if equipped). Remove idle position switch and adjusting nut (if equipped).

CAUTION: DO NOT remove throttle valve. DO NOT use cleaning solvents on throttle position sensor, idle air control motor or idle position switch.

Cleaning

1) Clean all parts except throttle position sensor, idle air control motor and idle position switch in solvent.

WARNING: Safety glasses MUST be worn whenever compressed air is used for parts cleaning.

2) Check vacuum port and passage for clogging. Clean vacuum, vapor and fuel passages using compressed air.

Reassembly

To reassemble, reverse disassembly procedure.

Installation

To install, reverse removal procedure.

THROTTLE POSITION (TP) SENSOR

Removal & Installation

Throttle Position (TP) sensor is located on throttle body. Disconnect TP sensor electrical connector. Remove TP sensor screws and TP sensor. To install, reverse removal procedure. Tighten TP sensor screws to specification. See TORQUE SPECIFICATIONS. For TP sensor adjustment procedure, see C - SPECIFICATIONS - 3.0L article.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Applications	Ft. Lbs. (N.m)
EGR Valve	16 (22)
Engine Coolant Temperature Sensor	22 (30)
Exhaust Manifold-To-Engine Nuts	18-21 (24-29)
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Fuel Filter Line	27 (36)
Fuel Tank Drain Plug	11-18 (15-24)
Fuel Tank Nuts	15-21 (20-29)
Heated Oxygen Sensor	
Front	29-33 (39-44)
Rear	15-29 (20-39)
Intake Manifold Plenum Bolt/Nut	13 (18)
Knock Sensor	15-18 (20-24)
Oil Return Pipe-To-Engine	10-14 (14-19)
Oil Supply Pipe-To-Engine Nut	14 (19)
Plenum-To-Intake Manifold Bolts	11-15 (15-20)
Throttle Body	14 (19)
	INCH Lbs. (N.m)
Camshaft Position Sensor	80 (9)
Crankshaft Position Sensor	80 (9)
Distributor Hold-Down Bolt	106 (12)
Engine Cover	22-40 (2.5-4.5)
Fuel Pressure Regulator	80 (9)
Fuel Pump Nuts	22 (2.5)
Fuel Rail Bolts	80-106 (9.0-12.0)
Heat Protector Bolts	106-133 (12.0-15.0)
TP Sensor Screws	13-22 (1.5-2.5)
Wastegate Actuator Bolts	80-106 (9.0-12.0)

SCHEDULED SERVICES

1997-99 Mitsubishi Montero Sport

1997-99 MAINTENANCE
Mitsubishi Maintenance & Service Intervals

Mitsubishi: Montero Sport 2.4L
Mitsubishi: Montero Sport 3.0L

* READ THIS FIRST *

Before preforming maintenance on vehicle, ensure that all cautions and warnings have been observed to prevent vehicle damage or personal injury. See CAUTIONS & WARNINGS in MAINTENANCE INFORMATION article in this section.

Introduction
The frequency of scheduled inspection and maintenance services in this article are based on "normal" vehicle usage. They DO NOT take into account the following "severe" conditions:

* Driving In Dusty Conditions
* Trailer Towing, Police, Taxi, commercial Type Operation
* Extensive Idling, Driving In Stop-And-Go Traffic
* Short Trip Operation At Freezing Temperatures (Engine Not Thoroughly Warmed Up)
* Driving In Sandy Areas
* Driving In Salty Areas
* More Than 50% Operation In Heavy City Traffic Or At Sustained High Speeds During Hot Weather Above 90°F (32°C)
* Driving On Off-Road

If any of these severe conditions exist, the "normal" service schedule frequency for some service items is inadequate and must be supplemented. See the following section for specific details, SEVERE SERVICE CONDITIONS/ACTIONS.

SEVERE SERVICE CONDITIONS/ACTIONS

The following table identifies eight "severe" conditions that cause faster-than-normal wear. Each condition lists affected service item(s) and their revised (more frequent) service interval.
If any severe condition(s) is applicable, its revised service interval(s) supersede those found in the "normal" schedules. Depending on the specific mileage/time, the revised interval(s) may overlap a normal schedule (in which case they can be done together). If not, it must be performed outside of the normal schedule.

SEVERE SERVICE CONDITIONS/ACTIONS TABLE

Condition	Action	Item	Perform Every (1)
Driving In Dusty Conditions	Replace	Engine Oil	3,000 Mile (4800 KM) Or 3 Months
	Replace	Oil Filter	6,000 Mile (9600 KM) Or 6 Months
	Replace	Air Cleaner Filter	15,000 Mile (24,000 KM)
	Inspect	Disk Brake	6,000 Mile (9,600 KM)

		Pads	Or 6 Months
	Inspect	Rear Brake System	24,000 Mile (15,000 KM) Or 12 Months
Trailer Towing Or Police, Taxi Or Commercial Type Operation	Replace	Engine Oil	3,000 Mile (4800 KM) Or 3 Months
	Replace	Oil Filter	6,000 Mile (9600 KM) Or 6 Months
	Replace	Spark Plugs	15,000 Mile (24,000 KM)
	Replace	Manual Transmission Fluid	30,000 Mile (48,000 KM)
	Replace	Automatic Transmission Fluid	30,000 Mile (48,000 KM)
	Replace	Transfer Oil	30,000 Mile (48,000 KM)
Extensive Idling Driving in Stop & Stop & Go Traffic	Replace	Engine Oil	3,000 Mile (4800 KM) Or 3 Months
	Replace	Oil Filter	6,000 Mile (9600 KM) Or 6 Months
Short-trip Operation at Freezing Temperatures (Engine not thoroughly warmed)	Replace	Engine Oil	3,000 Mile (4800 KM) Or 3 Months
	Replace	Oil Filter	6,000 Mile (9600 KM) Or 6 Months
	Replace	Spark Plugs	15,000 Mile (24,000 KM)
Driving In Sandy Areas	Replace	Air Cleaner Filter	15,000 Mile (24,000 KM)
Driving In Salty Areas	Inspect	Disc Brake Pads	6,000 Mile (9,600 KM) Or 6 Months
	Inspect	Rear Brake System	24,000 Mile (15,000 KM) Or 12 Months
More than 50 % Operation in Heavy City Traffic Or At Sustained High Speeds During Hot Weather Above 90° F (32° C)	Replace	Engine Oil	3,000 Mile (4800 KM) Or 3 Months
	Replace	Oil Filter	6,000 Mile (9600 KM) Or 6 Months
	Replace	Manual Transmission Fluid	30,000 Mile (48,000 KM)
	Replace	Automatic Transmission Fluid	30,000 Mile (48,000 KM)
	Replace	Transfer Oil	30,000 Mile (48,000 KM)

Driving On Off-Road	Replace	Manual Transmission Fluid	30,000 Mile (48,000 KM)
	Replace	Automatic Transmission Fliud	30,000 Mile (48,000 KM)
	Replace	Transfer Oil	30,000 Mile (48,000 KM)

(1) - Perform these services at the mileage or number of months (since the last time), WHICHEVER COMES FIRST.

7,500 MILE (12,000 KM) NORMAL SERVICE

7,500 MILE (12,000 KM) NORMAL SERVICE

REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

15,000 MILE (24,000 KM) NORMAL SERVICE

15,000 MILE (24,000 KM) NORMAL SERVICE

INSPECT	

	Disc Brake Pads (3)
	Brake Hoses (3)
	Drive Shaft Boots (3)
	Automatic Transmission Fluid
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every year.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Brake Fluid	All	DOT 3 Or DOT 4
Automatic Transmission	All	"ATF DEXRON II" Or Equivalent

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)
Automatic Transmission	Drained	10.4 Qts. (9.8L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

22,500 MILE (36,000 KM) NORMAL SERVICE

22,500 MILE (36,000 KM) NORMAL SERVICE

	VERIFY
	Last Major Service Was Performed

	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

30,000 MILE (48,000 KM) NORMAL SERVICE

30,000 MILE (48,000 KM) NORMAL SERVICE

	VERIFY
	Last Major Service Was Performed
	SERVICE
	Ball Joints With Grease Nipple (6)
	Propeller Shaft Joints (6)
	INSPECT
	Fuel Hoses (3)
	Drive Belt (For Generator, Water Pump, Power Steering Pump)
	Manual Transmission Oil
	Transfer Oil
	Disc Brake Pads (4)

	Brake Hoses (4)
	Rear Drum Brake Linings & Rear Wheel Cylinders
	Ball Joint & Steering Linkage Seals (3)
	Drive Shaft Boots (4)
	Exhaust System (3)
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)
	Engine Coolant
	Automatic Transmission Fluid
	Rear Axle Oil
	Air Cleaner Filter

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every 2 years.
(4) - Or inspect every year.
(5) - Or change every 2 years.
(6) - Or lubricate grease every 2 years.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Manual Transmission	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Automatic Transmission	All	"ATF DEXRON II" Or Equivalent
Brake Fluid	All	DOT 3 Or DOT 4
Rear Axle	All	API Classification GL-5 Or Higher (2)
Transfer Case	All	API Classification GL-4 SAE 75W-85W Or 75W-90

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if

the Ambient Temperature is above 0° F (-18° C).
(2) - SAE90, 85W-90, 80W-90 may be used in temperatures above -10° F (-23° C). SAE 80W, 80W-90 may be used in temperatures from -30° F (-34° C) to -10° F (-23° C). SAE 75W may be used in temperatures below -30° F (-34° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)
Engine Coolant	Drained; With Reserve Tank	10 Qts. (9.5L)
Automatic Transmission	Drained	8.9 Qts. (8.5L)
Manual Transmission	Drained	3.3 Qts. (3.2L)
Rear Axle	Drained	3.3 Qts. (3.2L)
Transfer Case	Drained	2.6 Qts. (2.5L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

37,500 MILE (60,000 KM) NORMAL SERVICE

37,500 MILE (60,000 KM) NORMAL SERVICE

	VERIFY
	Last Major Service Was Performed
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if

the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

45,000 MILE (72,000 KM) NORMAL SERVICE

45,000 MILE (72,000 KM) NORMAL SERVICE

	VERIFY
	Last Major Service Was Performed
	INSPECT
	Disc Brake Pads (3)
	Brake Hoses (3)
	Drive Shaft Boots (3)
	Automatic Transmission Fluid
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every year.

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Brake Fluid	All	DOT 3 Or DOT 4
Automatic Transmission	All	"ATF DEXRON II" Or Equivalent

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)
Automatic Transmission	Drained	10.4 Qts. (9.8L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

52,500 MILE (84,000 KM) NORMAL SERVICE

52,500 MILE (84,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)
(1) - Change once a year or every 7,500 miles (12,000 KM). (2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.	

LUBRICATION SPECIFICATIONS		
Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES		
Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

60,000 MILE (96,000 KM) NORMAL SERVICE

60,000 MILE (96,000 KM) NORMAL SERVICE

	VERIFY
	Last Major Service Was Performed
	SERVICE
	Ball Joints With Grease Nipple (6)
	Propeller Shaft Joints (6)
	INSPECT
	Fuel Hoses (3)
	Fuel System (Tank, Pipe Line, Connection & Fuel Tank Filler Tube Cap) (3)
	Evaporative Emission Control System (Except Evaporative Emission Canister) (7)
	Drive Belt (For Generator, Water Pump, Power Steering Pump)
	Manual Transmission Oil
	Transfer Oil
	Disc Brake Pads (4)
	Brake Hoses (4)
	Rear Drum Brake Linings & Rear Wheel Cylinders
	Ball Joint & Steering Linkage Seals (3)
	Drive Shaft Boots (4)
	Exhaust System (3)
	Distributor Cap & Rotor (7)
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)
	Engine Coolant
	Automatic Transmission Fluid
	Rear Axle Oil
	Spark Plugs
	Timing Belt (9)
	Ignition Cables (8)

	Air Cleaner Filter

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every 2 years.
(4) - Or inspect every year.
(5) - Or change every 2 years.
(6) - Or lubricate grease every 2 years.
(7) - Or inspect every 5 years.
(8) - Or replace every 5 years.
(9) - For California & Massachusettes, this maintenance is recommended but not required.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Manual Transmission	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Automatic Transmission	All	"ATF DEXRON II" Or Equivalent
Brake Fluid	All	DOT 3 Or DOT 4
Rear Axle	All	API Classification GL-5 Or Higher (2)
Transfer Case	All	API Classification GL-4 SAE 75W-85W Or 75W-90

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).
(2) - SAE90, 85W-90, 80W-90 may be used in temperatures above -10° F (-23° C). SAE 80W, 80W-90 may be used in temperatures from -30° F (-34° C) to -10° F (-23° C). SAE 75W may be used in temperatures below -30° F (-34° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)
Engine Coolant	Drained; With Reserve Tank	10 Qts. (9.5L)

Automatic Transmission	Drained	8.9 Qts. (8.5L)
Manual Transmission	Drained	3.3 Qts. (3.2L)
Rear Axle	Drained	3.3 Qts. (3.2L)
Transfer Case	Drained	2.6 Qts. (2.5L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

67,500 MILE (108,000 KM) NORMAL SERVICE

67,500 MILE (108,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)
(1) - Change once a year or every 7,500 miles (12,000 KM). (2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.	

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).		

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)
(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.		

75,000 MILE (120,000 KM) NORMAL SERVICE

75,000 MILE (120,000 KM) NORMAL SERVICE

	VERIFY
	Last Major Service Was Performed
	INSPECT
	Disc Brake Pads (3)
	Brake Hoses (3)
	Drive Shaft Boots (3)
	Automatic Transmission Fluid
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every year.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Brake Fluid	All	DOT 3 Or DOT 4
Automatic Transmission	All	"ATF DEXRON II" Or Equivalent

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)
Automatic Transmission	Drained	10.4 Qts. (9.8L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

82,500 MILE (132,000 KM) NORMAL SERVICE

82,500 MILE (132,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

90,000 MILE (144,000 KM) NORMAL SERVICE

90,000 MILE (144,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
SERVICE	
	Ball Joints With Grease Nipple (6)
	Propeller Shaft Joints (6)
INSPECT	
	Fuel Hoses (3)

	Drive Belt (For Generator, Water Pump, Power Steering Pump)
	Manual Transmission Oil
	Transfer Oil
	Disc Brake Pads (4)
	Brake Hoses (4)
	Rear Drum Brake Linings & Rear Wheel Cylinders
	Ball Joint & Steering Linkage Seals (3)
	Drive Shaft Boots (4)
	Exhaust System (3)
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)
	Engine Coolant
	Automatic Transmission Fluid
	Rear Axle Oil
	Air Cleaner Filter

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every 2 years.
(4) - Or inspect every year.
(5) - Or change every 2 years.
(6) - Or lubricate grease every 2 years.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Manual Transmission	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Automatic Transmission	All	"ATF DEXRON II" Or Equivalent
Brake Fluid	All	DOT 3 Or DOT 4
Rear Axle	All	API Classification GL-5

		Or Higher (2)
Transfer Case	All	API Classification GL-4 SAE 75W-85W Or 75W-90

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).
(2) - SAE90, 85W-90, 80W-90 may be used in temperatures above -10° F (-23° C). SAE 80W, 80W-90 may be used in temperatures from -30° F (-34° C) to -10° F (-23° C). SAE 75W may be used in temperatures below -30° F (-34° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)
Engine Coolant	Drained; With Reserve Tank	10 Qts. (9.5L)
Automatic Transmission	Drained	8.9 Qts. (8.5L)
Manual Transmission	Drained	3.3 Qts. (3.2L)
Rear Axle	Drained	3.3 Qts. (3.2L)
Transfer Case	Drained	2.6 Qts. (2.5L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

97,500 MILE (156,000 KM) NORMAL SERVICE

97,500 MILE (156,000 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification

Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

105,000 MILE (168,000 KM) NORMAL SERVICE

105,000 MILE (168,000 KM) NORMAL SERVICE

	VERIFY
	Last Major Service Was Performed
	INSPECT
	Disc Brake Pads (3)
	Brake Hoses (3)
	Drive Shaft Boots (3)
	Automatic Transmission Fluid
	Ball Joints With Grease Nipple (4)
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)
	Rear Axle Oil

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every year.
(4) - Or lubricate grease every 2 years.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil	Ambient Temperature Less Than	SAE 5W-30

(1)	0°F (-18°C) To 100°F (38°C)	
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Brake Fluid	All	DOT 3 Or DOT 4
Automatic Transmission	All	"ATF DEXRON II" Or Equivalent
Rear Axle	All	API Classification GL-5 Or Higher (2)

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).
(2) - SAE90, 85W-90, 80W-90 may be used in temperatures above -10° F (-23° C). SAE 80W, 80W-90 may be used in temperatures from -30° F (-34° C) to -10° F (-23° C). SAE 75W may be used in temperatures below -30° F (-34° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)
Automatic Transmission	Drained	10.4 Qts. (9.8L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

112,500 MILE (187,500 KM) NORMAL SERVICE

112,500 MILE (187,500 KM) NORMAL SERVICE

VERIFY	
	Last Major Service Was Performed
REPLACE	
	Engine Oil (1)
	Engine Oil Filter (2)

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30

	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

120,000 MILE (200,000 KM) NORMAL SERVICE

120,000 MILE (200,000 KM) NORMAL SERVICE

	VERIFY
	Last Major Service Was Performed
	SERVICE
	Ball Joints With Grease Nipple (6)
	Propeller Shaft Joints (6)
	INSPECT
	Fuel Hoses (3)
	Fuel System (Tank, Pipe Line, Connection & Fuel Tank Filler Tube Cap) (3)
	Evaporative Emission Control System (Except Evaporative Emission Canister) (7)
	Drive Belt (For Generator, Water Pump, Power Steering Pump)
	Manual Transmission Oil
	Automatic Transmission Fluid
	Transfer Oil
	Disc Brake Pads (4)
	Brake Hoses (4)
	Ball Joint & Steering Linkage Seals (3)
	Drive Shaft Boots (4)
	Exhaust System (3)

	Distributor Cap & Rotor (7)
	REPLACE
	Engine Oil (1)
	Engine Oil Filter (2)
	Engine Coolant
	Automatic Transmission Fluid
	Rear Axle Oil
	Spark Plugs
	Timing Belt (9)
	Ignition Cables (8)
	Air Cleaner Filter

(1) - Change once a year or every 7,500 miles (12,000 KM).
(2) - If mileage is less than 7,500 miles (12,000 KM) each year, replace the oil filter at every oil change.
(3) - Or inspect every 2 years.
(4) - Or inspect every year.
(5) - Or change every 2 years.
(6) - Or lubricate grease every 2 years.
(7) - Or inspect every 5 years.
(8) - Or replace every 5 years.
(9) - For California & Massachusettes, this maintenance is recommended but not required.

LUBRICATION SPECIFICATIONS

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Manual Transmission	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Automatic Transmission	All	"ATF DEXRON II" Or Equivalent
Brake Fluid	All	DOT 3 Or DOT 4
Rear Axle	All	API Classification GL-5 Or Higher (2)
Transfer Case	All	API Classification GL-4 SAE 75W-85W Or 75W-90

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if

the Ambient Temperature is above 0° F (-18° C).
(2) - SAE90, 85W-90, 80W-90 may be used in temperatures above -10° F (-23° C). SAE 80W, 80W-90 may be used in temperatures from -30° F (-34° C) to -10° F (-23° C). SAE 75W may be used in temperatures below -30° F (-34° C).

FLUID CAPACITIES

Item	Condition	Specification (1)
Engine Oil (1)	Oil Pan	4.5 Qts. (4.3L)
	Oil Filter	0.32 Qts. (0.3L)
	Oil Cooler	0.32 Qts. (0.3L)
Engine Coolant	Drained; With Reserve Tank	10 Qts. (9.5L)
Automatic Transmission	Drained	8.9 Qts. (8.5L)
Manual Transmission	Drained	3.3 Qts. (3.2L)
Rear Axle	Drained	3.3 Qts. (3.2L)
Transfer Case	Drained	2.6 Qts. (2.5L)

(1) - Capacities are recommended or calculated levels. Always use dipstick to measure level.

LUBRICATION SPECIFICATIONS

LUBRICATION SPECIFICATIONS TABLE

Material	Condition	Specification
Engine Oil (1)	Ambient Temperature Less Than 0°F (-18°C) To 100°F (38°C)	SAE 5W-30
	Ambient Temperature Above 0°F (-18°C) To Over 100°F (38°C)	SAE 10W-30
Power Steering Fluid	All	Automatic Transmission Fluid DEXRON II
Engine Coolant	All	50/50 Mixture Of Distilled Water & Ethylene Glycol
Transfer Case	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Front & Rear Axle (2)	Conventional	API GL-5 or higher
	Limited Slip	Gear Oil
Clutch Fluid	All	DOT 3 Or DOT 4

Hook Lock Catch, Door Lock Strikers Seat Adjust-ers, Backdoor Lock, Parking Brake Cable Mechanism	All	Multipurpose Grease NLGI Grade 2
Front Wheel Bearings	All	Multipurpose Grease NLGI Grade 2 Or Equivalent
Door Hinges, Back Door Hinges	All	Engine Oil
A/C Refrigerant	All	HFC-134a
Manual Transmission	All	API Classification GL-4 SAE 75W-85W Or 75W-90
Automatic Transmission	All	"ATF DEXRON II" Or Equivalent
Brake Fluid	All	DOT 3 Or DOT 4

(1) - SAE 5W-30 engine oil is preferred. SAE 10W-30 may be used if the Ambient Temperature is above 0° F (-18° C).
(2) - SAE90, 85W-90, 80W-90 may be used in temperatures above -10° F (-23° C). SAE 80W, 80W-90 may be used in temperatures from -30° F (-34° C) to -10° F (-23° C). SAE 75W may be used in temperatures below -30° F (-34° C).

FLUID CAPACITIES

FLUID CAPACITIES TABLE (1)

Item	Condition	Specification
Engine Oil (1)	2.4L: Oil Change W/Filter	4.5 Qts. (4.3L)
	3.0L: Oil Change W/Filter	5.2 Qts. (5L)
Engine Coolant	2.4L: With Rear Heater	9.5 Qts. (9.0L)
	2.4L: WO/Rear Heater	8.5 Qts. (8.0L)
	3.0L: With Rear Heater	10.6 Qts. (10L)
	3.0L: WO/Rear Heater	9.5 Qts. (9.0L)
Power Steering	Drained	.85 Qts. (.8L)
Automatic Transmission	Drained	10.4 Qts. (9.8L)

Manual Transmission	Drained	2.4 Qts. (2.3L)
Transfer Case	Drained	2.4 Qts. (2.3L)
Front Axle	Drained	1.2 Qts. (1.1L)
Rear Axle	2.4L: Drained	1.58 Qts. (1.5L)
	3.0L: Drained	2.75 Qts. (2.6L)
Fuel Tank	Capacity	19.5 Gal (74L)

(1) - Capacities are recommended or calculated levels. Always use dipstick (if available) to measure level.

MISCELLANEOUS NOTES

* The Supplemental Restraint System must be inspected by an authorized dealer 10 years after the Manufacture date.

K - SENSOR RANGE CHARTS - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Sensor Operating Range Charts

Montero Sport - 2.4L

INTRODUCTION

Sensor operating range information can help determine if a sensor is out of calibration. An out-of-calibration sensor may not set a diagnostic trouble code, but it may cause driveability problems. For sensors not listed in this article, see appropriate G - TESTS W/CODES - 2.4L article.

SENSOR OPERATING RANGE CHARTS

NOTE: Unless stated otherwise in test procedure, perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance. For connector terminal identification, see TERMINAL IDENTIFICATION in the G - TESTS W/CODES - 2.4L article.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR RESISTANCE TABLE (1)

Application & Temperature °F (°C)	Ohms
68 (20)	2100-2700
176 (80)	260-360

(1) - Check resistance across ECT sensor terminals.

INTAKE AIR TEMPERATURE (IAT) SENSOR RESISTANCE TABLE (1)

Application & Temperature °F (°C)	Ohms
68 (20)	2300-3000
176 (80)	300-420

(1) - Check resistance across IAT sensor terminals No. 5 and 6.

Throttle Position (TP) Sensor

Measure total and variable resistance between specified TP sensor connector terminals. Total resistance should be 3500-6500 ohms. Variable resistance should change smoothly between 3500 and 6500 ohms as throttle valve is moved from closed to wide open throttle.

TP SENSOR TEST TERMINALS TABLE

Application	Terminals No.
Total Resistance	1 & 4
Variable Resistance	2 & 4

VOLUME AIRFLOW HERTZ TEST TABLE (1)

Application	Hz @ 700 RPM	Hz @ 2500 RPM

Montero Sport 2.4L	25-51	80-120

(1) - Measure Hertz frequency using a scan tool.

K - SENSOR RANGE CHARTS - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Sensor Operating Range Charts

Montero Sport - 3.0L

INTRODUCTION

Sensor operating range information can help determine if a sensor is out of calibration. An out-of-calibration sensor may not set a diagnostic trouble code, but it may cause driveability problems. For sensors not listed in this article, see appropriate G - TESTS W/CODES - 3.0L article.

SENSOR OPERATING RANGE CHARTS

NOTE: Unless stated otherwise in test procedure, perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance. For connector terminal identification, see TERMINAL IDENTIFICATION in the G - TESTS W/CODES - 3.0L article.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR RESISTANCE TABLE (1)

Application & Temperature °F (°C)	Ohms
68 (20)	2100-2700
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(1) - Check resistance across ECT sensor terminals.

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Application & Temperature °F (°C)	Ohms
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(1) - Check resistance across IAT sensor terminals No. 5 and 6.

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Measure total and variable resistance between specified TP sensor connector terminals. Total resistance should be 3500-6500 ohms. Variable resistance should change smoothly between 3500 and 6500 ohms as throttle valve is moved from closed to wide open throttle.

TP SENSOR TEST TERMINALS TABLE

Application	Terminals No.
Total Resistance	1 & 4
Variable Resistance	1 & 3

VOLUME AIRFLOW HERTZ TEST TABLE (1)

Application	Hz @ 700 RPM	Hz @ 2500 RPM

Montero Sport 3.0L 25-51 74-114

(1) - Measure Hertz frequency using a scan tool.

C - SPECIFICATIONS - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Service & Adjustment Specifications

Montero Sport - 2.4L

INTRODUCTION

Use this article to quickly find specifications related to servicing and on-vehicle adjustments. This is a quick reference article to use when you are familiar with an adjustment procedure and only need a specification.

CAPACITIES

BATTERY SPECIFICATIONS TABLE

Application	Group Size	CCA Rating
Montero Sport	75D23R	520

NOTE: Refill capacities are approximate. Correct fluid level should be determined by mark on dipstick, if applicable.

FLUID CAPACITIES TABLE

Application	Quantity
Automatic Transmission (Mitsubishi Plus/Mopar Plus/Dexron II)	10.4 Qts. (9.8L)
Cooling System (Includes Heater & Reserve Tank)	
With Rear Heater	9.5 Qts. (9.0L)
Without Rear Heater	8.5 Qts. (8.0L)
Crankcase (Includes Filter)	4.5 Qts. (4.3L)
Differential (SAE 80W-90/API GL-5)	
Front	1.2 Qts. (1.1L)
Rear	1.6 Qts. (1.5L)
Manual Transmission (SAE 75W-85/API GL-4)	2.4 Qts. (2.3L)
Power Steering (Dexron-II)	1.9 Pts. (0.9L)
Transfer Case (SAE 75W-85/API GL-4)	4.6 Pts. (2.3L)

(1) - Use Texaco MTX FM fluid.

QUICK-SERVICE

SERVICE INTERVALS & SPECIFICATIONS

REPLACEMENT INTERVALS TABLE

Component	Miles
Air Filter	30,000
Automatic Transmission	
Except 4WD	(1)
4WD	30,000
Axle Fluid (3)	30,000
Coolant	30,000

Oil	7500
Oil Filter	(2) 15,000
Spark Plugs (4)	60,000
Spark Plug Wires	60,000
Timing Belt	60,000

(1) - Inspect fluid every 15,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.
(2) - Replace oil filter at oil change if annual mileage is less than 7500 miles.
(3) - Limited-slip differential.
(4) - Use Platinum spark plugs only.

BELT ADJUSTMENT TABLE

Application	(1) Deflection New Belt - In. (mm)	(1) Deflection Used Belt - In. (mm)
Generator	.22-.29 (5.5-7.5)	.30-.33 (7.5-8.5)
P/S	.24-.28 (6.0-7.0)	.16-.24 (4.0-6.0)
A/C	.24-.26 (6.0-6.5)	.20-.22 (5.0-6.0)

(1) - With 22 lbs. (10 kg) pressure applied midway on longest belt run.

MECHANICAL CHECKS

ENGINE COMPRESSION

Check engine compression with engine at normal operating temperature, all spark plugs removed and throttle wide open.

COMPRESSION SPECIFICATIONS TABLE

Application	Specification
Compression Ratio (VIN G)	9.5:1
Compression Pressure (VIN G)	192 psi (13.4 kg/cm²)

IGNITION SYSTEM

IGNITION COIL

IGNITION COIL RESISTANCE TABLE - Ohms @ 68°F (20°C)

Application	Primary	Secondary
2.4L (VIN G)	.67-.81	11,300-15,300

HIGH TENSION WIRE RESISTANCE

Wire resistance should not exceed 22,000 ohms.

SPARK PLUGS

SPARK PLUG TYPE TABLE

Application	Nippondenso No.
2.4L (VIN G)	K16PR-U11

SPARK PLUG SPECIFICATIONS TABLE

Application	(1) Gap In. (mm)	Torque Ft. Lbs. (N.m)
Montero Sport	.039-.043 (1.0-1.1)	18 (25)

(1) - DO NOT adjust gap on Platinum spark plugs.

FIRING ORDER

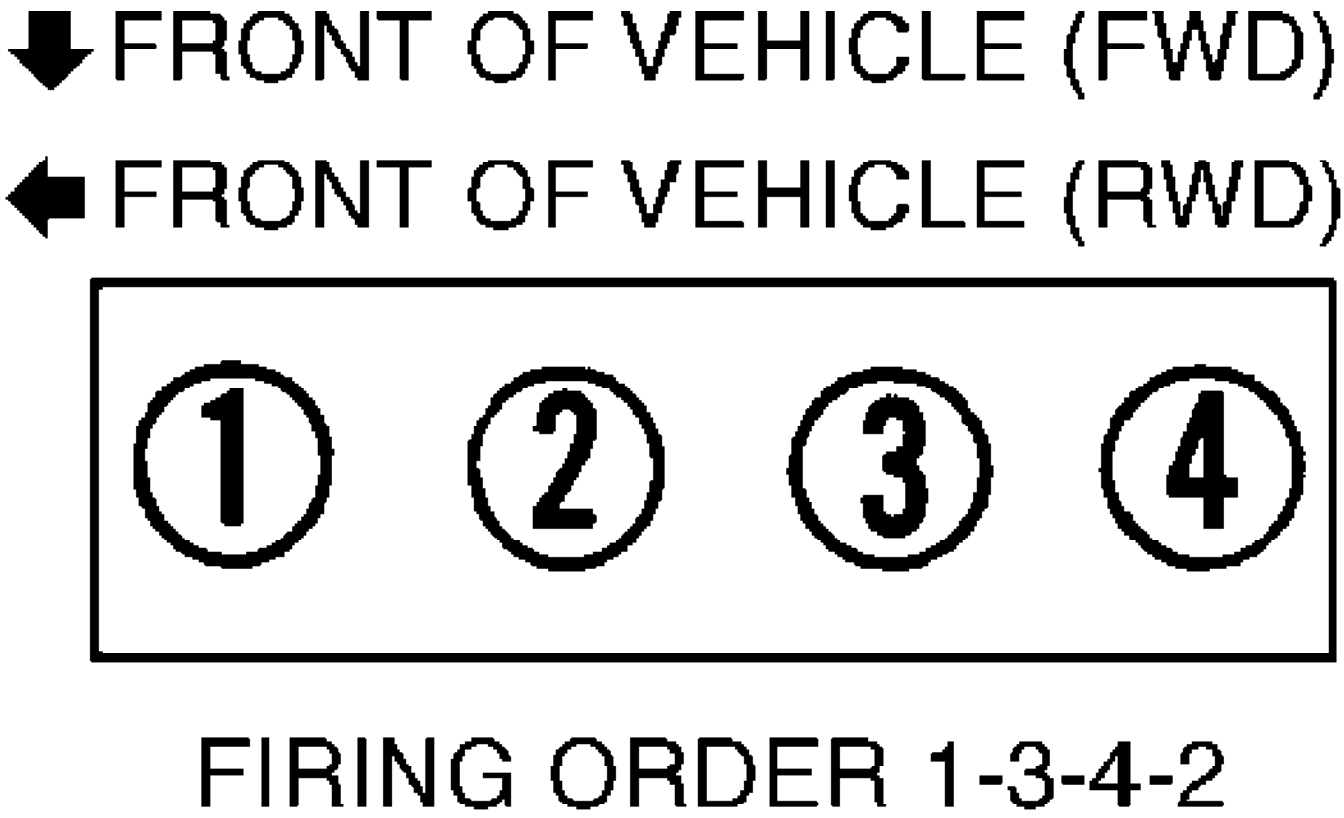

Fig. 1: Firing Order Firing Order (4-Cylinder)

IGNITION TIMING

IGNITION TIMING TABLE (Degrees BTDC @ RPM)

Application	(1) Basic	(2) (3) Actual
2.4L	2-8 @ 650-850	10 @ 650-850

(1) - With ignition timing adjustment connector grounded or vacuum hose (farthest from distributor) disconnected.
(2) - With ignition timing adjustment connector ungrounded or vacuum hose (farthest from distributor) connected. Actual ignition timing is approximate and may fluctuate.
(3) - If vehicle altitude is more than 2300 feet above sea level, actualtiming may be advanced (5 degrees).

FUEL SYSTEM

FUEL PUMP

REGULATED FUEL PRESSURE TABLE

Application	Specification
At Idle With Vacuum	38 psi (2.7 kg/cm²)
At Idle Without Vacuum	47-50 psi (3.3-3.5 kg/cm²)

IDLE SPEED

IDLE SPEED SPECIFICATIONS TABLE

Application	Curb Idle	Basic Idle
2.4L	650-850	700-800

THROTTLE POSITION (TP) SENSOR

TP SENSOR SPECIFICATIONS TABLE

Application	(1) Volts
Montero Sport	.4-1.0

(1) - At idle.

C - SPECIFICATIONS - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Service & Adjustment Specifications

Montero Sport - 3.0L

INTRODUCTION

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Application	Group Size	CCA Rating
Montero Sport	75D23R	520

NOTE: Refill capacities are approximate. Correct fluid level should be determined by mark on dipstick, if applicable.

FLUID CAPACITIES TABLE

Application	Quantity
Automatic Transmission (Mitsubishi Plus/Mopar Plus/Dexron II)	10.4 Qts. (9.8L)
Cooling System (Includes Heater & Reserve Tank)	
With Rear Heater	10.6 Qts. (10.0L)
Without Rear Heater	9.5 Qts. (9.0L)
Crankcase (Includes Filter)	5.0 Qts. (4.6L)
Differential (SAE 80W-90/API GL-5)	
Front	1.2 Qts. (1.1L)
Rear	2.8 Qts. (2.7L)
Manual Transmission (SAE 75W-85/API GL-4)	2.4 Qts. (2.3L)
Power Steering (Dexron-II)	1.9 Pts. (0.9L)
Transfer Case (SAE 75W-85/API GL-4)	4.6 Pts. (2.3L)

(1) - Use Texaco MTX FM fluid.

QUICK-SERVICE

SERVICE INTERVALS & SPECIFICATIONS

REPLACEMENT INTERVALS TABLE

Component	Miles
Air Filter	30,000
Automatic Transmission	
Except 4WD	(1)
4WD	30,000
Axle Fluid (3)	30,000
Coolant	30,000

Oil	7500
Oil Filter	(2) 15,000
Spark Plugs (4)	60,000
Spark Plug Wires	60,000
Timing Belt	60,000

(1) - Inspect fluid every 15,000 miles. Replace fluid if evidence of contamination appears, after repairing reason for contamination.
(2) - Replace oil filter at oil change if annual mileage is less than 7500 miles.
(3) - Limited-slip differential.
(4) - Use Platinum spark plugs only.

BELT ADJUSTMENT TABLE

Application	(1) Deflection New Belt - In. (mm)	(1) Deflection Used Belt - In. (mm)
Generator	.22-.29 (5.5-7.5)	.31-.35 (8.0-9.0)
P/S	.56-.64 (14.0-16.0)	.44-.52 (11.0-13.0)
A/C	.22-.26 (5.6-65)	.17-.20 (4.3-5.1)

(1) - With 22 lbs. (10 kg) pressure applied midway on longest belt run.

MECHANICAL CHECKS

ENGINE COMPRESSION

Check engine compression with engine at normal operating temperature, all spark plugs removed and throttle wide open.

COMPRESSION SPECIFICATIONS TABLE

Application	Specification
Compression Ratio	9.0:1
Compression Pressure	171 psi (12.0 kg/cm²)

IGNITION SYSTEM

IGNITION COIL

IGNITION COIL RESISTANCE TABLE - Ohms @ 68°F (20°C)

Application	Primary	Secondary
3.0L	.74-.90	20,100-27,300

HIGH TENSION WIRE RESISTANCE

Wire resistance should not exceed 22,000 ohms.

SPARK PLUGS

SPARK PLUG TYPE TABLE

Application	Nippondenso No.
3.0L	PK20PR-P11

SPARK PLUG SPECIFICATIONS TABLE

Application	(1) Gap In. (mm)	Torque Ft. Lbs. (N.m)
Montero Sport	.039-.043 (1.0-1.1)	..... 18 (25)

(1) - DO NOT adjust gap on Platinum spark plugs.

FIRING ORDER

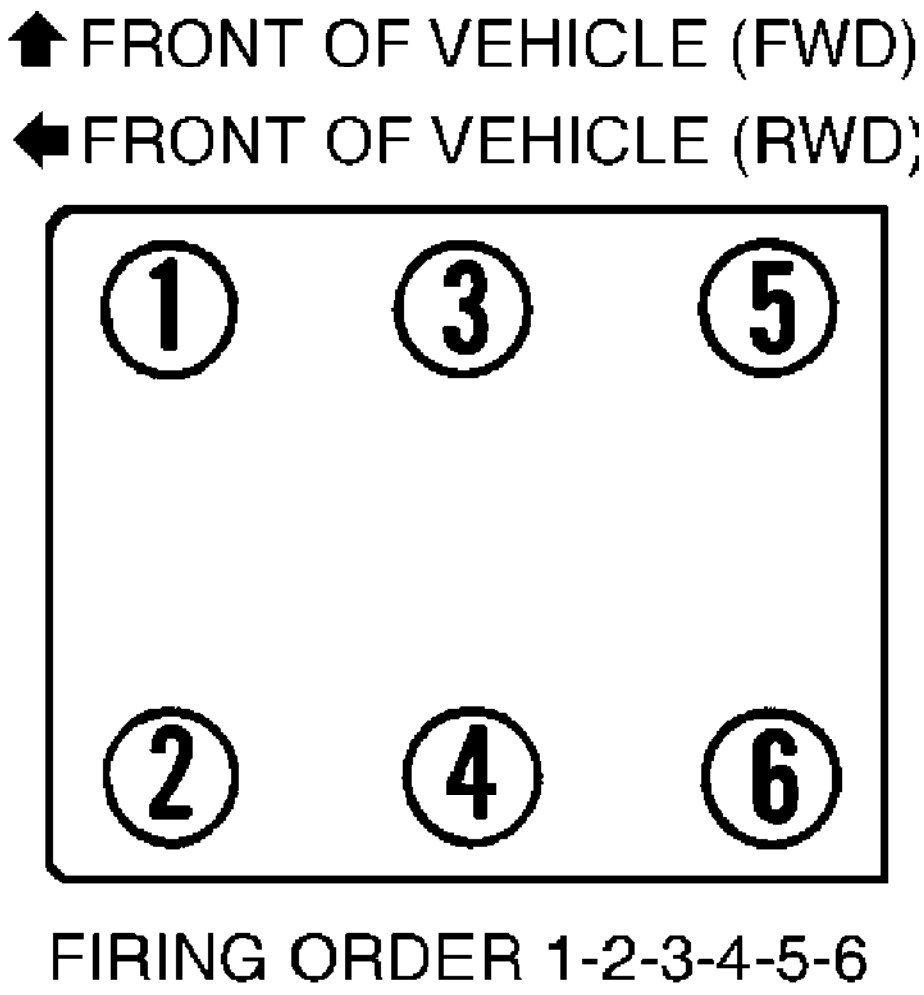

Fig. 1: Firing Order Firing Order

IGNITION TIMING

IGNITION TIMING TABLE (Degrees BTDC @ RPM)

Application	(1) Basic	(2) (3) Actual
3.0L	2-8 @ 600-800	15 @ 600-800

(1) - With ignition timing adjustment connector grounded or vacuum hose (farthest from distributor) disconnected.
(2) - With ignition timing adjustment connector ungrounded or vacuum hose (farthest from distributor) connected. Actual ignition timing is approximate and may fluctuate.
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FUEL PUMP

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Application	Specification
At Idle With Vacuum	38 psi (2.7 kg/cm²)
At Idle Without Vacuum	47-50 psi (3.3-3.5 kg/cm²)

IDLE SPEED

IDLE SPEED SPECIFICATIONS TABLE

Application	Curb Idle	Basic Idle
3.0L	600-800	650-750

THROTTLE POSITION (TP) SENSOR

TP SENSOR SPECIFICATIONS TABLE

Application	(1) Volts
Montero Sport	.4-1.0

(1) - At idle.

STARTER

1997-99 Mitsubishi Montero Sport

1997-99 STARTING & CHARGING SYSTEMS
Mitsubishi - Starter

Montero Sport

DESCRIPTION & OPERATION

The starter is a conventional 12-volt, 4-pole brush-type motor, with direct or gear reduction drive. The starter-mounted solenoid shifts overrunning clutch and pinion into flywheel when starter is energized.

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING - BASIC PROCEDURES article in GENERAL INFORMATION.

ON-VEHICLE TESTING

TROUBLE SHOOTING

1) If starter motor does not operate at all:

* Check starter coil.
* Check electrical connections.
* Check clutch pedal position switch (M/T).
* Check starter relay (M/T).
* Check park/neutral position switch (A/T).

2) If starter motor does not stop, check starter magnetic switch solenoid.

STARTER RELAY

1) Remove starter relay. See STARTER RELAY LOCATIONS table. With no power supplied to any relay, continuity should exist between relay terminals No. 1 and 2 and between relay terminals No. 3 and 4. See Fig. 1.

2) Connect a jumper wire from positive battery terminal to relay terminal No. 1 and another jumper wire from negative battery terminal to relay terminal No. 2. Continuity should exist between relay terminals No. 4 and 5. See Fig. 1.

STARTER RELAY LOCATIONS TABLE

Application	Location
Montero Sport	In Left Underhood Fuse/Relay Block

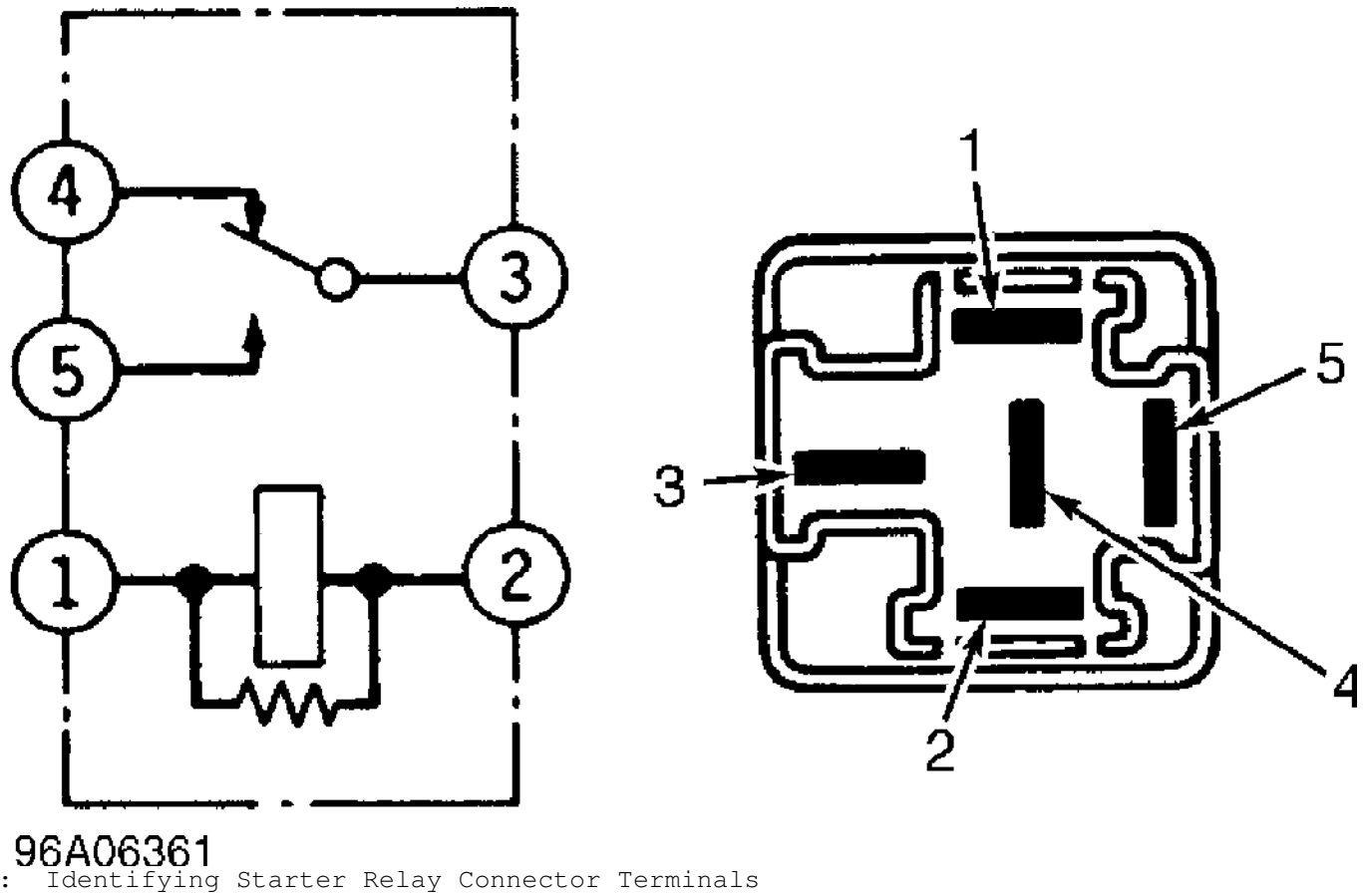


Fig. 1: Identifying Starter Relay Connector Terminals
Courtesy of Chrysler Corp.

BENCH TESTING

NO-LOAD TEST

CAUTION: Perform tests in less than 10 seconds to prevent damage to coil.

1) Install starter in soft-jawed vise. Connect starter in series with a fully-charged 12-volt battery. Connect a 100-amp ammeter and carbon pile rheostat in series with positive battery post and starter motor terminal. See Fig. 2.

2) Install voltmeter across starter motor. Adjust carbon pile rheostat to full resistance. Connect cable from starter motor body to negative battery terminal. Adjust carbon pile rheostat to proper test voltage. Ensure maximum amperage is as specified and starter rotates smoothly. See STARTER NO-LOAD TEST SPECIFICATIONS table.

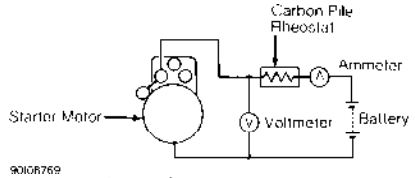


Fig. 2: Performing Starter No-Load Test
Courtesy of Mitsubishi Motor Sales of America.

STARTER NO-LOAD TEST SPECIFICATIONS TABLE

Application	(1) Starter Type	Test Voltage	Maximum Amps @ Minimum RPM
Montero Sport	GR	12	(2)

(1) - DD indicates direct drive. GR indicates gear reduction.
(2) - Information not available at time of publication.

PULL-IN COIL TEST

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 3. Connect jumper wire between positive battery terminal of 12-volt battery and terminal "S" of solenoid.
2) Connect a second jumper wire from negative battery terminal and touch terminal "M" of starter solenoid. If solenoid plunger moves inward, solenoid is good. If solenoid plunger does not move inward, replace solenoid.

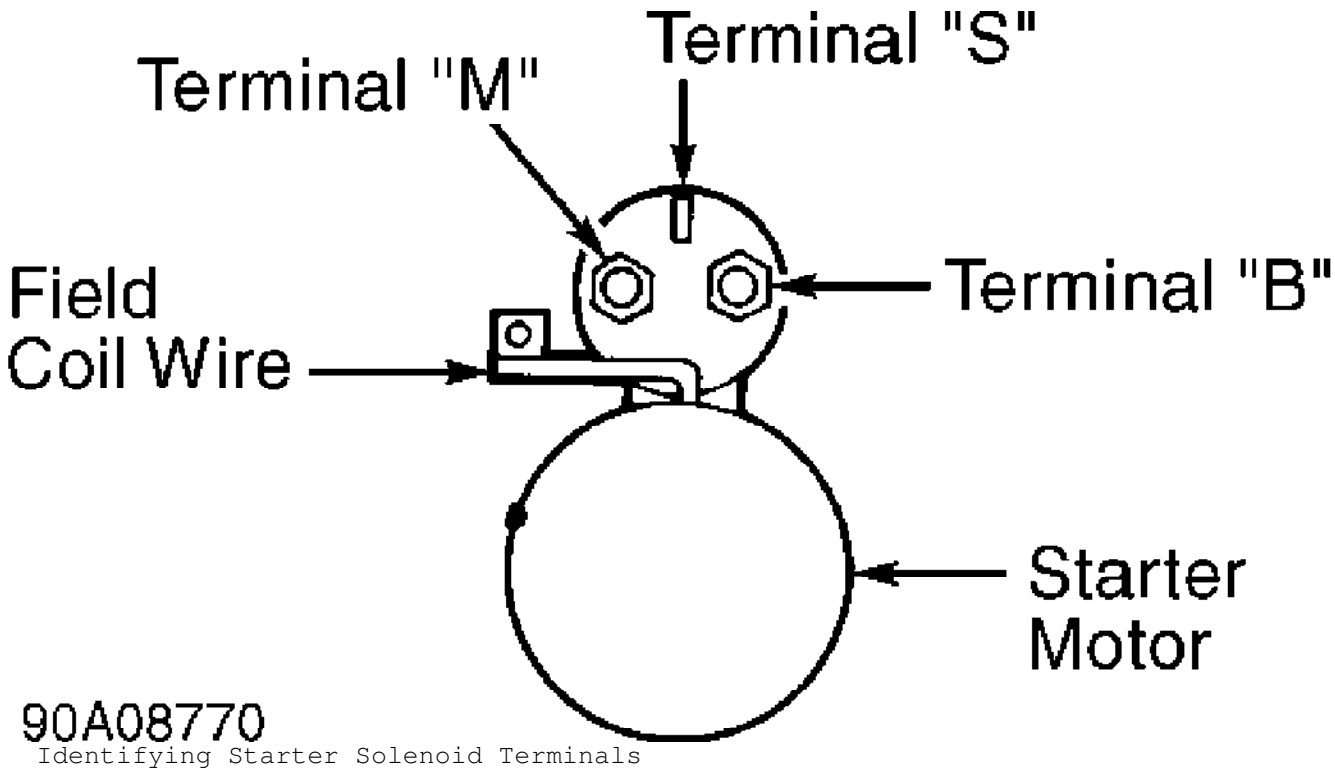


Fig. 3: Identifying Starter Solenoid Terminals
Courtesy of Mitsubishi Motor Sales of America.

HOLD-IN COIL TEST

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 3. Connect jumper wire between positive battery terminal of 12-volt battery and terminal "S" of starter solenoid.
2) Connect a second jumper wire from negative battery terminal and touch starter case. If solenoid plunger is pulled in, hold-in coil is good. If solenoid plunger is not pulled in, replace solenoid.

PINION RETURN TEST

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 3. Connect jumper wire between positive battery terminal of 12-volt battery and terminal "M" of starter solenoid.
2) Connect a second jumper wire from negative battery terminal and touch starter case. Pull pinion outward and release it. Replace solenoid if pinion remains out.

PINION GAP MEASUREMENT

1) Disconnect field coil wire from terminal "M" at starter solenoid. See Fig. 3. Connect jumper wire between positive battery terminal of 12-volt battery and terminal "S" of starter solenoid.
2) Connect a second jumper wire from negative battery terminal and touch terminal "M" of starter solenoid. Measure clearance between pinion and stopper. See Fig. 4.
3) Clearance should be within specification. See STARTER SPECIFICATIONS table. Adjust clearance by adding or removing gaskets between solenoid and front housing.

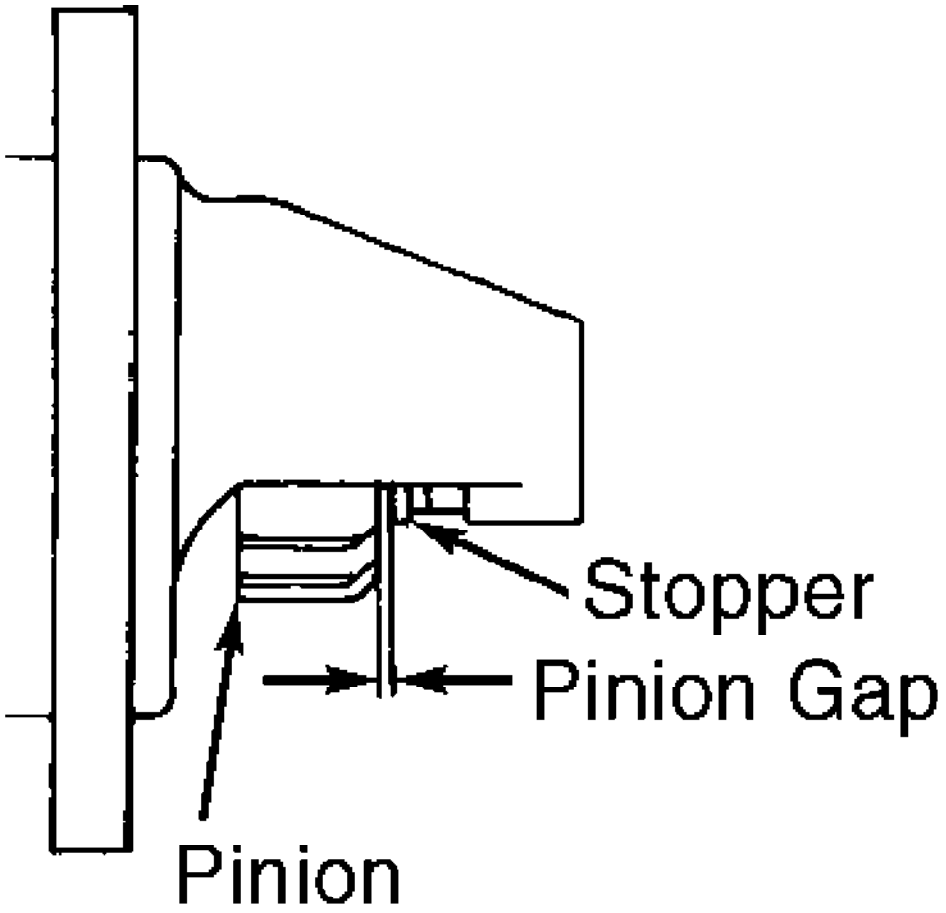


Fig. 4: Measuring Pinion Gap
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

Removal & Installation

Disconnect negative battery cable. If necessary, raise vehicle on hoist. Remove starter mounting bolts and starter. To install, reverse removal procedure.

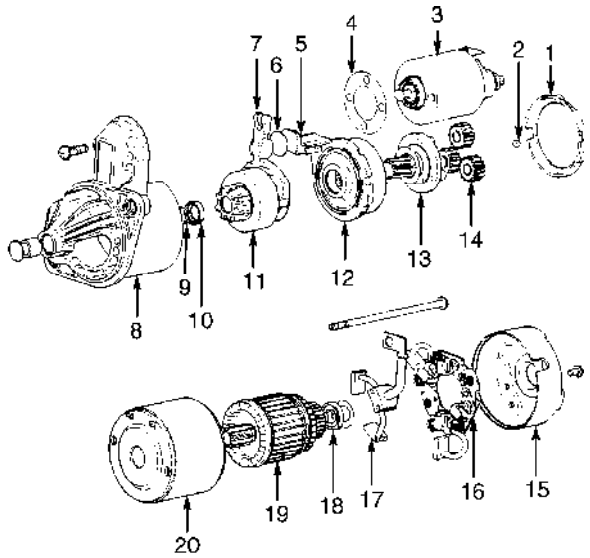
OVERHAUL

Check commutator for out-of-round and proper amount of undercut. Replace or repair armature if not within specification. See STARTER SPECIFICATIONS. Ensure brushes are not worn beyond wear line (outer line closest to commutator contact surface). Check pinion gap. See PINION GAP MEASUREMENT under BENCH TESTING. See Figs. 5 and 6.

STARTER SPECIFICATIONS

STARTER SPECIFICATIONS TABLE

Application	In. (mm)
Commutator Maximum Runout	.004 (.10)
Commutator Minimum Diameter	1.13 (28.8)
Commutator Undercut Depth	.020 (.51)
Pinion Gap	.020-.079 (.51-2.01)



1. Packing
2. Ball
3. Starter Solenoid
4. Gasket
5. Packing
6. Plate
7. Lever
8. Front Housing
9. Snap Ring
10. Stopper
11. Pinion
12. Internal Gear
13. Planetary Gear Holder
14. Planetary Gear
15. Rear Housing
16. Brush Holder
17. Brush
18. Rear Bearing
19. Armature
20. Yoke Assembly

Fig. 5: Exploded View Of Gear Reduction Starter (Typical) Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Starter-To-Block Bolts	20-25 (26-33)

WIRING DIAGRAMS

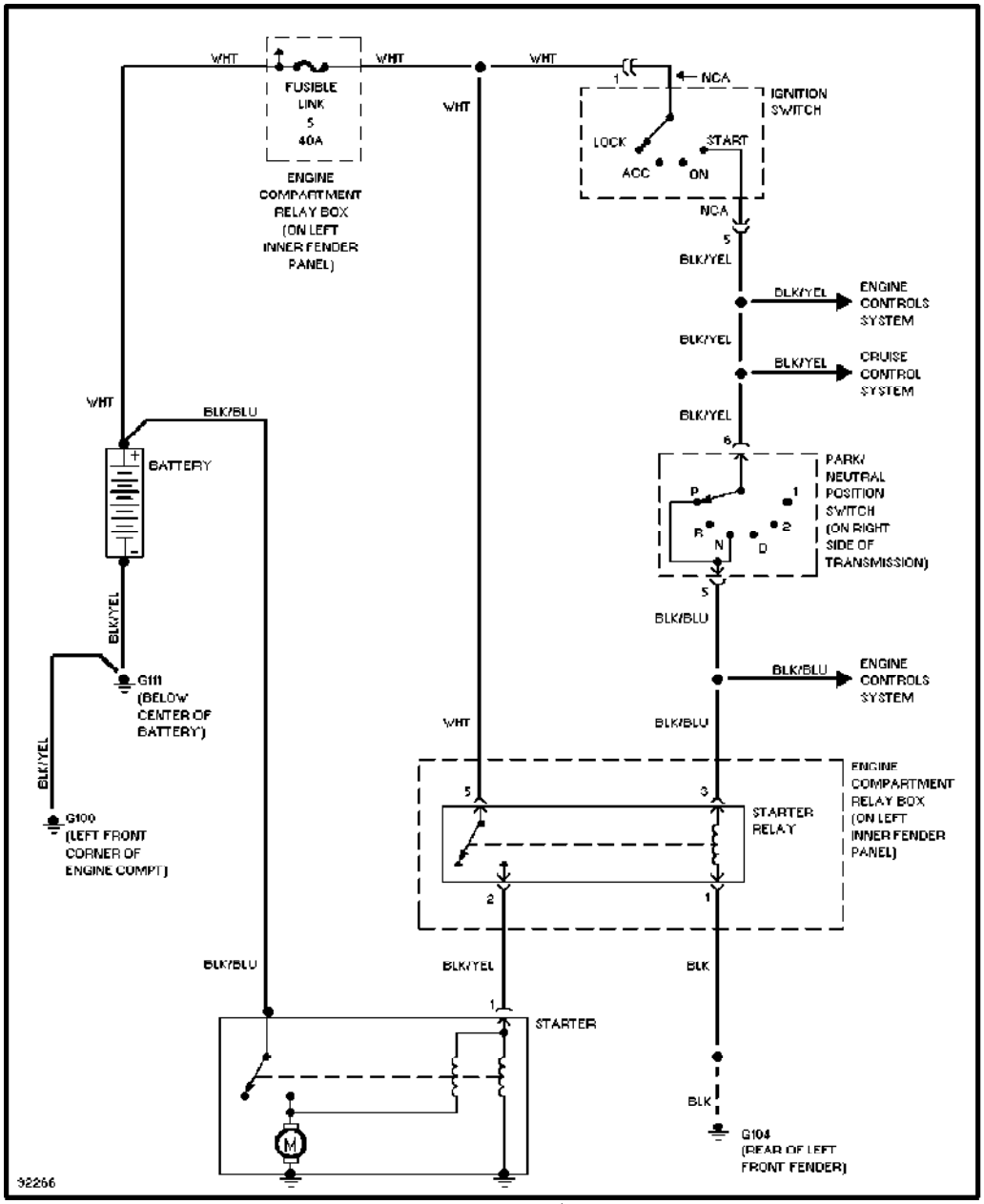


Fig. 6: Starting System Wiring Diagram (A/T)

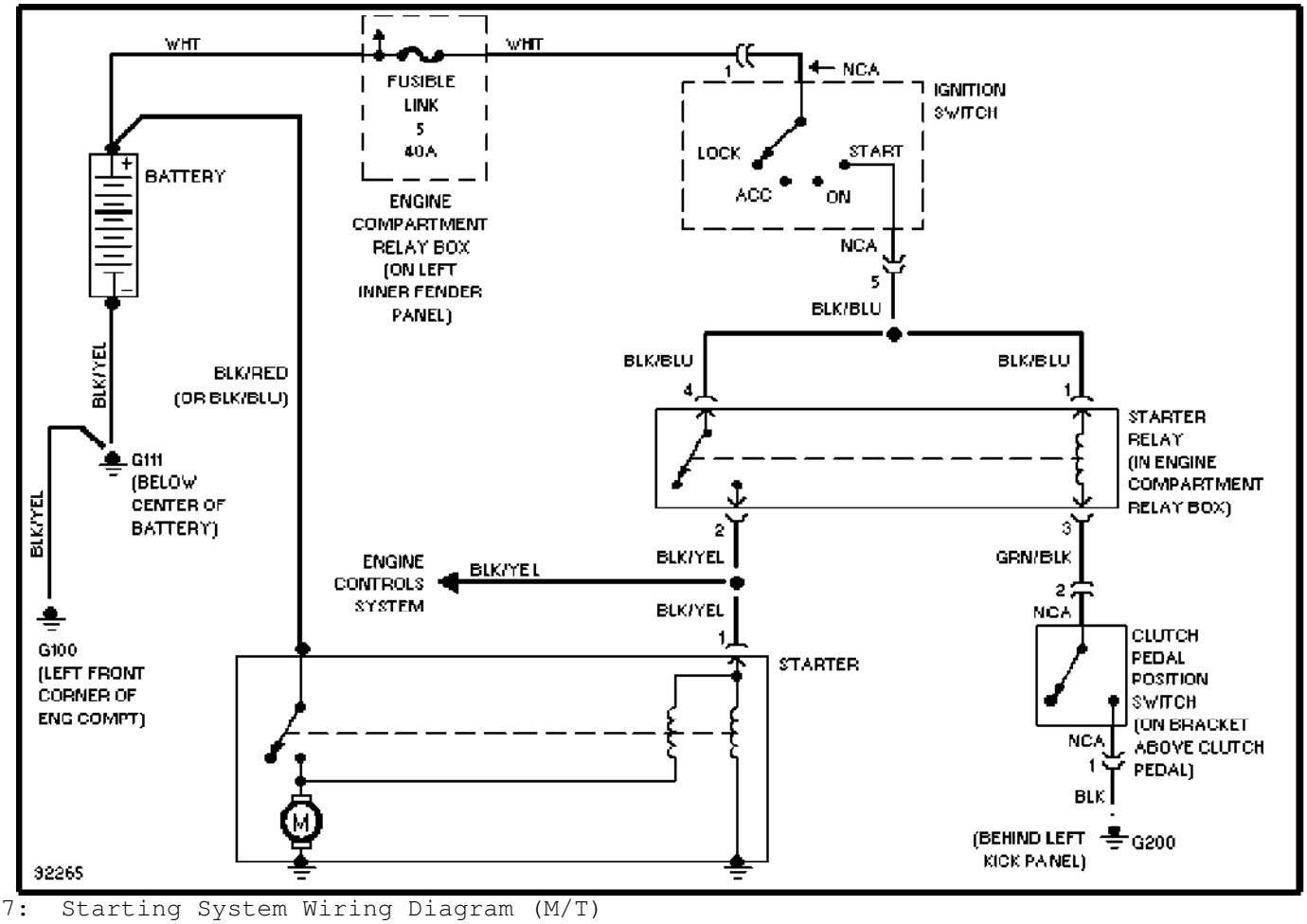


Fig. 7: Starting System Wiring Diagram (M/T)

STEERING COLUMN SWITCHES

1997-99 Mitsubishi Montero Sport

1997-99 ACCESSORIES & EQUIPMENT
Mitsubishi - Steering Column Switches

Montero Sport

* PLEASE READ THIS FIRST *

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEM article. DO NOT apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

DESCRIPTION

Headlight and turn signal switch and wiper/washer switch are part of the combination switch. For information on cruise control switch (right side of column), see CRUISE CONTROL SYSTEM article.

COMPONENT LOCATIONS

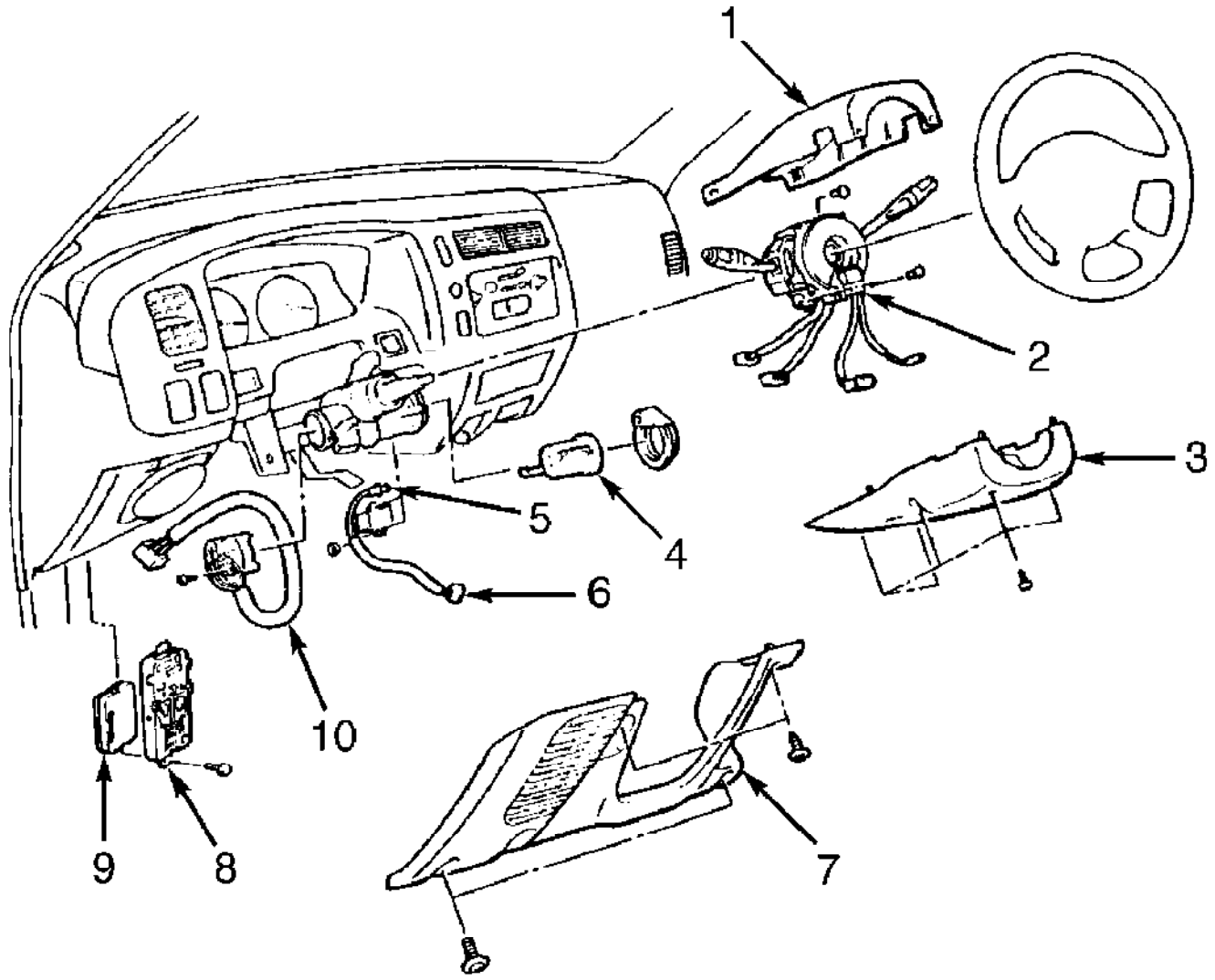
COMPONENT LOCATIONS TABLE

Component	Location
Headlight Relay	In Engine Compartment Fuse/Relay Block
Taillight Relay	In Engine Compartment Fuse/Relay Block Sport
Signal/Hazard Flasher Unit	Behind Left Side Of Dash
Wiper Relay	
Front	On Steering Column
Rear	On Relay Block, Behind Left Side Of Dash

COMPONENT TESTS

Ignition Switch Test

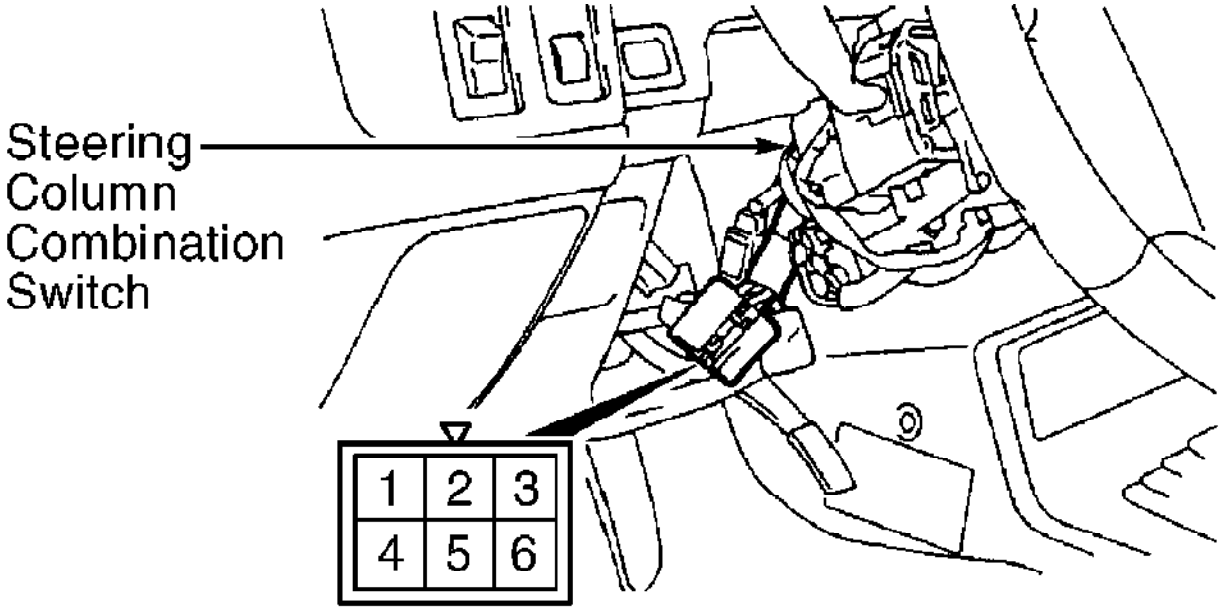
Disconnect ignition switch connectors. Check continuity between specified terminals. See Figs. 1 and 2. If continuity is not as specified, replace ignition switch.



1. Upper Steering Column Cover
2. Steering Column Combination Switch & Clockspring Assembly
3. Lower Steering Column Cover
4. Steering Lock Cylinder
5. Key Hole Illumination Light
6. Key Reminder Switch
7. Lower Instrument Panel Cover
8. Fuse/Relay Block
9. ETACS-ECU
10. Ignition Switch

97J11865

Fig. 1: Exploded View Of Steering Column
Courtesy of Mitsubishi Motor Sales of America.



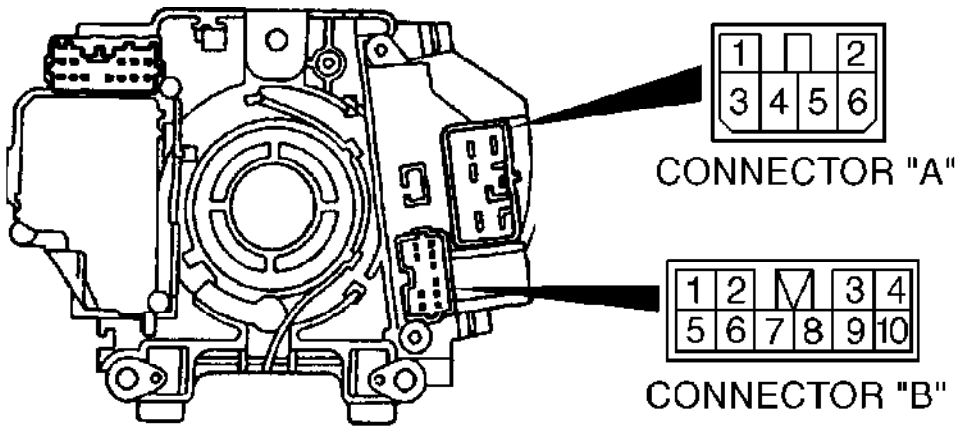
IGNITION KEY POSITION	TERMINAL NO.				
	1	2	4	5	6
LOCK					
ACC	○	—	—	—	○
ON	○	○	○		○
START	○	○		○	

97A11866

Fig. 2: Testing Ignition Switch
Courtesy of Mitsubishi Motor Sales of America.

Lighting & Turn Signal Switch Tests

Disconnect steering column combination switch connector. Check continuity between specified terminals. See Figs. 1 and 3. If continuity is not as specified, replace steering column combination switch.



SWITCH POSITION		CONNECTOR A-TERMINAL NO.					CONNECTOR B-TERMINAL NO.					
		1	2	3	4	6	3	5	6	7	8	9
LIGHTING SWITCH	OFF											
	TAIL							○		○		
	HEAD	○						○	○	○		
DIMMER/ PASSING SWITCH	LOWER			○	○							
	UPPER				○	○						
	PASSING	○	○	○	○	○*						
					○	○						

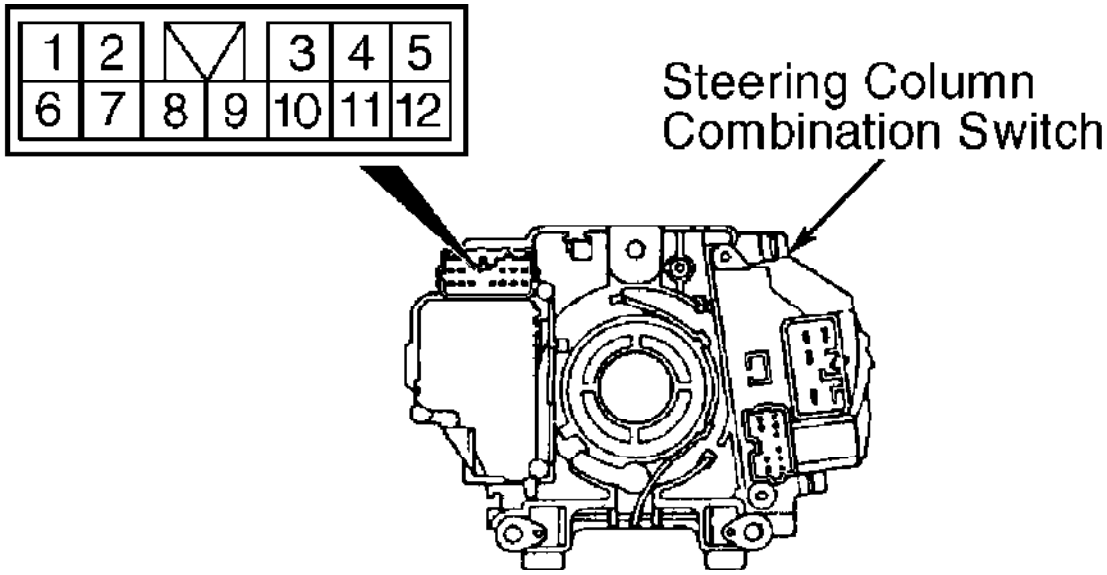
NOTE
* indicates continuity with the dimmer switch in the lower beam position.

SWITCH POSITION		TERMINAL NO.				
		3	5	7	8	9
TURN-SIGNAL LIGHT SWITCH	RH				○	○
	OFF					
	LH	○			○	

97B11867
Fig. 3: Testing Lighting & Turn Signal Switches
Courtesy of Mitsubishi Motor Sales of America.

Key Reminder Switch Test
Disconnect key reminder switch connectors. Check continuity

between specified terminals. See Figs. 1 and 4. If continuity is not as specified, replace key reminder switch.



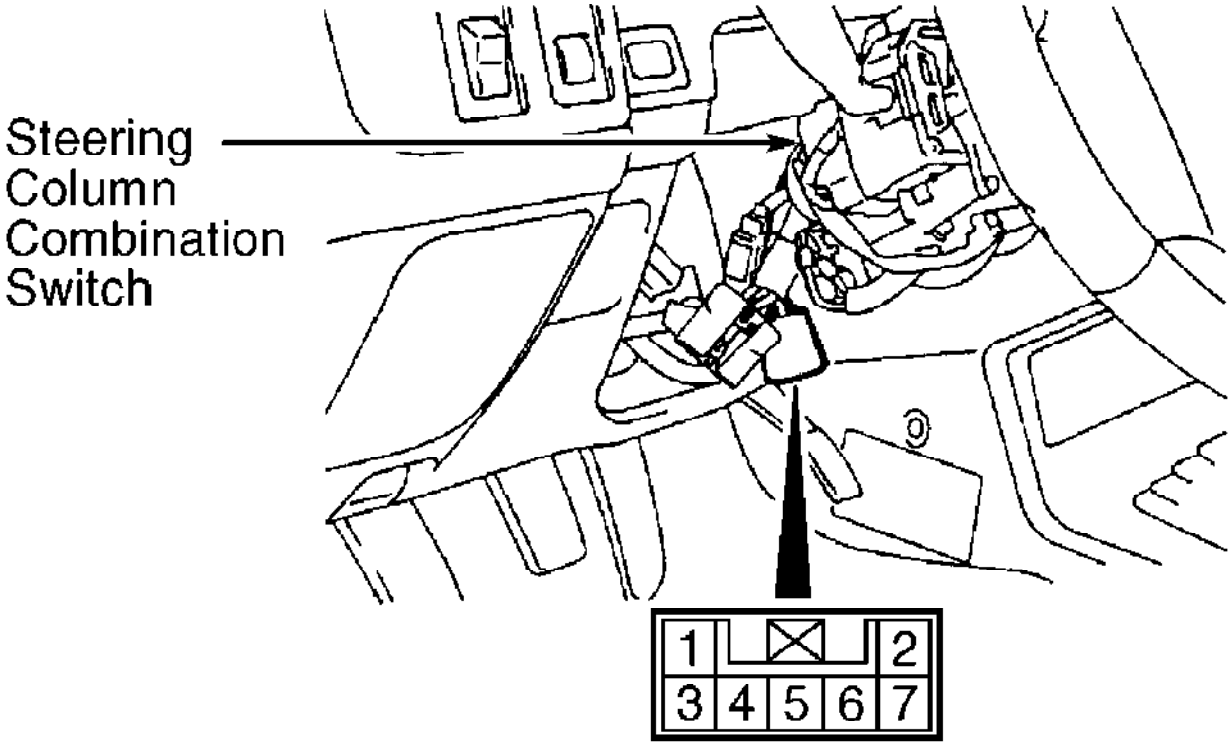
SWITCH POSITION		TERMINAL NO.				
		6	7	8	9	10
WIPER SWITCH	OFF		○	○		
	INTER-MITTENT		○	○		
	1 (LOW)			○		○
	2 (HIGH)				○	○
WASHER SWITCH	ON	○				○

97C11868

Fig. 4: Testing Key Reminder Switch
Courtesy of Mitsubishi Motor Sales of America.

Rear Wiper Switch Test

Disconnect steering column combination switch connector. Check continuity between specified terminals. See Fig. 5. If continuity is not as specified, replace steering column combination switch.



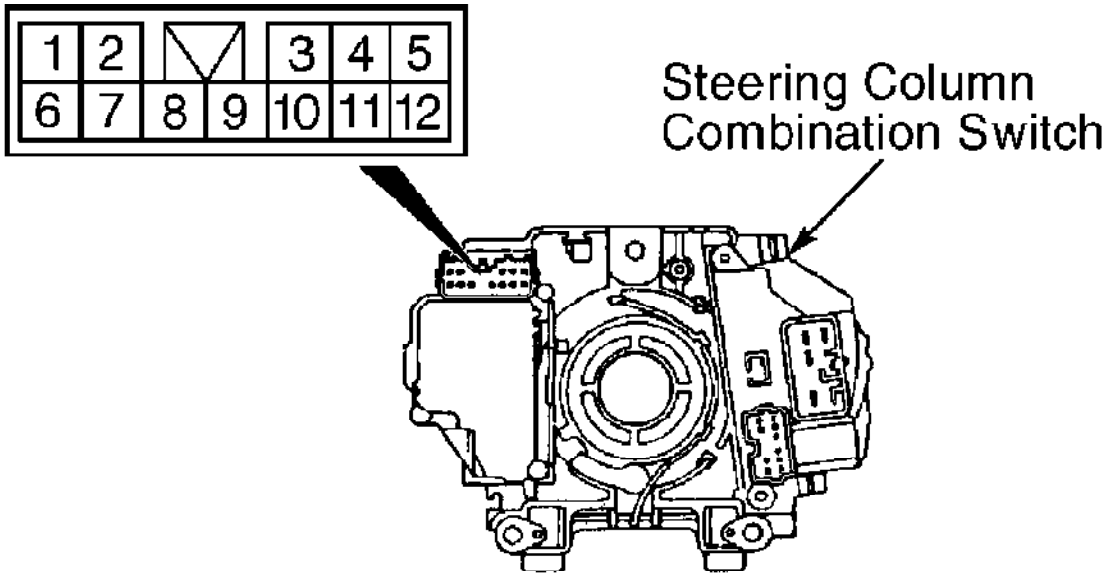
IGNITION KEY POSITION	TERMINAL NO.				
	1		2	4	6
PULLED OUT		ILL			
INSERTED		ILL			

97D11869

Fig. 5: Testing Rear Wiper Switch
Courtesy of Mitsubishi Motor Sales of America.

Wiper/Washer Switch Test

Disconnect steering column combination switch connector. Check continuity between specified terminals. See Figs. 1 and 6. If continuity is not as specified, replace steering column combination switch.



SWITCH POSITION		TERMINAL NO.			
		2	3	4	10
WIPER SWITCH	INTERMITTENT		○		○
	ON			○	○
WASHER SWITCH	ON	○		○	○

97G11870

Fig. 6: Testing Wiper/Washer Switch
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

WARNING: Deactivate air bag system before performing any service operation. See AIR BAG RESTRAINT SYSTEM article. DO NOT apply electrical power to any component on steering column without first deactivating air bag system. Air bag may deploy.

IGNITION SWITCH

Removal & Installation

Remove lower instrument panel cover. Remove upper and lower column covers. See Fig. 1. Remove ignition switch. To install, reverse

removal procedure.

STEERING COLUMN SWITCH

CAUTION: DO NOT hammer on steering wheel. Collapsible steering column mechanism may be damaged.

Removal & Installation

Remove lower instrument panel cover. Remove upper and lower steering column covers. See Fig. 1. Remove ignition switch. To install, reverse removal procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs (N.m)
Steering Wheel Nut	30 (41)
	INCH Lbs. (N.m)
Air Bag Module Bolts/Nuts	78 (8.8)

WIRING DIAGRAMS

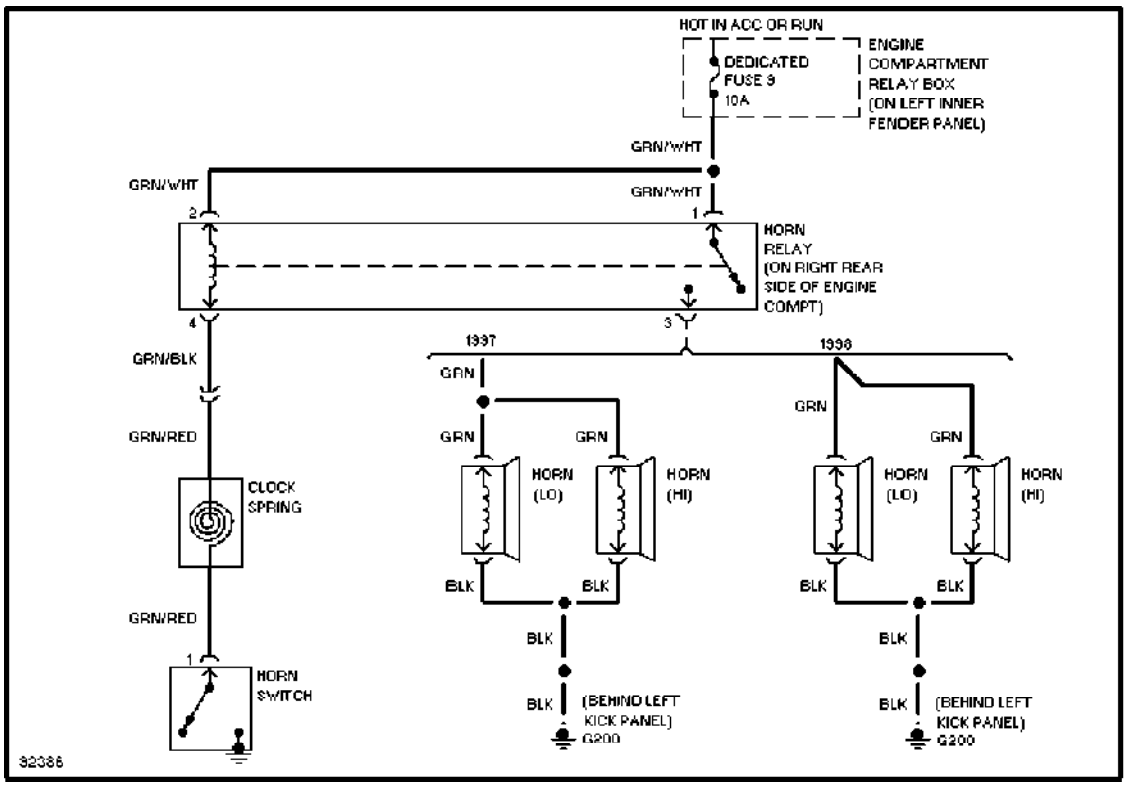


Fig. 7: Horn Circuit Wiring Diagram

STEERING COLUMN

1997-99 Mitsubishi Montero Sport

1997-99 STEERING
Mitsubishi - Steering Columns - RWD & 4WD

Mitsubishi: Montero, Montero Sport

DESCRIPTION & OPERATION

WARNING: Vehicle is equipped with a Supplemental Restraint System (SRS) that includes an air bag located in steering wheel. Use caution when working around steering column. Ensure battery is disconnected before attempting any repair. DO NOT apply electrical power to any component on steering column without disconnecting air bag module (air bag could deploy).

Steering column consists of a collapsible steering shaft with lower joint assembly. Vehicle is equipped with a Supplemental Restraint System (SRS) that includes an air bag and clockspring located in steering column wheel.

NOTE: For information not covered in this article, air bag DIAGNOSIS & TESTING or DISPOSAL PROCEDURES, see AIR BAG RESTRAINT SYSTEM article.

DISABLING & ACTIVATING AIR BAG SYSTEM

WARNING: Wait at least 60 seconds after disconnecting negative battery cable before servicing SRS. System reserve capacitor maintains SRS voltage for about 60 seconds after battery is disconnected. Servicing SRS before 60-second period may cause accidental air bag deployment and possible personal injury.

To disable system, turn ignition switch to OFF position. Disconnect and isolate negative battery cable end. Wait at least 60 seconds. To activate system, reconnect negative battery cable.

AIR BAG SERVICE PRECAUTIONS

The following precautions should be observed when working with SRS:

* Disable SRS before servicing any SRS or steering column component. Failure to do this may result in accidental air bag deployment and possible personal injury. See DISABLING & ACTIVATING AIR BAG SYSTEM.
* Wait at least 60 SECONDS after disabling air bag system. SRS system retains enough voltage, for a short time after system is disabled, to deploy air bag.
* After repairs, always turn ignition on to ensure SRS warning light is working properly and no system faults are indicated.
* Always wear safety glasses when servicing or handling an air bag.
* DO NOT expose air bag module and clockspring to temperatures more than 200°F (93°C).
* When placing a live air bag on a bench or other surface, always face air bag and trim cover up, away from surface. This will reduce motion of module if air bag accidentally

deploys.
* After air bag deploys, air bag surface may contain deposits of sodium hydroxide, which irritate skin. Always wear safety glasses, rubber gloves and long-sleeved shirt during clean up. Wash hands using mild soap and water. Follow correct clean-up and disposal procedures.
* Because of critical system operating requirements, DO NOT service any SRS components. Repairs are only made by replacing defective part(s).
* DO NOT allow any electrical source near inflator on the back of air bag module.
* When carrying live air bag module, trim cover should be pointed away from body to minimize injury in case of accidental air bag deployment.
* If SRS is not fully functional for any reason, DO NOT drive

vehicle until system is repaired and is fully functional. DO NOT remove bulbs, modules, sensors or other components, or in any way disable system from operating normally. If SRS is not functional, park vehicle until repairs are made.

REMOVAL & INSTALLATION

STEERING WHEEL

WARNING: Wait at least 60 seconds after disconnecting negative battery cable before servicing SRS. System reserve capacitor maintains SRS voltage for about 60 seconds after battery is disconnected. Servicing SRS before 60-second period may cause accidental air bag deployment and possible personal injury.

Removal

Disable air bag. See DISABLING & ACTIVATING AIR BAG SYSTEM. Ensure steering wheel is straight ahead. Remove air bag. Place reference mark on steering wheel and steering column shaft for installation reference. Remove steering wheel nut and washer. Using steering wheel puller, remove steering wheel.

CAUTION: DO NOT hammer on steering wheel during removal or installation, as it may damage steering column.

Installation

To install, reverse removal procedure. Ensure reference marks are aligned. Tighten fasteners to specification. See TORQUE SPECIFICATIONS. Activate air bag. See DISABLING & ACTIVATING AIR BAG SYSTEM.

COMBINATION SWITCH

CAUTION: When installing steering wheel, if rotating part of clockspring is not properly centered with steering column and front wheels, clockspring failure will result.

Removal & Installation

Remove lower instrument cover and lower heater duct. Remove air bag and steering wheel. See STEERING WHEEL under REMOVAL & INSTALLATION. Remove upper and lower steering column covers. Disconnect clockspring electrical connector. Remove screws attaching colckspring and remove clockspring. Disconnect combination switch electrical connectors. Remove screws and combination switch. To install, reverse removal procedure.

IGNITION SWITCH

Removal & Installation

1) Remove upper and lower steering column covers. Disconnect harness connector from ignition switch. Using hacksaw, cut slots in bolt heads of lock assembly. Using screwdriver, remove bolts and lock assembly.

2) To install, reverse removal procedure. Tighten new bolts until heads of bolts sheer off.

STEERING COLUMN

WARNING: Failure to follow air bag service precautions may result in air bag deployment and personal injury. See AIR BAG SERVICE PRECAUTIONS. Follow all service precautions before attempting repairs. After component replacement, perform a system operational check to ensure proper system operation.

CAUTION: Applying excessive pressure or causing impact to steering shaft during service may cause column to collapse. Before removing steering column, ensure wheels are in straight-ahead position. Note steering wheel location for installation reference.

Removal

1) Remove steering wheel. Remove combination switch and ignition switch (if necessary). See STEERING WHEEL under REMOVAL & INSTALLATION.

2) Remove lower instrument panel cover and air duct. Disconnect all electrical connections. Disconnect brake pedal return spring (if equipped). Disconnect gearshift control cable.

3) Remove bolts for dust cover at firewall. Remove bolt from clamp at steering gear. Remove steering column bolts and remove steering column.

Installation

To install, reverse removal procedure. Apply sealant (3M ATD 8663) to dust cover bolts before installing. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

OVERHAUL

STEERING COLUMN

WARNING: Failure to follow air bag service precautions may result in air bag deployment and personal injury. See AIR BAG SERVICE PRECAUTIONS. Follow all service precautions before attempting repairs. After component replacement, perform a system operational check to ensure proper system operation.

NOTE: Vehicle steering column is not repairable. See below for joint assembly and steering lock removal and installation.

Disassembly

Remove steering column from vehicle. See STEERING COLUMN under REMOVAL & INSTALLATION. Remove clamp bolt from joint assembly. See Fig. 1. Remove assembly. Remove lower boot, upper boot and dust cover from joint assembly. To remove steering lock, use a hacksaw to cut bolts at steering lock bracket side. Remove steering lock and bracket.

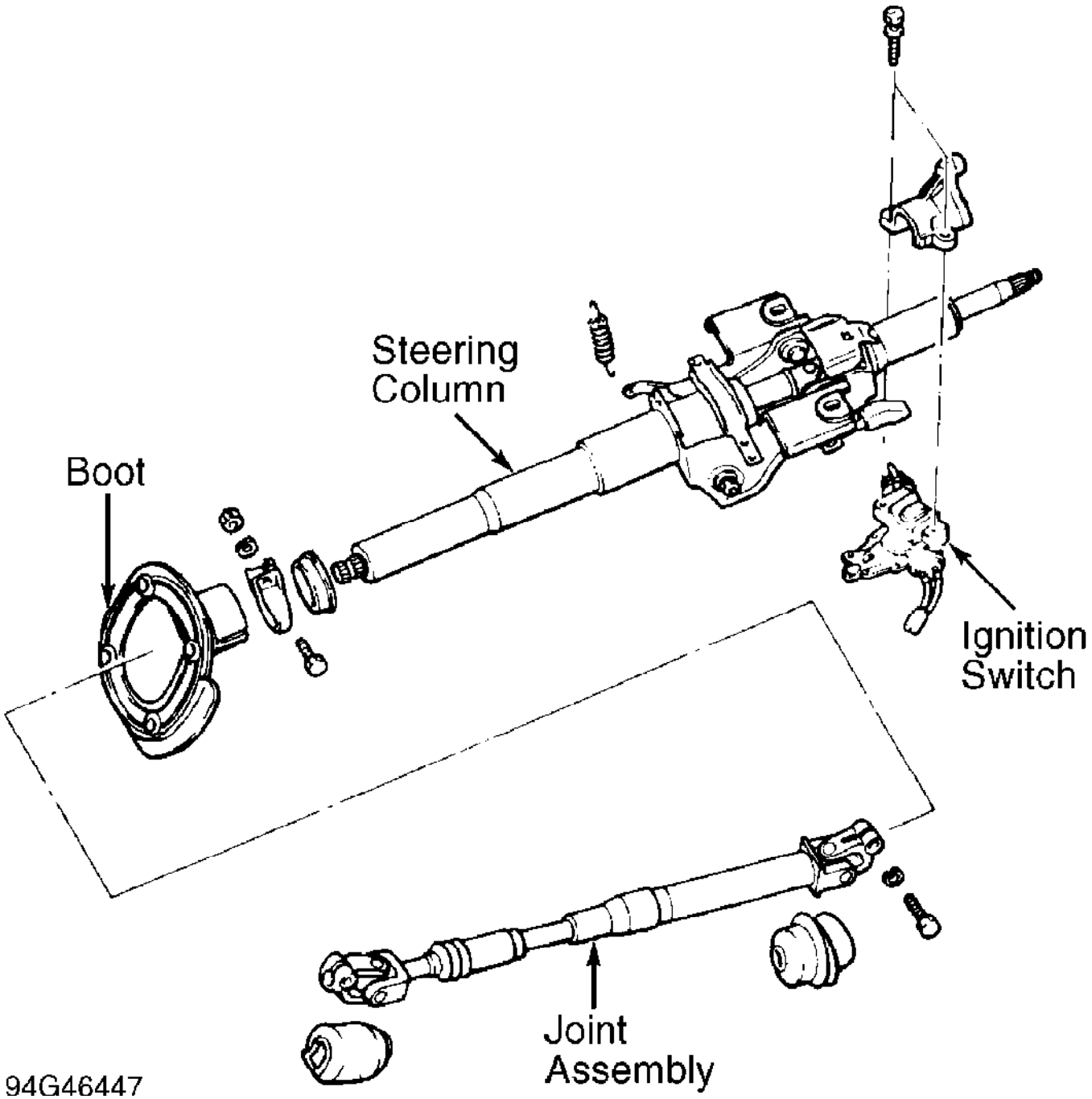


Fig. 1: Exploded View Of Steering Column (Montero Shown, Montero Sport Similar)
Courtesy of Mitsubishi Motor Sales of America.

Reassembly

1) To reassemble, reverse disassembly procedure. Install upper boot on joint assembly. Install lower boot and dust cover on joint assembly. Leave boots on shafts without assembling them to universal joint.

2) Apply multipurpose grease to universal joints of joint assembly. When installing upper boot, lower boot and dust cover, ensure arrows on boots align with slit area on yoke. Align steering

lock with column boss. Ensure steering lock is operational. Tighten bolt until bolt head breaks off.

3) Assemble upper steering column with lower joint assembly. Ensure mating mark on lower steering shaft aligns with yoke groove in upper steering shaft. See Fig. 2. Apply thread sealant to bolts and nuts of lower steering column.

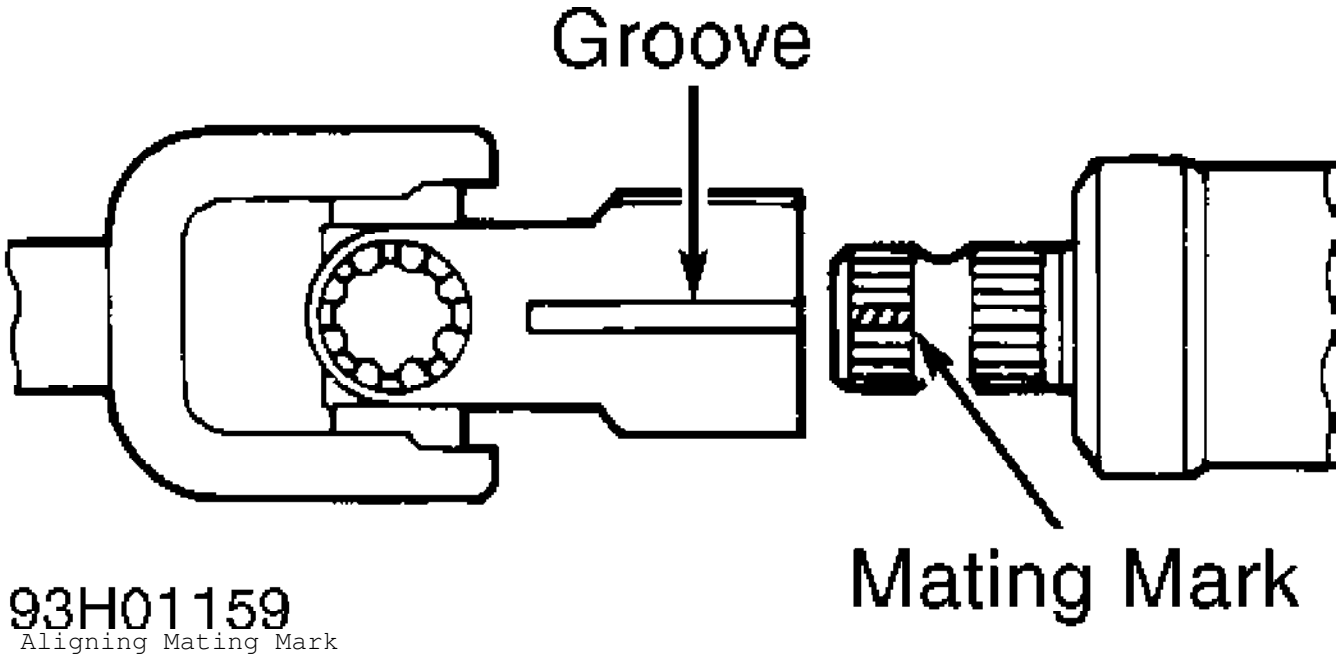


Fig. 2: Aligning Mating Mark
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Column Bracket Bolts	
Montero	16 (22)
Montero Sport	(1)
Lower Steering Shaft Clamp Bolt	
Montero	22-25 (30-34)
Montero Sport	14 (19)
Steering Wheel Nut	29 (40)
Upper Steering Shaft Clamp Bolt	13 (18)
Dust Cover Bolt	
Montero	3 (4)
Montero Sport	(1)
Air Bag Bolts	7 (9)
Steering Column Tube Clamp	4 (5)

(1) - Tighten bolts to 106 INCH lbs. (12 N.m).
(2) - Tighten bolts to 43 INCH lbs. (4.9 N.m).

END OF ALE

STEERING SYSTEM - POWER RECIRCULATING BALL

1997-99 Mitsubishi Montero Sport

1997-99 STEERING
Mitsubishi - Power Recirculating Ball

Montero, Montero Sport

DESCRIPTION & OPERATION

STEERING GEAR

The power steering gear displaces fluid to provide hydraulic pressure assist while turning. A one-piece rack piston nut is geared to cross shaft. Backlash is adjusted with an adjusting screw.

STEERING LINKAGE

Linkage consists of an idler arm, relay rod, steering knuckles and adjustable tie rods. Components are connected by ball joints. Linkage assembly is connected to steering gear by pitman arm.

LUBRICATION

FLUID TYPE

Recommended fluid type is Dexron-II ATF.

FLUID LEVEL CHECK

Place vehicle in level position. Start engine and let idle. Turn steering wheel left and right. Replace fluid if it has bubbles or has become White. Fluid level should be between MIN and MAX marks on dipstick. Fill to proper level.

FLUID REPLACEMENT

CAUTION: DO NOT crank engine for more than 15-20 seconds at a time.

1) Remove reservoir cap. Disconnect return hose at reservoir. Drain fluid. Disconnect coil high tension wire. Raise and support vehicle.
2) Turn steering wheel lock-to-lock several times while cranking engine to drain fluid from steering gear. Reconnect hose. Fill power steering system with fluid. Bleed system. See HYDRAULIC SYSTEM BLEEDING.

HYDRAULIC SYSTEM BLEEDING

CAUTION: DO NOT crank engine for more than 15-20 seconds at a time. Add fluid as needed during procedure to prevent reservoir level from dropping.

1) Ensure reservoir is filled before bleeding. Add fluid (if necessary) during bleeding. Raise and support front of vehicle. Disconnect coil high tension wire.
2) While cranking engine, turn steering wheel lock-to-lock 5 or 6 times. Lower vehicle. Connect coil wire. Start engine and let idle. Turn steering wheel lock-to-lock until no more bubbles appear in oil reservoir.

3) Turn steering wheel lock-to-lock. Fluid level should not change more than .2" (5 mm). If pump is noisy, fluid rises after engine is turned off, or fluid level changes more than specified, repeat bleeding procedure.

ADJUSTMENTS

BELT TENSION ADJUSTMENT SPECIFICATIONS

BELT ADJUSTMENT

Application	(1) Deflection: In. (mm)
Montero	
New Belt	.42-.54 (11-14)
Used Belt	.58-.66 (15-17)
Montero Sport	
2.4L	
New Belt	.16-.24 (4-6)
Used Belt	.24-.28 (6-7)
3.0L	
New Belt	.44-.52 (11-13)
Used Belt	.56-.64 (14-16)

(1) - With 22 lbs. (10 kg) pressure applied midway on longest belt run.

STEERING WHEEL PLAY

Raise and support vehicle. Start engine and let idle. With steering wheel in center position, ensure free play is 1.1" (27 mm) or less. If measured value exceeds specification, check steering gear backlash and linkage ball joint end play. See STEERING GEAR BACKLASH and LINKAGE BALL JOINT END PLAY.

STEERING GEAR BACKLASH

1) Set steering wheel in straight-ahead position. Raise and support vehicle. Disconnect relay rod from pitman arm. Using a dial indicator, measure steering gear backlash at top end of pitman arm.

2) Steering gear backlash should not exceed .02" (.5 mm). If measured value exceeds limit, turn steering gearbox adjusting bolt until steering wheel free play is within specification. See Fig. 1.

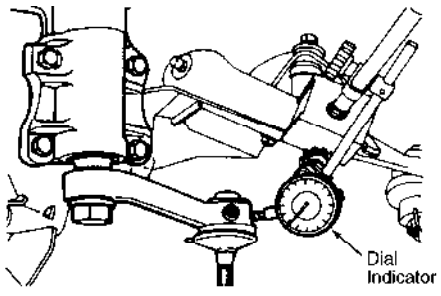


Fig. 1: Measuring Steering Gear Backlash
Courtesy of Mitsubishi Motor Sales of America.

TESTING

HYDRAULIC SYSTEM PRESSURE TEST

1) Disconnect pressure hose from power steering pump. Attach Pressure Gauge (MB990662-01) and Adapters (MB990993-01 and MB990994-01). See Fig. 2. Tighten fittings to 22-29 ft. lbs. (30-39 N.m).

2) Bleed system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Turn wheel several times to bleed air from gauge. Start engine and let idle. Place thermometer in reservoir. Check fluid level. Add fluid as necessary.

3) When fluid temperature reaches 122-140°F (50-60°C), check pressure. See POWER STEERING PUMP PRESSURE SPECIFICATIONS table. Reinstall pressure hose. Do not twist hose or let hose interfere with adjacent parts. Replace power steering pump if pressure is not within specification. Bleed system.

CAUTION: DO NOT keep shutoff valve closed more than 3 seconds at a time. DO NOT keep steering wheel turned to full lock position for more than 10 seconds at a time.

POWER STEERING PUMP PRESSURE SPECIFICATIONS

Application	psi (kg/cm²)
Valve Closed Or Wheel At Full Lock	1204-1305 (83-90)
Valve Open (Standard)	114-142 (8-10)

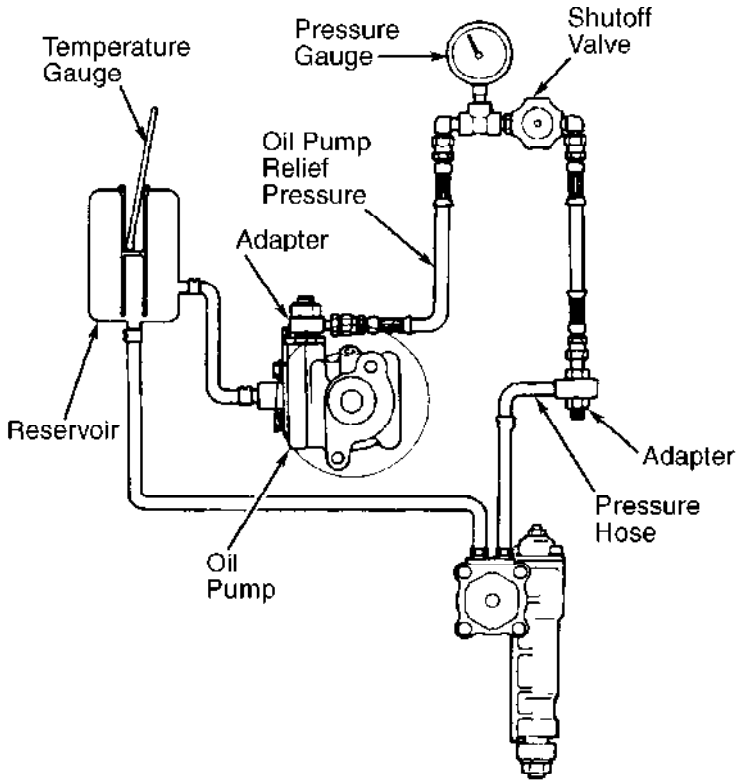


Fig. 2: Connecting Pressure Gauge & Shutoff Valve
Courtesy of Mitsubishi Motor Sales of America.

P/S PRESSURE SWITCH

1) Disconnect pressure hose from power steering pump. Attach Pressure Gauge (MB990662-01) and Adapters (MB990993-01 and MB990994-01). See Fig. 2. Tighten fittings to 22-29 ft. lbs. (30-39 N.m).

2) Bleed system. See HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Turn wheel several times to bleed air from gauge. Start engine and let idle. Place thermometer in reservoir. Check fluid level. Add fluid as necessary.

3) When fluid temperature reaches 122-140°F (50-60°C), disconnect connector from P/S pressure switch. Connect ohmmeter across switch terminals. Slowly close shut-off valve. Check pressure when ohmmeter indicates switch has closed (continuity). Pressure should be 218-290 (15-20 N.m). Slowly open shut-off valve. Check pressure when ohmmeter indicates switch has opened (no continuity). Pressure should be 102-174 (7-12 N.m). Reinstall pressure hose. Do not twist hose or let hose interfere with adjacent parts. Replace P/S pressure switch if pressure is not within specification. Bleed system.

CAUTION: DO NOT keep shutoff valve closed more than 3 seconds at a time. DO NOT keep steering wheel turned to full lock position for more than 10 seconds at a time.

STEERING WHEEL TURNING FORCE

Stationary Test

1) Position vehicle on level surface. Place steering wheel in straight-ahead position. Start engine and let idle. Using a spring scale, measure steering wheel turning force clockwise and counterclockwise.

2) On Montero, turning force should be 8.2 lbs. (3.7 kg) or less. On Montero Sport, turning force should be 8.8 lbs. (3.9 kg) or less. If turning force exceeds specification, check for loose or damaged belt, insufficient fluid, air in power steering fluid, and collapsed or twisted hoses. Repair or replace as necessary.

REMOVAL & INSTALLATION

IDLER ARM

Removal

Loosen relay rod-to-idler arm lock nut. Using Steering Linkage Puller (MB991113 or MB990635), separate idler arm from relay rod and remove relay rod-to-idler arm lock nut. Remove idler arm bolts and nuts. Remove idler arm. On Montero, loosen, but DO NOT remove idler arm-to-bracket nut. Press arm from bracket and remove nut and arm.

Inspection

Check idler arm bushings for damage or wear. Check idler arm ball stud for looseness.

Installation

1) Apply multipurpose grease to inside surface of bushing and idler arm support shaft. Insert bushing in idler arm. Insert idler arm support in idler arm.

2) Install washer (knurled side toward bushing) and NEW lock nut. Tighten lock nut to specification. See TORQUE SPECIFICATIONS. Place idler arm assembly in vise. Using a spring gauge, measure turning resistance.

3) On all models, turning resistance should be 3-18 INCH lbs. (.3-2.0 N.m). On Montero, if turning resistance is not within specification, loosen or tighten lock nut to obtain proper resistance.

4) Install idler arm bolts and nuts. Install relay rod-to-

idler arm. See TORQUE SPECIFICATIONS.

POWER STEERING GEAR

Removal & Installation

1) Drain power steering fluid. See FLUID REPLACEMENT under LUBRICATION. Remove steering shaft-to-steering gear clamp bolt. Disconnect pressure and return hoses from steering gear.

2) Remove cotter pin and castle nut from pitman arm. Using Puller (C-3894-A), separate pitman arm from relay rod.

3) Remove steering gear mounting nuts. Disconnect steering shaft from steering gear. Remove steering gear. To install, reverse removal procedure.

POWER STEERING PUMP & RESERVOIR

Removal

Drain power steering fluid. See FLUID REPLACEMENT under LUBRICATION. Disconnect hoses from reservoir. Remove reservoir. Disconnect hoses from pump. Loosen pump retaining bolts. Remove belt. Remove pump and mounting bracket(s).

Installation

To install, reverse removal procedure. Check power steering pump bracket for slack. Tighten bracket (if necessary). Fill and bleed reservoir. See FLUID REPLACEMENT and HYDRAULIC SYSTEM BLEEDING under LUBRICATION. Start engine and turn steering wheel lock-to-lock to check for fluid leaks.

RELAY ROD

Removal

Remove inner tie rod end cotter pins and lock nuts. Separate tie rod ends from relay rod. Remove cotter pins and castle nuts from idler arm and pitman arm. Using a puller, separate relay rod from idler arm and pitman arm.

Installation

To install relay rod, reverse removal procedure. Ensure dust covers are well greased and lower edge of covers are coated with packing sealer. Tighten relay rod-to-idler arm and relay rod-to-pitman arm castle nuts to specification. See TORQUE SPECIFICATIONS.

TIE ROD ASSEMBLY

Removal

1) Remove skid plate (if necessary). Remove cotter pins and loosen lock nuts from tie rod ball studs at steering knuckle and relay rod end.

2) Using Steering Linkage Puller (MB991113 or MB990635), separate tie rod ends from knuckle and relay rod end and remove lock nuts. Loosen tie rod adjusting sleeve lock nuts, and unscrew tie rod ends.

Inspection

Check tie rod ends for damage and ball studs for looseness. On Montero, measure ball stud starting torque. Torque should be 9-27 INCH lbs. (1.0-3.0 N.m). If ball stud starting torque exceeds specification, replace tie rod.

Installation

1) Install "O" ring on ball socket. Grease inside of tie rod

end dust cover. Coat lower edge of cup with packing sealer. Install tie rod ends into adjusting sleeves.

2) Measure center-to-center distance between tie rod studs for both tie rod assemblies. Adjust center-to-center distance to specification. See TIE ROD INSTALLATION LENGTH table.

3) An equal number of threads should be visible on each side of adjusting sleeve. Install tie rod ends in steering knuckle and relay rod. Install tie rod end castle nuts and NEW cotter pins. Tighten castle nuts to specification. See TORQUE SPECIFICATIONS. Adjust toe-in. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

TIE ROD INSTALLATION LENGTH

Application	In. (mm)
Montero	12.05 (306.0)
Montero Sport	12.0 (305)

OVERHAUL

POWER STEERING GEAR

Disassembly

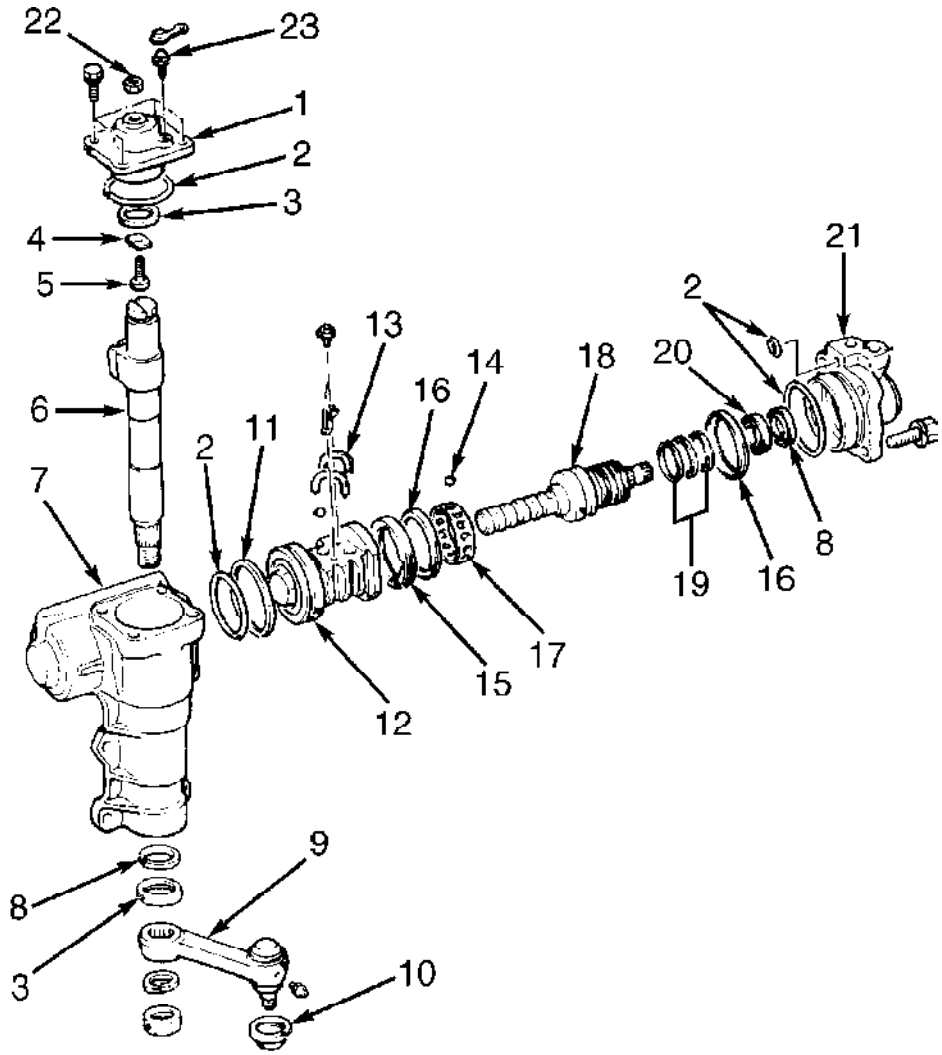
1) Scribe mating marks on pitman arm and cross shaft. Remove pitman arm nut. Using a puller, remove pitman arm. Drain power steering fluid. Remove side cover bolts. See Fig. 3. Loosen adjusting bolt lock nut, and screw in adjusting bolt so side cover raises slightly.

2) With mainshaft and cross shaft placed in straight-ahead position, tap bottom of cross shaft with plastic hammer. Remove cross shaft and side cover as an assembly. Remove side cover from cross shaft by turning adjusting bolt.

3) Remove valve housing and rack piston as an assembly by turning rack piston counterclockwise. See Fig. 3. Carefully remove rack piston from mainshaft without losing balls inside rack piston.

4) Remove cross shaft oil seal from gearbox housing. Put rack piston in soft jawed vise. Using Spanner Wrench (MB991367) and Pin Set (MB991394), remove lock nut. Remove mainshaft while applying pressure to bearing race to prevent balls from falling out. Drive out bearing and oil seal.

NOTE: DO NOT remove cross shaft "U" packing at rear of needle bearing unless fluid leakage is found coming from adjusting bolt threads. If leakage exists, replace "U" packing.



1. Side Cover
2. "O" Ring
3. "U" Packing
4. Adjusting Plate
5. Adjusting Bolt
6. Cross Shaft
7. Gear Box Housing
8. Oil Seal
9. Pitman Arm
10. Dust Cover
11. Seal Ring
12. Rack Piston
13. Circulator
14. Ball
15. Lock Nut
16. Bearing Race
17. Cage
18. Mainshaft
19. Seal Rings
20. Bearing
21. Valve Housing
22. Adjusting Bolt Lock Nut
23. Breather Screw

92I00776

Fig. 3: Exploded View Of Power Recirculating Ball Steering Gear
Courtesy of Mitsubishi Motor Sales of America.

Inspection
Check mainshaft for wear and damage. Check tooth surface of

cross shaft and rack piston for wear and damage. Check contact part of adjusting bolt for uneven wear. Check dust seal, oil seal and "O" rings for wear and damage.

Reassembly

1) Install NEW cross shaft lower "U" packing (if removed). Press lower cross shaft oil seal into gearbox housing. See Fig. 3. Press bearing and oil seal into top cover. Install bearing race and "O" ring.

2) Apply transmission fluid to seal ring contact areas on mainshaft, and install seal rings firmly into valve grooves. Wrap serrated part of mainshaft with vinyl tape. Mount valve body to valve housing. Install cage and align hole in cage with channel in mainshaft. Install bearing race and insert balls.

3) Install mainshaft into valve housing while pressing on bearing race to prevent balls from falling out. Using spanner wrench, install lock nut and tighten until it contacts bearing race.

4) Tighten lock nut while measuring mainshaft endplay using dial indicator. When mainshaft endplay is .001" (.003 mm), use a punch to crimp circumference of lock nut. Ensure mainshaft rotates freely.

5) Apply transmission fluid to "O" ring and piston seal ring, and install into gearbox housing. Install rack piston until it contacts edge of mainshaft. Rotate mainshaft to align ball raceway with insertion hole. Install 19 balls.

NOTE: Insert balls so no clearance exists between balls.

6) Place remaining 7 balls in circulator and install circulator to rack piston. Install circulator holder. Install NEW cross shaft upper "U" packing (if removed). Install upper cross shaft "O" ring. Apply transmission fluid to rack piston seal ring and insert valve housing. Rotate mainshaft until rack piston is centered (neutral position).

7) Install adjusting plate so beveled part is facing upward. Using a feeler gauge, measure clearance between adjusting bolt and cross shaft. If clearance is greater than .002" (.05 mm), replace with appropriate adjusting plate.

8) Apply multipurpose grease to seal surface of "U" packing. Apply transmission fluid to cross shaft teeth and side cover "O" ring. Install cross shaft to side cover, and temporarily tighten adjusting bolt lock nut.

CAUTION: DO NOT rotate side cover during installation, or damage to cross shaft oil seal may result.

9) Apply transmission fluid to rack piston teeth and shaft areas. Apply multipurpose grease to oil seal lip. Install side cover assembly (with cross shaft) to gearbox.

10) Position mainshaft in straight-ahead position. While turning adjusting bolt, measure mainshaft combined starting torque using Preload Socket (MB990228-01) and an INCH-lb. torque wrench. Combined starting torque should be 4-11 INCH lbs. (.5-1.3 N.m). Center reading should be 2 INCH lbs. (.2 N.m) higher than reading at either end.

11) Tighten adjusting bolt lock nut to specification. See TORQUE SPECIFICATIONS. Install pitman arm with mating marks aligned.

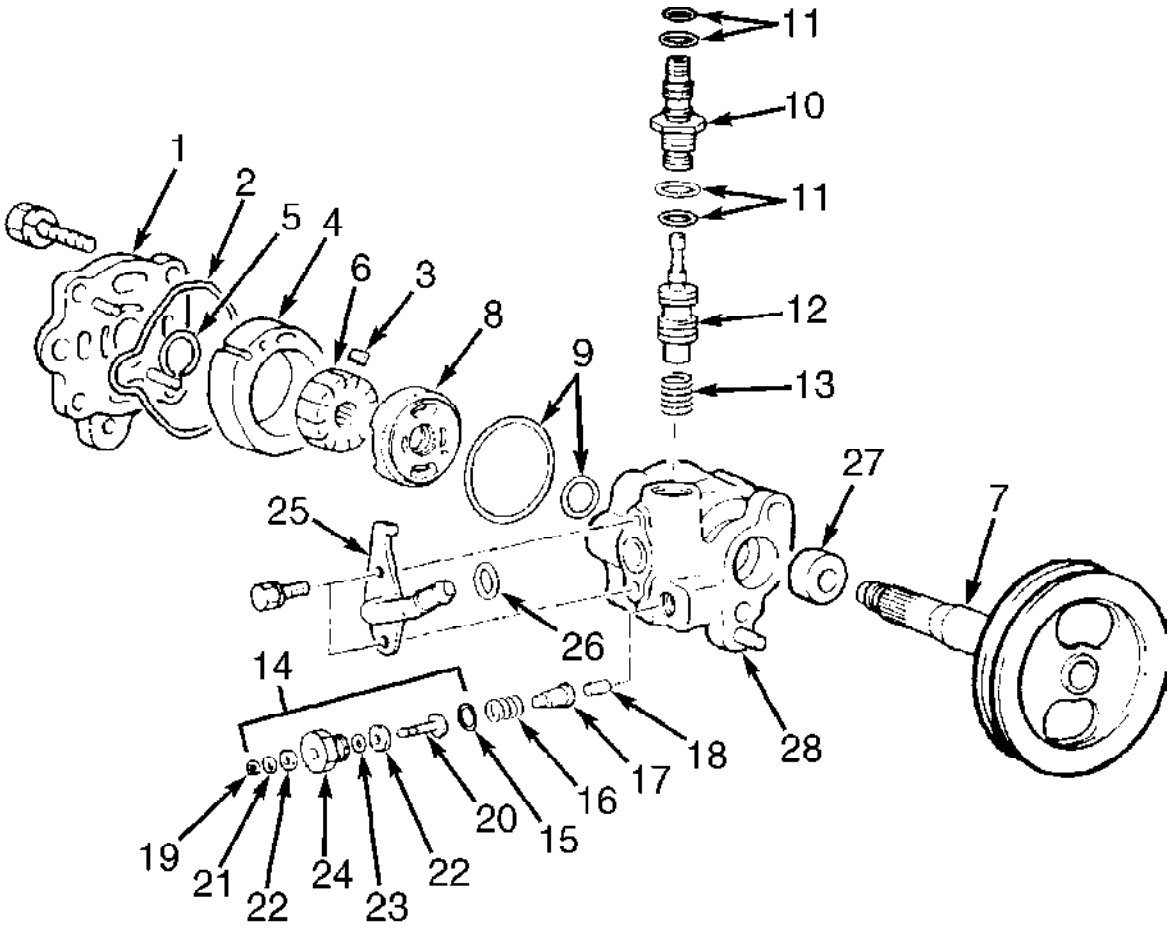
POWER STEERING PUMP

Disassembly

1) Remove suction connector bolts. Mount pump in a soft-jawed vise. Remove pump cover bolts and cover. Using a plastic mallet, tap pulley assembly shaft from pump housing. See Fig. 4.

2) Remove cam ring, vanes, shaft assembly and "O" rings. Remove snap ring from shaft assembly. Remove collar, rotor and side plate from shaft.

3) Pry oil seal out of housing. Remove pressure connector. Remove flow control valve assembly, flow control spring and 2 "O" rings. DO NOT disassemble flow control valve assembly.



1. Pump Cover	10. Connection	19. Snap Ring
2. "O" Ring	11. "O" Ring	20. Terminal
3. Vanes	12. Flow Control Valve	21. Washer
4. Cam Ring	13. Flow Control Spring	22. Insulator
5. Snap Ring	14. Terminal Assembly	23. "O" Ring
6. Rotor	15. "O" Ring	24. Plug
7. Pulley Assembly	16. Spring	25. Suction Connector
8. Side Plate	17. Plunger	26. "O" Ring
9. "O" Ring	18. Piston Rod	27. Oil Seal
		28. Oil Pump Body

96H18967

Fig. 4: Exploded View Of Power Steering Pump
Courtesy of Mitsubishi Motor Sales of America.

Inspection

1) Inspect pump shaft oil seal lip and bushing end for

damage. Inspect groove of rotor vane and cam surface for stepped wear. Check vane for damage. Install vane into rotor groove. Measure clearance between vane and rotor groove. If clearance exceeds .0024" (.061 mm), replace entire assembly.

2) Check ring and rotor sides for damage. Replace entire assembly if any damage is present. Check sliding surfaces of control valve for obstructions. Replace parts as required. If control valve is replaced, always use valve with same identification mark as one being replaced. Check power steering fluid pressure.

Reassembly

1) Lubricate "O" rings and internal pump components with ATF before reassembly. Install flow control valve spring and control valve in housing.

2) Install and tighten pressure connector. Depress control valve to check for smooth operation. Apply grease to lip of oil seal. Install oil seal into pump body. Install pulley assembly into pump body.

3) Install rotor to pulley assembly with punch mark at pump cover side. Install snap ring. Lift rotor to ensure that snap ring is in countersunk part of shaft. Align cam ring dowel holes and install cam ring with punch mark on pump body side.

4) Apply transmission fluid to vanes, and install vanes onto rotor with rounded edges outward. Install "O" ring, cam case and pump cover. Install and tighten suction connector.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Adjusting Bolt Lock Nut	27 (37)
Idler Arm Bracket-To-Frame Bolt & Nut	
Montero	40-47 (54-64)
Montero Sport	43 (59)
Idler Arm-To-Bracket Lock Nut	101 (44)
Oil Pump Cover Bolts	15 (20)
Pitman Arm-To-Cross Shaft Nut	
Montero	108-123 (146-176)
Montero Sport	108-123 (147-167)
Pressure Hose In-Line Fitting	
Montero	25 (34)
Montero Sport	16 (22)
Relay Rod-To-Idler Arm Nut	33 (44)
Relay Rod-To-Pitman Arm Nut	33 (44)
Side Cover Bolts	
Montero	36 (49)
Montero Sport	41-47 (50-64)
Steering Gear Hose Fittings	11 (15)
Steering Gear-To-Frame Bolts	40-47 (54-64)
Tie Rod Adjusting Sleeve Lock Nuts	69 (93)
Tie Rod End Castle Nuts	33 (44)
Valve Housing Bolts	
Montero	36 (49)
Montero Sport	41-47 (56-64)
Valve Housing Lock Nut	(1)

(1) - Tighten lock nut until it contacts bearing race.

* STEERING UNIFORM INSPECTION GUIDELINES *

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Steering, Suspension, Wheel Alignment, Wheels and Tires
Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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WHEEL BEARINGS, RACES AND SEALS

Wheel Alignment

WHEEL ALIGNMENT

Wheels and Tires

TIRES
VALVE STEMS
WHEEL ATTACHMENT HARDWARE
WHEELS (RIMS)

MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt 1) a Pledge of Assurance to their Customers and 2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-

profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A - Part no longer performs intended purpose
B - Part does not meet a design specification (regardless of performance)
C - Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present

the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

STEERING AND SUSPENSION

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

Steering and suspension are complex systems made up of a variety of interdependent components. For proper vehicle handling, ride, and tire wear, a thorough inspection is required whenever suspension work is being performed.

Conditions listed assume that the problem has been isolated to the specific component by proper testing procedures.

NOTE: When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

CAUTION: DO NOT use ride height altering or load compensating components, such as variable rate springs and coil over shocks, on vehicles with height or load sensing proportioning valve-equipped braking systems, unless these components are original equipment.

AIR RIDE SUSPENSION

NOTE: Depending on the air suspension design, there are some aftermarket products available to eliminate the air ride suspension on certain vehicles. If the system has been eliminated with one of these products, then no service is suggested or required.

AIR RIDE SUSPENSION - AIR SHOCKS AND AIR STRUTS

NOTE: This section covers the air spring portion of the air shock or strut. For damping portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

AIR RIDE SUSPENSION - AIR SHOCK AND AIR STRUT INSPECTION

Condition	Code	Procedure
Inner fabric of air bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.

AIR RIDE SUSPENSION - AIR SPRING VALVES

AIR RIDE SUSPENSION - AIR SPRING VALVE INSPECTION

Condition	Code	Procedure

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Blocked	A	Require repair or replacement.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Inoperative	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.

AIR RIDE SUSPENSION - AIR SPRINGS

AIR RIDE SUSPENSION - AIR SPRING INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Collar cracked	A	Require replacement.
End cap cracked	A	Require replacement.
Inner fabric of bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.
Piston cracked	A	Require replacement.

AIR RIDE SUSPENSION - COMPRESSORS

AIR RIDE SUSPENSION - COMPRESSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Does not build pressure	A	(1) Further inspection required.
Excessive run time	B	(2) Further inspection required.
Inoperative	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

(1) - If failure to build pressure is traced to the compressor, require replacement.
(2) - If excessive run time is traced to the compressor, require replacement.

AIR RIDE SUSPENSION - HEIGHT SENSORS

AIR RIDE SUSPENSION - HEIGHT SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware		

threads damaged	A	... Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
Dust boot missing	2	..... (1) Suggest replacement.
Dust boot split	2	..... (1) Suggest replacement.
Dust boot torn	2	..... (1) Suggest replacement.
Housing cracked	A	..... Require replacement.
Lead routing incorrect ..	B	.. Require rerouting according to vehicle manufacturer's specifications.
Loose	B	... Require adjustment to vehicle manufacturer's specifications.
Missing	C	..... Require replacement.
Output signal incorrect .	A	.. Require repair or replacement.
Wire lead damaged	A	.. Require repair or replacement.

(1) - This condition can lead to damage of the sliding magnet, which, in turn, causes premature sensor failure.

AIR RIDE SUSPENSION - MODULES

AIR RIDE SUSPENSION - MODULE INSPECTION

Condition	Code	Procedure
Attaching hardware loose	A	... Require repair or replacement of loose part.
Attaching hardware missing	C	.. Require replacement of missing part.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
Housing cracked	2	.. Suggest repair or replacement.
Inoperative	A	..... Require replacement.
Missing	C	..... Require replacement.

AIR RIDE SUSPENSION - RELAYS (COMPRESSOR)

AIR RIDE SUSPENSION - RELAY (COMPRESSOR) INSPECTION

Condition	Code	Procedure
Housing cracked	2	..... (1) Suggest replacement.
Intermittent	A	..... Require replacement.
Missing	C	..... Require replacement.
Output signal incorrect .	A	..... Require replacement.

(1) - If moisture enters the relay, it can reduce life expectancy or impair function.

AIR RIDE SUSPENSION - SWITCHES (ON/OFF)

AIR RIDE SUSPENSION - SWITCH (ON/OFF) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	A	Require replacement.

AIR RIDE SUSPENSION - TORSION SPRINGS (COUNTER BALANCING)

AIR RIDE SUSPENSION - TORSION SPRING (COUNTER BALANCING) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken	A	Require replacement.
Missing	C	Require replacement.

AIR RIDE SUSPENSION - TUBING

AIR RIDE SUSPENSION - TUBING INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Blocked	A	Require repair or replacement.
Fitting incorrect	B	Require replacement.
Leaking	A	Require repair or replacement.
Line type incorrect	B	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Routed incorrectly	B	Require routing correction.

AIR RIDE SUSPENSION - WARNING LAMPS

AIR RIDE SUSPENSION – WARNING LAMP INSPECTION

Condition	Code	Procedure
Bulb burned out	A	Require replacement.
Warning light does not come on during bulb check	B	Further inspection required to determine cause.
Warning light flashes	B	Further inspection required to determine cause.
Warning light is intermittent	B	Further inspection required to determine cause.
Warning light stays on after initial bulb check	B	Further inspection required to determine cause.

AIR RIDE SUSPENSION - WIRING HARNESSES

AIR RIDE SUSPENSION – WIRING HARNESS INSPECTION

Condition	Code	Procedure
Connector bent	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector loose	A	Require repair or replacement.
Damaged (cut, burned, or chafed)	A	Require repair or replacement.
Excessive resistance	B	Require repair or replacement.
Fuse blown	A	Require replacement.
Fusible link blown	A	Require replacement.
Open	A	Require repair or replacement.
Poor ground	A	Require repair or replacement.
Routed incorrectly	B	Require rerouting according to vehicle manufacturer’s specifications.
Shorted	A	Require repair or replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

BALL JOINTS

Before requiring or suggesting ball joint replacement, the approved OEM procedure must be used to measure ball joint wear. The measurement(s) obtained, along with the vehicle manufacturer’s specifications, must be noted on the inspection report. Some states require that these measurements also appear on the invoice.

NOTE: The term "perceptible movement," defined as any visible movement in any direction, has been the industry standard for determining the need for replacement of follower ball joints. Some vehicle manufacturers are now publishing specifications for follower ball joints that were

previously diagnosed by the "perceptible movement" standard. Before requiring or suggesting any parts be replaced based on "perceptible movement," consult your repair manual to determine if OEM specifications exist.

You are not required to replace ball joints in axle sets. However, when replacing a ball joint due to wear exceeding manufacturer's specification, you may suggest replacement of the other ball joint if its measurement shows it is close to the end of its useful life, for preventive maintenance.

BALL JOINT INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace ball joint.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace ball joint.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace ball joint.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace ball joint.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace ball joint.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace ball joint.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads if available; otherwise, replace ball joint.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace ball joint.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Greaseable ball joint will		

not take grease	2	(5) Suggest replacement of grease fitting.
Nut on ball joint loose	A	(6) Require repair or replacement.
Pre-load adjustment incorrect	B	Require repair or replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease ball joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(5) - If the greaseable ball joint still will not take grease after replacing the grease fitting, suggest replacement of ball joint.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

BUSHINGS

BUSHING INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace bushing.
Attaching hardware threads damaged	A	Require repair or replacement

			of part with damaged threads if available; otherwise, replace bushing.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads if available; otherwise, replace bushing.
Binding	A	..	Require repair or replacement.
Deteriorated, affecting performance	A	..	Require repair or replacement.
Distorted, affecting performance	A	..	Require repair or replacement.
Leaking (fluid-filled type)	A	.....	Require replacement.
Missing	C	.....	Require replacement.
Noisy	2	.....	(1) Further inspection required.
Rubber separating from internal metal sleeve on bonded bushing	A	.....	Require replacement.
Seized	A	.....	Require replacement.
Shifted (out of position)	B	..	Require repair or replacement.
Split	A	.....	Require replacement.
Surface cracking (weather-checked)	..	.....	No service suggested or required.

(1) - If noise isolated to bushing, suggest repair or replacement.
CAUTION: Use only approved lubricant on rubber bushings. Petroleum-based lubricants may damage rubber bushings.

CENTER LINKS

CENTER LINK INSPECTION

Condition	Code		Procedure
Attaching hardware incorrect	A	.....	Require replacement of incorrect part, if available; otherwise, replace center link.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace center link.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace center link.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace center link.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if

			available; otherwise, replace center link.
Bent	B	.....	Require replacement.
Binding	A	.....	(1) Further inspection required.
Grease boot cracked	2	.....	(2) Suggest replacement.
Grease boot missing	2	.....	(3) Suggest replacement.
Grease boot torn	2	.....	(4) Suggest replacement.
Grease fitting broken	A	...	Require replacement of grease fitting.
Grease fitting missing	C	...	Require replacement of grease fitting.
Grease fitting won't seal	A	...	Require replacement of grease fitting.
Grease seal missing	2	.....	(3) Suggest replacement.
Grease seal torn	2	.....	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	.....	(5) Suggest replacement.
Looseness that is excessive	B	.....	(5)(6) Require replacement.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(7) Require replacement.
Stud broken	A	.....	(7) Require replacement.
Stud loose in taper hole	A	.....	(7) Require repair or replacement.
Taper hole elongated	A	.....	(8) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

CONTROL ARM SHAFTS

CONTROL ARM SHAFT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require replacement of broken

			part, if available; otherwise, replace shaft.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace shaft.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace shaft.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace shaft.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace shaft.
Bent	B	.....	Require replacement.
Shaft bushing surface undersized (worn)	B	.....	Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

CONTROL ARMS

CONTROL ARM INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part, if available; otherwise, replace control arm.
Attaching hardware broken	A	...	Require replacement of broken part, if available; otherwise, replace control arm.
Attaching hardware corroded, affecting structural integrity	A	.	Require replacement of corroded part, if available; otherwise, replace control arm.
Attaching hardware incorrect	A	.....	Require replacement of incorrect part, if available; otherwise, replace control arm.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace control arm.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace control arm.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads,

		if available; otherwise, replace control arm.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace control arm.
Bent	B	..... Require replacement.
Bushing hole oversized ..	B	..... Require replacement.
Ball joint hole oversized (loose interference or press fit)	B	..... (1) Further inspection required.
Corroded, affecting structural integrity ...	A	..... Require replacement.
Holes distorted	A	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - If oversized ball joint is available, require replacement of ball joint. If oversized ball joint is not available, require replacement of control arm.

DRAG LINKS

DRAG LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace drag link.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace drag link.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace drag link.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace drag link.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace drag link.
Bent	B	..... Require replacement.
Binding	A	..... (1) Further inspection required.
Grease boot cracked	2	..... (2) Suggest replacement.
Grease boot missing	2	..... (3) Suggest replacement.
Grease boot torn	2	..... (4) Suggest replacement.
Grease fitting broken ...	A	... Require replacement of grease fitting.

Grease fitting missing	C	...	Require replacement of grease fitting.
Grease fitting won't seal	A	...	Require replacement of grease fitting.
Grease seal missing	2	.....	(5) Suggest replacement.
Grease seal torn	2	.....	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	.....	(6) Suggest replacement.
Looseness that is excessive	B	.....	(6)(7) Require replacement.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(8) Require replacement.
Stud broken	A	.....	(8) Require replacement.
Stud loose in taper hole	A	.....	(8) Require repair or replacement.
Taper hole elongated	A	.....	(9) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(8) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter the joint and will accelerate wear.
(6) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(7) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

ELECTRONIC RIDE CONTROL SHOCKS AND STRUTS

NOTE: This section covers the electronic damping control portion of the electronic shock or strut. For dampening portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

ELECTRONIC RIDE CONTROL SHOCK AND STRUT INSPECTION

Condition	Code		Procedure
Connector bent	A	..	Require repair or replacement.
Connector broken	A	..	Require repair or replacement.
Connector loose	A	..	Require repair or replacement.
Electronic valve control			

inoperative	2	..... (1) Suggest replacement.
Terminal bent	A	.. Require repair or replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal corroded	A	.. Require repair or replacement.
Terminal loose	A	.. Require repair or replacement.

(1) - It is acceptable to replace with a non-electronically controlled unit, where available.

IDLER ARMS

IDLER ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require replacement of broken part, if available; otherwise, replace idler arm.
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace idler arm.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace idler arm.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace idler arm.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace idler arm.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace idler arm.
Binding	A	..... (1) Further inspection required.
Grease boot cracked	2	..... (2) Suggest replacement.
Grease boot missing	2	..... (3) Suggest replacement.
Grease boot torn	2	..... (4) Suggest replacement.
Grease fitting broken ...	A	... Require replacement of grease fitting.
Grease fitting missing ..	C	... Require replacement of grease fitting.
Grease fitting won't seal	A	... Require replacement of grease fitting.
Grease seal missing	2	..... (5) Suggest replacement.
Grease seal torn	2	..... (4) Suggest replacement.
Greaseable joint will not take grease	2	..... (1) Suggest replacement of grease fitting.
Looseness at frame bracket end	B	..... (6)(7) Require repair or replacement.

Looseness at link end (perceptible horizontal movement)	1	(8)	Suggest replacement.
Looseness at link end that is excessive	B	(8)(9)	Require replacement.
Mounted out of position (center link not parallel)	B		Require repositioning.
Nut on stud loose	A	(10)	Require repair or replacement.
Seized	A		Require replacement.
Stud bent	B	(11)	Require replacement.
Stud broken	A	(11)	Require replacement.
Taper hole elongated	A	(12)	Require replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A	(11)	Require replacement.
Wear exceeds manufacturer's specifications	B		Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter joint and will accelerate wear.
(6) - If manufacturer's procedures and specifications exist, use those procedures and specifications; otherwise, use an approved inspection method such as the dry park check.
(7) - Looseness is defined as movement that creates excessive toe change.
(8) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(9) - Excessive looseness is defined as significant enough to affect vehicle handling or structural integrity.
(10) - Check for bent stud or damaged taper hole.
(11) - Check for damaged taper hole.
(12) - Check for damaged stud.

KING PINS

You are not required to replace king pins in axle sets. However, when replacing a king pin due to wear exceeding manufacturer's specifications, you may suggest replacement of the other king pin on the axle if its measurement shows it is close to the end of its useful life.

KING PIN INSPECTION

Condition	Code	Procedure
Bearing balls pitted	A	Require replacement.
Bearing balls worn	A	Require replacement.
Bearing races pitted	A	Require replacement.

Condition	Code	Procedure
Bearing races worn	A	Require replacement.
Bearing rollers pitted	A	Require replacement.
Bearing rollers worn	A	Require replacement.
Bearing seal bent	2	Suggest replacement of seal or bearing.
Bearing seal missing	2	Suggest replacement of seal or bearing.
Bearing seal torn	2	Suggest replacement of seal or bearing.
Binding	A	Require repair or replacement of affected parts.
End caps missing	C	Require replacement of missing part, if available; otherwise, replace king pin.
End play exceeds specifications	B	Require repair.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Locating pins missing	C	Require replacement of missing part, if available; otherwise, replace king pin.
Looseness exceeds manufacturer's specifications	B	Require replacement of worn parts.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Will not take grease	2	(1) Suggest replacement of grease fitting.

(1) - If king pin will not take grease after replacement of grease fitting, suggest replacement of king pin.

PITMAN ARMS

PITMAN ARM INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace pitman arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace pitman arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace pitman arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise,

			replace pitman arm.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace pitman arm.
Bent	B	.....	Require replacement.
Binding	A	.....	(1) Further inspection required.
Grease boot cracked	2	.....	(2) Suggest replacement.
Grease boot missing	2	.....	(3) Suggest replacement.
Grease boot torn	2	.....	(4) Suggest replacement.
Grease fitting broken	A	.....	Require replacement grease fitting.
Grease fitting missing	C	...	Require replacement of grease fitting.
Grease fitting won't seal	A	...	Require replacement of grease fitting.
Grease seal missing	2	.....	(3) Suggest replacement of seal.
Grease seal torn	2	.....	(4) Suggest replacement of seal.
Looseness (perceptible horizontal movement)	1	.....	(5) Suggest replacement.
Looseness that is excessive	B	.....	(5)(6) Require replacement.
Nut on stud loose	A	.....	(7) Require repair or replacement.
Seized	A	.....	Require replacement.
Splines damaged	A	..	Require repair or replacement.
Splines stripped (splines missing)	A	.....	Require replacement.
Stud bent	B	.....	(8) Require replacement.
Stud broken	A	.....	(8) Require replacement.
Stud loose in taper hole	A	.....	(8) Require repair or replacement.
Taper hole elongated	A	.....	(9) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(8) Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for bent stud of damaged taper hole.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

POWER STEERING HOSES

POWER STEERING HOSE INSPECTION

Condition	Code	Procedure
Blistered	B	Require replacement.
Blocked	A	Require repair or replacement.
Fitting threads damaged	A	Require repair or replacement.
Fitting threads stripped (threads missing)	A	Require replacement.
Inner fabric (webbing) cut	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Outer covering is cracked to the extent that the inner fabric of hose is visible	B	Require replacement.
Restricted	A	Require repair or replacement.

POWER STEERING (HYDRAULIC) PUMPS

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

POWER STEERING (HYDRAULIC) PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Belt alignment incorrect	B	(1) Further inspection required.
Belt cracked	1	Suggest replacement.
Belt frayed	1	Suggest replacement.
Belt missing	C	Require replacement.
Belt noisy	2	(2) Further inspection required.
Belt plies separated	A	Require replacement.

Belt tension out of specification	B	Require adjustment or replacement.
Belt worn beyond adjustment range	B	Require replacement.
Belt worn so it contacts bottom of pulley	A	Require replacement.
Binding	A	Require repair or replacement.
Fluid at or beyond service interval	3	Suggest fluid change.
Fluid contaminated	B	(3) Require flushing and refilling of the system.
Fluid level incorrect	B	Require adjustment of fluid level.
Inadequate assist	A	(4) Further inspection required.
Leaking	A	Require repair or replacement.
Noise	2	(5) Further inspection required.
Pulley bent	A	Require repair or replacement of pulley.
Pulley missing	C	Require replacement of pulley.
Remote reservoir leaking	A	Require replacement of reservoir,
Reservoir cap broken	A	Require replacement of cap.
Reservoir cap missing	C	Require replacement of cap.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.
(3) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(4) - If pump is source of inadequate assist, require repair or replacement.
(5) - If noise is isolated to pump, suggest repair or replacement.

RADIUS ARMS

RADIUS ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.

Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

RELAY RODS

RELAY ROD INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace relay rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace relay rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace relay rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace relay rod.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace relay rod.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.

Stud loose in taper hole	A		(7) Require repair or replacement.
Taper hole elongated	A		(8) Require replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A		(7) Require replacement.
Wear exceeds manufacturer's specifications	B		Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES

You are not required to replace shocks or struts in axle sets. However, when replacing a shock or strut due to the conditions that follow, you may suggest replacement of the other shock or strut on the same axle for improved performance and preventive maintenance.

* Part is close to the end of its useful life
* To extend tire life
* To balance ride and handling
* To improve stopping distance

When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

Under no circumstances should a technician bend struts or strut housings.

A vehicle's load-carrying and handling abilities are limited by its suspension, tires, brakes, and driveline. Installing coil over shocks or any other load assist device does not increase the vehicle's load capacity. See the vehicle owner's manual for more details.

NOTE: If vehicle is equipped with original equipment coil over shocks, apply the conditions for coil springs from the SPRINGS - COIL, LEAF AND TORSION BAR section of the STEERING AND SUSPENSION guidelines. If the vehicle is equipped with add-on coil over shocks, you may suggest replacing the shocks with standard shocks for any spring-related condition.

SHOCK ABSORBER, STRUT CARTRIDGE AND STRUT ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace shock or strut.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace shock or strut.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace shock or strut.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace shock or strut.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shock or strut.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shock or strut.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shock or strut.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shock or strut.
Binding	A	Require replacement.
Body dented	A	(1) Further inspection required.
Body punctured	A	Require replacement.
Brake hose bracket bent	B	Require repair or replacement.
Brake hose bracket missing	C	Require replacement.
Brake hose bracket threads damaged	A	Require repair or replacement.
Brake hose bracket threads stripped (threads missing)	C	Require replacement.
Compression bumper missing	C	Require replacement of compression bumper.
Compression bumper split	1	Suggest replacement of compression bumper.
Damping (none)	A	Require replacement.
Dust boot (bellows) split	2	(2) Suggest replacement of boot.

Dust boot (bellows) missing	2	.....	(2) Suggest replacement of boot.
Dust boot (bellows) torn	2	.....	(2) Suggest replacement of boot.
Dust shield broken	2	.....	(2) Suggest replacement.
Dust shield missing	2	.....	(2) Suggest replacement.
Gland nut (strut housing cap) is not removable using appropriate tool	A	..	(3) Require replacement of nut and/or housing.
Gland nut (strut housing cap) threads damaged	A	...	Require repair or replacement of nut.
Gland nut (strut housing cap) threads stripped (threads missing)	A	.....	Require replacement of nut.
Housing dented	A	.....	(1) Further inspection required.
Housing punctured	A	.....	Require replacement.
Jounce bumper missing	C	...	Require replacement of jounce bumper.
Jounce bumper split	1	...	Suggest replacement of jounce bumper.
Leaking oil, enough for fluid to be running down the body	A	.....	(4) Require replacement.
Noise	2	.....	(5) Further inspection required.
Piston rod bent	A	.....	Require replacement.
Piston rod broken	A	.....	Require replacement.
Piston rod has surface defect	2	.....	Suggest replacement.
Piston rod threads damaged	A	..	Require repair or replacement.
Piston rod threads stripped (threads missing)	A	.....	Require replacement.
Seized	A	.....	Require replacement.
Shock missing	C	.....	Require replacement.
Strut housing bent	A	.....	Require replacement.
Strut housing cap (gland nut) is not removable using appropriate tool	A	.....	(3) Require replacement of nut and/or housing.
Strut housing cap (gland nut) threads damaged	A	...	Require repair or replacement of nut.
Strut housing cap (gland nut) threads stripped (threads missing)	A	.....	Require replacement of nut.
Strut housing severely corroded, affecting structural integrity	A	.....	Require replacement.
Strut housing threads damaged	A	..	Require repair or replacement.
Strut housing threads stripped (threads missing)	A	.....	Require replacement.
Tire cupping	A	.....	(6) Further inspection required.

(1) - Require replacement of units where dents restrict shock or strut piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube shocks.
(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.
(3) - Only required if replacing cartridge.
(4) - CAUTION: If the strut cartridge has been replaced previously, the oil on the strut housing may be filler oil. The technician must identify the source of the oil.
(5) - If noise is isolated to shock or strut, suggest replacement.
(6) - Although shocks or struts may have contributed to tire cupping, an inspection is needed of the entire suspension system. If the shock or strut is found to be contributing to the tire cupping, require replacement.

SPINDLES

SPINDLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Race seat area undersized	B	Require replacement.
Scored	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

SPRINGS - COIL, LEAF AND TORSION BAR

When springs are replaced, it is suggested, but not required, that both springs on an axle be replaced to maintain equal height from side to side and to provide a balanced ride and proper handling.

When variable rate springs are installed in place of conventional coil springs, they must be installed in axle sets to ensure proper handling, uniform ride, and proper chassis height.

Erroneous height measurements may result from: improper tire inflation, non-standard tire or wheel size, and heavy load in vehicle or trunk.

SPRING (COIL, LEAF AND TORSION BAR) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken (all springs except secondary leave(s) on multi-leaf springs)	A	Require replacement.
Coil clash	..	(1) Require ride height check.
Coil spring insulator deteriorated	2	Suggest replacement of insulator.
Coil spring insulator missing	2	Suggest replacement of insulator.
Coil spring insulator split	2	Suggest replacement of insulator.
Coil spring plastic coating deteriorated - rust present	A	(2) Refer to manufacturer's service requirements.
Composite spring damaged	..	(3) Further inspection required.
Cracked (all springs except composite leaf and secondary leave(s) on multi-leaf springs)	A	Require replacement.
Installed incorrectly	B	Require repair.
Leaf spring insulators missing	2	Suggest replacement of insulators.
Secondary leaf on multi-leaf spring broken	1	Suggest repair or replacement
Secondary leaf on multi-leaf spring cracked	1	Suggest repair or replacement
Torsion bar		

adjuster bent	A	.....	(4) Require repair or replacement of adjuster.
Torsion bar adjuster seized	A	....	(4) Require repair or replacement of adjuster.
Torsion bar adjuster threads damaged	A	....	(4) Require repair or replacement of part with damaged threads.
Torsion bar adjuster threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Vehicle suspension height not within OEM specifications	B	.....	Require adjustment or replacement.

(1) - If vehicle is within manufacturer's height specifications, no service is suggested or required.
(2) - Some manufacturers require replacement under these conditions.
(3) - Check vehicle ride height. If ride height is OK, no service is suggested or required.
(4) - Only required if ride height needs to be adjusted.

STEEL POWER STEERING LINES

CAUTION: When replacing steel power steering lines, be sure to use a replacement product that meets or exceeds OEM design specifications.

STEEL POWER STEERING LINE INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part.
Attaching hardware broken	A	...	Require replacement of broken part.
Attaching hardware loose	A	...	Require repair or replacement of loose part.
Attaching hardware missing	C	..	Require replacement of missing part.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Blocked	A	..	Require repair or replacement.
Fitting incorrect (such as compression fitting)	B	.....	Require replacement.
Flare type incorrect	B	.....	Required replacement.
Leaking	A	.....	Require tightening or replacement.
Line type incorrect	B	.....	Require replacement.

Restricted	A	.....	Require replacement.
Routed incorrectly	B	.....	Require routing correction.
Rust-pitted	1	.....	Suggest replacement.
Rust pitted, affecting structural integrity	A	.....	Require replacement.

STEERING ARMS

STEERING ARM INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part.
Attaching hardware broken	A	...	Require replacement of broken part.
Attaching hardware incorrect	A	.....	Require replacement of incorrect part.
Attaching hardware loose	A	...	Require repair or replacement of loose part.
Attaching hardware missing	C	..	Require replacement of missing part.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Bent	B	.....	Require replacement.
Broken	A	.....	Require replacement.
Taper hole elongated	A	.....	(1) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

(1) - Check for damaged stud.

STEERING DAMPERS

The following procedures are only required if the vehicle was originally equipped from the factory with a steering damper. If the steering damper is an add-on unit, then the unit may be removed instead of repairing or replacing.

STEERING DAMPER INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part, if available; otherwise, replace steering damper.
Attaching hardware broken	A	...	Require replacement of broken part, if available; otherwise,

		replace steering damper.
Attaching hardware corroded, affecting structural integrity ...	A	. Require replacement of corroded part, if available; otherwise, replace steering damper.
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace steering damper.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace steering damper.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace steering damper.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace steering damper.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace steering damper.
Binding	A	..... Require replacement.
Damper body dented	A	..... (1) Further inspection required.
Damper body punctured ...	A	..... Require replacement.
Damping (none)	A	..... Require replacement.
Dust boot (bellows) missing	2	..... (2) Suggest replacement of boot.
Dust boot (bellows) split	2	..... (2) Suggest replacement of boot.
Dust shield broken	2	..... (2) Suggest replacement.
Dust shield missing	2	..... (2) Suggest replacement.
Leaking oil, enough for fluid to be running down the body	A	..... Require replacement.
Loose	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Noise	2	..... (3) Further inspection required.
Piston rod bent	A	..... Require replacement.
Piston rod broken	A	..... Require replacement.
Piston rod has surface defect	2	..... Suggest replacement.
Piston rod threads stripped (threads missing)	A	..... Require replacement.
Piston rod threads damaged	A	.. Require repair or replacement.
Seized	A	..... Require replacement.

(1) - Require replacement of units where dents restrict damper

piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube dampers.

(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.

(3) - If noise is isolated to damper, suggest replacement.

STEERING GEARS (EXCEPT RACK AND PINION)

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEAR (EXCEPT RACK AND PINION) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Binding	A	Require repair or replacement
Flex coupler binding	A	Require repair or replacement of coupler.
Flex coupler loose	A	Require repair or replacement of coupler.
Flex coupler missing parts	A	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	Require replacement of coupler.
Flex coupler torn	A	Require replacement of coupler.
Fluid contaminated	B	(1) Require flushing and refilling of the system.
Gasket leaking	A	Require repair or replacement of gasket.
Housing leaking	A	Require replacement.
Hydraulic fittings leaking	A	Require repair or replacement of fittings.
Inadequate power assist	A	(2) Further inspection required. See note below.
Lash exceeds manufacturer's specifications	B	Require repair or replacement.
Seal leaking	A	Require repair or replacement

			of seal and/or mating part.
Splines damaged	A	...	Require repair or replacement of splines.
Splines stripped	A	.	Require replacement of splines.
Steering coupler shield cracked	2	.....	Suggest replacement.
Steering coupler shield missing	C	.....	Require replacement.
Threads damaged	A	...	Require repair or replacement of part with damaged threads.
Threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
U-joint binding	A	...	Require repair or replacement of joint.
U-joint loose	A	...	Require repair or replacement of joint.
Unequal power assist	A	..	Require repair or replacement.

(1) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(2) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING GEARS - RACK AND PINION

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEARS - RACK AND PINION INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	.....	Require replacement of broken part.
Attaching hardware loose	A	..	Require repair or replacement of loose part.
Attaching hardware missing	C	.....	Require replacement of missing part.
Attaching hardware threads damaged	A	..	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	....	Require replacement of part with stripped threads.
Balance tube blocked	A	..	Require repair or replacement of balance tube.
Balance tube missing	C	..	Require replacement of balance tube.
Balance tube restricted	A	...	Require repair or replacement of balance tube.
Bellows boot clamp missing	C	...	Require replacement of clamp.
Bellows boot cracked			

(not through)	2	..	Suggest replacement of bellows boot.
Bellows boot missing	C	..	Require replacement of bellows boot.
Bellows boot not sealing	A	...	Require repair or replacement of bellows boot.
Bellows boot torn	A	..	Require replacement of bellows boot.
Bellows boot twisted (from toe adjustment) ..	B	.....	Require repair.
Fitting leaking	A	..	Require repair or replacement.
Fitting missing	A	.	Require replacement of fitting.
Fitting threads damaged	A	...	Require repair or replacement of part with damaged threads.
Fitting threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Flex coupler binding	A	...	Require repair or replacement of coupler.
Flex coupler loose	A	...	Require repair or replacement of coupler.
Flex coupler missing parts	A	...	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	.	Require replacement of coupler.
Flex coupler torn	A	.	Require replacement of coupler.
Fluid contaminated	B	.....	(1) Require flushing and refilling of the system.
Gasket leaking	A	..	Require repair or replacement.
Hard steering on cold start-up	1	.....	(2) Suggest repair or replacement.
Housing cracked, affecting structural integrity	B	.....	Require replacement.
Housing leaking	A	.....	Require replacement.
Inadequate power assist .	A	.....	(3) Further inspection required.
Lash exceeds manufacturer's specifications	B	..	Require repair or replacement.
Seal leaking	A	..	Require repair or replacement.
Splines damaged	A	..	Require repair or replacement.
Splines stripped (splines missing)	A	.....	Require replacement.
Steel line blocked	A	...	Require repair or replacement of line.
Steel line leaking	A	...	Require repair or replacement of line.
Steel line missing	C	....	Require replacement of line.
Steel line restricted ...	A	...	Require repair or replacement of line.
Steering coupler shield cracked	2	.....	Suggest replacement.
Steering coupler shield missing	C	.....	Require replacement.
Steering coupler shield torn	2	.....	Suggest replacement.
Threads damaged	A	...	Require repair or replacement of part with damaged threads.

Threads stripped (threads missing)	A	Require replacement of part with stripped threads.
U-joint binding	A	Require repair or replacement of joint.
U-joint loose	A	Require repair or replacement of joint.
Unequal power assist	A	Require repair or replacement.

(1) - Determine and correct source of contamination. Follow OE specifications for fluid type.
(2) - Indicates internal wear.
(3) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING KNUCKLES

STEERING KNUCKLE INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Pinch bolt incorrect	B	Require replacement with bolt that meets OE design.
Pinch bolt loose	B	Require repair.
Pinch bolt missing	B	Require replacement.
Pinch bolt tabs deformed (pinched together), .032" or more before clamping	B	(1) Require replacement.
Taper hole elongated	A	(2) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Steering knuckle deformation can cause pinch bolt breakage.
(2) - Check for damaged stud.

STRIKE OUT BUMPERS

STRIKE OUT BUMPER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Missing	C	Require replacement.
Split	1	Suggest replacement.

STRUT RODS

STRUT ROD INSPECTION

Condition	Code	Procedure
Adjusting nut seized	A	(1) Require repair or replacement.
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace strut rod.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace strut rod.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace strut rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace strut rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace strut rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads,

			if available; otherwise, replace strut rod.
Attaching hardware threads stripped (threads missing)	.....	A	..... Require replacement of part with stripped threads, if available; otherwise, replace strut rod.
Attaching (mating) hole oversized	.....	A	... Require repair or replacement of frame.
Attaching point on frame corroded, affecting structural integrity	...	A	..... Require repair of frame.
Bent	.....	A	..... Require replacement.
Mating (attaching) hole oversized	.....	A	... Require repair or replacement of frame.
Threads damaged	.....	A	.. Require repair or replacement.
Threads stripped (threads missing)	.....	A	..... Require replacement.

(1) - Only required if an alignment is being performed.

STRUT UPPER BEARING PLATE ASSEMBLIES

NOTE: When the following guidelines indicate replacement of bearing, only the bearing should be replaced if it is available separately; otherwise, replace the bearing plate assembly.

STRUT UPPER BEARING PLATE ASSEMBLY INSPECTION

Condition	Code		Procedure
Attaching hardware broken	.....	A	... Require replacement of broken part, if available; otherwise, replace bearing plate assembly.
Attaching hardware loose	.....	A	... Require repair or replacement of loose part, if available; otherwise, replace bearing plate assembly.
Attaching hardware missing	.....	C	.. Require replacement of missing part, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads damaged	.....	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads stripped (threads missing)	.....	A	..... Require replacement of part with stripped threads, if available; otherwise, replace bearing plate assembly.
Bearing axial or radial movement exceeds vehicle manufacturer's			

specifications	B	..... Require replacement of bearing.
Bearing binding	A	..... Require replacement of bearing.
Bearing missing	C	..... Require replacement of bearing.
Bearing seized	A	..... Require replacement of bearing.
Bent	B	..... Require replacement.
Holes distorted	A	..... Require replacement.
Missing	C	..... Require replacement.
Severely corroded, affecting structural integrity	A	..... Require replacement.

SWAY BAR LINKS

SWAY BAR LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace link.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace link.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace link.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace link.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace link.
Ball and socket has looseness (perceptible vertical movement)	1	..... (1) Suggest replacement.
Ball and socket has looseness that is excessive	B	..... (1)(2) Require replacement.
Bent	B	..... Require replacement.
Broken	A	..... Require replacement.
Corroded, affecting structural integrity ...	A	..... Require replacement.
Grease boot cracked	2	..... (3) Suggest replacement.
Grease boot missing	2	..... (4) Suggest replacement.
Grease boot torn	2	..... (5) Suggest replacement.
Missing	C	..... Require replacement.
Nut on stud loose	A	..... (6) Require repair.
Stud bent	B	..... (7) Require replacement.
Stud broken	A	..... (7) Require replacement.
Threads damaged	A	.. Require repair or replacement.

Threads stripped (threads missing)	A	.....	(7) Require replacement.

(1) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(2) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(3) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

SWAY BARS

SWAY BAR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace sway bar.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace sway bar.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace sway bar.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace sway bar.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace sway bar.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace sway bar.
Bent	B	Require replacement.
Broken	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

TIE ROD ENDS (INNER AND OUTER)

TIE ROD END (INNER AND OUTER) INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace tie rod end.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace tie rod end.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace tie rod end.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace tie rod end.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace tie rod end.
Adjusting sleeve bent	B	Require replacement of sleeve or tie rod end.
Adjusting sleeve clamps out of position	B	Require repair.
Adjusting sleeve corroded, affecting structural integrity	A	Require replacement of sleeve or tie rod end.
Adjusting sleeve missing	C	Require replacement of sleeve or tie rod end.
Adjusting sleeve seized	A	(1) Require repair or replacement.
Adjusting sleeve threads damaged	A	Require repair or replacement of sleeve or tie rod end.
Adjusting sleeve threads stripped (threads missing)	A	Require replacement of sleeve or tie rod end.
Binding	A	(2) Further inspection required.
Grease boot cracked	2	(3) Suggest replacement.
Grease boot missing	2	(4) Suggest replacement.
Grease boot torn	2	(5) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(4) Suggest replacement of seal.

Condition	Code	Procedure
Grease seal torn	2	(5) Suggest replacement of seal.
Greaseable tie rod end won't take grease	2	(6) Suggest replacement of grease fitting.
Looseness (perceptible horizontal movement)	1	(7) Suggest replacement.
Looseness exceeds manufacturer's specifications	B	Require replacement.
Looseness that is excessive	B	(7)(8) Require replacement.
Nut on stud loose	A	(9) Require repair or replacement of nut.
Seized	A	Require replacement
Stud bent	B	(10) Require replacement.
Stud broken	A	(10) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(10) Require replacement.

(1) - Only required if toe needs to be adjusted.
(2) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(3) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(6) - If greaseable tie rod end will not take grease after replacing the grease fitting, suggest replacement of tie rod end.
(7) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(8) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(9) - Check for bent stud or damaged taper hole.
(10) - Check for damaged taper hole.

TRACK BARS

TRACK BAR INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace track bar.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace track bar.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace track bar.
Attaching hardware		

threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace track bar.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace track bar.
Bent	B	.....	Require replacement.
Corroded, affecting structural integrity ...	A	.....	Require replacement.
Grease boot cracked	2	.....	(1) Suggest replacement.
Grease boot missing	2	.....	(2) Suggest replacement.
Grease boot torn	2	.....	(3) Suggest replacement.
Holes distorted	A	.....	Require replacement.
Looseness (perceptible horizontal movement) ...	1	.....	(4) Suggest replacement.
Looseness that is excessive	B	.....	(4)(5) Require replacement.
Nut on stud loose	A	.....	(6) Require repair or replacement of nut.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(7) Require replacement.
Stud broken	A	.....	(7) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(2) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(5) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

TRAILING ARMS

TRAILING ARM INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require replacement of broken part, if available; otherwise, replace trailing arm.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available;

			otherwise, replace trailing arm.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace trailing arm.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace trailing arm.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace trailing arm.
Bent	B	.....	Require replacement.
Bushing hole oversized	B	.....	Require replacement.
Corroded, affecting structural integrity	A	.....	Require replacement.
Holes distorted	A	.....	Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

WHEEL BEARINGS, RACES AND SEALS

NOTE: When replacing or repacking wheel bearings, grease seal replacement is required. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

WHEEL BEARING, RACE AND SEAL INSPECTION

Condition	Code		Procedure
Rear axle seal on rear-wheel drive leaking	A	.....	Require replacement of seal and inspection of axle, bearing, housing, and vent tube.
Seal bent	1	.....	Suggest replacement.
Seal leaking	A	.	Require replacement of seal and inspection of bearings.
Seal missing	C	.....	Require replacement.
Seal torn	A	.....	Require replacement.
Wheel bearing assembly feels rough when rotated	A	..	Require replacement of bearing assembly.
Wheel bearing balls are pitted	A	..	Require replacement of bearing assembly.
Wheel bearing balls are worn	A	..	Require replacement of bearing assembly.
Wheel bearing end-play exceeds vehicle manufacturer's specifications	B	..	Require adjustment of bearing,

			if possible. If proper adjustment cannot be obtained, require repair or replacement of worn component.
Wheel bearing race is loose in the hub bore	.....	A	..... Require replacement of hub assembly and wheel bearings.
Wheel bearing races are pitted	.....	A	.. Require replacement of bearing assembly.
Wheel bearing races are worn	.....	A	.. Require replacement of bearing assembly.
Wheel bearing rollers are pitted	.....	A	.. Require replacement of bearing assembly.
Wheel bearing rollers are worn	.....	A	.. Require replacement of bearing assembly.

WHEEL ALIGNMENT

WHEEL ALIGNMENT

Wheel alignment is defined as the measurement, analysis, and adjustment of steering and suspension angles to conform to OEM specifications. These angles usually include, but are not limited to: caster, camber, toe, and thrust angle. Where these angles are not adjustable and not in specification, component replacement or correction kits may be required. Errors in set-back and steering axis inclination (SAI) are often attributable to failed or damaged components and must be corrected prior to performing an alignment.

Failure to replace or correct suggested parts or service may prevent a proper alignment.

Before performing an alignment check, inspect and verify the following:

* Tire pressure and size
* Vehicle loading
* Ride height
* Steering and suspension parts

If the inspection reveals that all the above are within published specifications, a wheel alignment check and an alignment, if needed, may be performed.

CAUTION: Under no circumstances should a technician bend or heat any steering or suspension component, unless specified by the vehicle manufacturer, for example, Ford forged twin "I" beam axles. All measurements and specifications must be noted on the inspection report.

WHEEL ALIGNMENT INSPECTION

Condition	Code	Procedure
Dog tracking, shown to be caused by faulty alignment	 2	..... Suggest repair.
Lead, shown to		

be caused by faulty alignment	A	.....	Require alignment.
Part has been changed, affecting alignment	A	.....	Require alignment check.
Pull, shown to be caused by faulty alignment	A	.....	Require alignment.
Steering wheel off-center	2	.....	Suggest alignment.
Tire wear, shown to be caused by faulty alignment	A	.....	Require alignment.
Wander, shown to be caused by faulty alignment	A	.....	Require alignment.

WHEELS AND TIRES

TIRES

These guidelines do not apply to split rims. Some vehicle manufacturers restrict replacement of tires to specific brands, types, or sizes.

WARNING: High pressure temporary compact spare tires should not be used with any other rims or wheels, nor should standard tires, snow tires, wheel covers, or trim rings be used with high pressure compact spare rims or wheels. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death.

WARNING: Only specially trained persons should dismount or mount tires. Explosions of tire and wheel assembly can result from improper mounting, possibly causing serious injury or death.

WARNING: Consult the vehicle owner's manual or vehicle placard for correct size, speed rating, designation, and cold inflation pressure of the original tires. DO NOT exceed the maximum load or inflation capacity of the tire specified by the Tire and Rim Association

WARNING: When replacing tires, it is suggested that the replacement tires match or exceed the OEM speed rating designation. If tires of different speed rating designations are mixed on the same vehicle, the tires may vary in handling characteristics. DO NOT mix different speed rating designations on the same axle.

WARNING: DO NOT mix radials with non-radial tires on the same axle, as this may affect vehicle handling and stability. If radial tires and bias or bias-belted ply tires are mixed on the same vehicle, the radials must be on the rear. High-pressure temporary compact spare tires are exempt from this rule.

WARNING: DO NOT mix size or type (all season, performance, mud and snow) of tires on the same axle.

TIRE INSPECTION

Condition	Code	Procedure
Air pressure incorrect	B	Require repair
Bead broken	A	Require replacement.
Bead leaking, caused by tire	A	Require repair or replacement.
Bead wire/cord exposed	A	Require replacement.
Cord or belt material exposed	A	Require replacement.
Cord ply separations	A	Require replacement.
Directional/asymmetrical tires mounted incorrectly	B	Require remounting and/or repositioning.
Irregular tread wear, affecting performance	2	(1) Suggest replacement.
Load ratings less than OEM specifications	B	Require replacement.
Mixed tread types (all season, performance, mud and snow) on same axle	A	Require replacement.
Number of punctures exceeds manufacturer's limit	B	Require replacement.
Out of balance	B	Require rebalance of tire/wheel assembly.
Ply separation	A	Require replacement.
Pull or lead, caused by tire	A	Require repair or replacement.
Radial and bias or bias-belted ply tires on same axle	B	Require repair or replacement.
Radials are on the front and not on the rear	B	(2) Require repair or replacement.
Run flat damage	A	Require replacement.
Shoulder cut	A	Require replacement.
Shoulder puncture	A	Require replacement.
Shoulder with plug	A	Require replacement.
Sidewall bulge	A	Require replacement.
Sidewall cut	A	Require replacement.
Sidewall indentation	..	No service required or suggested.
Sidewall puncture	A	Require replacement.
Sidewall with plug	A	Require replacement.
Speed rating designations different on same axle	2	Suggest repair or replacement.
Tire and wheel assembly has excessive run-out	B	(3) Require repair or replacement of appropriate part.
Tires with more than 1/4" diameter difference on a four-wheel drive vehicle	B	Require replacement.
Tread area puncture larger in diameter than manufacturer's specifications	B	Require replacement.
Tread missing pieces		

(chunking), exposing cord	A		Require replacement.
Tread missing pieces (chunking), not exposing cord	1		Suggest replacement.
Tread separations	A		Require replacement.
Tube in tubeless tire	3	(4)	Suggest removal of tube.
Weather-checking	..		No service required or suggested.
Worn to tread wear indicators	B		Require replacement.

(1) - Determine and correct cause of irregular tire wear.
(2) - If radials and bias or bias-belted ply tires are on the same vehicle, the radials must be on the rear axle, except for high-pressure temporary spares.
(3) - Excessive is defined as enough to contribute to performance problems. Match mounting may correct run-out. If not, require replacement of appropriate part. Refer to manufacturer's specifications.
(4) - Most manufacturers do not recommend tubes in tubeless tires. Inspect tire and wheel assembly to determine the reason for a tube in tubeless tire. Recommendation for repair or replacement should be based upon condition of tires and/or wheel listed in these guidelines.

VALVE STEMS

VALVE STEM INSPECTION

Condition	Code	Procedure
Bent	1	Suggest replacement.
Broken	A	Require replacement.
Cut, but not leaking	1	Suggest replacement.
Deteriorated (cracking, dry rot)	1	Suggest replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped	A	Require replacement.
Valve cap missing	C	Require replacement of cap.
Weather-checking	1	Suggest replacement.
Won't take air	A	Require repair or replacement.

WHEEL ATTACHMENT HARDWARE

For conditions noted below, also check conditions of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHMENT HARDWARE INSPECTION

Condition	Code		Procedure
Bent	A		Require replacement.
Broken	A	(1)	Require replacement.

Condition	Code	Procedure
Loose	B	Require repair or replacement of affected component.
Lug nut installed backward	B	Require repair or replacement.
Lug nut mating type incorrect	B	Require replacement of nut.
Lug nut mating surface dished	A	Require replacement of nut.
Lug nut rounded	A	(2) Require replacement of nut.
Lug nut seized	A	(2) Require replacement of nut.
Stud incorrect	B	Require replacement of stud.
Threads damaged	A	Require repair or replacement of component with damaged threads.
Threads stripped	A	Require replacement of component with stripped threads.

(1) - Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.
(2) - Only required if removing wheel.

WHEELS (RIMS)

WARNING: Mounting a regular tire on a high-pressure compact spare wheel is not permitted. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death. If the wheel identification stamp is not legible, or cannot be found, do not use the wheel until the size and type have been properly identified. Wheels of different diameter, offset, or width cannot be mixed on the same axle. Bead seat tapers cannot be interchanged.

WHEEL (RIM) INSPECTION

Condition	Code	Procedure
Bead leaking, caused by wheel	A	(1) Require repair or replacement.
Bent hub mounting surface	A	Require replacement.
Bent rim, causing vibration	2	(1) Suggest replacement.
Broken	A	Require replacement.
Cast wheel porous, causing a leak	A	Require repair or replacement.
Clip-on balance weight is incorrect type for rim flange	2	Suggest replacement.
Corrosion, affecting structural integrity	A	Require replacement.
Corrosion build-up on wheel mounting surface	A	Require repair.
Cracked	A	Require replacement.
Directional/asymmetrical wheels mounted incorrectly	B	Require remounting and/or repositioning.

Load capacity less than OEM specifications	B	.....	Require replacement.
Offset mismatched on same axle	B	.....	Require replacement.
Rivets leaking	A	.....	Require replacement.
Run-out beyond OEM specs	B	.....	Require replacement.
Stud holes elongated	A	..... (2)	Require replacement.
Welded or brazed repair	2	.....	Suggest replacement.
Welds leaking	A	.....	Require replacement.
Wheel centering (pilot) hole incorrect	B	.....	Require replacement.

(1) - CAUTION: DO NOT attempt to correct a bent rim.
(2) - Inspect wheel attaching hardware for damage.

SUN ROOF - POWER

1997-99 Mitsubishi Montero Sport

1997-99 ACCESSORIES & EQUIPMENT
Mitsubishi - Sun Roof - Power

Montero Sport

DESCRIPTION & OPERATION

The sun roof is actuated by an overhead console-mounted switch. The motor, located near switch, moves sun roof panel by means of drive cables. If necessary, sun roof can be closed manually using manual closure wrench stored in vehicle's tool pouch.

On vehicles equipped with Electronic Timer Alarm Control System (ETACS) ECU, sun roof can be operated up to 30 seconds after ignition switch is turned to OFF position.

Sun roof motor incorporates a safety feature that initially limits opening or closing of roof glass panel. The sun roof will not fully close from fully open position without first releasing and then depressing slide switch during operation. Sun roof initially stops about 8" short of fully closed position.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Data Link Connector (DLC)	Under Left Side Of Dash, Below Steering Column
Sun Roof ECU	Inside Headliner, On Right Front Of Sun Roof
Sun Roof Motor	Inside Headliner, Near ECU

SERVICING

LUBRICATION

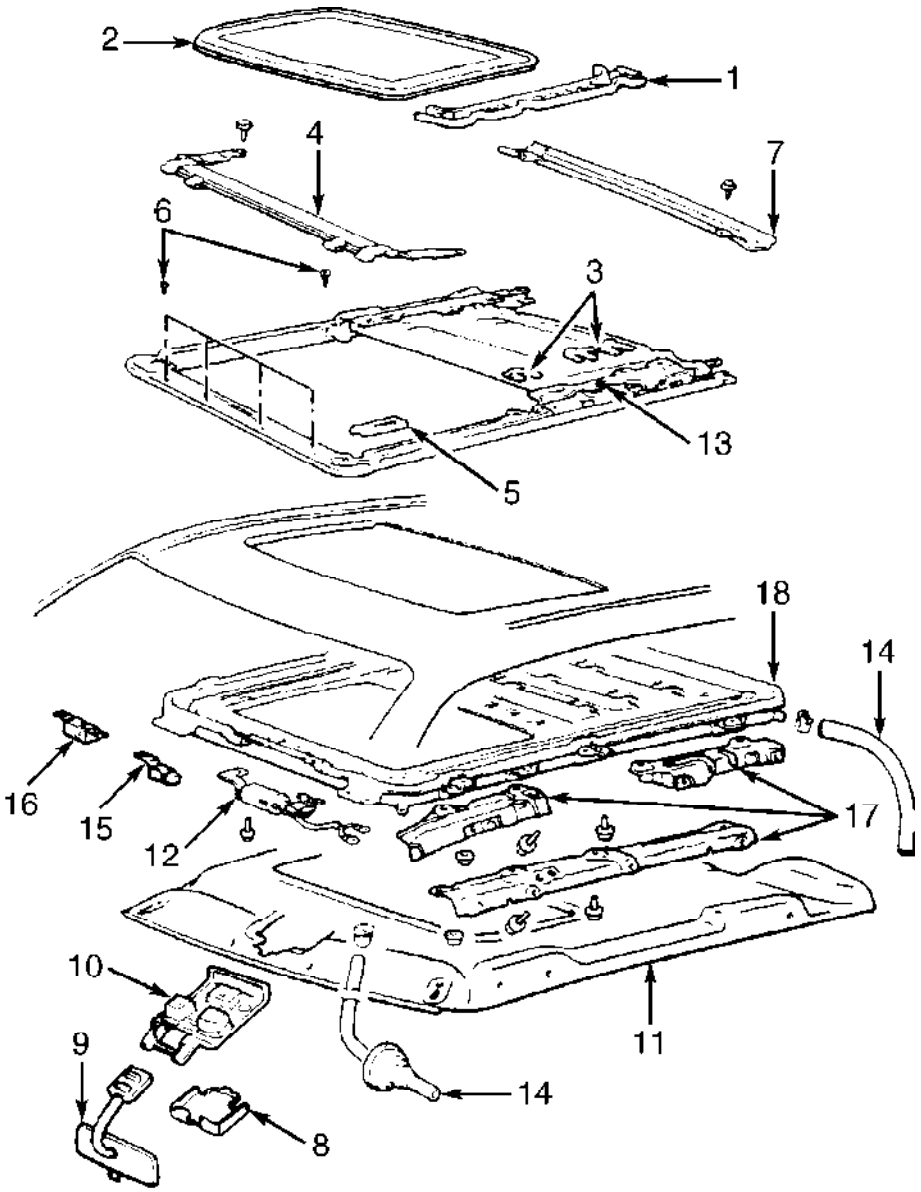
NOTE: Manufacturer only provides lubrication procedures during reassembly of sliding roof assembly components.

ADJUSTMENTS

ROOF GLASS PANEL ADJUSTMENT

1) Fully close sun roof. Ensure roof glass panel is parallel with roof opening. If roof glass panel parallelism is within .04" (1 mm), go to next step. If parallelism is greater than specified, go to step 5).

2) Open sun shade and remove side trim strips. See Fig. 1. Lightly pull down on strip to remove. Loosen mounting nuts on each side. Move glass panel as needed. Once panel is correctly adjusted, tighten nuts and install trim strip.



1. Side Trim Strip
2. Roof Glass Panel
3. Adjust Plate
4. Deflector
5. Guide Rail Cover
6. Screw
7. Rear Drip Channel
8. Cover
9. Rear View Mirror
10. Switch Assembly
11. Headliner
12. Motor
13. Sliding Roof Assembly
14. Drain Hose
15. Power Relay
16. Control Relay
17. Set Plate
18. Housing Assembly

93B83445

Fig. 1: Exploded View Of Sun Roof Assembly (Typical)
Courtesy of Mitsubishi Motor Sales of America.

TROUBLE SHOOTING

Check following items listed below symptom to aid in diagnosis and repair of sun roof assembly.

SUN ROOF INOPERATIVE

* Fusible link or multipurpose fuse.
* Sun roof switch.
* Drive motor.

ROOF GLASS PANEL DOES NOT OPERATE CORRECTLY

* Foreign matter lodged in guide rail.
* Drive motor drive gear not correctly indexed with drive cables.
* Decrease in clutch slipping force of drive motor.
* Misaligned roof glass panel causing binding.

NOISY MOTOR OPERATION

* Drive motor drive gear not correctly indexed with drive cables.
* Worn or damaged drive motor pinion bearing.
* Worn or deformed drive cable.

NOISY ROOF PANEL OPERATION

* Foreign matter lodged in guide rail.
* Loose guide rail and lid.

WATER LEAKS

* Dust accumulation in housing assembly.
* Clogged drain hose.
* Broken or disconnected drain hose.
* Worn roof lid weatherstrip.
* Excessive roof panel-to-roof opening clearance and/or incorrectly fitted weatherstrip.

WIND NOISE

* Loose or deformed deflector.

COMPONENT TESTS

DRIVE MOTOR

Remove drive motor. See MOTOR under REMOVAL & INSTALLATION. Using 12-volt power supply, apply voltage to 2-terminal connector. Reverse power supply leads to reverse motor direction. Replace motor as needed.

DRIVE MOTOR LIMIT SWITCH

1) Remove sun roof ECU (located in roof at front of sun roof). Look into viewing windows while turning rotating wheel. See Fig. 2. Turn rotating wheel until White marks appear. When White marks appear in viewing windows at same time, stop turning rotating wheel.

2) Close sun roof fully. Install timed sun roof control unit. Ensure wiring connector is properly inserted into control unit. Insert a flat-tipped screwdriver, place on tab and press to right, being

careful not to pinch wiring. See Fig. 3.

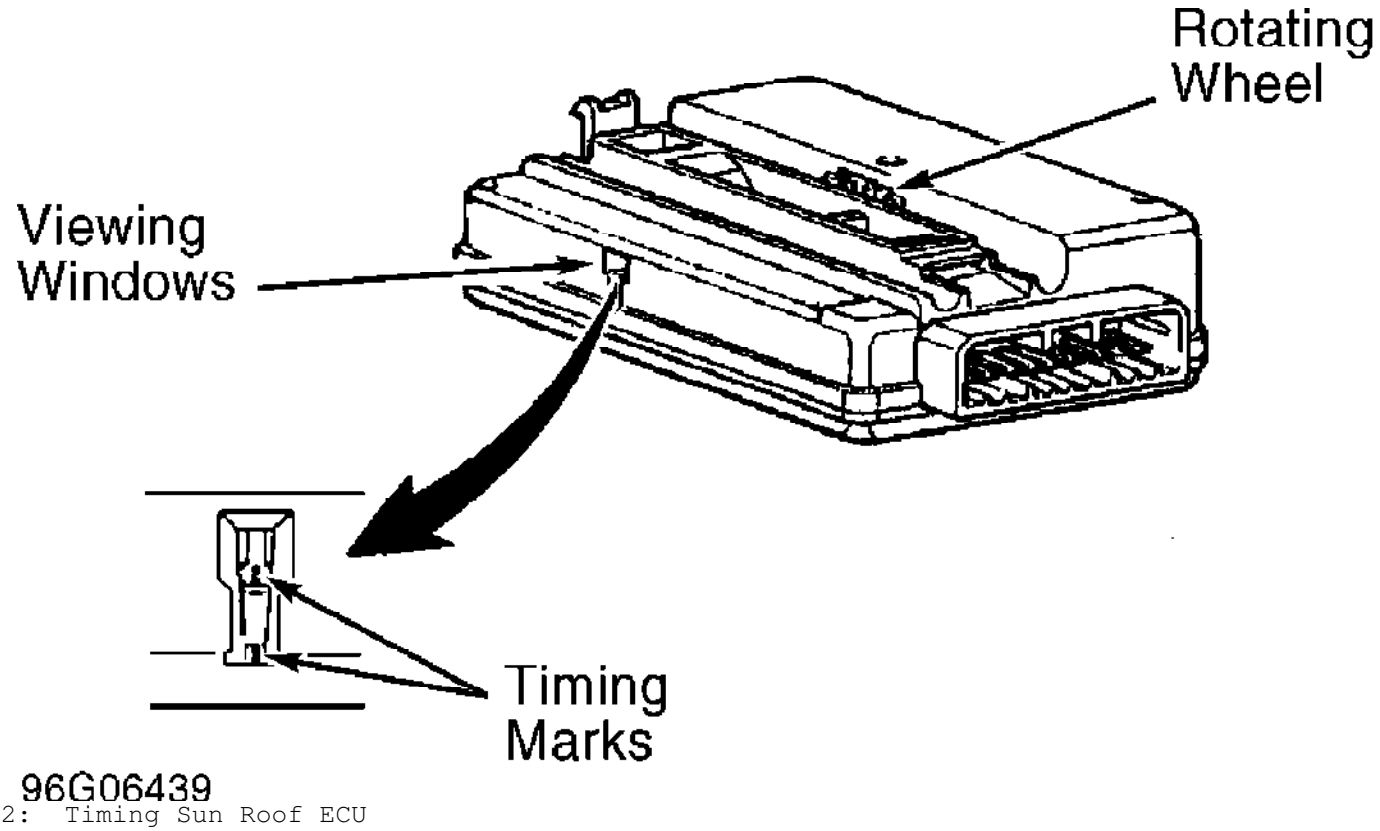


Fig. 2: Timing Sun Roof ECU
Courtesy of Mitsubishi Motor Sales of America.

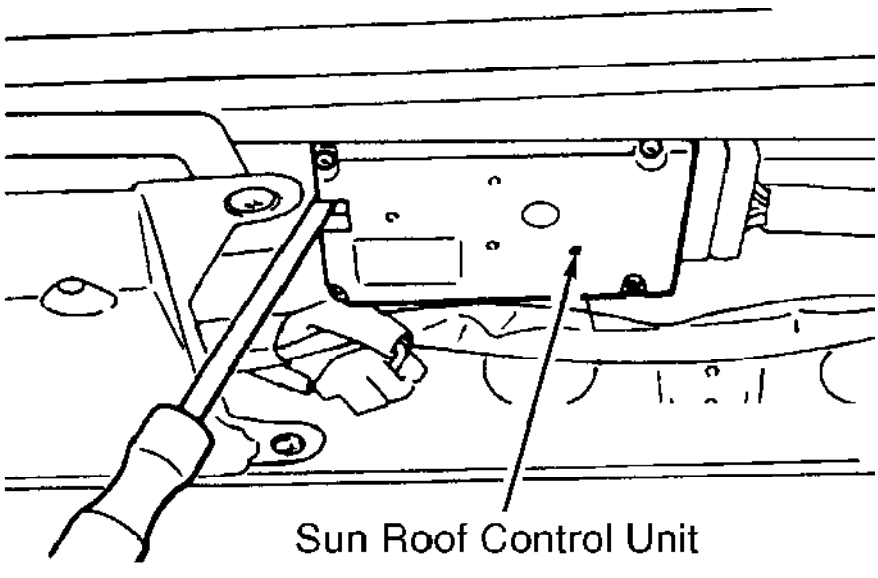
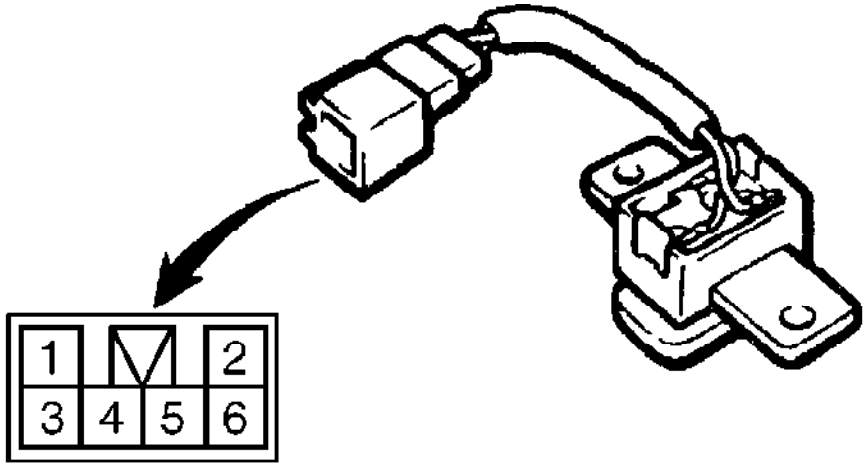


Fig. 3: Installing Sun Roof ECU
Courtesy of Mitsubishi Motor Sales of America.

SUN ROOF SWITCH

Using ohmmeter, check continuity between selected switch terminals. See Fig. 4. Replace switch as needed.



SWITCH POSITION	TERMINAL NO.		
	1	3	4
OPEN		○	○
OFF			
CLOSE	○		○

97B04292

Fig. 4: Inspecting Sun Roof Switch Continuity
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

DRIVE CABLES

Removal & Installation

Tilt sun roof guide assembly. Remove sun roof guide rail rod holder. Close sun roof guide assembly and disconnect drive cable end from sun roof guide assembly. To reassemble, reverse remove procedure. Always replace cables in pair. Apply multipurpose grease to all moving components.

MOTOR

Removal & Installation

Remove sun roof switch and dome light assembly. Remove bracket. Remove headliner. Remove drive motor. To install, reverse removal procedure.

SUN ROOF ASSEMBLY

Removal & Installation

Remove sun roof switch and dome light assembly. Remove bracket behind dome light. Remove head liner. Remove drain hose retaining clips and remove drain hose. Remove sun roof assembly. To install, reverse removal procedure.

WIRING DIAGRAMS

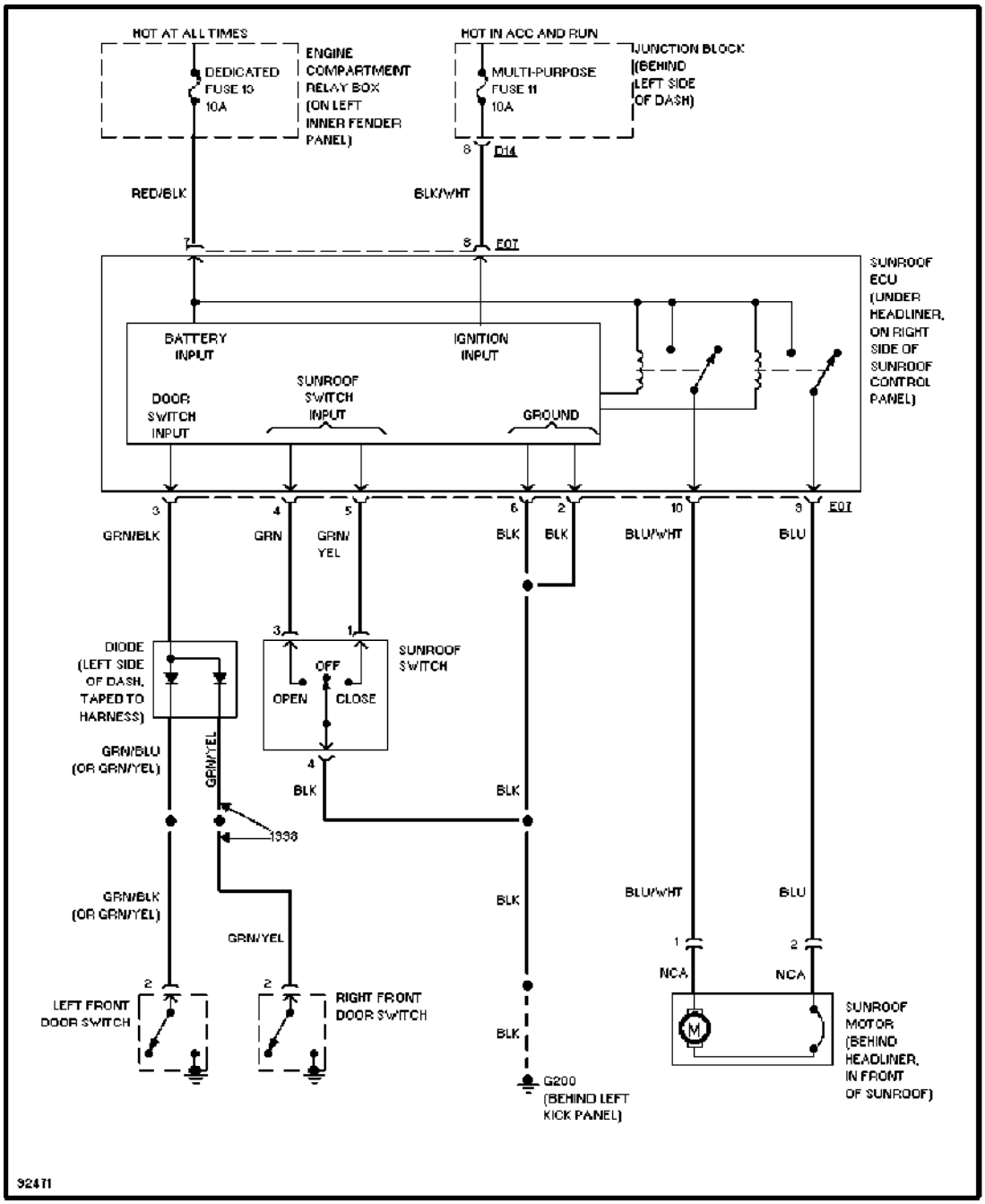


Fig. 5: Power Sun Roof System Wiring Diagram

SUSPENSION - FRONT

1997-99 Mitsubishi Montero Sport

1997-99 SUSPENSION
Mitsubishi - Front - 4WD & RWD

Montero, Montero Sport

DESCRIPTION

Independent front suspension uses double wishbone construction with torsion bar. Components used with this system include upper control arm, lower control arm, shock absorber, stabilizer bar and steering knuckle. See Fig. 1.

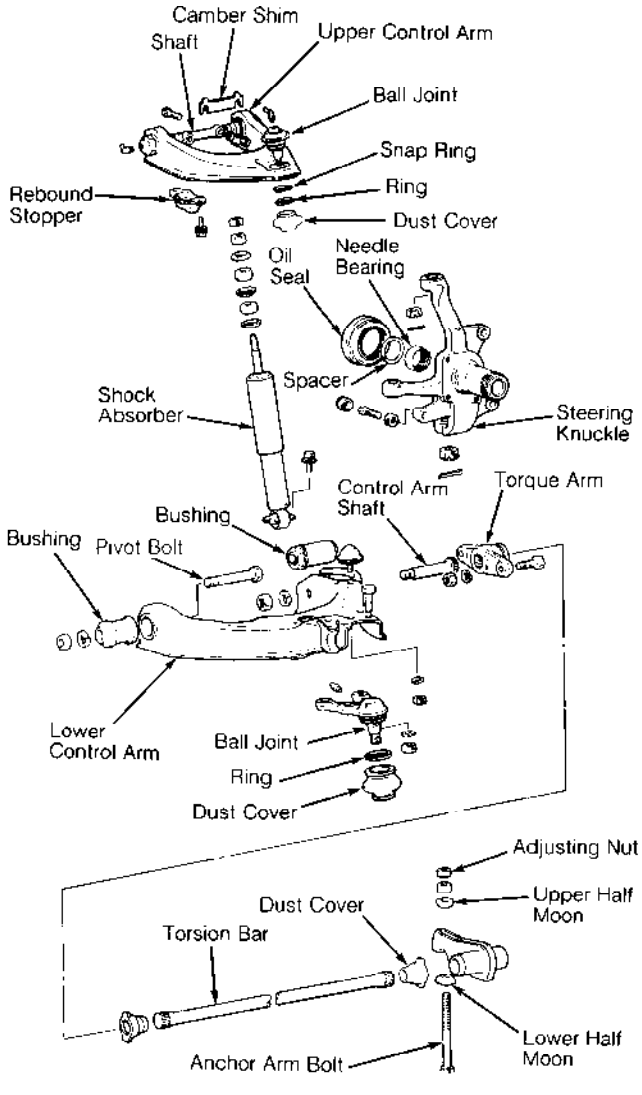


Fig. 1: Exploded View Of 4WD Front Suspension (Montero Shown, Montero Sport Similar)
Courtesy of Mitsubishi Motor Sales of America.

ADJUSTMENTS & INSPECTION

WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES

NOTE: See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

WHEEL BEARING

Preload

1) Using Socket (MB990954) and torque wrench, tighten axle lock nut to 119 ft. lbs. (162 N.m) on Montero, 94-145 ft. lbs. (127-196 N.m) on Montero Sport. Loosen nut to 0 ft. lbs. (0 N.m). Retighten nut to 18 ft. lbs. (25 N.m).

2) Loosen nut 30-40 degrees on Montero, 30 degrees on Montero Sport. Install lock washer. If lock washer hole is not aligned with lock nut hole, lock nut may be rotated up to 20 degrees to obtain alignment. After setting preload, check hub turning resistance and axial play (4WD only).

Hub Turning Resistance & Axial Play (4WD Only)

1) Using dial indicator, check front hub axial play. Axial play should be 0.002" (0.05 mm) or less. Using INCH-lb. torque wrench or spring scale attached to wheel stud, measure hub turning resistance. Turning resistance should be 1.1-4.0 lbs. (5-18 N) on Montero or 0.9-4.3 lbs. (4-19 N) on Montero Sport if measured using spring scale, or 2.6-11.3 INCH lbs. (0.3-1.3 N.m) on both models if measured using torque wrench.

2) Adjust wheel bearing so turning resistance and axial play are within specification. If turning resistance and axial play cannot be adjusted to specification, check wheel bearing condition and installation.

Drive Axle End Play (4WD Only)

Install drive axle shim and snap ring. Push drive shaft in toward knuckle. Measure clearance between drive flange and shim with a feeler gauge. If clearance is not 0.016-0.028" (0.4-0.7 mm) replace shim to bring clearance into specification.

BALL JOINT CHECKING

Lower Ball Joint

Place ball joint in soft-jawed vise. Install dial indicator with stem resting on end of ball joint stud. Measure ball joint stud end play. Replace ball joint if end play exceeds 0.012" (0.3 mm). For ball joint replacement, see LOWER BALL JOINT under REMOVAL & INSTALLATION.

Upper Ball Joint

1) Disconnect ball joint from steering knuckle. Place nut on ball joint stud. Using INCH-lb. torque wrench, measure starting torque required to rotate ball joint stud.

2) Starting torque should be 7-30 INCH lbs. (0.8-3.5 N.m). Replace ball joint if starting torque is not within specification. For ball joint replacement, see UPPER BALL JOINT under REMOVAL & INSTALLATION.

REMOVAL & INSTALLATION

AXLE HUB ASSEMBLY

Removal

Raise and support vehicle. Remove wheel assembly. Remove hub cap. Remove snap ring and shim. Remove drive flange. Remove brake caliper and suspend with wire. On vehicles with ABS, remove ABS speed sensor. On all models, remove lock washer. Remove lock nut using Socket (MB990954). See Fig. 2. Remove front rotor and hub assembly.

Installation

To install, reverse removal procedure. Adjust wheel bearing preload and check drive shaft endplay. See ADJUSTMENTS.

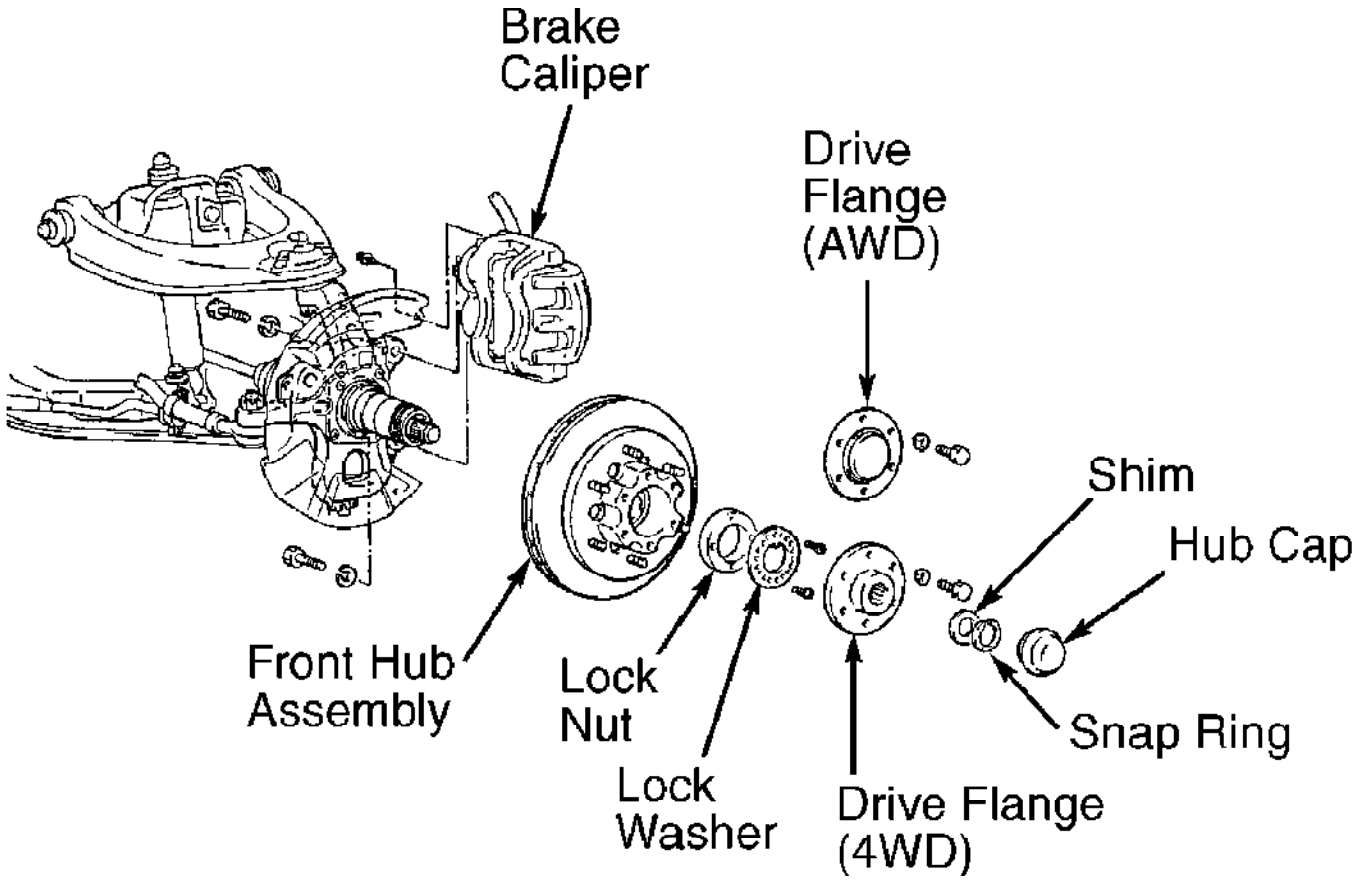


Fig. 2: Exploded View Of Hub Assembly (Montero Sport Shown, Montero Similar)
Courtesy of Mitsubishi Motor Sales of America.

STEERING KNUCKLE

Removal

1) Raise and support vehicle. Remove wheel assembly. Remove brake caliper. Remove axle hub assembly. See AXLE HUB ASSEMBLY under REMOVAL & INSTALLATION. Remove brake dust cover from steering knuckle. If equipped with ABS, remove ABS speed sensor.

2) On all models, disconnect tie rod end from steering knuckle. Mark torsion bar adjusting nut for installation reference. Loosen torsion bar anchor arm assembly adjusting nut. Loosen, but DO NOT remove, ball joint-to-steering knuckle nuts.

3) Using Steering Linkage Puller (MB991406), separate ball joints from steering knuckle. Detach upper and lower ball joints from steering knuckle. Remove steering knuckle from axle shaft. Remove oil

seal and spacer from steering knuckle.

Inspection
Inspect steering knuckle for cracks. Inspect spindle for wear and heat damage.

Installation
1) If needle bearing needs replacement, drive bearing from steering knuckle. Use Bearing Driver (MB990956-01) and Handle (MB9909938-01) to install NEW needle bearing until it is even with steering knuckle end face.

NOTE: DO NOT reuse steering knuckle needle bearing if it is removed.

2) Lubricate bearing roller surface and spacer-to-steering knuckle contact areas. Install spacer with chamfered side toward inside of vehicle. Using Seal Installer (MB990985-01) and handle, install seal in steering knuckle until seal is even with steering knuckle end face. Apply grease to seal lip area and inside of seal. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

LOWER BALL JOINT

Removal
1) Raise and support vehicle. Remove skid plate (if equipped). Remove wheel assembly. Mark torsion bar adjusting nut for reassembly reference. Release torsion bar tension.
2) Loosen, but DO NOT remove, lower ball joint stud nut. Using Steering Linkage Puller (MB991406), separate ball joint from steering knuckle. Remove ball joint stud nut. Remove ball joint-to-lower control arm bolts. Remove ball joint.

Installation
Lubricate ball joint. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

LOWER CONTROL ARM

Removal
1) Raise and support vehicle. Remove wheel assembly. Remove front skid plate and undercover (if equipped). Remove bump stop and bump stop bracket. Remove heat shield (if equipped). Remove torsion bar. See TORSION BAR. Loosen, but DO NOT remove, lower ball joint-to-steering knuckle nut. Using Steering Linkage Puller (MB991406), separate lower ball joint from steering knuckle. Support with cord tied to nearby part.
2) Remove stabilizer bar bolt from control arm. Remove shock absorber mounting bolts. Remove ball joint stud nut from steering knuckle. Remove control arm shaft. See Fig. 1. Remove torque arm. Remove bump stopper and lower control arm. Remove lower ball joint from lower control arm.

Inspection
1) Inspect control arm for cracks and deformation. Check ball joints. See BALL JOINT CHECKING under ADJUSTMENTS & INSPECTION.
2) Inspect ball joint dust covers for damage. Replace damaged dust covers. Inspect control arm bushing and frame bracket bushing for damage. Replace bushings if necessary.

NOTE: Differential carrier may require detachment in order to

replace left bracket bushing.

NOTE: Tighten lower control arm shaft and pivot bolt to specification with vehicle at normal operating height.

Installation

To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Tighten lower control arm shaft and pivot bolt to specification with vehicle at normal operating height.

STABILIZER BAR

Removal

Remove skid plate (if equipped). Disconnect stabilizer bar link bolt. Remove stabilizer bar clamp bolts. Remove stabilizer bar and bushings. On Montero Sport remove the stabilizer link brackets and bushings.

Installation

1) To install, reverse removal procedure. Note that slit in stabilizer bushing faces vehicle. Marks on bar should be approximately 0.39" (10 mm) from edge of bracket. On Montero Sport adjust the stabilizer link assembly mounting nut so there is 0.2-0.3" (6-8 mm) of threads exposed from the top of the nut to the top of the threads.

TORSION BAR

NOTE: Mark torsion bar and anchor arm location for reassembly reference before removing.

Removal

1) Raise and support vehicle. Support lower control arm using jack stand. Loosen anchor arm adjusting bolt lock nut. Remove heat protector from frame (right side only). Loosen anchor arm bolt to release torsion bar tension.

2) Mark front of torsion bar and torque arm for reassembly reference. Remove anchor arm. See Fig. 1. Remove dust covers from torsion bar. Remove heat cover (right side only) located between dust cover and torsion bar. Remove torsion bar.

Inspection

Inspect all splined areas for damage. Inspect dust covers for cracks and damage. Check for bent anchor arm bolts. Replace components as necessary.

Installation

1) Apply grease to splined areas of torsion bar, anchor arm, torque arm splines, anchor arm bolt threads and inside of dust cover. Check for left and right identification marks on torsion bar ends. Ensure torsion bars are installed in correct locations.

2) Install torsion bar in torque arm, with identification mark toward front of vehicle and the slit in the anchor collar facing downward. Align mark on torque arm with mating mark on torsion bar. When installing a new torsion bar, align White paint spline with index mark on front anchor arm.

3) Tighten anchor arm bolt adjusting nut to obtain correct final bolt protrusion. See FINAL ANCHOR ARM BOLT PROTRUSION table. Final bolt protrusion depends upon curb weight of vehicle. With vehicle unladen, measure distance from bump stopper bracket to bump stopper. Distance should be 0.83-0.91" (21-23 mm) on Montero, 0.7" (18 mm) on Montero Sport. If not, adjust anchor bolt nut.

FINAL ANCHOR ARM BOLT PROTRUSION

Application/ Model	Right Bolt In. (mm)	Left Bolt In. (mm)
Montero	3.15 (80.0)	3.15 (80.0)

4) To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Check riding height and front wheel alignment. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

UPPER BALL JOINT

Removal

1) Raise and support vehicle. Remove wheel assembly. Mark torsion bar adjusting nut for reassembly reference. Release torsion bar tension. Loosen, but DO NOT remove, upper ball joint-to-steering knuckle nut.

2) Using Steering Linkage Puller (MB991406), separate ball joint from steering knuckle. Remove ball joint nut from steering knuckle. Remove ball joint-to-upper control arm bolts. Remove ball joint.

Installation

Lubricate ball joint. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

SHOCK ABSORBER & UPPER CONTROL ARM

Removal

1) Disconnect actuator on vehicles with Variable Shock Absorbers. On all models, raise and support vehicle. Support lower control arm using jackstand. Remove front wheels. Remove lower shock absorber bolt. Remove nut from top of shock absorber and remove shock assembly from vehicle.

2) Remove the bump stop from the bump stop bracket. Mark anchor arm bolt for reassembly reference. Loosen anchor arm bolt to release torsion bar tension. Disconnect and plug brake hose at frame mount bracket.

3) Remove cotter pin from upper ball joint stud. Loosen, but DO NOT remove, ball joint stud nut. Using Steering Linkage Puller (MB991406), loosen ball joint from steering knuckle. Remove brake hose clip and rebound stopper. Remove rebound stopper and brake hose support from control arm.

4) Remove ABS sensor bracket (if equipped) and rebound stoppers. Remove upper control arm mounting bolts and shim(s). Note direction of bolt installation and locations of camber adjustment shims. Remove control arm. Remove upper ball joint from control arm.

Inspection

Inspect control arm for cracks and deformation. Check ball joints. See BALL JOINT CHECKING under ADJUSTMENTS & INSPECTION. Inspect ball joint dust cover for damage, and replace cover as necessary.

Installation

1) To install, reverse removal procedure. Install control arm bolts from outside of frame, with nuts against control arm. Install the upper control with the marking "OUT" on shaft facing outside of vehicle.

2) Ensure alignment shims are placed in original locations. Tighten shock absorber upper nut to end of threads, and install lock nut. Tighten shock absorber upper nut until distance from end of threads to nut is 0.04-0.08" (1.0-2.0 mm) on vehicles with standard shock absorbers, and 0.06-0.10" (1.5-2.5 mm) on vehicles with Variable Shock Absorbers. Install lock nut.

3) Tighten bolts to specification. See TORQUE SPECIFICATIONS. Bleed brakes. Adjust anchor arm bolt to proper torsion bar setting. See TORSION BAR under REMOVAL & INSTALLATION. Check wheel alignment, and adjust it if necessary. See WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES article in WHEEL ALIGNMENT section.

WHEEL BEARING

Removal

Raise and support vehicle. Remove wheel assembly. Remove axle hub. See AXLE HUB under REMOVAL & INSTALLATION. Clean any grease from the inside surface of the front hub. Drive out the inner and outer bearing races by tapping them uniformly using brass drift and hammer.

Installation

Lubricate bearing races. Install bearing races in hub using Handle and Bearing Installer (MB990938 and MB990935). Ensure bearing races are fully seated. To complete installation, reverse removal procedure. Adjust wheel bearing preload. See WHEEL BEARING under ADJUSTMENTS & INSPECTION.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS (MONTERO)

Application	Ft. Lbs. (N.m)
Anchor Arm Bolt Lock Nut	33 (44)
Anchor Collar Vertical Bolt	33 (44)
Ball Joint Nut	
Lower	108 (147)
Upper	54 (74)
Bump Stop	18 (25)
Drive Flange	36-43 (49-59)
Ball Joint-To-Lower Control Arm Bolt	60 (81)
Ball Joint-To-Upper Control Arm Bolt	19 (25)
Caliper Bolt	65 (88)
Control Arm-To-Frame Bolt/Nut	
Lower	108 (147)
Upper	80 (108)
Shock Absorber Shaft Nut	1 (15)
Skid Plate	17 (24)
Stabilizer Bar Brackets	17 (24)
Stabilizer Bar Lower Link	25 (33)
Stabilizer Bar Upper Link	69 (93)
Torque Arm Nut	78 (106)

TORQUE SPECIFICATIONS (MONTERO SPORT)

Application	Ft. Lbs. (N.m)
Anchor Arm Adjusting Nut	32 (44)
Anchor Arm Nut	78 (106)
Ball Joint Nut	
Lower	87-131 (118-177)

Upper	44-65 (59-88)
Ball Joint-To-Lower Control Arm Bolt	60 (81)
Ball Joint-To-Upper Control Arm Bolt	18 (25)
Bump Stop	18 (25)
Caliper Bolt	65 (88)
Control Arm-To-Frame Bolt/Nut	
Lower	101-116 (137-157)
Upper	72-87 (98-118)
Drive Flange	36-44 (49-59)
Shock Absorber Lower Mount Bolt	65-76 (88-103)
Shock Absorber Upper Nut	11 (15)
Torque Arm Nut	78 (106)
	INCH Lbs. (N.m)
Stabilizer Bar Clamp Bolt	106 (12)

SUSPENSION - REAR

1997-99 Mitsubishi Montero Sport

1997-99 SUSPENSION
Rear - RWD & 4WD

Montero, Montero Sport

DESCRIPTION

NOTE: For testing and diagnosis information on electronically controlled shocks, see ELECTRONIC - Montero article.

Montero
Rear suspension system is multi-link type with shock absorbers, coil springs, lateral rod and stabilizer bar. See Fig. 2.

Montero Sport
Rear suspension system is a leaf spring type with shock absorbers and stabilizer bar. See Fig. 2.

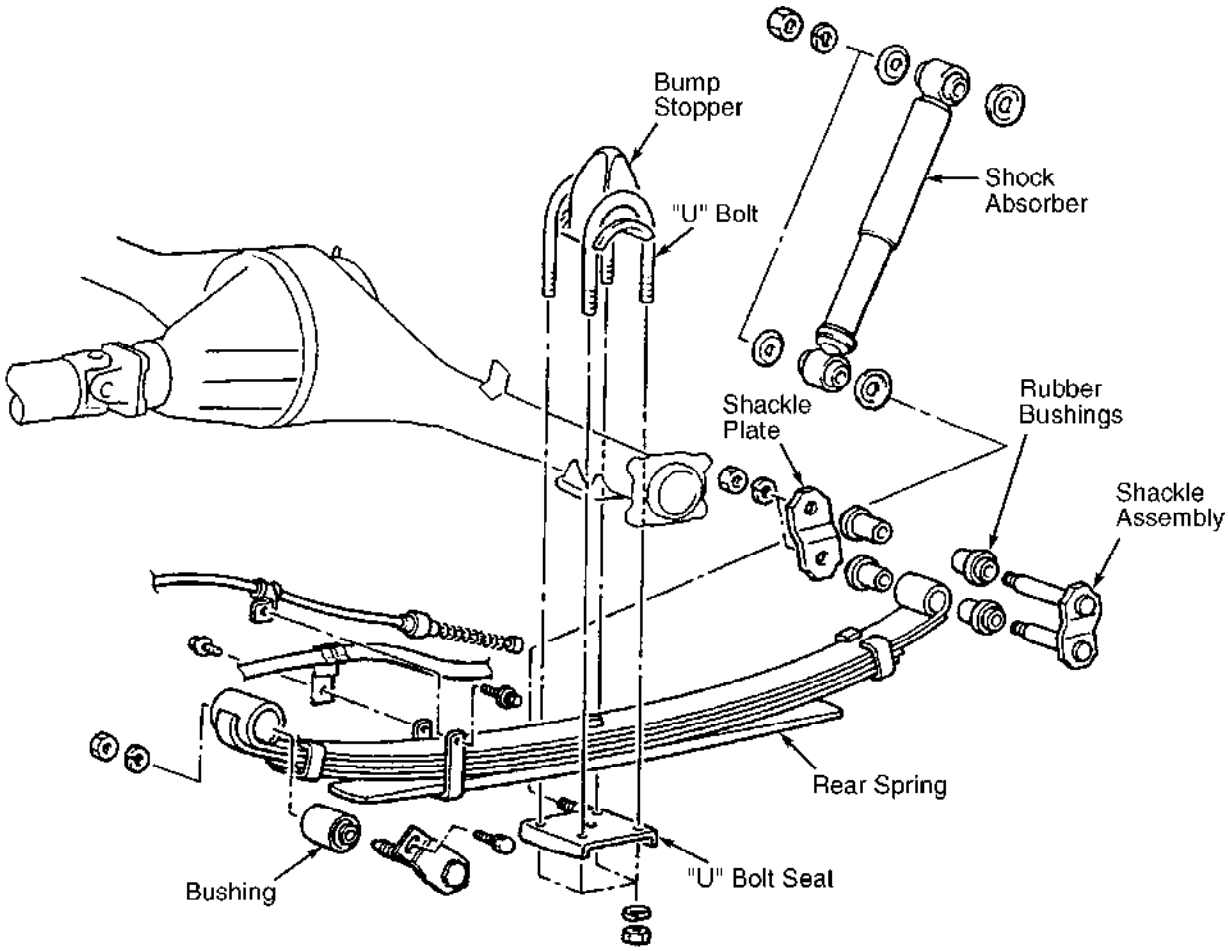


Fig. 1: Exploded View Of Rear Suspension (Montero Sport)
Courtesy of Mitsubishi Motor Sales of America.

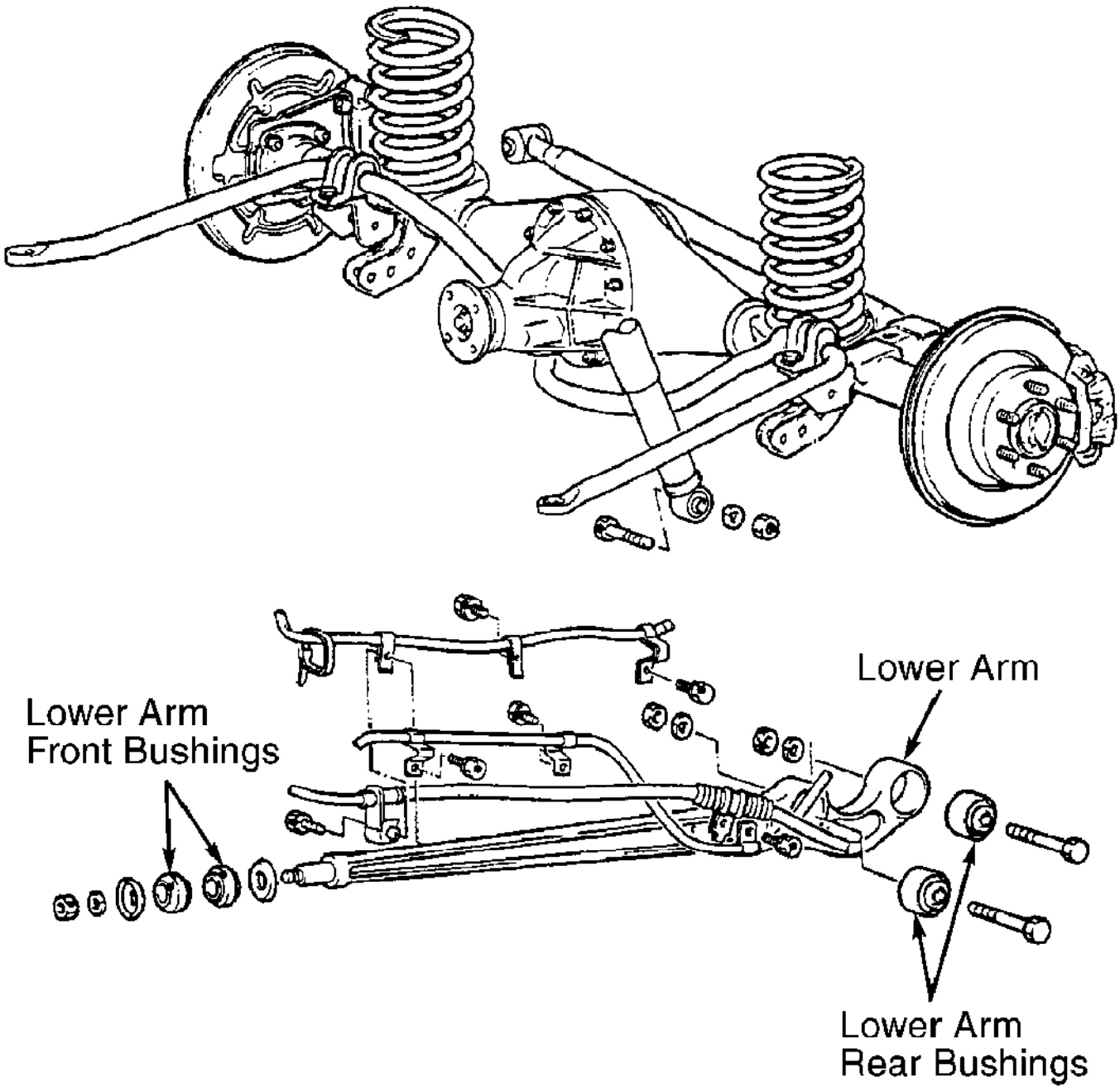


Fig. 2: Exploded View Of Rear Suspension (Montero)
Courtesy of Mitsubishi Motor Sales of America.

ADJUSTMENTS & INSPECTION

WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES

NOTE: Wheel alignment is factory set and cannot be adjusted.

REMOVAL & INSTALLATION

REAR SUSPENSION ASSEMBLY

NOTE: Procedures for Montero are for lateral rod, coil springs and lower arms only. Procedures for Montero Sport are for leaf springs only.

Removal (Montero)

1) Raise and support rear of vehicle. Place a jack under center of rear axle housing. Remove parking brake cable attaching bolts.

2) Remove rear speed sensor attaching bolt (if equipped). Remove rear axle housing lock position harness attaching bolt and lower shock bolts.

3) Remove lateral rod bolts and remove lateral rod. Remove lower arm rear bolts. Remove lower arm front mounting nut and remove lower arm. See Fig. 2.

Inspection

Check lateral rod for straightness and damage. Check rubber bushings for deterioration, cracks and wear.

Installation

If lateral rod bushings need replacing, remove and install using Lower Arm Bushing Arbor (MB990650). Apply a sufficient amount of liquid soap to bushings when installing them into lateral rod. If lower arm rear bushings need replacing, remove and install rear bushings using Rear Bushing Arbor (MB991293). To complete installation, reverse removal procedure. Tighten all suspension fasteners to specification with vehicle on ground and suspension unloaded. See TORQUE SPECIFICATIONS.

Removal (Montero Sport)

1) Raise and support rear of vehicle. Place a jack under center of rear axle housing.

2) Disconnect parking brake cable attaching bolts. Remove rear speed sensor attaching bolt. Remove rear shock nuts and washers. Remove rear shocks.

NOTE: The yellow shock mounts on left side and the pink one mounts to the right side of vehicle.

3) Remove U-bolt nuts, U-bolt seat and U-bolts. Remove bump stopper. Remove rear shackle plate nuts, shackle plate, bushings and shackle assembly. Remove front shackle nuts and bolts. Remove leaf spring. See Fig. 1.

Inspection

Check leaf springs for cracks and other damage. Inspect all components and bushings for damage and wear. Replace components as necessary.

Installation

To install, reverse removal procedure. Ensure shocks are installed on proper side of vehicle. Tighten all suspension fasteners to specification with vehicle on ground and suspension unloaded. See TORQUE SPECIFICATIONS.

SHOCKS

Removal

1) Raise and support rear of vehicle. Place a jack under center of rear axle housing. On Montero remove shock actuator (if equipped).

2) Remove upper shock mounting nuts and washers. On Montero remove shock lower mounting nuts and bolts. On Montero Sport remove shock lower mounting nuts and washers. Remove shock assembly.

Inspection

Check shock for oil leakage, abnormal noise and poor function. Check coil spring for bending and weakness. Check rubber parts for deterioration and cracks.

Installation

To install, reverse removal procedure. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS.

STABILIZER BAR

Removal

Raise and support vehicle. Support rear suspension assembly using a jack. On Montero remove shock lower mounting bolts and nuts. Remove stabilizer bar bracket and bushings. Remove stabilizer link mounting nut and bolt. Remove stabilizer link joint cups, bushings and collar. Remove stabilizer bar.

Inspection

1) Check bushings for wear and deterioration. Check stabilizer bar, stabilizer link and all bolts for damage and wear. Replace components as necessary.

Installation

To install, reverse removal procedure. When installing stabilizer link, hold link using wrench and tighten nut until distance from end of bolt to edge of nut is .59-.70" (15-17 mm). Tighten all fasteners to specification. See TORQUE SPECIFICATIONS.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Upper Shock Nut	
Montero	11 (15)
Montero Sport	16 (22)
Lower Shock Nut And Bolt	
Montero	159-181 (216-245)
Montero Sport	16 (22)
Lateral Rod Nut And Bolt	
Montero	170 (230)
Lower Arm Rear Nut And Bolt	
Montero	170 (230)
Lower Arm Front Nut	
Montero	101 (137)
Leaf Spring Rear Shackle Nut	
Montero Sport	38 (52)
Leaf Spring Front Shackle Nut And Bolt	
Montero Sport	145 (196)
"U" Bolt Nut	
Montero Sport	72-87 (98-118)
Stabilizer Bar Bracket Bolt	25-26 (34-35)

* SUSPENSION UNIFORM INSPECTION GUIDELINES *

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Steering, Suspension, Wheel Alignment, Wheels and Tires
Motorist Assurance Program
Standards For Automotive Repair

All Makes and Models

INTRODUCTION TO MOTORIST ASSURANCE PROGRAM (MAP)

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TRACK BARS
TRAILING ARMS
WHEEL BEARINGS, RACES AND SEALS

Wheel Alignment

WHEEL ALIGNMENT

Wheels and Tires

TIRES
VALVE STEMS
WHEEL ATTACHMENT HARDWARE
WHEELS (RIMS)

MOTORIST ASSURANCE PROGRAM (MAP)

OVERVIEW

The Motorist Assurance Program is the consumer outreach effort of the Automotive Maintenance and Repair Association, Inc. (AMRA). Participation in the Motorist Assurance Program is drawn from retailers, suppliers, independent repair facilities, vehicle manufacturers and industry associations.

Our organization's mission is to strengthen the relationship between the consumer and the auto repair industry. We produce materials that give motorists the information and encouragement to take greater responsibility for their vehicles-through proper, manufacturer-recommended, maintenance. We encourage participating service and repair shops (including franchisees and dealers) to adopt 1) a Pledge of Assurance to their Customers and 2) the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction.

These Standards of Service require that an inspection of the vehicle's (problem) system be made and the results communicated to the customer according to industry standards. Given that the industry did not have such standards, the Motorist Assurance Program successfully promulgated industry inspection communication standards in 1994-95 for the following systems: Exhaust, Brakes, ABS, Steering and Suspension, Engine Maintenance and Performance, HVAC, and Electrical Systems. Further, revisions to all of these inspection communication standards are continually re-published. In addition to these, standards for Drive Train and Transmissions have recently been promulgated. Participating shops utilize these Uniform Inspection & Communication Standards as part of the inspection process and for communicating their findings to their customers.

The Motorist Assurance Program continues to work cooperatively and proactively with government agencies and consumer groups toward solutions that both benefit the customer and are mutually acceptable to both regulators and industry. We maintain the belief that industry must retain control over how we conduct our business, and we must be viewed as part of the solution and not part of the problem. Meetings with state and other government officials (and their representatives), concerned with auto repair and/or consumer protection, are conducted. Feedback from these sessions is brought back to the association, and the program adjusted as needed.

To assure auto repair customers recourse if they were not satisfied with a repair transaction, the Motorist Assurance Program offers mediation and arbitration through MAP/BBB-CARE and other non-

profit organizations. MAP conducted pilot programs in twelve states before announcing the program nationally in October, 1998. During the pilots, participating repair shops demonstrated their adherence to the Pledge and Standards and agreed to follow the UICS in communicating the results of their inspection to their customers. To put some "teeth" in the program, an accreditation requirement for shops was initiated. The requirements are stringent, and a self-policing method has been incorporated which includes the "mystery shopping" of outlets.

We welcome you to join us as we continue our outreach... with your support, both the automotive repair industry and your customers will reap the benefits. Please visit MAP at our Internet site www.motorist.org or contact us at:

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Washington, DC 20005
Phone (202) 712-9042 Fax (202) 216-9646
January 1999

MAP UNIFORM INSPECTION GENERAL GUIDELINES

OVERVIEW OF SERVICE REQUIREMENTS & SUGGESTIONS

It is MAP policy that all exhaust, brake, steering, suspension, wheel alignment, drive-line, engine performance and maintenance, and heating, ventilation and air conditioning, and electrical services be offered and performed under the standards and procedures specified in these sections.

Before any service is performed on a vehicle, an inspection of the appropriate system must be performed. The results of this inspection must be explained to the customer and documented on an inspection form. The condition of the vehicle and its components will indicate what services/part replacements may be "Required" or "Suggested". In addition, suggestions may be made to satisfy the requests expressed by the customer.

When a component is suggested or required to be repaired or replaced, the decision to repair or replace must be made in the customer's best interest, and at his or her choice given the options available.

This section lists the various parts and conditions that indicate a required or suggested service or part replacement. Although this list is extensive, it is not fully inclusive. In addition to this list, a technician may make a suggestion. However, any suggestions must be based on substantial and informed experience, or the vehicle manufacturer's recommended service interval and must be documented.

Some conditions indicate that service or part replacement is required because the part in question is no longer providing the function for which it is intended, does not meet a vehicle manufacturer's design specification or is missing.

Example:
An exhaust pipe has corroded severely and has a hole in it through which exhaust gases are leaking. Replacement of the exhaust pipe in this case is required due to functional failure.

Example:
A brake rotor has been worn to the point where it measures less than the vehicle manufacturer's discard specifications. Replacement of the rotor is required because it does not meet design specifications.

Some conditions indicate that a service or part replacement is suggested because the part is close to the end of its useful life or addresses a customer's need, convenience or request. If a customer's vehicle has one of these conditions, the procedure may be only to suggest service.

Example:
An exhaust pipe is rusted, corroded or weak, but no leaks are present. In this case, the exhaust pipe has not failed. However, there is evidence that the pipe may need replacement in the near future. Replacement of the pipe may be suggested for the customer's convenience in avoiding a future problem.

Example:
The customer desires improved ride and/or handling, but the vehicle's shocks or struts have not failed. In this case, replacement may be suggested to satisfy the customer's wishes. In this case, replacement of the shocks or struts may not be sold as a requirement.

A customer, of course, has the choice of whether or not a shop will service his or her vehicle. He or she may decide not to follow some of your suggestions. When a repair is required, a MAP shop must refuse partial service on that system if, in the judgment of the service provider, proceeding with the work could create or continue an unsafe condition. When a procedure states that required or suggested repair or replacement is recommended, the customer must be informed of the generally acceptable repair/replacement options whether or not performed by the shop.

When presenting suggested repairs to the customer, you must present the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

The following reasons may be used for required and suggested services. These codes are shown in the "Code" column of the MAP Uniform Inspection & Communications Standards that follow:

Reasons to Require Repair or Replacement

A - Part no longer performs intended purpose
B - Part does not meet a design specification (regardless of performance)
C - Part is missing

NOTE: When a repair is required, the shop must refuse partial service to the system in question, if the repair creates or continues an unsafe condition.

Reasons to Suggest Repair or Replacement

1 - Part is close to the end of its useful life (just above discard specifications, or weak; failure likely to occur soon, etc.)
2 - To address a customer need, convenience, or request (to stiffen ride, enhance performance, eliminate noise, etc.)
3 - To comply with maintenance recommended by the vehicle's Original Equipment Manufacturer (OEM)
4 - Technician's recommendation based on substantial and informed experience

NOTE: Suggested services are always optional. When presenting suggested repairs to the customer, you must present

the facts, allowing the customer to draw their own conclusions and make an informed decision about how to proceed.

STEERING AND SUSPENSION

SERVICE PROCEDURES REQUIRED AND SUGGESTED FOR PROPER VEHICLE OPERATION

Steering and suspension are complex systems made up of a variety of interdependent components. For proper vehicle handling, ride, and tire wear, a thorough inspection is required whenever suspension work is being performed.

Conditions listed assume that the problem has been isolated to the specific component by proper testing procedures.

NOTE: When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

CAUTION: DO NOT use ride height altering or load compensating components, such as variable rate springs and coil over shocks, on vehicles with height or load sensing proportioning valve-equipped braking systems, unless these components are original equipment.

AIR RIDE SUSPENSION

NOTE: Depending on the air suspension design, there are some aftermarket products available to eliminate the air ride suspension on certain vehicles. If the system has been eliminated with one of these products, then no service is suggested or required.

AIR RIDE SUSPENSION - AIR SHOCKS AND AIR STRUTS

NOTE: This section covers the air spring portion of the air shock or strut. For damping portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

AIR RIDE SUSPENSION - AIR SHOCK AND AIR STRUT INSPECTION

Condition	Code	Procedure
Inner fabric of air bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.

AIR RIDE SUSPENSION - AIR SPRING VALVES

AIR RIDE SUSPENSION - AIR SPRING VALVE INSPECTION

Condition	Code	Procedure

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Blocked	A	Require repair or replacement.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Inoperative	A	Require repair or replacement.
Leaking	A	Require repair or replacement.
Restricted	A	Require repair or replacement.

AIR RIDE SUSPENSION - AIR SPRINGS

AIR RIDE SUSPENSION - AIR SPRING INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Collar cracked	A	Require replacement.
End cap cracked	A	Require replacement.
Inner fabric of bag damaged	A	Require replacement.
Leaking	A	Require repair or replacement.
Outer covering of air bag is cracked to the extent that inner fabric of air bag is visible	1	Suggest replacement.
Piston cracked	A	Require replacement.

AIR RIDE SUSPENSION - COMPRESSORS

AIR RIDE SUSPENSION - COMPRESSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Connector bent	A	Require repair or replacement.
Connector broken	A	Require replacement.
Connector loose	A	Require repair or replacement.
Does not build pressure	A	(1) Further inspection required.
Excessive run time	B	(2) Further inspection required.
Inoperative	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.

(1) - If failure to build pressure is traced to the compressor, require replacement.
(2) - If excessive run time is traced to the compressor, require replacement.

AIR RIDE SUSPENSION - HEIGHT SENSORS

AIR RIDE SUSPENSION - HEIGHT SENSOR INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware		

threads damaged	A	... Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
Dust boot missing	2	..... (1) Suggest replacement.
Dust boot split	2	..... (1) Suggest replacement.
Dust boot torn	2	..... (1) Suggest replacement.
Housing cracked	A	..... Require replacement.
Lead routing incorrect ..	B	.. Require rerouting according to vehicle manufacturer's specifications.
Loose	B	... Require adjustment to vehicle manufacturer's specifications.
Missing	C	..... Require replacement.
Output signal incorrect .	A	.. Require repair or replacement.
Wire lead damaged	A	.. Require repair or replacement.

(1) - This condition can lead to damage of the sliding magnet, which, in turn, causes premature sensor failure.

AIR RIDE SUSPENSION - MODULES

AIR RIDE SUSPENSION - MODULE INSPECTION

Condition	Code	Procedure
Attaching hardware loose	A	... Require repair or replacement of loose part.
Attaching hardware missing	C	.. Require replacement of missing part.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads.
Housing cracked	2	.. Suggest repair or replacement.
Inoperative	A	..... Require replacement.
Missing	C	..... Require replacement.

AIR RIDE SUSPENSION - RELAYS (COMPRESSOR)

AIR RIDE SUSPENSION - RELAY (COMPRESSOR) INSPECTION

Condition	Code	Procedure
Housing cracked	2	..... (1) Suggest replacement.
Intermittent	A	..... Require replacement.
Missing	C	..... Require replacement.
Output signal incorrect .	A	..... Require replacement.

(1) - If moisture enters the relay, it can reduce life expectancy or impair function.

AIR RIDE SUSPENSION - SWITCHES (ON/OFF)

AIR RIDE SUSPENSION - SWITCH (ON/OFF) INSPECTION

Condition	Code	Procedure
Broken	A	Require replacement.
Missing	C	Require replacement.
Output signal incorrect	A	Require replacement.

AIR RIDE SUSPENSION - TORSION SPRINGS (COUNTER BALANCING)

AIR RIDE SUSPENSION - TORSION SPRING (COUNTER BALANCING) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken	A	Require replacement.
Missing	C	Require replacement.

AIR RIDE SUSPENSION - TUBING

AIR RIDE SUSPENSION - TUBING INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Blocked	A	Require repair or replacement.
Fitting incorrect	B	Require replacement.
Leaking	A	Require repair or replacement.
Line type incorrect	B	Require replacement.
Missing	C	Require replacement.
Restricted	A	Require repair or replacement.
Routed incorrectly	B	Require routing correction.

AIR RIDE SUSPENSION - WARNING LAMPS

AIR RIDE SUSPENSION – WARNING LAMP INSPECTION

Condition	Code	Procedure
Bulb burned out	A	Require replacement.
Warning light does not come on during bulb check	B	Further inspection required to determine cause.
Warning light flashes	B	Further inspection required to determine cause.
Warning light is intermittent	B	Further inspection required to determine cause.
Warning light stays on after initial bulb check	B	Further inspection required to determine cause.

AIR RIDE SUSPENSION - WIRING HARNESSES

AIR RIDE SUSPENSION – WIRING HARNESS INSPECTION

Condition	Code	Procedure
Connector bent	A	Require repair or replacement.
Connector broken	A	Require repair or replacement.
Connector loose	A	Require repair or replacement.
Damaged (cut, burned, or chafed)	A	Require repair or replacement.
Excessive resistance	B	Require repair or replacement.
Fuse blown	A	Require replacement.
Fusible link blown	A	Require replacement.
Open	A	Require repair or replacement.
Poor ground	A	Require repair or replacement.
Routed incorrectly	B	Require rerouting according to vehicle manufacturer’s specifications.
Shorted	A	Require repair or replacement.
Terminal bent	A	Require repair or replacement.
Terminal broken	A	Require repair or replacement.
Terminal corroded	A	Require repair or replacement.
Terminal loose	A	Require repair or replacement.

BALL JOINTS

Before requiring or suggesting ball joint replacement, the approved OEM procedure must be used to measure ball joint wear. The measurement(s) obtained, along with the vehicle manufacturer’s specifications, must be noted on the inspection report. Some states require that these measurements also appear on the invoice.

NOTE: The term "perceptible movement," defined as any visible movement in any direction, has been the industry standard for determining the need for replacement of follower ball joints. Some vehicle manufacturers are now publishing specifications for follower ball joints that were

previously diagnosed by the "perceptible movement" standard. Before requiring or suggesting any parts be replaced based on "perceptible movement," consult your repair manual to determine if OEM specifications exist.

You are not required to replace ball joints in axle sets. However, when replacing a ball joint due to wear exceeding manufacturer's specification, you may suggest replacement of the other ball joint if its measurement shows it is close to the end of its useful life, for preventive maintenance.

BALL JOINT INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace ball joint.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace ball joint.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace ball joint.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace ball joint.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace ball joint.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace ball joint.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads if available; otherwise, replace ball joint.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads if available; otherwise, replace ball joint.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Greaseable ball joint will		

not take grease	2	(5) Suggest replacement of grease fitting.
Nut on ball joint loose	A	(6) Require repair or replacement.
Pre-load adjustment incorrect	B	Require repair or replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.
Stud broken	A	(7) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	Require replacement.

(1) - If greaseable, grease ball joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the ball joint and will accelerate wear.
(5) - If the greaseable ball joint still will not take grease after replacing the grease fitting, suggest replacement of ball joint.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

BUSHINGS

BUSHING INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part if available; otherwise, replace bushing.
Attaching hardware broken	A	Require replacement of broken part if available; otherwise, replace bushing.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part if available; otherwise, replace bushing.
Attaching hardware incorrect	A	Require replacement of incorrect part if available; otherwise, replace bushing.
Attaching hardware loose	A	Require repair or replacement of loose part if available; otherwise, replace bushing.
Attaching hardware missing	C	Require replacement of missing part if available; otherwise, replace bushing.
Attaching hardware threads damaged	A	Require repair or replacement

			of part with damaged threads if available; otherwise, replace bushing.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads if available; otherwise, replace bushing.
Binding	A	..	Require repair or replacement.
Deteriorated, affecting performance	A	..	Require repair or replacement.
Distorted, affecting performance	A	..	Require repair or replacement.
Leaking (fluid-filled type)	A	.....	Require replacement.
Missing	C	.....	Require replacement.
Noisy	2	.....	(1) Further inspection required.
Rubber separating from internal metal sleeve on bonded bushing	A	.....	Require replacement.
Seized	A	.....	Require replacement.
Shifted (out of position)	B	..	Require repair or replacement.
Split	A	.....	Require replacement.
Surface cracking (weather-checked)	..	.....	No service suggested or required.

(1) - If noise isolated to bushing, suggest repair or replacement.
CAUTION: Use only approved lubricant on rubber bushings. Petroleum-based lubricants may damage rubber bushings.

CENTER LINKS

CENTER LINK INSPECTION

Condition	Code		Procedure
Attaching hardware incorrect	A	.....	Require replacement of incorrect part, if available; otherwise, replace center link.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace center link.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace center link.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace center link.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if

			available; otherwise, replace center link.
Bent	B	.....	Require replacement.
Binding	A	.....	(1) Further inspection required.
Grease boot cracked	2	.....	(2) Suggest replacement.
Grease boot missing	2	.....	(3) Suggest replacement.
Grease boot torn	2	.....	(4) Suggest replacement.
Grease fitting broken	A	...	Require replacement of grease fitting.
Grease fitting missing	C	...	Require replacement of grease fitting.
Grease fitting won't seal	A	...	Require replacement of grease fitting.
Grease seal missing	2	.....	(3) Suggest replacement.
Grease seal torn	2	.....	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	.....	(5) Suggest replacement.
Looseness that is excessive	B	.....	(5)(6) Require replacement.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(7) Require replacement.
Stud broken	A	.....	(7) Require replacement.
Stud loose in taper hole	A	.....	(7) Require repair or replacement.
Taper hole elongated	A	.....	(8) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

CONTROL ARM SHAFTS

CONTROL ARM SHAFT INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require replacement of broken

			part, if available; otherwise, replace shaft.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace shaft.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace shaft.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace shaft.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace shaft.
Bent	B	.....	Require replacement.
Shaft bushing surface undersized (worn)	B	.....	Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

CONTROL ARMS

CONTROL ARM INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part, if available; otherwise, replace control arm.
Attaching hardware broken	A	...	Require replacement of broken part, if available; otherwise, replace control arm.
Attaching hardware corroded, affecting structural integrity	A	.	Require replacement of corroded part, if available; otherwise, replace control arm.
Attaching hardware incorrect	A	.....	Require replacement of incorrect part, if available; otherwise, replace control arm.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available; otherwise, replace control arm.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace control arm.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads,

		if available; otherwise, replace control arm.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace control arm.
Bent	B	..... Require replacement.
Bushing hole oversized ..	B	..... Require replacement.
Ball joint hole oversized (loose interference or press fit)	B	..... (1) Further inspection required.
Corroded, affecting structural integrity ...	A	..... Require replacement.
Holes distorted	A	..... Require replacement.
Threads damaged	A	.. Require repair or replacement.
Threads stripped (threads missing)	A	..... Require replacement.

(1) - If oversized ball joint is available, require replacement of ball joint. If oversized ball joint is not available, require replacement of control arm.

DRAG LINKS

DRAG LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace drag link.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace drag link.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace drag link.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace drag link.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace drag link.
Bent	B	..... Require replacement.
Binding	A	..... (1) Further inspection required.
Grease boot cracked	2	..... (2) Suggest replacement.
Grease boot missing	2	..... (3) Suggest replacement.
Grease boot torn	2	..... (4) Suggest replacement.
Grease fitting broken ...	A	... Require replacement of grease fitting.

Grease fitting missing	C	...	Require replacement of grease fitting.
Grease fitting won't seal	A	...	Require replacement of grease fitting.
Grease seal missing	2	.....	(5) Suggest replacement.
Grease seal torn	2	.....	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	.....	(6) Suggest replacement.
Looseness that is excessive	B	.....	(6)(7) Require replacement.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(8) Require replacement.
Stud broken	A	.....	(8) Require replacement.
Stud loose in taper hole	A	.....	(8) Require repair or replacement.
Taper hole elongated	A	.....	(9) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(8) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter the joint and will accelerate wear.
(6) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(7) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

ELECTRONIC RIDE CONTROL SHOCKS AND STRUTS

NOTE: This section covers the electronic damping control portion of the electronic shock or strut. For dampening portion of shock or strut conditions and procedures, refer to the SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES section.

ELECTRONIC RIDE CONTROL SHOCK AND STRUT INSPECTION

Condition	Code		Procedure
Connector bent	A	..	Require repair or replacement.
Connector broken	A	..	Require repair or replacement.
Connector loose	A	..	Require repair or replacement.
Electronic valve control			

inoperative	2	..... (1) Suggest replacement.
Terminal bent	A	.. Require repair or replacement.
Terminal broken	A	.. Require repair or replacement.
Terminal corroded	A	.. Require repair or replacement.
Terminal loose	A	.. Require repair or replacement.

(1) - It is acceptable to replace with a non-electronically controlled unit, where available.

IDLER ARMS

IDLER ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	... Require replacement of broken part, if available; otherwise, replace idler arm.
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace idler arm.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace idler arm.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace idler arm.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace idler arm.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace idler arm.
Binding	A	..... (1) Further inspection required.
Grease boot cracked	2	..... (2) Suggest replacement.
Grease boot missing	2	..... (3) Suggest replacement.
Grease boot torn	2	..... (4) Suggest replacement.
Grease fitting broken ...	A	... Require replacement of grease fitting.
Grease fitting missing ..	C	... Require replacement of grease fitting.
Grease fitting won't seal	A	... Require replacement of grease fitting.
Grease seal missing	2	..... (5) Suggest replacement.
Grease seal torn	2	..... (4) Suggest replacement.
Greaseable joint will not take grease	2	..... (1) Suggest replacement of grease fitting.
Looseness at frame bracket end	B	..... (6)(7) Require repair or replacement.

Looseness at link end (perceptible horizontal movement)	1	(8)	Suggest replacement.
Looseness at link end that is excessive	B	(8)(9)	Require replacement.
Mounted out of position (center link not parallel)	B		Require repositioning.
Nut on stud loose	A	(10)	Require repair or replacement.
Seized	A		Require replacement.
Stud bent	B	(11)	Require replacement.
Stud broken	A	(11)	Require replacement.
Taper hole elongated	A	(12)	Require replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A	(11)	Require replacement.
Wear exceeds manufacturer's specifications	B		Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Missing grease seal will allow contaminants to enter joint and will accelerate wear.
(6) - If manufacturer's procedures and specifications exist, use those procedures and specifications; otherwise, use an approved inspection method such as the dry park check.
(7) - Looseness is defined as movement that creates excessive toe change.
(8) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(9) - Excessive looseness is defined as significant enough to affect vehicle handling or structural integrity.
(10) - Check for bent stud or damaged taper hole.
(11) - Check for damaged taper hole.
(12) - Check for damaged stud.

KING PINS

You are not required to replace king pins in axle sets. However, when replacing a king pin due to wear exceeding manufacturer's specifications, you may suggest replacement of the other king pin on the axle if its measurement shows it is close to the end of its useful life.

KING PIN INSPECTION

Condition	Code	Procedure
Bearing balls pitted	A	Require replacement.
Bearing balls worn	A	Require replacement.
Bearing races pitted	A	Require replacement.

Condition	Code	Procedure
Bearing races worn	A	Require replacement.
Bearing rollers pitted	A	Require replacement.
Bearing rollers worn	A	Require replacement.
Bearing seal bent	2	Suggest replacement of seal or bearing.
Bearing seal missing	2	Suggest replacement of seal or bearing.
Bearing seal torn	2	Suggest replacement of seal or bearing.
Binding	A	Require repair or replacement of affected parts.
End caps missing	C	Require replacement of missing part, if available; otherwise, replace king pin.
End play exceeds specifications	B	Require repair.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Locating pins missing	C	Require replacement of missing part, if available; otherwise, replace king pin.
Looseness exceeds manufacturer's specifications	B	Require replacement of worn parts.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.
Will not take grease	2	(1) Suggest replacement of grease fitting.

(1) - If king pin will not take grease after replacement of grease fitting, suggest replacement of king pin.

PITMAN ARMS

PITMAN ARM INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace pitman arm.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace pitman arm.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace pitman arm.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise,

			replace pitman arm.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace pitman arm.
Bent	B	.....	Require replacement.
Binding	A	.....	(1) Further inspection required.
Grease boot cracked	2	.....	(2) Suggest replacement.
Grease boot missing	2	.....	(3) Suggest replacement.
Grease boot torn	2	.....	(4) Suggest replacement.
Grease fitting broken	A	.....	Require replacement grease fitting.
Grease fitting missing	C	...	Require replacement of grease fitting.
Grease fitting won't seal	A	...	Require replacement of grease fitting.
Grease seal missing	2	.....	(3) Suggest replacement of seal.
Grease seal torn	2	.....	(4) Suggest replacement of seal.
Looseness (perceptible horizontal movement)	1	.....	(5) Suggest replacement.
Looseness that is excessive	B	.....	(5)(6) Require replacement.
Nut on stud loose	A	.....	(7) Require repair or replacement.
Seized	A	.....	Require replacement.
Splines damaged	A	..	Require repair or replacement.
Splines stripped (splines missing)	A	.....	Require replacement.
Stud bent	B	.....	(8) Require replacement.
Stud broken	A	.....	(8) Require replacement.
Stud loose in taper hole	A	.....	(8) Require repair or replacement.
Taper hole elongated	A	.....	(9) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(8) Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for bent stud of damaged taper hole.
(8) - Check for damaged taper hole.
(9) - Check for damaged stud.

POWER STEERING HOSES

POWER STEERING HOSE INSPECTION

Condition	Code	Procedure
Blistered	B	Require replacement.
Blocked	A	Require repair or replacement.
Fitting threads damaged	A	Require repair or replacement.
Fitting threads stripped (threads missing)	A	Require replacement.
Inner fabric (webbing) cut	A	Require replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Outer covering is cracked to the extent that the inner fabric of hose is visible	B	Require replacement.
Restricted	A	Require repair or replacement.

POWER STEERING (HYDRAULIC) PUMPS

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

POWER STEERING (HYDRAULIC) PUMP INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Belt alignment incorrect	B	(1) Further inspection required.
Belt cracked	1	Suggest replacement.
Belt frayed	1	Suggest replacement.
Belt missing	C	Require replacement.
Belt noisy	2	(2) Further inspection required.
Belt plies separated	A	Require replacement.

Belt tension out of specification	B	Require adjustment or replacement.
Belt worn beyond adjustment range	B	Require replacement.
Belt worn so it contacts bottom of pulley	A	Require replacement.
Binding	A	Require repair or replacement.
Fluid at or beyond service interval	3	Suggest fluid change.
Fluid contaminated	B	(3) Require flushing and refilling of the system.
Fluid level incorrect	B	Require adjustment of fluid level.
Inadequate assist	A	(4) Further inspection required.
Leaking	A	Require repair or replacement.
Noise	2	(5) Further inspection required.
Pulley bent	A	Require repair or replacement of pulley.
Pulley missing	C	Require replacement of pulley.
Remote reservoir leaking	A	Require replacement of reservoir,
Reservoir cap broken	A	Require replacement of cap.
Reservoir cap missing	C	Require replacement of cap.
Seized	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

(1) - Determine cause of incorrect alignment and require repair.
(2) - Determine cause of noise and suggest repair.
(3) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(4) - If pump is source of inadequate assist, require repair or replacement.
(5) - If noise is isolated to pump, suggest repair or replacement.

RADIUS ARMS

RADIUS ARM INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.

Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Corroded, affecting structural integrity	A	Require replacement.
Holes distorted	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

RELAY RODS

RELAY ROD INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace relay rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace relay rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace relay rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace relay rod.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace relay rod.
Bent	B	Require replacement.
Binding	A	(1) Further inspection required.
Grease boot cracked	2	(2) Suggest replacement.
Grease boot missing	2	(3) Suggest replacement.
Grease boot torn	2	(4) Suggest replacement.
Grease fitting broken	A	Require replacement grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(3) Suggest replacement.
Grease seal torn	2	(4) Suggest replacement.
Looseness (perceptible horizontal movement)	1	(5) Suggest replacement.
Looseness that is excessive	B	(5)(6) Require replacement.
Seized	A	Require replacement.
Stud bent	B	(7) Require replacement.

Stud loose in taper hole	A		(7) Require repair or replacement.
Taper hole elongated	A		(8) Require replacement.
Threads damaged	A		Require repair or replacement.
Threads stripped (threads missing)	A		(7) Require replacement.
Wear exceeds manufacturer's specifications	B		Require replacement.

(1) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(2) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(3) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(6) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(7) - Check for damaged taper hole.
(8) - Check for damaged stud.

SHOCK ABSORBERS, STRUT CARTRIDGES AND STRUT ASSEMBLIES

You are not required to replace shocks or struts in axle sets. However, when replacing a shock or strut due to the conditions that follow, you may suggest replacement of the other shock or strut on the same axle for improved performance and preventive maintenance.

* Part is close to the end of its useful life
* To extend tire life
* To balance ride and handling
* To improve stopping distance

When replacing steering and/or suspension components which may affect an alignment angle, you are required to check and adjust alignment as needed. Refer to the OEM specifications.

Under no circumstances should a technician bend struts or strut housings.

A vehicle's load-carrying and handling abilities are limited by its suspension, tires, brakes, and driveline. Installing coil over shocks or any other load assist device does not increase the vehicle's load capacity. See the vehicle owner's manual for more details.

NOTE: If vehicle is equipped with original equipment coil over shocks, apply the conditions for coil springs from the SPRINGS - COIL, LEAF AND TORSION BAR section of the STEERING AND SUSPENSION guidelines. If the vehicle is equipped with add-on coil over shocks, you may suggest replacing the shocks with standard shocks for any spring-related condition.

SHOCK ABSORBER, STRUT CARTRIDGE AND STRUT ASSEMBLY INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace shock or strut.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace shock or strut.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace shock or strut.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace shock or strut.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace shock or strut.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace shock or strut.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace shock or strut.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace shock or strut.
Binding	A	Require replacement.
Body dented	A	(1) Further inspection required.
Body punctured	A	Require replacement.
Brake hose bracket bent	B	Require repair or replacement.
Brake hose bracket missing	C	Require replacement.
Brake hose bracket threads damaged	A	Require repair or replacement.
Brake hose bracket threads stripped (threads missing)	C	Require replacement.
Compression bumper missing	C	Require replacement of compression bumper.
Compression bumper split	1	Suggest replacement of compression bumper.
Damping (none)	A	Require replacement.
Dust boot (bellows) split	2	(2) Suggest replacement of boot.

Dust boot (bellows) missing	2	.....	(2) Suggest replacement of boot.
Dust boot (bellows) torn	2	.....	(2) Suggest replacement of boot.
Dust shield broken	2	.....	(2) Suggest replacement.
Dust shield missing	2	.....	(2) Suggest replacement.
Gland nut (strut housing cap) is not removable using appropriate tool	A	..	(3) Require replacement of nut and/or housing.
Gland nut (strut housing cap) threads damaged	A	...	Require repair or replacement of nut.
Gland nut (strut housing cap) threads stripped (threads missing)	A	.....	Require replacement of nut.
Housing dented	A	.....	(1) Further inspection required.
Housing punctured	A	.....	Require replacement.
Jounce bumper missing	C	...	Require replacement of jounce bumper.
Jounce bumper split	1	...	Suggest replacement of jounce bumper.
Leaking oil, enough for fluid to be running down the body	A	.....	(4) Require replacement.
Noise	2	.....	(5) Further inspection required.
Piston rod bent	A	.....	Require replacement.
Piston rod broken	A	.....	Require replacement.
Piston rod has surface defect	2	.....	Suggest replacement.
Piston rod threads damaged	A	..	Require repair or replacement.
Piston rod threads stripped (threads missing)	A	.....	Require replacement.
Seized	A	.....	Require replacement.
Shock missing	C	.....	Require replacement.
Strut housing bent	A	.....	Require replacement.
Strut housing cap (gland nut) is not removable using appropriate tool	A	.....	(3) Require replacement of nut and/or housing.
Strut housing cap (gland nut) threads damaged	A	...	Require repair or replacement of nut.
Strut housing cap (gland nut) threads stripped (threads missing)	A	.....	Require replacement of nut.
Strut housing severely corroded, affecting structural integrity	A	.....	Require replacement.
Strut housing threads damaged	A	..	Require repair or replacement.
Strut housing threads stripped (threads missing)	A	.....	Require replacement.
Tire cupping	A	.....	(6) Further inspection required.

(1) - Require replacement of units where dents restrict shock or strut piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube shocks.
(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.
(3) - Only required if replacing cartridge.
(4) - CAUTION: If the strut cartridge has been replaced previously, the oil on the strut housing may be filler oil. The technician must identify the source of the oil.
(5) - If noise is isolated to shock or strut, suggest replacement.
(6) - Although shocks or struts may have contributed to tire cupping, an inspection is needed of the entire suspension system. If the shock or strut is found to be contributing to the tire cupping, require replacement.

SPINDLES

SPINDLE INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Race seat area undersized	B	Require replacement.
Scored	A	Require repair or replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

SPRINGS - COIL, LEAF AND TORSION BAR

When springs are replaced, it is suggested, but not required, that both springs on an axle be replaced to maintain equal height from side to side and to provide a balanced ride and proper handling.

When variable rate springs are installed in place of conventional coil springs, they must be installed in axle sets to ensure proper handling, uniform ride, and proper chassis height.

Erroneous height measurements may result from: improper tire inflation, non-standard tire or wheel size, and heavy load in vehicle or trunk.

SPRING (COIL, LEAF AND TORSION BAR) INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Broken (all springs except secondary leave(s) on multi-leaf springs)	A	Require replacement.
Coil clash	..	(1) Require ride height check.
Coil spring insulator deteriorated	2	Suggest replacement of insulator.
Coil spring insulator missing	2	Suggest replacement of insulator.
Coil spring insulator split	2	Suggest replacement of insulator.
Coil spring plastic coating deteriorated - rust present	A	(2) Refer to manufacturer's service requirements.
Composite spring damaged	..	(3) Further inspection required.
Cracked (all springs except composite leaf and secondary leave(s) on multi-leaf springs)	A	Require replacement.
Installed incorrectly	B	Require repair.
Leaf spring insulators missing	2	Suggest replacement of insulators.
Secondary leaf on multi-leaf spring broken	1	Suggest repair or replacement
Secondary leaf on multi-leaf spring cracked	1	Suggest repair or replacement
Torsion bar		

adjuster bent	A	.....	(4) Require repair or replacement of adjuster.
Torsion bar adjuster seized	A	....	(4) Require repair or replacement of adjuster.
Torsion bar adjuster threads damaged	A	....	(4) Require repair or replacement of part with damaged threads.
Torsion bar adjuster threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Vehicle suspension height not within OEM specifications	B	.....	Require adjustment or replacement.

(1) - If vehicle is within manufacturer's height specifications, no service is suggested or required.
(2) - Some manufacturers require replacement under these conditions.
(3) - Check vehicle ride height. If ride height is OK, no service is suggested or required.
(4) - Only required if ride height needs to be adjusted.

STEEL POWER STEERING LINES

CAUTION: When replacing steel power steering lines, be sure to use a replacement product that meets or exceeds OEM design specifications.

STEEL POWER STEERING LINE INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part.
Attaching hardware broken	A	...	Require replacement of broken part.
Attaching hardware loose	A	...	Require repair or replacement of loose part.
Attaching hardware missing	C	..	Require replacement of missing part.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Blocked	A	..	Require repair or replacement.
Fitting incorrect (such as compression fitting)	B	.....	Require replacement.
Flare type incorrect	B	.....	Required replacement.
Leaking	A	.....	Require tightening or replacement.
Line type incorrect	B	.....	Require replacement.

Restricted	A	.....	Require replacement.
Routed incorrectly	B	.....	Require routing correction.
Rust-pitted	1	.....	Suggest replacement.
Rust pitted, affecting structural integrity	A	.....	Require replacement.

STEERING ARMS

STEERING ARM INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part.
Attaching hardware broken	A	...	Require replacement of broken part.
Attaching hardware incorrect	A	.....	Require replacement of incorrect part.
Attaching hardware loose	A	...	Require repair or replacement of loose part.
Attaching hardware missing	C	..	Require replacement of missing part.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Bent	B	.....	Require replacement.
Broken	A	.....	Require replacement.
Taper hole elongated	A	.....	(1) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

(1) - Check for damaged stud.

STEERING DAMPERS

The following procedures are only required if the vehicle was originally equipped from the factory with a steering damper. If the steering damper is an add-on unit, then the unit may be removed instead of repairing or replacing.

STEERING DAMPER INSPECTION

Condition	Code		Procedure
Attaching hardware bent	B	...	Require repair or replacement of bent part, if available; otherwise, replace steering damper.
Attaching hardware broken	A	...	Require replacement of broken part, if available; otherwise,

		replace steering damper.
Attaching hardware corroded, affecting structural integrity ...	A	. Require replacement of corroded part, if available; otherwise, replace steering damper.
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace steering damper.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace steering damper.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace steering damper.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace steering damper.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace steering damper.
Binding	A	..... Require replacement.
Damper body dented	A	..... (1) Further inspection required.
Damper body punctured ...	A	..... Require replacement.
Damping (none)	A	..... Require replacement.
Dust boot (bellows) missing	2	..... (2) Suggest replacement of boot.
Dust boot (bellows) split	2	..... (2) Suggest replacement of boot.
Dust shield broken	2	..... (2) Suggest replacement.
Dust shield missing	2	..... (2) Suggest replacement.
Leaking oil, enough for fluid to be running down the body	A	..... Require replacement.
Loose	A	.. Require repair or replacement.
Missing	C	..... Require replacement.
Noise	2	..... (3) Further inspection required.
Piston rod bent	A	..... Require replacement.
Piston rod broken	A	..... Require replacement.
Piston rod has surface defect	2	..... Suggest replacement.
Piston rod threads stripped (threads missing)	A	..... Require replacement.
Piston rod threads damaged	A	.. Require repair or replacement.
Seized	A	..... Require replacement.

(1) - Require replacement of units where dents restrict damper

piston rod movement. If dents don't restrict movement, no service is suggested or required. Especially critical on mono-tube dampers.

(2) - This condition can lead to damage of the piston rod, which, in turn, causes premature piston rod seal wear.

(3) - If noise is isolated to damper, suggest replacement.

STEERING GEARS (EXCEPT RACK AND PINION)

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEAR (EXCEPT RACK AND PINION) INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Binding	A	Require repair or replacement
Flex coupler binding	A	Require repair or replacement of coupler.
Flex coupler loose	A	Require repair or replacement of coupler.
Flex coupler missing parts	A	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	Require replacement of coupler.
Flex coupler torn	A	Require replacement of coupler.
Fluid contaminated	B	(1) Require flushing and refilling of the system.
Gasket leaking	A	Require repair or replacement of gasket.
Housing leaking	A	Require replacement.
Hydraulic fittings leaking	A	Require repair or replacement of fittings.
Inadequate power assist	A	(2) Further inspection required. See note below.
Lash exceeds manufacturer's specifications	B	Require repair or replacement.
Seal leaking	A	Require repair or replacement

			of seal and/or mating part.
Splines damaged	A	...	Require repair or replacement of splines.
Splines stripped	A	.	Require replacement of splines.
Steering coupler shield cracked	2	.....	Suggest replacement.
Steering coupler shield missing	C	.....	Require replacement.
Threads damaged	A	...	Require repair or replacement of part with damaged threads.
Threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
U-joint binding	A	...	Require repair or replacement of joint.
U-joint loose	A	...	Require repair or replacement of joint.
Unequal power assist	A	..	Require repair or replacement.

(1) - Determine and correct source of contamination. OEM specifications must be followed for fluid type.
(2) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING GEARS - RACK AND PINION

If diagnosis has determined that complete disassembly is necessary to determine the extent of the system failure, the suggestion may be made to rebuild or replace the power steering pump. Repair or replacement of the following components may be required, if performed as part of a power steering pump overhaul or rebuild service to meet a minimum rebuild standard.

STEERING GEARS - RACK AND PINION INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	.....	Require replacement of broken part.
Attaching hardware loose	A	..	Require repair or replacement of loose part.
Attaching hardware missing	C	.....	Require replacement of missing part.
Attaching hardware threads damaged	A	..	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	....	Require replacement of part with stripped threads.
Balance tube blocked	A	..	Require repair or replacement of balance tube.
Balance tube missing	C	..	Require replacement of balance tube.
Balance tube restricted	A	...	Require repair or replacement of balance tube.
Bellows boot clamp missing	C	...	Require replacement of clamp.
Bellows boot cracked			

(not through)	2	..	Suggest replacement of bellows boot.
Bellows boot missing	C	..	Require replacement of bellows boot.
Bellows boot not sealing	A	...	Require repair or replacement of bellows boot.
Bellows boot torn	A	..	Require replacement of bellows boot.
Bellows boot twisted (from toe adjustment) ..	B	.....	Require repair.
Fitting leaking	A	..	Require repair or replacement.
Fitting missing	A	.	Require replacement of fitting.
Fitting threads damaged	A	...	Require repair or replacement of part with damaged threads.
Fitting threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads.
Flex coupler binding	A	...	Require repair or replacement of coupler.
Flex coupler loose	A	...	Require repair or replacement of coupler.
Flex coupler missing parts	A	...	Require repair or replacement of coupler.
Flex coupler soft/spongy	A	.	Require replacement of coupler.
Flex coupler torn	A	.	Require replacement of coupler.
Fluid contaminated	B	.....	(1) Require flushing and refilling of the system.
Gasket leaking	A	..	Require repair or replacement.
Hard steering on cold start-up	1	.....	(2) Suggest repair or replacement.
Housing cracked, affecting structural integrity	B	.....	Require replacement.
Housing leaking	A	.....	Require replacement.
Inadequate power assist .	A	.....	(3) Further inspection required.
Lash exceeds manufacturer's specifications	B	..	Require repair or replacement.
Seal leaking	A	..	Require repair or replacement.
Splines damaged	A	..	Require repair or replacement.
Splines stripped (splines missing)	A	.....	Require replacement.
Steel line blocked	A	...	Require repair or replacement of line.
Steel line leaking	A	...	Require repair or replacement of line.
Steel line missing	C	....	Require replacement of line.
Steel line restricted ...	A	...	Require repair or replacement of line.
Steering coupler shield cracked	2	.....	Suggest replacement.
Steering coupler shield missing	C	.....	Require replacement.
Steering coupler shield torn	2	.....	Suggest replacement.
Threads damaged	A	...	Require repair or replacement of part with damaged threads.

Threads stripped (threads missing)	A	Require replacement of part with stripped threads.
U-joint binding	A	Require repair or replacement of joint.
U-joint loose	A	Require repair or replacement of joint.
Unequal power assist	A	Require repair or replacement.

(1) - Determine and correct source of contamination. Follow OE specifications for fluid type.
(2) - Indicates internal wear.
(3) - If steering gear is source of inadequate assist, require repair or replacement.

STEERING KNUCKLES

STEERING KNUCKLE INSPECTION

Condition	Code	Procedure
Attaching hardware bent	B	Require repair or replacement of bent part.
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware incorrect	A	Require replacement of incorrect part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Bent	B	Require replacement.
Broken	A	Require replacement.
Pinch bolt incorrect	B	Require replacement with bolt that meets OE design.
Pinch bolt loose	B	Require repair.
Pinch bolt missing	B	Require replacement.
Pinch bolt tabs deformed (pinched together), .032" or more before clamping	B	(1) Require replacement.
Taper hole elongated	A	(2) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require repair or replacement.

(1) - Steering knuckle deformation can cause pinch bolt breakage.
(2) - Check for damaged stud.

STRIKE OUT BUMPERS

STRIKE OUT BUMPER INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part.
Attaching hardware loose	A	Require repair or replacement of loose part.
Attaching hardware missing	C	Require replacement of missing part.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads.
Missing	C	Require replacement.
Split	1	Suggest replacement.

STRUT RODS

STRUT ROD INSPECTION

Condition	Code	Procedure
Adjusting nut seized	A	(1) Require repair or replacement.
Attaching hardware bent	B	Require repair or replacement of bent part, if available; otherwise, replace strut rod.
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace strut rod.
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace strut rod.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace strut rod.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace strut rod.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads,

			if available; otherwise, replace strut rod.
Attaching hardware threads stripped (threads missing)	.....	A	..... Require replacement of part with stripped threads, if available; otherwise, replace strut rod.
Attaching (mating) hole oversized	.....	A	... Require repair or replacement of frame.
Attaching point on frame corroded, affecting structural integrity	...	A	..... Require repair of frame.
Bent	.....	A	..... Require replacement.
Mating (attaching) hole oversized	.....	A	... Require repair or replacement of frame.
Threads damaged	.....	A	.. Require repair or replacement.
Threads stripped (threads missing)	.....	A	..... Require replacement.

(1) - Only required if an alignment is being performed.

STRUT UPPER BEARING PLATE ASSEMBLIES

NOTE: When the following guidelines indicate replacement of bearing, only the bearing should be replaced if it is available separately; otherwise, replace the bearing plate assembly.

STRUT UPPER BEARING PLATE ASSEMBLY INSPECTION

Condition	Code		Procedure
Attaching hardware broken	.....	A	... Require replacement of broken part, if available; otherwise, replace bearing plate assembly.
Attaching hardware loose	.....	A	... Require repair or replacement of loose part, if available; otherwise, replace bearing plate assembly.
Attaching hardware missing	.....	C	.. Require replacement of missing part, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads damaged	.....	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace bearing plate assembly.
Attaching hardware threads stripped (threads missing)	.....	A	..... Require replacement of part with stripped threads, if available; otherwise, replace bearing plate assembly.
Bearing axial or radial movement exceeds vehicle manufacturer's			

specifications	B	..... Require replacement of bearing.
Bearing binding	A	..... Require replacement of bearing.
Bearing missing	C	..... Require replacement of bearing.
Bearing seized	A	..... Require replacement of bearing.
Bent	B	..... Require replacement.
Holes distorted	A	..... Require replacement.
Missing	C	..... Require replacement.
Severely corroded, affecting structural integrity	A	..... Require replacement.

SWAY BAR LINKS

SWAY BAR LINK INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	..... Require replacement of incorrect part, if available; otherwise, replace link.
Attaching hardware loose	A	... Require repair or replacement of loose part, if available; otherwise, replace link.
Attaching hardware missing	C	.. Require replacement of missing part, if available; otherwise, replace link.
Attaching hardware threads damaged	A	... Require repair or replacement of part with damaged threads, if available; otherwise, replace link.
Attaching hardware threads stripped (threads missing)	A	..... Require replacement of part with stripped threads, if available; otherwise, replace link.
Ball and socket has looseness (perceptible vertical movement)	1	..... (1) Suggest replacement.
Ball and socket has looseness that is excessive	B	..... (1)(2) Require replacement.
Bent	B	..... Require replacement.
Broken	A	..... Require replacement.
Corroded, affecting structural integrity ...	A	..... Require replacement.
Grease boot cracked	2	..... (3) Suggest replacement.
Grease boot missing	2	..... (4) Suggest replacement.
Grease boot torn	2	..... (5) Suggest replacement.
Missing	C	..... Require replacement.
Nut on stud loose	A	..... (6) Require repair.
Stud bent	B	..... (7) Require replacement.
Stud broken	A	..... (7) Require replacement.
Threads damaged	A	.. Require repair or replacement.

Threads stripped (threads missing)	A	.....	(7) Require replacement.

(1) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(2) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(3) - Cracked grease boot will allow contaminants to enter the joint and will accelerate wear.
(4) - Lack of grease boot will allow contaminants to enter the joint and will accelerate wear.
(5) - Torn grease boot will allow contaminants to enter the joint and will accelerate wear.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

SWAY BARS

SWAY BAR INSPECTION

Condition	Code	Procedure
Attaching hardware broken	A	Require replacement of broken part, if available; otherwise, replace sway bar.
Attaching hardware corroded, affecting structural integrity	A	Require replacement of corroded part, if available; otherwise, replace sway bar.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace sway bar.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace sway bar.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace sway bar.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace sway bar.
Bent	B	Require replacement.
Broken	A	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	Require replacement.

TIE ROD ENDS (INNER AND OUTER)

TIE ROD END (INNER AND OUTER) INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace tie rod end.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace tie rod end.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace tie rod end.
Attaching hardware threads damaged	A	Require repair or replacement of part with damaged threads, if available; otherwise, replace tie rod end.
Attaching hardware threads stripped (threads missing)	A	Require replacement of part with stripped threads, if available; otherwise, replace tie rod end.
Adjusting sleeve bent	B	Require replacement of sleeve or tie rod end.
Adjusting sleeve clamps out of position	B	Require repair.
Adjusting sleeve corroded, affecting structural integrity	A	Require replacement of sleeve or tie rod end.
Adjusting sleeve missing	C	Require replacement of sleeve or tie rod end.
Adjusting sleeve seized	A	(1) Require repair or replacement.
Adjusting sleeve threads damaged	A	Require repair or replacement of sleeve or tie rod end.
Adjusting sleeve threads stripped (threads missing)	A	Require replacement of sleeve or tie rod end.
Binding	A	(2) Further inspection required.
Grease boot cracked	2	(3) Suggest replacement.
Grease boot missing	2	(4) Suggest replacement.
Grease boot torn	2	(5) Suggest replacement.
Grease fitting broken	A	Require replacement of grease fitting.
Grease fitting missing	C	Require replacement of grease fitting.
Grease fitting won't seal	A	Require replacement of grease fitting.
Grease seal missing	2	(4) Suggest replacement of seal.

Condition	Code	Procedure
Grease seal torn	2	(5) Suggest replacement of seal.
Greaseable tie rod end won't take grease	2	(6) Suggest replacement of grease fitting.
Looseness (perceptible horizontal movement)	1	(7) Suggest replacement.
Looseness exceeds manufacturer's specifications	B	Require replacement.
Looseness that is excessive	B	(7)(8) Require replacement.
Nut on stud loose	A	(9) Require repair or replacement of nut.
Seized	A	Require replacement
Stud bent	B	(10) Require replacement.
Stud broken	A	(10) Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped (threads missing)	A	(10) Require replacement.

(1) - Only required if toe needs to be adjusted.
(2) - If greaseable, grease joint. If problem persists or joint is non-greaseable, require replacement.
(3) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(5) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(6) - If greaseable tie rod end will not take grease after replacing the grease fitting, suggest replacement of tie rod end.
(7) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(8) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(9) - Check for bent stud or damaged taper hole.
(10) - Check for damaged taper hole.

TRACK BARS

TRACK BAR INSPECTION

Condition	Code	Procedure
Attaching hardware incorrect	A	Require replacement of incorrect part, if available; otherwise, replace track bar.
Attaching hardware loose	A	Require repair or replacement of loose part, if available; otherwise, replace track bar.
Attaching hardware missing	C	Require replacement of missing part, if available; otherwise, replace track bar.
Attaching hardware		

threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace track bar.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace track bar.
Bent	B	.....	Require replacement.
Corroded, affecting structural integrity ...	A	.....	Require replacement.
Grease boot cracked	2	.....	(1) Suggest replacement.
Grease boot missing	2	.....	(2) Suggest replacement.
Grease boot torn	2	.....	(3) Suggest replacement.
Holes distorted	A	.....	Require replacement.
Looseness (perceptible horizontal movement) ...	1	.....	(4) Suggest replacement.
Looseness that is excessive	B	.....	(4)(5) Require replacement.
Nut on stud loose	A	.....	(6) Require repair or replacement of nut.
Seized	A	.....	Require replacement.
Stud bent	B	.....	(7) Require replacement.
Stud broken	A	.....	(7) Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	(7) Require replacement.
Wear exceeds manufacturer's specifications	B	.....	Require replacement.

(1) - Cracked grease boot will allow contaminants to enter joint and will accelerate wear.
(2) - Lack of grease boot will allow contaminants to enter joint and will accelerate wear.
(3) - Torn grease boot will allow contaminants to enter joint and will accelerate wear.
(4) - If manufacturer's procedures for inspection exist, use those procedures; otherwise, use an approved inspection method such as the dry park check.
CAUTION: DO NOT use pliers or pry bar to check ball and socket movement. Use only moderate hand pressure.
(5) - Excessive looseness is defined as being significant enough to affect vehicle handling or structural integrity.
(6) - Check for bent stud or damaged taper hole.
(7) - Check for damaged taper hole.

TRAILING ARMS

TRAILING ARM INSPECTION

Condition	Code		Procedure
Attaching hardware broken	A	...	Require replacement of broken part, if available; otherwise, replace trailing arm.
Attaching hardware loose	A	...	Require repair or replacement of loose part, if available;

			otherwise, replace trailing arm.
Attaching hardware missing	C	..	Require replacement of missing part, if available; otherwise, replace trailing arm.
Attaching hardware threads damaged	A	...	Require repair or replacement of part with damaged threads, if available; otherwise, replace trailing arm.
Attaching hardware threads stripped (threads missing)	A	.....	Require replacement of part with stripped threads, if available; otherwise, replace trailing arm.
Bent	B	.....	Require replacement.
Bushing hole oversized	B	.....	Require replacement.
Corroded, affecting structural integrity	A	.....	Require replacement.
Holes distorted	A	.....	Require replacement.
Threads damaged	A	..	Require repair or replacement.
Threads stripped (threads missing)	A	.....	Require replacement.

WHEEL BEARINGS, RACES AND SEALS

NOTE: When replacing or repacking wheel bearings, grease seal replacement is required. You are not required to replace these components in axle sets. Determine the need to replace based upon the individual component conditions that follow.

WHEEL BEARING, RACE AND SEAL INSPECTION

Condition	Code		Procedure
Rear axle seal on rear-wheel drive leaking	A	.....	Require replacement of seal and inspection of axle, bearing, housing, and vent tube.
Seal bent	1	.....	Suggest replacement.
Seal leaking	A	.	Require replacement of seal and inspection of bearings.
Seal missing	C	.....	Require replacement.
Seal torn	A	.....	Require replacement.
Wheel bearing assembly feels rough when rotated	A	..	Require replacement of bearing assembly.
Wheel bearing balls are pitted	A	..	Require replacement of bearing assembly.
Wheel bearing balls are worn	A	..	Require replacement of bearing assembly.
Wheel bearing end-play exceeds vehicle manufacturer's specifications	B	..	Require adjustment of bearing,

			if possible. If proper adjustment cannot be obtained, require repair or replacement of worn component.
Wheel bearing race is loose in the hub bore	.....	A	..... Require replacement of hub assembly and wheel bearings.
Wheel bearing races are pitted	.....	A	.. Require replacement of bearing assembly.
Wheel bearing races are worn	.....	A	.. Require replacement of bearing assembly.
Wheel bearing rollers are pitted	.....	A	.. Require replacement of bearing assembly.
Wheel bearing rollers are worn	.....	A	.. Require replacement of bearing assembly.

WHEEL ALIGNMENT

WHEEL ALIGNMENT

Wheel alignment is defined as the measurement, analysis, and adjustment of steering and suspension angles to conform to OEM specifications. These angles usually include, but are not limited to: caster, camber, toe, and thrust angle. Where these angles are not adjustable and not in specification, component replacement or correction kits may be required. Errors in set-back and steering axis inclination (SAI) are often attributable to failed or damaged components and must be corrected prior to performing an alignment.

Failure to replace or correct suggested parts or service may prevent a proper alignment.

Before performing an alignment check, inspect and verify the following:

* Tire pressure and size
* Vehicle loading
* Ride height
* Steering and suspension parts

If the inspection reveals that all the above are within published specifications, a wheel alignment check and an alignment, if needed, may be performed.

CAUTION: Under no circumstances should a technician bend or heat any steering or suspension component, unless specified by the vehicle manufacturer, for example, Ford forged twin "I" beam axles. All measurements and specifications must be noted on the inspection report.

WHEEL ALIGNMENT INSPECTION

Condition	Code	Procedure
Dog tracking, shown to be caused by faulty alignment	 2	..... Suggest repair.
Lead, shown to		

be caused by faulty alignment	A	.....	Require alignment.
Part has been changed, affecting alignment	A	.....	Require alignment check.
Pull, shown to be caused by faulty alignment	A	.....	Require alignment.
Steering wheel off-center	2	.....	Suggest alignment.
Tire wear, shown to be caused by faulty alignment	A	.....	Require alignment.
Wander, shown to be caused by faulty alignment	A	.....	Require alignment.

WHEELS AND TIRES

TIRES

These guidelines do not apply to split rims. Some vehicle manufacturers restrict replacement of tires to specific brands, types, or sizes.

WARNING: High pressure temporary compact spare tires should not be used with any other rims or wheels, nor should standard tires, snow tires, wheel covers, or trim rings be used with high pressure compact spare rims or wheels. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death.

WARNING: Only specially trained persons should dismount or mount tires. Explosions of tire and wheel assembly can result from improper mounting, possibly causing serious injury or death.

WARNING: Consult the vehicle owner's manual or vehicle placard for correct size, speed rating, designation, and cold inflation pressure of the original tires. DO NOT exceed the maximum load or inflation capacity of the tire specified by the Tire and Rim Association

WARNING: When replacing tires, it is suggested that the replacement tires match or exceed the OEM speed rating designation. If tires of different speed rating designations are mixed on the same vehicle, the tires may vary in handling characteristics. DO NOT mix different speed rating designations on the same axle.

WARNING: DO NOT mix radials with non-radial tires on the same axle, as this may affect vehicle handling and stability. If radial tires and bias or bias-belted ply tires are mixed on the same vehicle, the radials must be on the rear. High-pressure temporary compact spare tires are exempt from this rule.

WARNING: DO NOT mix size or type (all season, performance, mud and snow) of tires on the same axle.

TIRE INSPECTION

Condition	Code	Procedure
Air pressure incorrect	B	Require repair
Bead broken	A	Require replacement.
Bead leaking, caused by tire	A	Require repair or replacement.
Bead wire/cord exposed	A	Require replacement.
Cord or belt material exposed	A	Require replacement.
Cord ply separations	A	Require replacement.
Directional/asymmetrical tires mounted incorrectly	B	Require remounting and/or repositioning.
Irregular tread wear, affecting performance	2	(1) Suggest replacement.
Load ratings less than OEM specifications	B	Require replacement.
Mixed tread types (all season, performance, mud and snow) on same axle	A	Require replacement.
Number of punctures exceeds manufacturer's limit	B	Require replacement.
Out of balance	B	Require rebalance of tire/wheel assembly.
Ply separation	A	Require replacement.
Pull or lead, caused by tire	A	Require repair or replacement.
Radial and bias or bias-belted ply tires on same axle	B	Require repair or replacement.
Radials are on the front and not on the rear	B	(2) Require repair or replacement.
Run flat damage	A	Require replacement.
Shoulder cut	A	Require replacement.
Shoulder puncture	A	Require replacement.
Shoulder with plug	A	Require replacement.
Sidewall bulge	A	Require replacement.
Sidewall cut	A	Require replacement.
Sidewall indentation	..	No service required or suggested.
Sidewall puncture	A	Require replacement.
Sidewall with plug	A	Require replacement.
Speed rating designations different on same axle	2	Suggest repair or replacement.
Tire and wheel assembly has excessive run-out	B	(3) Require repair or replacement of appropriate part.
Tires with more than 1/4" diameter difference on a four-wheel drive vehicle	B	Require replacement.
Tread area puncture larger in diameter than manufacturer's specifications	B	Require replacement.
Tread missing pieces		

(chunking), exposing cord	A		Require replacement.
Tread missing pieces (chunking), not exposing cord	1		Suggest replacement.
Tread separations	A		Require replacement.
Tube in tubeless tire	3	(4)	Suggest removal of tube.
Weather-checking	..		No service required or suggested.
Worn to tread wear indicators	B		Require replacement.

(1) - Determine and correct cause of irregular tire wear.
(2) - If radials and bias or bias-belted ply tires are on the same vehicle, the radials must be on the rear axle, except for high-pressure temporary spares.
(3) - Excessive is defined as enough to contribute to performance problems. Match mounting may correct run-out. If not, require replacement of appropriate part. Refer to manufacturer's specifications.
(4) - Most manufacturers do not recommend tubes in tubeless tires. Inspect tire and wheel assembly to determine the reason for a tube in tubeless tire. Recommendation for repair or replacement should be based upon condition of tires and/or wheel listed in these guidelines.

VALVE STEMS

VALVE STEM INSPECTION

Condition	Code	Procedure
Bent	1	Suggest replacement.
Broken	A	Require replacement.
Cut, but not leaking	1	Suggest replacement.
Deteriorated (cracking, dry rot)	1	Suggest replacement.
Leaking	A	Require repair or replacement.
Missing	C	Require replacement.
Threads damaged	A	Require repair or replacement.
Threads stripped	A	Require replacement.
Valve cap missing	C	Require replacement of cap.
Weather-checking	1	Suggest replacement.
Won't take air	A	Require repair or replacement.

WHEEL ATTACHMENT HARDWARE

For conditions noted below, also check conditions of wheel stud holes.

CAUTION: Proper lug nut torque is essential. Follow recommended torque specifications and tightening sequence. DO NOT lubricate threads unless specified by the vehicle manufacturer.

WHEEL ATTACHMENT HARDWARE INSPECTION

Condition	Code		Procedure
Bent	A		Require replacement.
Broken	A	(1)	Require replacement.

Condition	Code	Procedure
Loose	B	Require repair or replacement of affected component.
Lug nut installed backward	B	Require repair or replacement.
Lug nut mating type incorrect	B	Require replacement of nut.
Lug nut mating surface dished	A	Require replacement of nut.
Lug nut rounded	A	(2) Require replacement of nut.
Lug nut seized	A	(2) Require replacement of nut.
Stud incorrect	B	Require replacement of stud.
Threads damaged	A	Require repair or replacement of component with damaged threads.
Threads stripped	A	Require replacement of component with stripped threads.

(1) - Some manufacturers require replacement of all studs on that wheel if two or more studs or nuts on the same wheel are broken or missing.
(2) - Only required if removing wheel.

WHEELS (RIMS)

WARNING: Mounting a regular tire on a high-pressure compact spare wheel is not permitted. Attempting to mount a tire of one diameter on a wheel of a different diameter or flange type may result in serious injury or death. If the wheel identification stamp is not legible, or cannot be found, do not use the wheel until the size and type have been properly identified. Wheels of different diameter, offset, or width cannot be mixed on the same axle. Bead seat tapers cannot be interchanged.

WHEEL (RIM) INSPECTION

Condition	Code	Procedure
Bead leaking, caused by wheel	A	(1) Require repair or replacement.
Bent hub mounting surface	A	Require replacement.
Bent rim, causing vibration	2	(1) Suggest replacement.
Broken	A	Require replacement.
Cast wheel porous, causing a leak	A	Require repair or replacement.
Clip-on balance weight is incorrect type for rim flange	2	Suggest replacement.
Corrosion, affecting structural integrity	A	Require replacement.
Corrosion build-up on wheel mounting surface	A	Require repair.
Cracked	A	Require replacement.
Directional/asymmetrical wheels mounted incorrectly	B	Require remounting and/or repositioning.

Load capacity less than OEM specifications	B	.....	Require replacement.
Offset mismatched on same axle	B	.....	Require replacement.
Rivets leaking	A	.....	Require replacement.
Run-out beyond OEM specs	B	.....	Require replacement.
Stud holes elongated	A	..... (2)	Require replacement.
Welded or brazed repair	2	.....	Suggest replacement.
Welds leaking	A	.....	Require replacement.
Wheel centering (pilot) hole incorrect	B	.....	Require replacement.

(1) - CAUTION: DO NOT attempt to correct a bent rim.
(2) - Inspect wheel attaching hardware for damage.

* SYMPTOM CHECK LIST *

1997-99 Mitsubishi Montero Sport

SYMPTOM CHECK LIST WORKSHEETS

* PLEASE READ THIS FIRST *

NOTE: This article is intended for general information purposes only. It does not apply specifically to one make or model.

PURPOSE

Why Use the Symptom Check List Worksheets?

One of the most difficult and critical lines of communication is between the service customer and the technician. The clearer the technician understands the customer's concerns, the more likely the problem will be "fixed right the first time".

The Symptom Check List Worksheets in this article are designed to improve this communication. When used consistently, they can be helpful in reducing shop comebacks, increasing technician productivity, and producing satisfied customers. They also provide other benefits:

* Reduce "No Trouble Found" problems
* Increase customer involvement
* Customer perceive that "they really care and listen"
* Save time during peak write-up periods
* Reduce recontacting customers for additional information
* Improve night drop information
* Insure all the right questions are asked at write-up

Making the Worksheets a Part of Your Normal Routine

The following information contains ideas that may be helpful in forming habits that promote daily use of the Symptom Check Lists:

* HAVE THE SERVICE ADVISER FILL OUT THE FORM(S) WITH THE CUSTOMER WHENEVER POSSIBLE.
* Place them in your night drop for the customer to fill out, along with an instruction sheet to help them understand what to do.
* Hand out the worksheets to customers while they wait in line during the peak morning rush and ask them to fill it out. It will save time for all concerned and improve the quality of information received from the customer.
* Make sure it is attached to the hard copy when it goes to the technician.
* Place a copy with the final repair papers and review it with the customer at delivery.
* Put a new worksheet in the glovebox of all departing customers.
* Require that you personally see a copy of all worksheets filled out for shop comebacks.
* Hold a shop meeting to get employee buy-in and their ideas on how to make it effective in your shop.

There are many other ways to utilize the concept, but as with every other idea, successful implementation depends on employee involvement and buy-in.

SYMPTOM CHECK LIST WORKSHEETS

CONDENSED VERSION - ALL ON ONE PAGE

NOTE: Have the service adviser fill out this form with the customer whenever possible.

DRIVEABILITY WORKSHEET

(To Be Filled Out By Vehicle Owner)

Name: _____ **Date:** _____ **Make:** _____

Model: _____ **Year:** _____ **Engine:** _____ **Mileage:** _____

FAULT CHARACTERISTICS - SYMPTOMS - DESCRIPTION OF PROBLEM (Please Check All That Apply In All Categories)

Starting Problems	☐ Will Not Crank ☐ Cranks, But Won't Start ☐ Starts, But Takes A Long Time
Engine Quits/ Running Problems	**Quits:** ☐ Right After Starting ☐ When Put Into Gear ☐ Right After Vehicle Comes To A Stop ☐ During Steady Speed Driving ☐ While Idling ☐ During Acceleration ☐ When Parking
Poor Idling Conditions	**Idle Speed:** ☐ Is Too Slow At All Times ☐ Is Too Slow With A/C On ☐ Is Too Fast ☐ Is Rough Or Uneven ☐ Fluctuates Up and Down
Poor Running Conditions	☐ Runs Rough ☐ Lacks Power ☐ Hesitates Or Stumbles On Acceleration ☐ Bucks and Jerks ☐ Engine Knocks, Pings, Rattles ☐ Backfires ☐ Poor Fuel Economy ☐ Misfires or Cuts Out ☐ Surges and/or Chuggles ☐ Dieseling or Run-On ☐ Engine Light Always On ☐ Engine Light On Sometimes ☐ Fuel, Gas, or Sulfur Smell
Auto. Transmission Problems	☐ Improper Shifting (early/late) ☐ Changes Gear Randomly On Its Own ☐ Vehicle Does Not Move When In Gear
Poor Handling	☐ Pulls To One Side ☐ Hard Steering ☐ Vehicle Shakes and/or Vibrates While Moving
Noise Problems	**Explain:**
Odor Problems	**Explain:**
Problem Frequency	☐ Always ☐ Often ☐ Occasionally
Usually Occurs	☐ Morning ☐ Afternoon ☐ Anytime
Engine Temp.	☐ Cold ☐ Warm ☐ Hot
Vehicle Speed	☐ Low ☐ Cruising ☐ High
Driving Conditions During Occurrence	☐ Short - Less Than 2 Miles ☐ 2-10 Miles ☐ Long - More Than 10 Miles ☐ Stop & Go ☐ While Turning ☐ While Braking ☐ At Gear Engagement ☐ With A/C Operating ☐ With Headlights On ☐ During Acceleration ☐ During Deceleration ☐ Mostly Downhill ☐ Mostly Uphill ☐ Mostly Level ☐ Mostly Curvy ☐ Rough Road
Driving Habits	☐ Drive Hard Before Engine Is Warmed ☐ Allow Engine To Warm ☐ Mostly City Driving ☐ Highway ☐ Park Vehicle Inside ☐ Outside **Drive Per Day:** ☐ Less Than 10 Miles ☐ 10-50 ☐ More Than 50 **Fuel Octane:** ☐ 87 ☐ 89 ☐ 91 ☐ More Than 91 **Brand:** _____ ☐ Gasohol ☐ Propane Conversion
Outside Weather	☐ Cold ☐ Warm ☐ Hot ☐ Wet/Rainy ☐ Fog ☐ Snow/Hail ☐ Dust/Dirt ☐ Dry ☐ Humid

Fig. 1: Entire Vehicle - Symptom Check List For Customer

FULL VERSION - ALL ON FOUR PAGES

NOTE: Have the service adviser fill out these forms with the

customer whenever possible.

Dear Valued Customer:
Our goal is to fix your problem correctly and get you back on the road as soon as possible in the unlikely event you experience a problem with your vehicle. Help us identify the exact nature of the concern by taking a few moments to complete the appropriate section of this diagnostic worksheet. Thank you.

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO.:**

DIAGNOSTIC WORKSHEET

DRIVEABILITY - ENGINE - AUTOMATIC TRANSMISSION

SYMPTOM (CHECK ALL THAT APPLY)
ENGINE

- ☐ "Service Engine Soon"/"Malfunction Indicator Light" on
- ☐ Hard start/no start (cranks OK)
- ☐ Won't crank
- ☐ Engine stalls
- ☐ Engine miss
- ☐ Miss while driving
- ☐ Hesitates, stumbles or sags
- ☐ Rough idle
- ☐ Idle is too high ☐ Idle is too low
- ☐ Poor power/performance
- ☐ Surge or chuggle, buck - jerk - skip
- ☐ Poor gas mileage ☐ Highway ☐ City
- ☐ Pings, detonates
- ☐ Suphur, rotten egg odor
- ☐ Backfires (popping noise) - underhood/tailpipe
- ☐ Exhaust smoke ☐ Increased oil consumption
- ☐ Runs on after key is turned off
- ☐ Speed fluctuates without moving accelerator
- ☐ Engine noise (explain): _____

(whine, rattle, groan, clunk, etc.)

- ☐ Other _____

TRANSMISSION

- ☐ Does not shift properly ☐ Hard shift
- ☐ Will not shift ☐ Up ☐ Down
- ☐ Will not shift into overdrive
- ☐ Engine starts in other than "P" or "N"
- ☐ Noise (describe): _____

(whine, rattle, groan, clunk, buzz, etc.)

- ☐ Shifts into gear too early
- ☐ Overdrive doesn't work with speed control, but is otherwise OK
- ☐ Highway speed - shudder, surge, etc
- ☐ Other: _____

EXPLAIN: _____

OPERATING CONDITIONS (CHECK ALL THAT APPLY)
HOW OFTEN DOES IT OCCUR? (Engine and/or Transmission)

- ☐ Always ☐ Few seconds ☐ Few minutes
- ☐ Few hours ☐ Few days ☐ Few weeks
- ☐ Few months ☐ Variable ☐ Only during event
- ☐ Every _____ to ___ miles ☐ Unknown
- ☐ Other (explain): _____
- ☐ Just started ☐ Getting better ☐ Getting worse
- ☐ Since new

WHEN DOES IT OCCUR? (Engine and/or Transmission)
When Engine Temperature is:

- ☐ Cold ☐ Warm ☐ Hot
- ☐ All the time ☐ Only during warmup

Weather Conditions:

- ☐ Very cold - below 0 degrees F ☐ Cold - 0 to 32 degrees F
- ☐ Cool - 32 to 60 degrees F ☐ Warm - 60 to 80 degrees F
- ☐ Hot - Above 80 degrees F ☐ Any environment
- ☐ Raining ☐ Dry ☐ Humid
- ☐ Snow/Ice ☐ Wet roads ☐ Other (explain below)

Driving Conditions:

- ☐ Light throttle ☐ Medium throttle ☐ Hard throttle
- ☐ Starting ☐ At idle ☐ Decelerating
- ☐ Over bumps ☐ When shifting ☐ While turning
- ☐ Cruising steady at _____ MPH ☐ While braking
- ☐ Anytime ☐ Uphill ☐ Downhill
- ☐ Highway ☐ City/town ☐ Stop and go
- ☐ Between _____ MPH and _____ MPH
- ☐ Only with A/C or Defrost on

What Type of Fuel? **What Brand?** _____

- ☐ Regular UL ☐ Mid range UL ☐ Premium Unleaded
- ☐ Gasohol ☐ Ethanol ☐ Methanol
- ☐ Diesel #1 ☐ Diesel #2 ☐ Various brands

When Gear Selector is in:

- ☐ Park/Neutral ☐ Reverse ☐ Overdrive
- ☐ Drive/3 ☐ Drive/2 ☐ Drive/1

Between Gears:

- ☐ Park to R or D ☐ Rev/Drive ☐ First/Second
- ☐ Second/Third ☐ Third/Overdrive

50G15061

Fig. 2: Symptom Check List - Page 1

BRAKES - STEERING - SUSPENSION

SYMPTOM

- ☐ Vehicle pulls right - When _____
- ☐ Vehicle pulls left - When _____
- ☐ Steering wheel vibrates at ____ MPH
- ☐ Excessive play in steering
- ☐ Erratic steering when braking
- ☐ Poor steering wheel return after cornering
- ☐ Suspension bottoms out
- ☐ Leans or sways in corners
- ☐ Brake light on
- ☐ Traction control light on
- ☐ Uneven tire wear
- ☐ Sits uneven
- ☐ "Dog" tracks
- ☐ ABS light on
- ☐ Soft ride

Hard to steer

- ☐ Effort
- ☐ Wanders
- ☐ Steering wheel off center

Shimmy/vibration (check box below for location)

- ☐ Front
- ☐ Rear
- ☐ Don't know
- ☐ Seat
- ☐ Floor
- ☐ Other _____

Brake pedal

- ☐ Noise
- ☐ Pulses
- ☐ Squeaks
- ☐ Hard
- ☐ Mushy
- ☐ Excessive travel

WHEN DOES IT OCCUR?

- ☐ Cold days
- ☐ Hot days
- ☐ Wet/rain
- ☐ All the time
- ☐ Intermittent
- ☐ Parking manuevers
- ☐ At road speed
- ☐ Accelerating
- ☐ Decelerating

EXPLAIN: _____

SQUEAK - RATTLE - NOISE CONDITIONS

AREA OF NOISE

☐ Engine Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Front Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Passenger Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Instrument Panel	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Doors	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear seat area	☐ Console	☐ Other _____		

NOISE SOUNDS LIKE

- ☐ Knocks
- ☐ Hard metal
- ☐ Light metal
- ☐ Roars
- ☐ Ticking
- ☐ Whine
- ☐ Squeaks
- ☐ Rattles
- ☐ Scraping
- ☐ Other _____

HOW OFTEN DOES IT OCCUR?

- ☐ Continuous
- ☐ Often
- ☐ Intermittent
- ☐ Just started
- ☐ Since new

WHEN DOES IT OCCUR?

- ☐ All the time
- ☐ Speed
- ☐ RPM
- ☐ Only moving
- ☐ On turns
- ☐ Braking
- ☐ Hard throttle
- ☐ Light throttle
- ☐ Decelerate
- ☐ Steady speed
- ☐ Idle in gear
- ☐ Idle out of gear
- ☐ Hot days
- ☐ Cold days
- ☐ Humid or rainy
- ☐ Temperature _____
- ☐ Heavy bumps
- ☐ Light bumps
- ☐ Smooth pavement

EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:

VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50H15062

Fig. 3: Symptom Check List - Page 2

AIR CONDITIONING - HEATER - VENTILATION

SYSTEM OR AREA AFFECTED

☐ Air conditioner ☐ Heater ☐ Defroster ☐ Vent ☐ Bi-Level ☐ Fan/blower
☐ Max A/C ☐ Automatic Temperature Control ☐ Mix/blend ☐ Economy ☐ All

SYMPTOM

☐ Does not work ☐ Blows wrong temperature air ☐ No air comes out of vents ☐ Rapid cycling
☐ Noisy (explain) ☐ Broken ☐ Odor ☐ Air comes from wrong outlets ☐ Blows fuse
☐ Leaks ☐ Insufficient heat or cool ☐ Other (explain below)

WHEN DOES IT OCCUR?

☐ All the time ☐ Hot ☐ Cold ☐ Intermittent ☐ Right after startup
☐ When change controls only ☐ Other (explain below) ☐ Fan blower speed High / Med / Low

EXPLAIN: _____

_____

ELECTRICAL - RADIO - TAPE/CD PLAYER

SYMPTOM - MUSIC SYSTEM

☐ Does not work ☐ Noisy ☐ Static ☐ Won't load ☐ Won't eject ☐ Poor reception
☐ Controls do not work ☐ Blows fuse ☐ Other (explain below)

SYSTEM AFFECTED

☐ Radio only ☐ AM ☐ FM ☐ FM stereo ☐ Graphic equalizer
☐ Tape player ☐ CD player ☐ Whole system ☐ Steering wheel buttons ☐ Phone
☐ Speakers ☐ Front ☐ Rear ☐ Left ☐ Right
☐ Antenna ☐ Clock ☐ Radio or player controls ☐ Rear seat controls

ALL OTHER ELECTRICAL ITEMS OR ACCESSORIES
Please list the complaint accessory or item and check any applicable symptom(s) from the list that follows:

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)

WHEN DOES IT OCCUR? ☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

☐ All the time ☐ Hot ☐ Cold ☐ Just after starting - malfunctions for a while
☐ Intermittent ☐ After runs for _____ minutes ☐ Rough roads or bumps only
☐ Other (explain below)

EXPLAIN: _____

_____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50115063

Fig. 4: Symptom Check List - Page 3

WATER LEAK - WINDNOISE

WATER LEAK
Leak Occurs When?

☐ Setting level ☐ Any time it rains ☐ While driving in the rain ☐ Car wash only
☐ Back lower than front (facing uphill) ☐ Front lower than back (facing downhill)

Location of Leak (where water appears):

☐ LF Door ☐ RF Door ☐ LR Door ☐ RR Door ☐ Windshield ☐ Rear window
☐ LF window ☐ RF window ☐ LR window ☐ RR window ☐ Side door ☐ Sunroof/T-Top
☐ Under instrument panel ☐ Rear door/rear hatch

WINDNOISE:
Location:

☐ LF Door ☐ RF Door ☐ LR Door ☐ RR Door ☐ Windshield ☐ Rear window
☐ LF window ☐ RF window ☐ LR window ☐ RR window ☐ Side door ☐ Sunroof/T-Top
☐ Under instrument panel ☐ Rear door/rear hatch

EXPLAIN: _____

MANUAL TRANSMISSION - CLUTCH

SYMPTOM - MANUAL GEAR SHIFT

☐ Hard to shift ☐ Doesn't shift
☐ Grinds going into____ gear
☐ Noisy when in _____ gear or neutral ____
☐ Slips/pops out of gear
☐ Noise (describe): _____

☐ Upshift light stays on
☐ Upshift light doesn't light

WHEN DOES IT OCCUR?

☐ All the time ☐ Light load
☐ Heavy load

SYMPTOM - CLUTCH

☐ Hard to push ☐ Fail to release
☐ Noise when pressing pedal down (describe) _____

☐ Slips ☐ Chattering (grabbing)
☐ Odor present ☐ Pedal stays on the floor
☐ Squealing sound

WHEN DOES IT OCCUR?
When Engine Temperature is:

☐ Cold ☐ Hot
☐ Accelerating ☐ Decelerating

EXPLAIN: _____

COMMENTS:

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50J15064

Fig. 5: Symptom Check List - Page 4

INDIVIDUAL SYSTEM-BASED CHECK LISTS

NOTE: Have the service adviser fill out these forms with the customer whenever possible.

DRIVEABILITY - ENGINE - AUTOMATIC TRANSMISSION

SYMPTOM (CHECK ALL THAT APPLY)
ENGINE

- ☐ "Service Engine Soon"/Malfunction Indicator Light" on
- ☐ Hard start/no start (cranks OK)
- ☐ Won't crank
- ☐ Engine stalls
- ☐ Engine miss
- ☐ Miss while driving
- ☐ Hesitates, stumbles or sags
- ☐ Rough idle
- ☐ Idle is too high ☐ Idle is too low
- ☐ Poor power/performance
- ☐ Surge or chuggle, buck - jerk - skip
- ☐ Poor gas mileage ☐ Highway ☐ City
- ☐ Ping, detonates
- ☐ Sulphur/rotten egg odor
- ☐ Backfires (popping noise) - underhood/tailpipe
- ☐ Exhaust smoke ☐ Increased oil consumption
- ☐ Runs on after key is turned off
- ☐ Speed fluctuates without moving accelerator
- ☐ Engine noise (explain): _____

(whine, rattle, groan, clunk, etc.)

- ☐ Other: _____

TRANSMISSION

- ☐ Does not shift properly ☐ Hard shift
- ☐ Will not shift ☐ Up ☐ Down
- ☐ Will not shift into overdrive
- ☐ Engine starts in other than "P" or "N"
- ☐ Noise (describe). _____

(whine, rattle, groan, clunk, buzz, etc.)

- ☐ Shifts into next gear too early
- ☐ Overdrive doesn't work with speed control, but is otherwise OK
- ☐ Highway speed - shudder, surge, etc.
- ☐ Other: _____

EXPLAIN: _____

OPERATING CONDITIONS (CHECK ALL THAT APPLY)
HOW OFTEN DOES IT OCCUR? (Engine &/or Transmission)

- ☐ Always ☐ Few Seconds ☐ Few minutes
- ☐ Few hours ☐ Few days ☐ Few weeks
- ☐ Few months ☐ Variable ☐ Only during event
- ☐ Every _____ to ____ miles ☐ Unknown
- ☐ Other (explain): _____
- ☐ Just started ☐ Getting better ☐ Getting worse
- ☐ Since new

WHEN DOES IT OCCUR? (Engine and/or Transmission)
When Engine Temperature is:

- ☐ Cold ☐ Warm ☐ Hot
- ☐ All the time ☐ Only during warmup

Weather Conditions:

- ☐ Very cold - below 0°F ☐ Cold - 0 to 32°F
- ☐ Cool - 32 to 60°F ☐ Warm - 60 to 80°F
- ☐ Hot - above 80°F ☐ Any environment
- ☐ Raining ☐ Dry ☐ Humid
- ☐ Snow/Ice ☐ Wet roads
- ☐ Other (explain): _____

Driving Conditions:

- ☐ Light throttle ☐ Medium throttle ☐ Hard throttle
- ☐ Starting ☐ At idle ☐ Decelerating
- ☐ Over bumps ☐ When shifting ☐ While turning
- ☐ Cruising - steady at MPH ☐ While braking
- ☐ Anytime ☐ Uphill ☐ Downhill
- ☐ Highway ☐ City/town ☐ Stop and go
- ☐ Between ___ MPH and ___ MPH
- ☐ Only with A/C or Defrost on

What Type of Fuel? What Brand?

- ☐ Regular UL ☐ Midrange UL ☐ Premium UL
- ☐ Gasohol ☐ Ethanol ☐ Methanol
- ☐ Diesel #1 ☐ Diesel #2 ☐ Various brands

When Gear Selector is in:

- ☐ Park/Neutral ☐ Reverse ☐ Overdrive
- ☐ Drive/3 ☐ Drive/2 ☐ Drive/1

Between Gears:

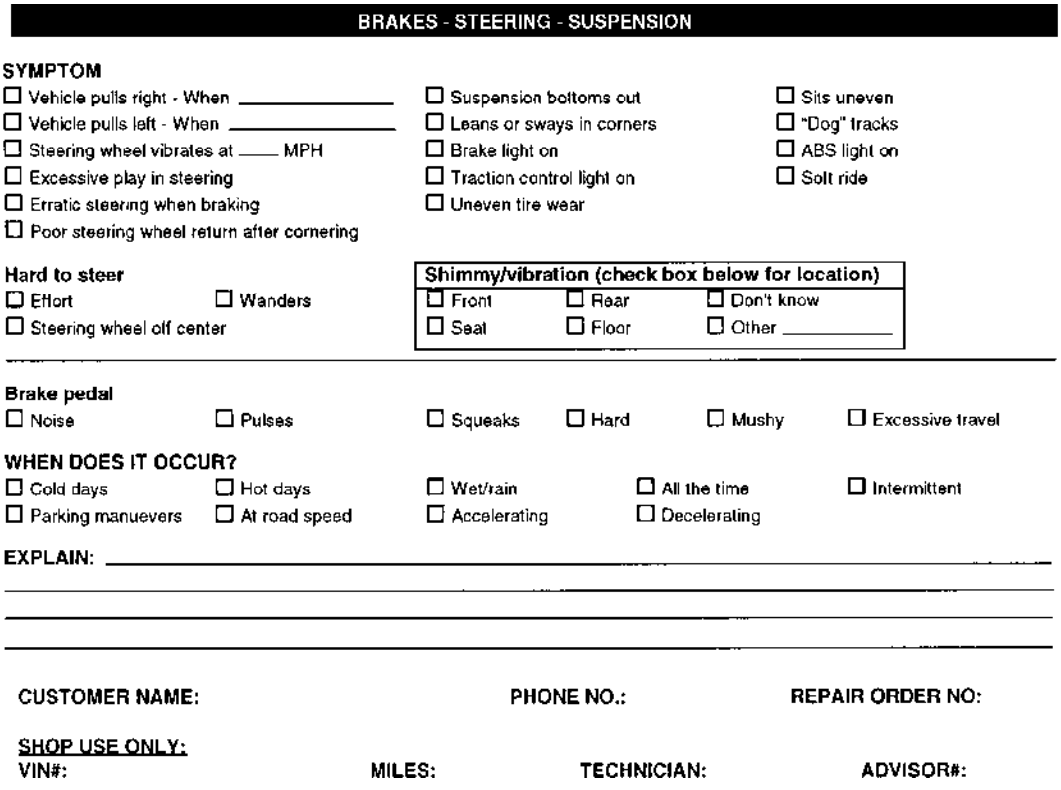
- ☐ Park to R or D ☐ Reverse/Drive ☐ First/Second
- ☐ Second/Third ☐ Third/Overdrive

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50H15054

Fig. 6: Engine Driveability & Automatic Transmission



BRAKES - STEERING - SUSPENSION

SYMPTOM

- ☐ Vehicle pulls right - When _____
- ☐ Vehicle pulls left - When _____
- ☐ Steering wheel vibrates at ____ MPH
- ☐ Excessive play in steering
- ☐ Erratic steering when braking
- ☐ Poor steering wheel return after cornering
- ☐ Suspension bottoms out
- ☐ Leans or sways in corners
- ☐ Brake light on
- ☐ Traction control light on
- ☐ Uneven tire wear
- ☐ Sits uneven
- ☐ "Dog" tracks
- ☐ ABS light on
- ☐ Soft ride

Hard to steer

- ☐ Effort
- ☐ Wanders
- ☐ Steering wheel off center

Shimmy/vibration (check box below for location)

- ☐ Front
- ☐ Rear
- ☐ Don't know
- ☐ Seat
- ☐ Floor
- ☐ Other _____

Brake pedal

- ☐ Noise
- ☐ Pulses
- ☐ Squeaks
- ☐ Hard
- ☐ Mushy
- ☐ Excessive travel

WHEN DOES IT OCCUR?

- ☐ Cold days
- ☐ Hot days
- ☐ Wet/rain
- ☐ All the time
- ☐ Intermittent
- ☐ Parking manuevers
- ☐ At road speed
- ☐ Accelerating
- ☐ Decelerating

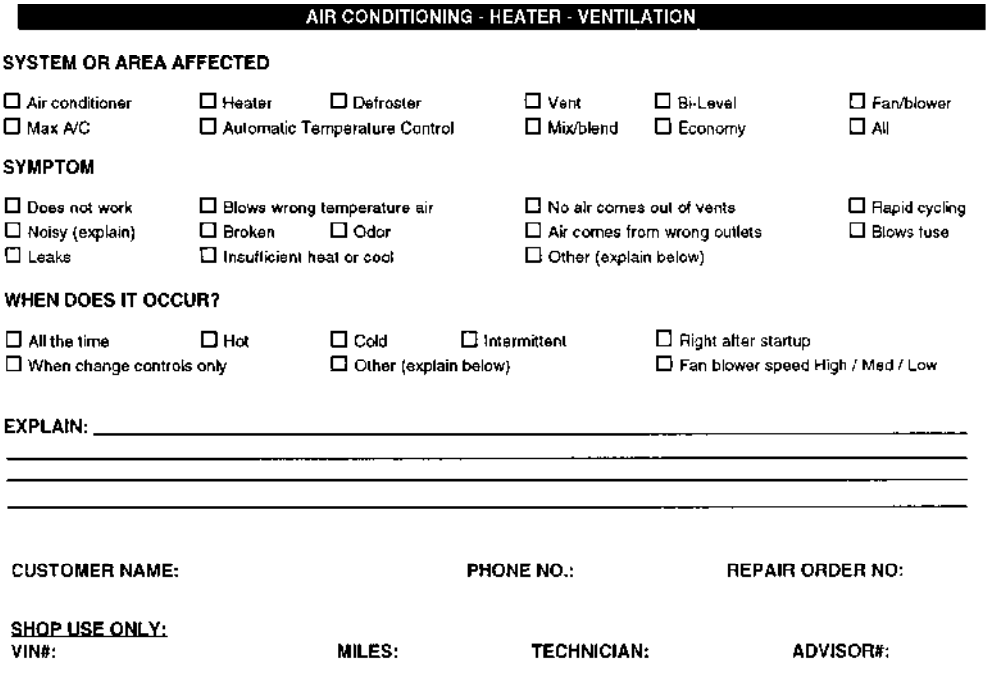
EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50C15059

Fig. 7: Brakes, Steering, & Suspension



AIR CONDITIONING - HEATER - VENTILATION

SYSTEM OR AREA AFFECTED

- ☐ Air conditioner
- ☐ Heater
- ☐ Defroster
- ☐ Vent
- ☐ Bi-Level
- ☐ Fan/blower
- ☐ Max A/C
- ☐ Automatic Temperature Control
- ☐ Mix/blend
- ☐ Economy
- ☐ All

SYMPTOM

- ☐ Does not work
- ☐ Blows wrong temperature air
- ☐ No air comes out of vents
- ☐ Rapid cycling
- ☐ Noisy (explain)
- ☐ Broken
- ☐ Odor
- ☐ Air comes from wrong outlets
- ☐ Blows fuse
- ☐ Leaks
- ☐ Insufficient heat or cool
- ☐ Other (explain below)

WHEN DOES IT OCCUR?

- ☐ All the time
- ☐ Hot
- ☐ Cold
- ☐ Intermittent
- ☐ Right after startup
- ☐ When change controls only
- ☐ Other (explain below)
- ☐ Fan blower speed High / Med / Low

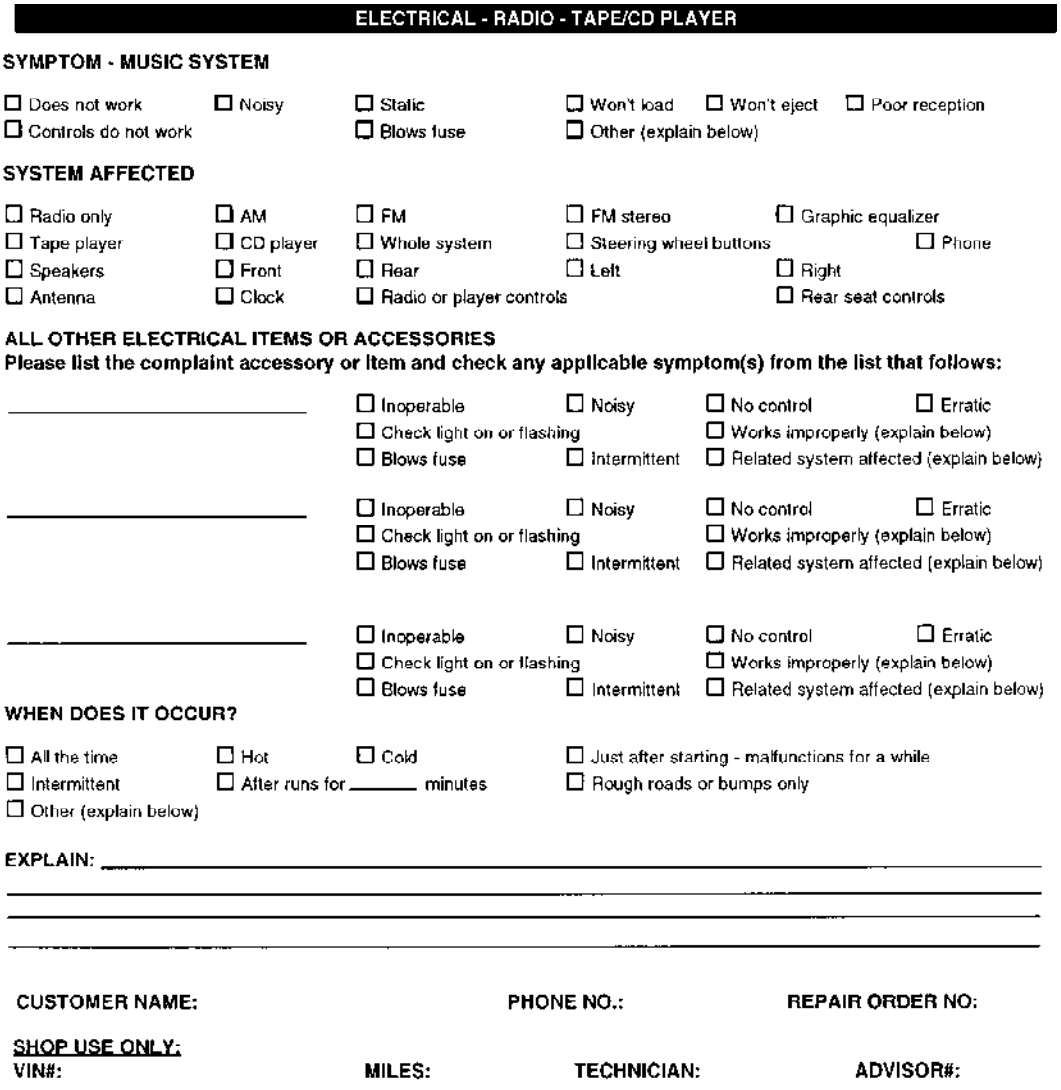
EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50A15057

Fig. 8: Air Conditioning, Heater & Ventilation



ELECTRICAL - RADIO - TAPE/CD PLAYER

SYMPTOM - MUSIC SYSTEM

☐ Does not work ☐ Noisy ☐ Static ☐ Won't load ☐ Won't eject ☐ Poor reception
☐ Controls do not work ☐ Blows fuse ☐ Other (explain below)

SYSTEM AFFECTED

☐ Radio only ☐ AM ☐ FM ☐ FM stereo ☐ Graphic equalizer
☐ Tape player ☐ CD player ☐ Whole system ☐ Steering wheel buttons ☐ Phone
☐ Speakers ☐ Front ☐ Rear ☐ Left ☐ Right
☐ Antenna ☐ Clock ☐ Radio or player controls ☐ Rear seat controls

ALL OTHER ELECTRICAL ITEMS OR ACCESSORIES
Please list the complaint accessory or item and check any applicable symptom(s) from the list that follows:

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

_____ ☐ Inoperable ☐ Noisy ☐ No control ☐ Erratic
☐ Check light on or flashing ☐ Works improperly (explain below)
☐ Blows fuse ☐ Intermittent ☐ Related system affected (explain below)

WHEN DOES IT OCCUR?

☐ All the time ☐ Hot ☐ Cold ☐ Just after starting - malfunctions for a while
☐ Intermittent ☐ After runs for _____ minutes ☐ Rough roads or bumps only
☐ Other (explain below)

EXPLAIN: _____

CUSTOMER NAME: PHONE NO.: REPAIR ORDER NO:

SHOP USE ONLY:
VIN#: MILES: TECHNICIAN: ADVISOR#:

50B15058

Fig. 9: Electrical, Radio & Tape/CD Player

MANUAL TRANSMISSION - CLUTCH

SYMPTOM - MANUAL GEAR SHIFT

- ☐ Hard to shift
- ☐ Doesn't shift
- ☐ Grinds going into____ gear
- ☐ Noisy when in _____ gear or neutral ____
- ☐ Slips/pops out of gear
- ☐ Noise (describe): _____
- ☐ Upshift light stays on
- ☐ Upshift light doesn't light

WHEN DOES IT OCCUR?

- ☐ All the time
- ☐ Light load
- ☐ Heavy load

SYMPTOM - CLUTCH

- ☐ Hard to push
- ☐ Fail to release
- ☐ Noise when pressing pedal down (describe): _____
- ☐ Slips
- ☐ Chattering (grabbing)
- ☐ Odor present
- ☐ Pedal stays on the floor
- ☐ Squealing sound

WHEN DOES IT OCCUR?
When Engine Temperature is:

- ☐ Cold
- ☐ Hot
- ☐ Accelerating
- ☐ Decelerating

EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50J15056

Fig. 10: Manual Transmission & Clutch

SQUEAK - RATTLE - NOISE CONDITIONS

AREA OF NOISE

☐ Engine Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Front Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear Suspension	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Passenger Compartment	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Instrument Panel	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Doors	☐ Left	☐ Right	☐ Center	☐ Don't know
☐ Rear seat area	☐ Console	☐ Other _____		

NOISE SOUNDS LIKE

☐ Knocks	☐ Hard metal	☐ Light metal	☐ Roars	☐ Ticking	☐ Whine
☐ Squeaks	☐ Rattles	☐ Scraping	☐ Other _____		

HOW OFTEN DOES IT OCCUR?

☐ Continuous	☐ Often	☐ Intermittent	☐ Just started	☐ Since new

WHEN DOES IT OCCUR?

☐ All the time	☐ Speed	☐ RPM	☐ Only moving	☐ On turns	☐ Braking
☐ Hard throttle	☐ Light throttle	☐ Decelerate	☐ Steady speed	☐ Idle in gear	☐ Idle out of gear
☐ Hot days	☐ Cold days	☐ Humid or rainy	☐ Temperature _____		
☐ Heavy bumps	☐ Light bumps	☐ Smooth pavement			

EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50F15060

Fig. 11: Squeak, Rattle, & Noise Conditions

WATER LEAK - WINDNOISE

WATER LEAK
Leak Occurs When?

☐ Setting level	☐ Any time it rains	☐ While driving in the rain	☐ Car wash only
☐ Back lower than front (facing uphill)		☐ Front lower than back (facing downhill)	

Location of Leak (where water appears):

☐ LF Door	☐ RF Door	☐ LR Door	☐ RR Door	☐ Windshield	☐ Rear window
☐ LF window	☐ RF window	☐ LR window	☐ RR window	☐ Side door	☐ Sunroof/T-Top
☐ Under instrument panel			☐ Rear door/rear hatch		

WINDNOISE:
Location:

☐ LF Door	☐ RF Door	☐ LR Door	☐ RR Door	☐ Windshield	☐ Rear window
☐ LF window	☐ RF window	☐ LR window	☐ RR window	☐ Side door	☐ Sunroof/T-Top
☐ Under instrument panel			☐ Rear door/rear hatch		

EXPLAIN: _____

CUSTOMER NAME: **PHONE NO.:** **REPAIR ORDER NO:**

SHOP USE ONLY:
VIN#: **MILES:** **TECHNICIAN:** **ADVISOR#:**

50I15055

Fig. 12: Water Leak & Wind Noise

I - SYSTEM/COMPONENT TESTS - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - System & Component Testing

Montero Sport - 2.4L

INTRODUCTION

NOTE: Testing individual components does not isolate shorts or opens. Perform all voltage tests using a Digital Volt-Ohmmeter (DVOM) with minimum 10-megohm input impedance, unless stated otherwise in test procedure. Use ohmmeter to isolate wiring harness shorts or opens. Testing procedures not covered in this article require a scan tool. See G - TESTS W/CODES - 2.4L article.

Before testing separate components or systems, perform procedures in F - BASIC TESTING - 2.4L article. Since many computer-controlled and monitored components set a diagnostic trouble code if they malfunction, also perform procedures in G - TESTS W/CODES - 2.4L article.

COMPUTERIZED ENGINE CONTROLS

CONTROL UNIT

NOTE: For Powertrain Control Module (PCM) location, see POWERTRAIN CONTROL MODULE (PCM) LOCATION table. To identify PCM power and ground terminals, see appropriate pin voltage chart in J - PIN VOLTAGE CHARTS - 2.4L article. To identify PCM power and ground circuits, see appropriate wiring diagram in L - WIRING DIAGRAMS - 2.4L article.

Ground Circuits

1) Turn ignition off. Using an ohmmeter, check continuity between chassis ground and PCM ground terminal(s). See Fig. 1. Ohmmeter should indicate zero ohms. If reading is not as specified, check and repair open circuit between PCM connector and chassis ground. If reading is as specified, go to next step.

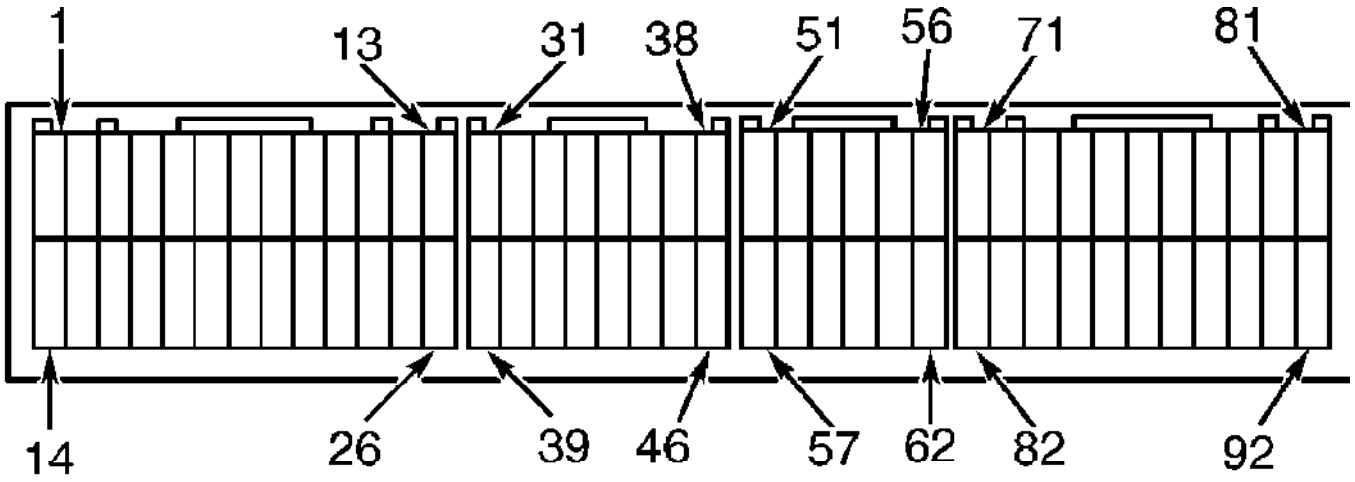
2) Connect voltmeter negative lead to chassis ground. Connect positive lead to PCM ground terminal(s). With engine running, voltmeter should indicate less than one volt. If reading is more than one volt, check for open, corrosion or loose connection in ground circuit.

Power Circuits

Turn ignition on. Check for battery voltage on both PCM power terminals. See Fig. 1. If battery voltage is not present, check operation of MFI relay. See RELAYS under MOTORS, RELAYS & SOLENOIDS.

POWERTRAIN CONTROL MODULE (PCM) LOCATION TABLE

Application	Location
Montero Sport	Behind Right Side Of Instrument Panel (Glove Box)



96C09836
Fig. 1: Identifying PCM Terminals
Courtesy of Mitsubishi Motor Sales of America.

ENGINE SENSORS & SWITCHES

NOTE: For circuit identification, see appropriate wiring diagram in L - WIRING DIAGRAMS - 2.4L article.

Automatic Transaxle/Transmission Range Switch Or Park Neutral Position Switch
See G - TESTS W/CODES - 2.4L article.

Barometric Pressure Sensor
Sensor is a part of volume airflow sensor assembly. See G - TESTS W/CODES - 2.4L article.

Closed Throttle Position Switch
Switch is part of throttle position sensor. See CLOSED THROTTLE POSITION (TP) SWITCH or THROTTLE POSITION (TP) SENSOR in G - TESTS W/CODES - 2.4L article.

Engine Coolant Temperature Sensor
See G - TESTS W/CODES - 2.4L article.

Heated Oxygen Sensor
See G - TESTS W/CODES - 2.4L article.

Intake Air Temperature Sensor
Sensor is a part of volume airflow sensor assembly. See G - TESTS W/CODES - 2.4L article.

Manifold Absolute Pressure Sensor
See G - TESTS W/CODES - 2.4L article.

Manifold Differential Pressure Sensor
See G - TESTS W/CODES - 2.4L article.

Power Steering Oil Pressure (PSP) Switch
See G - TESTS W/CODES - 2.4L article.

Throttle Position Sensor
See G - TESTS W/CODES - 2.4L article.

Vehicle Speed Sensor
See G - TESTS W/CODES - 2.4L article.

Volume Airflow Sensor
See G - TESTS W/CODES - 2.4L article.

MOTORS, RELAYS & SOLENOIDS

MOTORS

Idle Air Control Motor
See G - TESTS W/CODES - 2.4L article.

RELAYS

MFI Relay

1) Turn ignition off. Remove MFI relay. See MFI RELAY LOCATION table. Using DVOM, check for continuity between MFI relay terminals No. 2 and 4. See Fig. 2. If continuity does not exist, replace MFI relay. If continuity exist, go to next step.

2) Connect a 12-volt power supply to MFI relay terminal No. 4 and ground terminal No. 2. Using DVOM, check for continuity between MFI relay terminals No. 1 and 4. If continuity does not exist, replace MFI relay. If continuity exists, go to next step.

3) Check all related connectors and wiring harness between MFI relay and Powertrain Control Module (PCM). See L - WIRING DIAGRAMS - 2.4L article. Repair connectors and wiring harness as necessary. If connectors and wiring harness are okay, replace PCM.

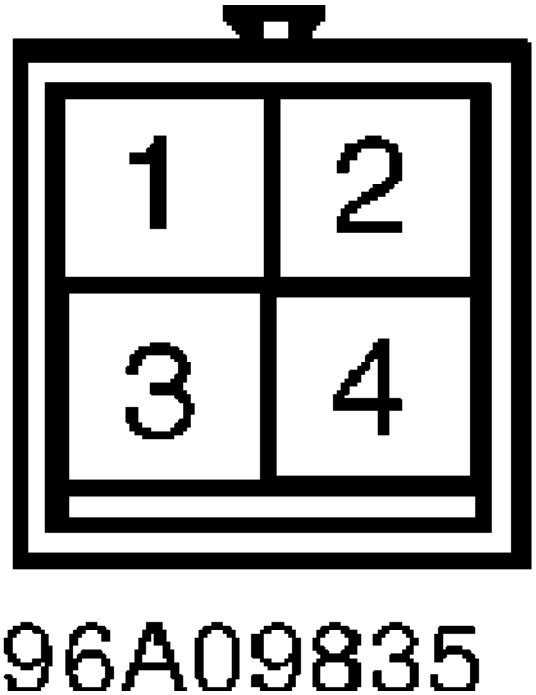


Fig. 2: Identifying MFI Relay Terminals
Courtesy of Mitsubishi Motor Sales of America.

MFI RELAY LOCATION TABLE

Application	Location
Montero Sport	Behind Right Kick Panel.

Radiator Cooling Fan Control Relay (Hi & Lo)
See G - TESTS W/CODES - 2.4L article.

SOLENOIDS

EGR Control Solenoid Valve
See EXHAUST GAS RECIRCULATION (EGR) under EMISSION SYSTEMS & SUB-SYSTEMS.

EVAP Purge Control Solenoid Valve
See FUEL EVAPORATION under EMISSION SYSTEMS & SUB-SYSTEMS.

FUEL SYSTEM

FUEL DELIVERY

NOTE: For system pressure testing, see F - BASIC TESTING - 2.4L article.

FUEL CONTROL

Fuel Injectors
See G - TESTS W/CODES - 2.4L article.

IDLE CONTROL SYSTEM

IDLE AIR CONTROL (IAC) MOTOR

For testing procedures, see G - TESTS W/CODES - 2.4L article.

IGNITION SYSTEM

NOTE: For basic ignition checks, see F - BASIC TESTING - 2.4L article.

TIMING CONTROL SYSTEMS

Camshaft Position Sensor
See G - TESTS W/CODES - 2.4L article.

Crankshaft Position Sensor
See G - TESTS W/CODES - 2.4L article.

Knock Sensor
See G - TESTS W/CODES - 2.4L article.

EMISSION SYSTEMS & SUB-SYSTEMS

EXHAUST GAS RECIRCULATION (EGR)

EGR Control Solenoid Valve
1)See G - TESTS W/CODES - 2.4L article.

FUEL EVAPORATION

EVAP Purge Control Valve
See G - TESTS W/CODES - 2.4L article.

EVAP Purge Control Solenoid Valve)
See G - TESTS W/CODES - 2.4L article.

POSITIVE CRANKCASE VENTILATION (PCV)

PCV Valve
Remove PCV valve. Shake valve by hand. Valve should rattle if moving freely. Apply air pressure to valve. Air should flow in one direction only. Connect PCV valve to vacuum hose and start engine. Ensure vacuum is flowing through valve.

MISCELLANEOUS CONTROLS

NOTE: Although the controlled devices listed here are not technically engine performance components, they can affect driveability if they malfunction.

NOTE: To identify PCM A/C power supply voltage terminal, see pin voltage chart in J - PIN VOLTAGE CHARTS - 2.4L article. To identify PCM A/C power supply circuit, see appropriate wiring diagram in L - WIRING DIAGRAMS - 2.4L article.

A/C Switch & Compressor Clutch Relay
Using DVOM, check A/C power supply voltage from PCM. Turn ignition to OFF position. Disconnect PCM connector. Turn A/C switch and ignition switch to ON positions. Check voltage between PCM A/C power supply terminal and chassis ground. If battery voltage is not as present, check and repair circuit(s).

I - SYSTEM/COMPONENT TESTS - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - System & Component Testing

Montero Sport - 3.0L

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COMPUTERIZED ENGINE CONTROLS

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NOTE: For Powertrain Control Module (PCM) location, see POWERTRAIN CONTROL MODULE (PCM) LOCATION table. To identify PCM power and ground terminals, see appropriate pin voltage chart in J - PIN VOLTAGE CHARTS - 3.0L article. To identify PCM power and ground circuits, see appropriate wiring diagram in L - WIRING DIAGRAMS - 3.0L article.

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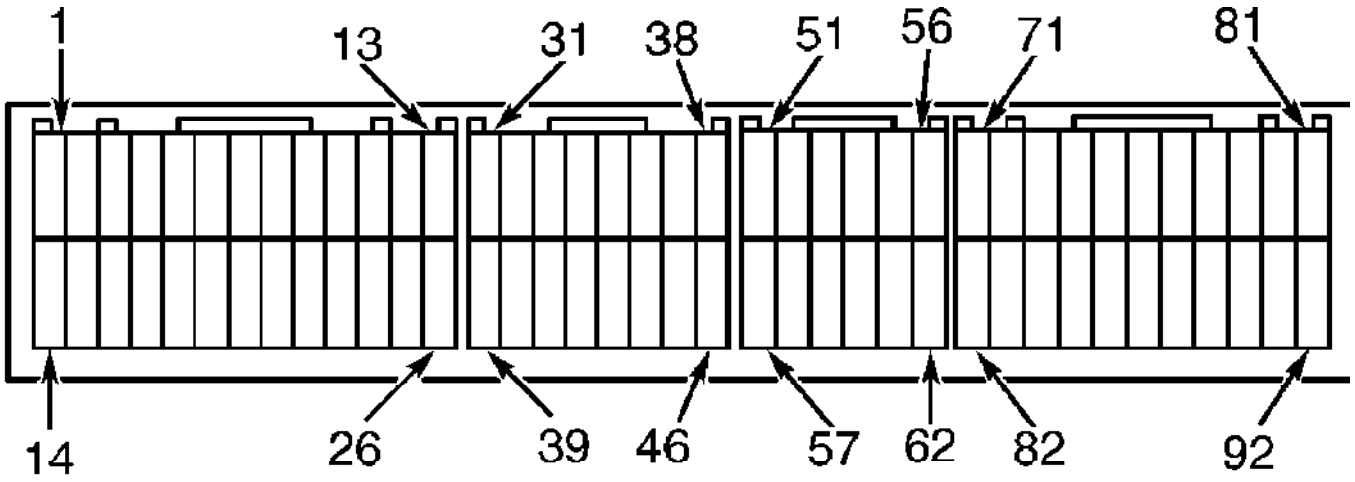
2) Connect voltmeter negative lead to chassis ground. Connect positive lead to PCM ground terminal(s). With engine running, voltmeter should indicate less than one volt. If reading is more than one volt, check for open, corrosion or loose connection in ground circuit.

Power Circuits

Turn ignition on. Check for battery voltage on both PCM power terminals. See Fig. 1. If battery voltage is not present, check operation of MFI relay. See RELAYS under MOTORS, RELAYS & SOLENOIDS.

POWERTRAIN CONTROL MODULE (PCM) LOCATION TABLE

Application	Location
Montero Sport	Behind Right Side Of Instrument Panel (Glove Box)



96C09836
Fig. 1: Identifying PCM Terminals
Courtesy of Mitsubishi Motor Sales of America.

ENGINE SENSORS & SWITCHES

NOTE: For circuit identification, see appropriate wiring diagram in L - WIRING DIAGRAMS - 3.0L article.

Automatic Transaxle/Transmission Range Switch Or Park Neutral Position Switch
See G - TESTS W/CODES - 3.0L article.

Barometric Pressure Sensor
Sensor is a part of volume airflow sensor assembly. See G - TESTS W/CODES - 3.0L article.

Closed Throttle Position Switch
Switch is part of throttle position sensor. See CLOSED THROTTLE POSITION (TP) SWITCH or THROTTLE POSITION (TP) SENSOR in G - TESTS W/CODES - 3.0L article.

Engine Coolant Temperature Sensor
See G - TESTS W/CODES - 3.0L article.

Heated Oxygen Sensor
See G - TESTS W/CODES - 3.0L article.

Intake Air Temperature Sensor
Sensor is a part of volume airflow sensor assembly. See G - TESTS W/CODES - 3.0L article.

Manifold Absolute Pressure Sensor
See G - TESTS W/CODES - 3.0L article.

Manifold Differential Pressure Sensor
See G - TESTS W/CODES - 3.0L article.

Power Steering Oil Pressure (PSP) Switch
See G - TESTS W/CODES - 3.0L article.

Throttle Position Sensor
See G - TESTS W/CODES - 3.0L article.

Vehicle Speed Sensor
See G - TESTS W/CODES - 3.0L article.

Volume Airflow Sensor
See G - TESTS W/CODES - 3.0L article.

MOTORS, RELAYS & SOLENOIDS

MOTORS

Idle Air Control Motor
See G - TESTS W/CODES - 3.0L article.

RELAYS

MFI Relay

1) Turn ignition off. Remove MFI relay. See MFI RELAY LOCATION table. Using DVOM, check for continuity between MFI relay terminals No. 2 and 4. See Fig. 2. If continuity does not exist, replace MFI relay. If continuity exist, go to next step.

2) Connect a 12-volt power supply to MFI relay terminal No. 4 and ground terminal No. 2. Using DVOM, check for continuity between MFI relay terminals No. 1 and 4. If continuity does not exist, replace MFI relay. If continuity exists, go to next step.

3) Check all related connectors and wiring harness between MFI relay and Powertrain Control Module (PCM). See L - WIRING DIAGRAMS - 3.0L article. Repair connectors and wiring harness as necessary. If connectors and wiring harness are okay, replace PCM.

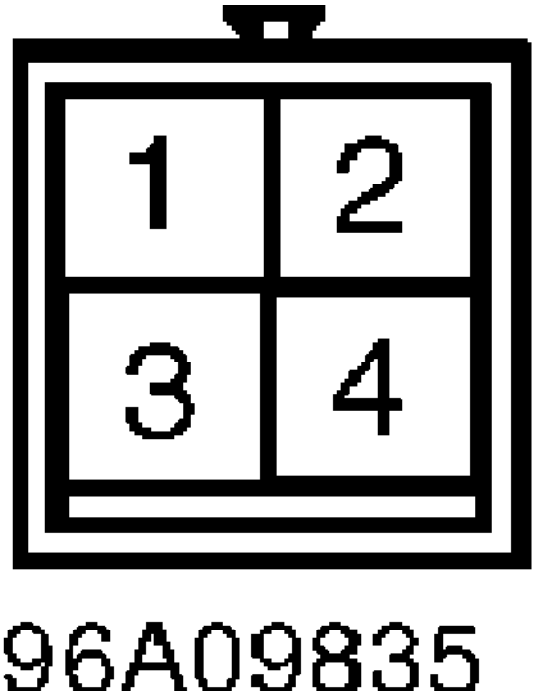


Fig. 2: Identifying MFI Relay Terminals
Courtesy of Mitsubishi Motor Sales of America.

MFI RELAY LOCATION TABLE

Application	Location
Montero Sport	Behind Right Kick Panel.

Radiator Cooling Fan Control Relay (Hi & Lo)
See G - TESTS W/CODES - 3.0L article.

SOLENOIDS

EGR Control Solenoid Valve
See EXHAUST GAS RECIRCULATION (EGR) under EMISSION SYSTEMS & SUB-SYSTEMS.

EVAP Purge Control Solenoid Valve
See FUEL EVAPORATION under EMISSION SYSTEMS & SUB-SYSTEMS.

FUEL SYSTEM

FUEL DELIVERY

NOTE: For system pressure testing, see F - BASIC TESTING - 3.0L article.

FUEL CONTROL

Fuel Injectors
See G - TESTS W/CODES - 3.0L article.

IDLE CONTROL SYSTEM

IDLE AIR CONTROL (IAC) MOTOR

For testing procedures, see G - TESTS W/CODES - 3.0L article.

IGNITION SYSTEM

NOTE: For basic ignition checks, see F - BASIC TESTING - 3.0L article.

TIMING CONTROL SYSTEMS

Camshaft Position Sensor
See G - TESTS W/CODES - 3.0L article.

Crankshaft Position Sensor
See G - TESTS W/CODES - 3.0L article.

Knock Sensor
See G - TESTS W/CODES - 3.0L article.

EMISSION SYSTEMS & SUB-SYSTEMS

EXHAUST GAS RECIRCULATION (EGR)

EGR Control Solenoid Valve
1)See G - TESTS W/CODES - 3.0L article.

FUEL EVAPORATION

EVAP Purge Control Valve
See G - TESTS W/CODES - 3.0L article.

EVAP Purge Control Solenoid Valve)
See G - TESTS W/CODES - 3.0L article.

POSITIVE CRANKCASE VENTILATION (PCV)

PCV Valve
Remove PCV valve. Shake valve by hand. Valve should rattle if moving freely. Apply air pressure to valve. Air should flow in one direction only. Connect PCV valve to vacuum hose and start engine. Ensure vacuum is flowing through valve.

MISCELLANEOUS CONTROLS

NOTE: Although the controlled devices listed here are not technically engine performance components, they can affect driveability if they malfunction.

NOTE: To identify PCM A/C power supply voltage terminal, see pin voltage chart in J - PIN VOLTAGE CHARTS - 3.0L article. To identify PCM A/C power supply circuit, see appropriate wiring diagram in L - WIRING DIAGRAMS - 3.0L article.

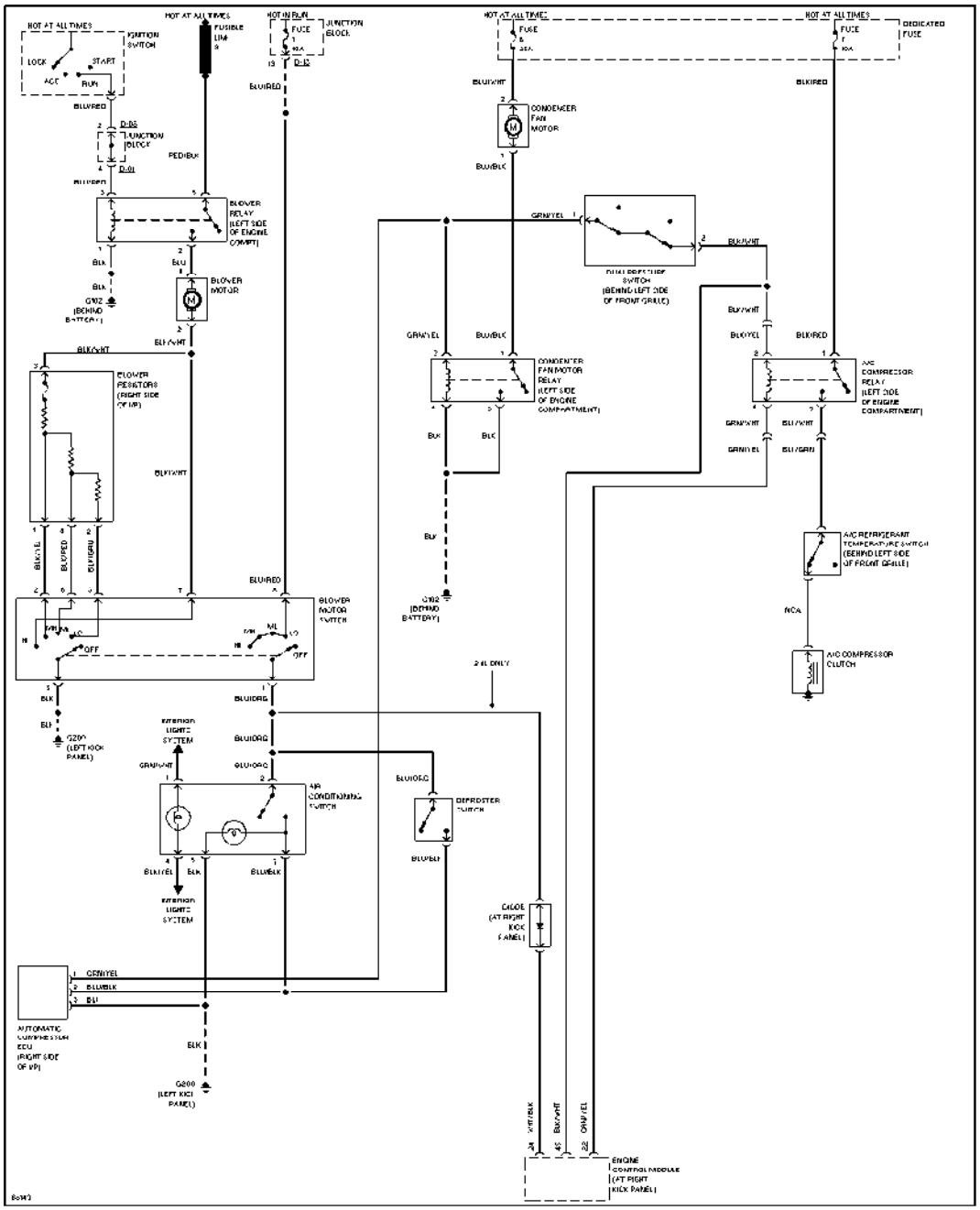
A/C Switch & Compressor Clutch Relay
Using DVOM, check A/C power supply voltage from PCM. Turn ignition to OFF position. Disconnect PCM connector. Turn A/C switch and ignition switch to ON positions. Check voltage between PCM A/C power supply terminal and chassis ground. If battery voltage is not as present, check and repair circuit(s).

SYSTEM WIRING DIAGRAMS

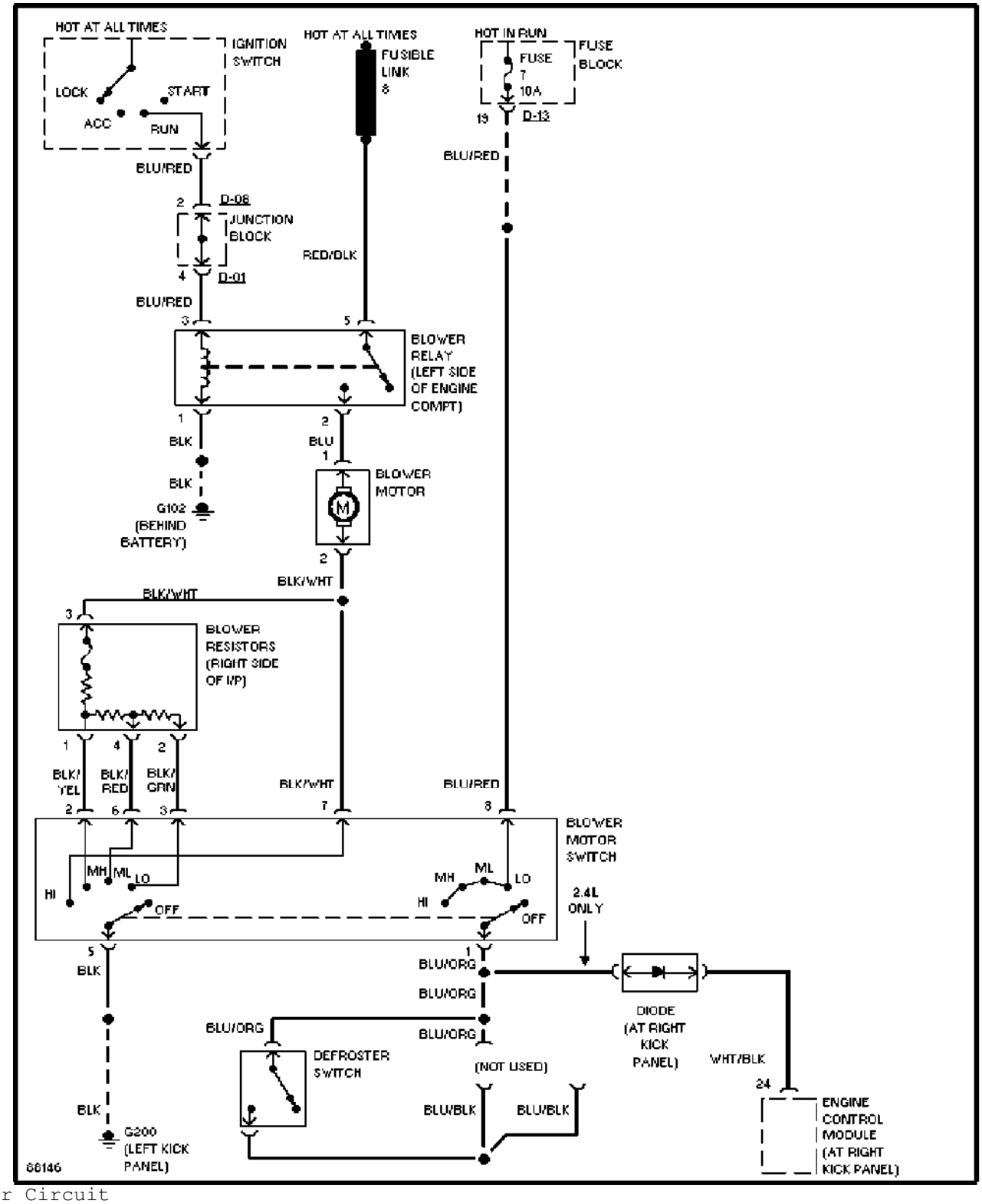
1997-99 Mitsubishi Montero Sport

1997-99 System Wiring Diagrams
Mitsubishi - Montero Sport

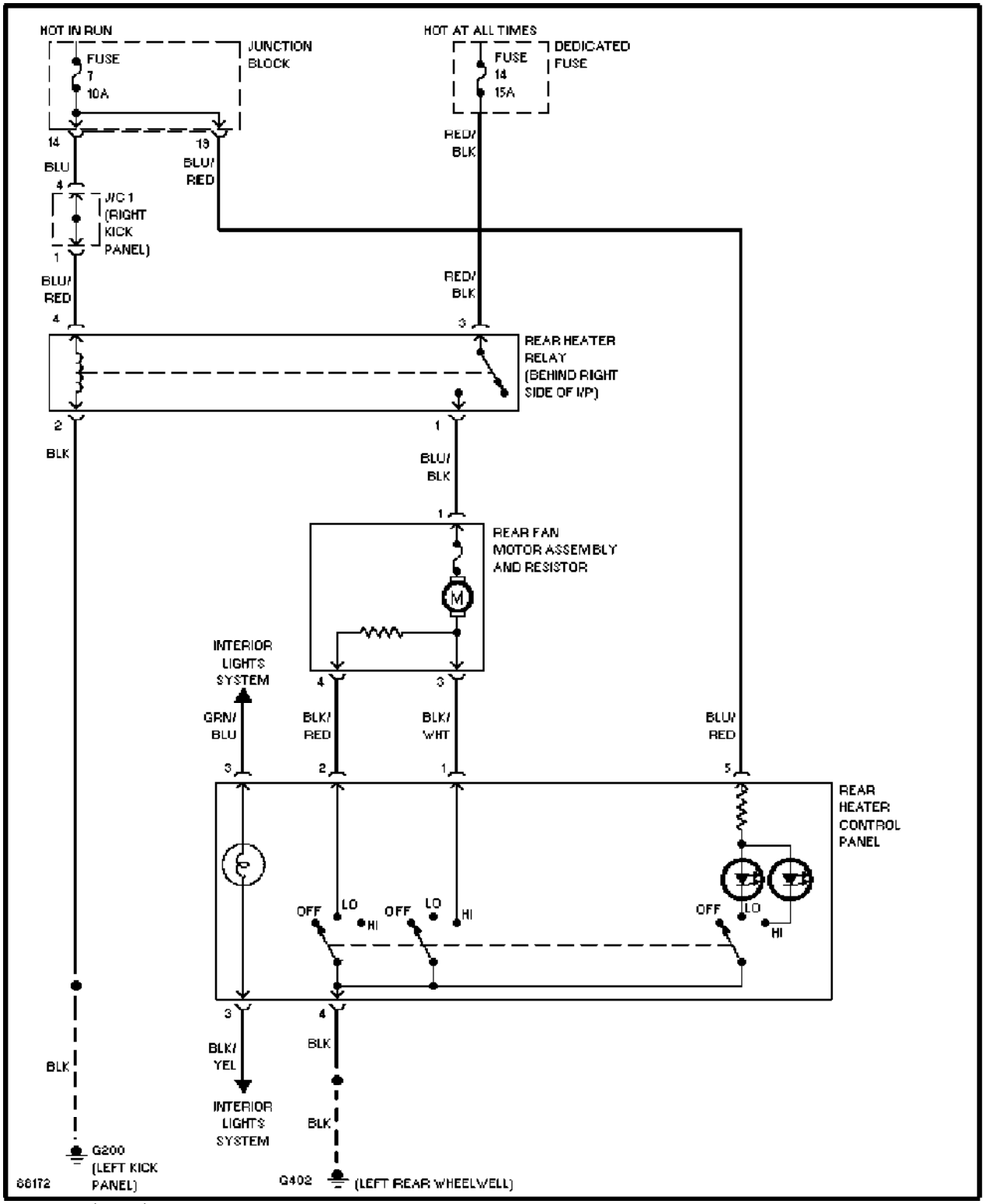
AIR CONDITIONING



A/C Circuit

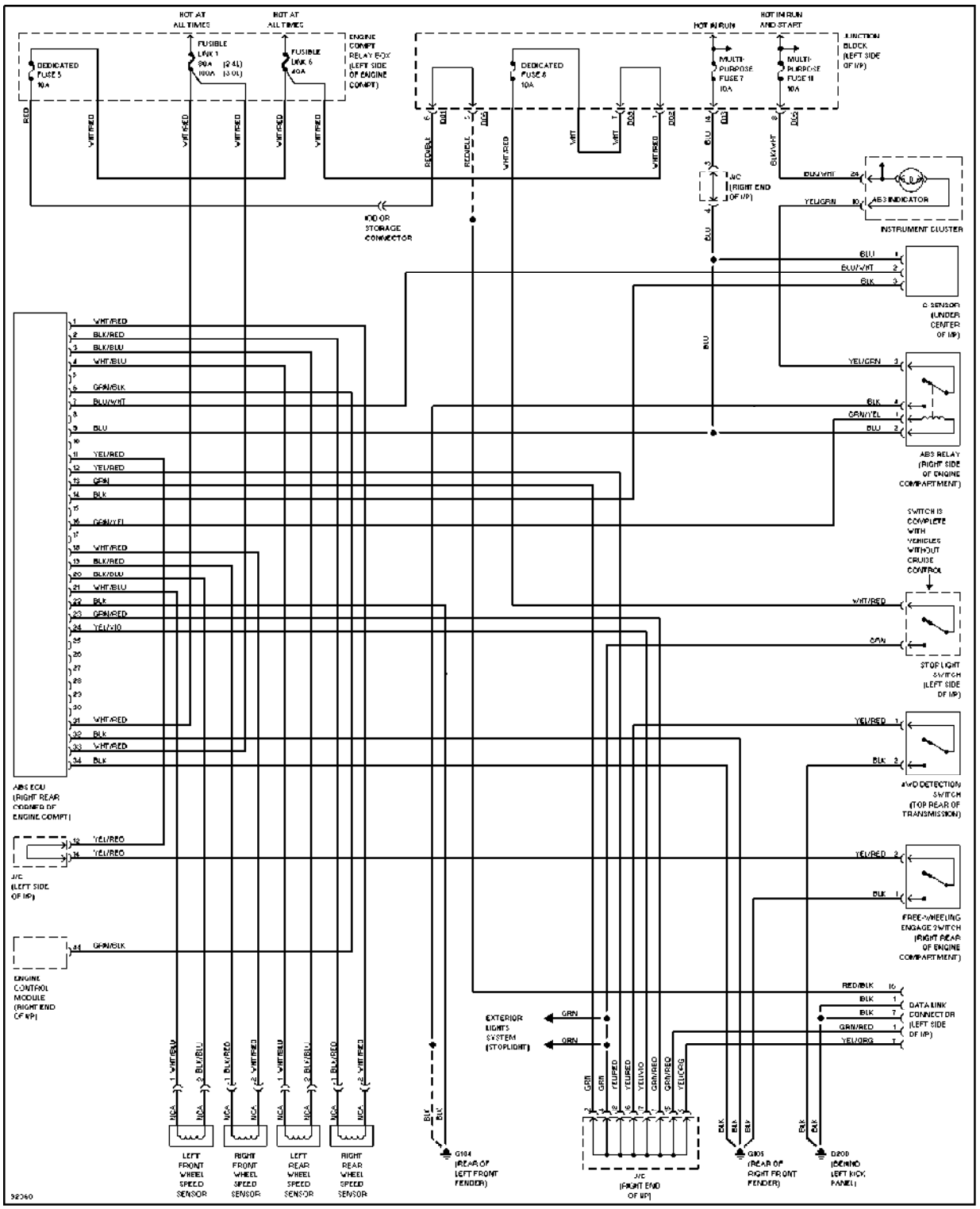


Heater Circuit

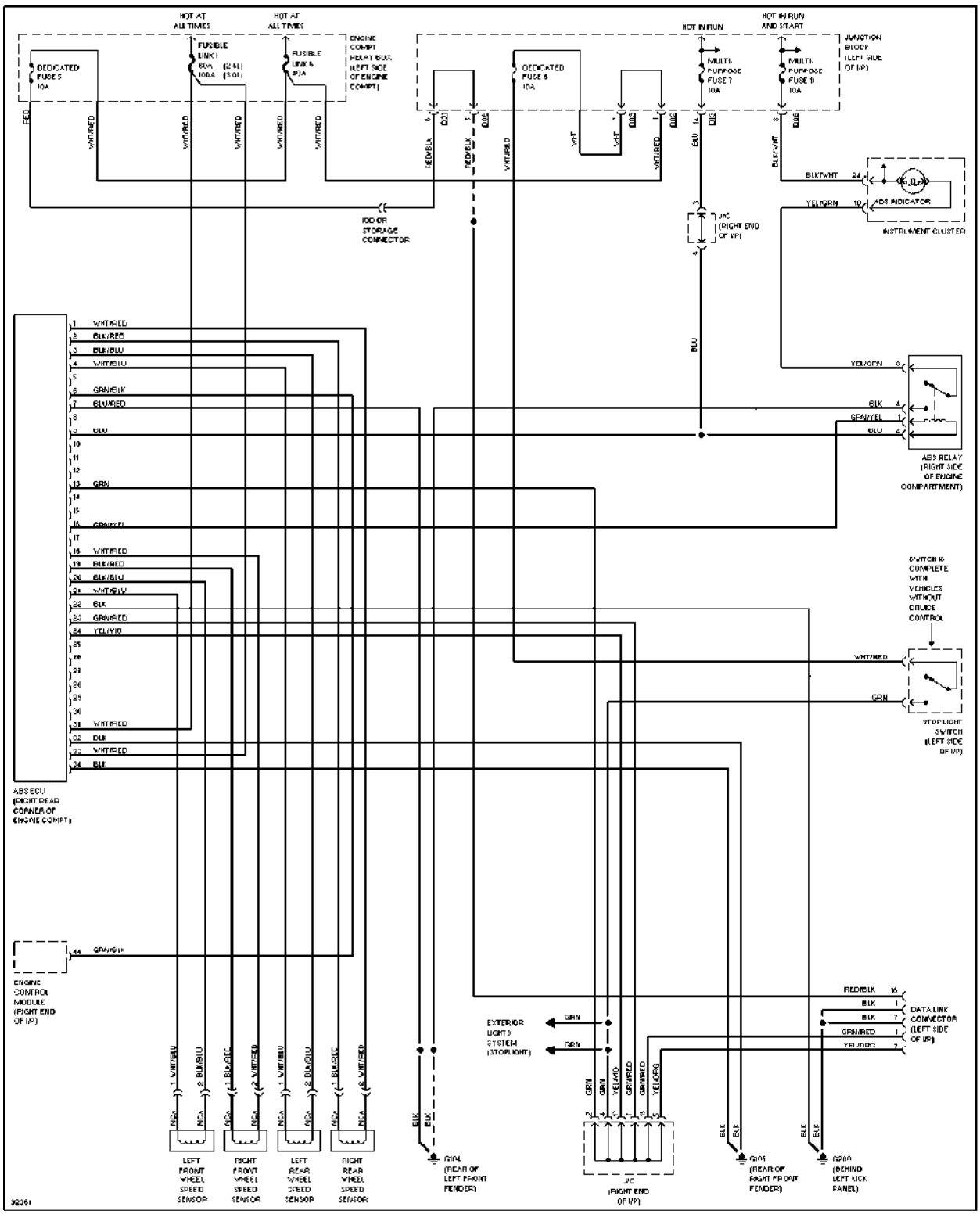


Rear Heater Circuit

ANTI-LOCK BRAKES

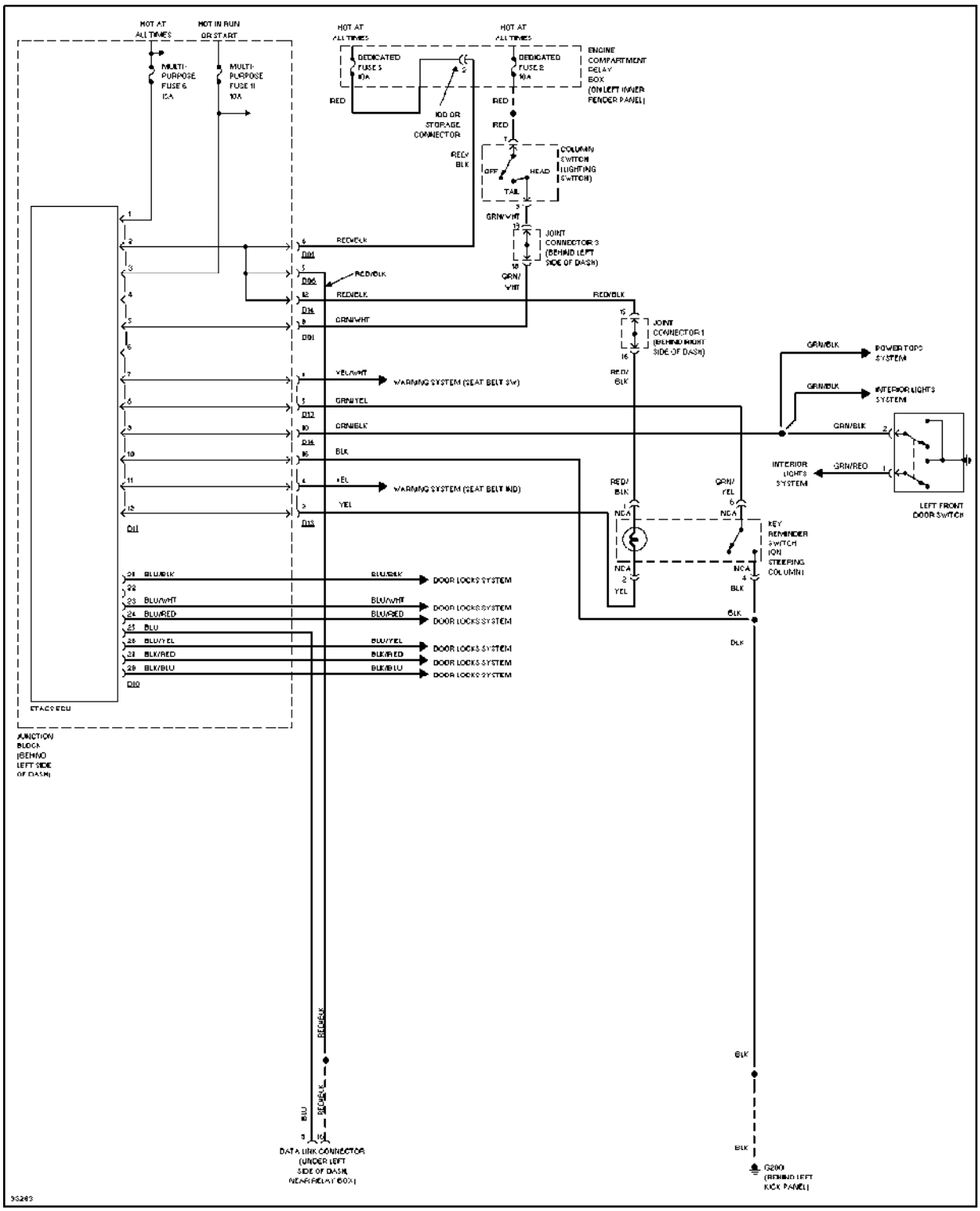


Anti-lock Brake Circuits, 4-Wheel Drive



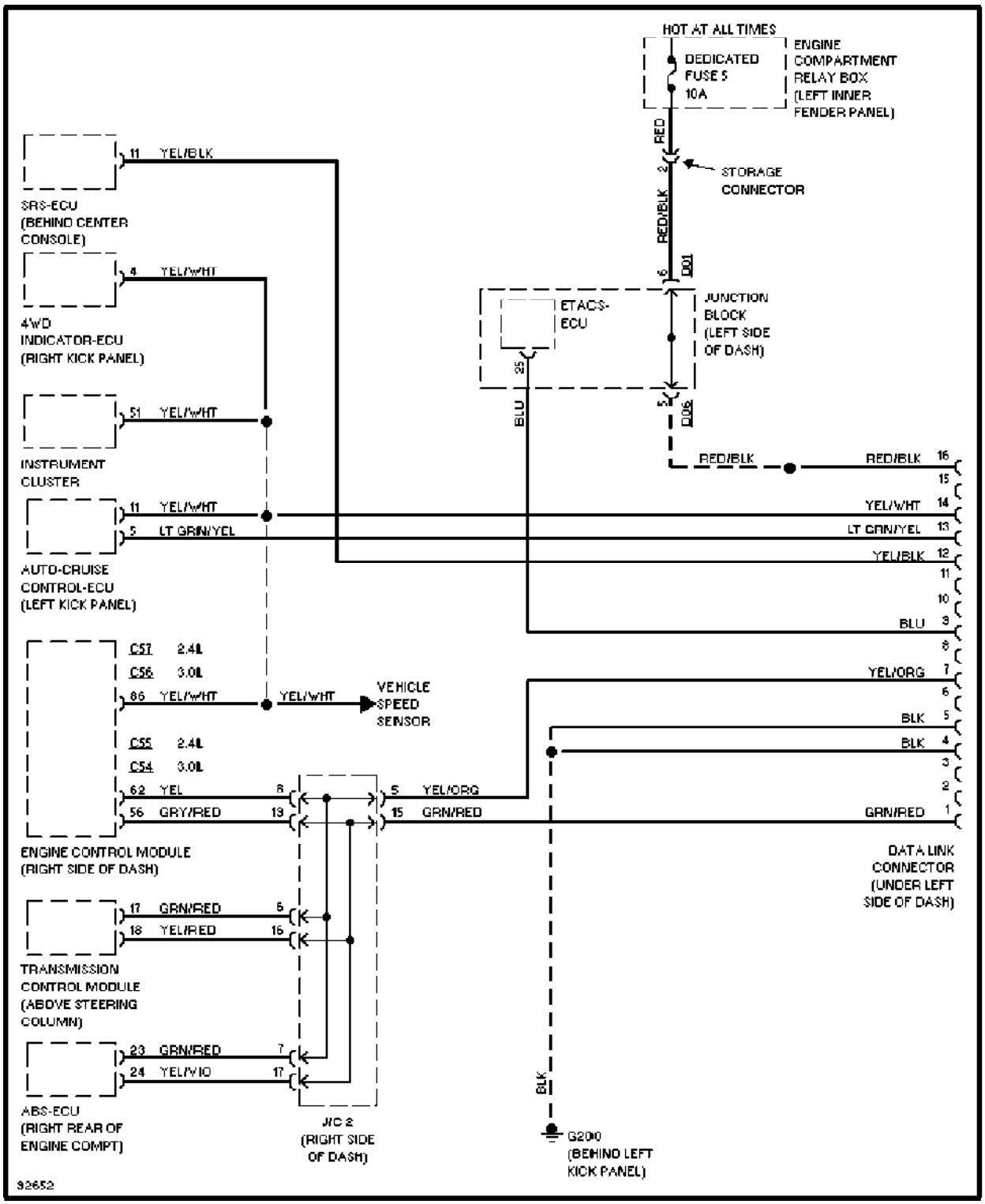
Anti-lock Brake Circuits, RWD

BODY COMPUTER



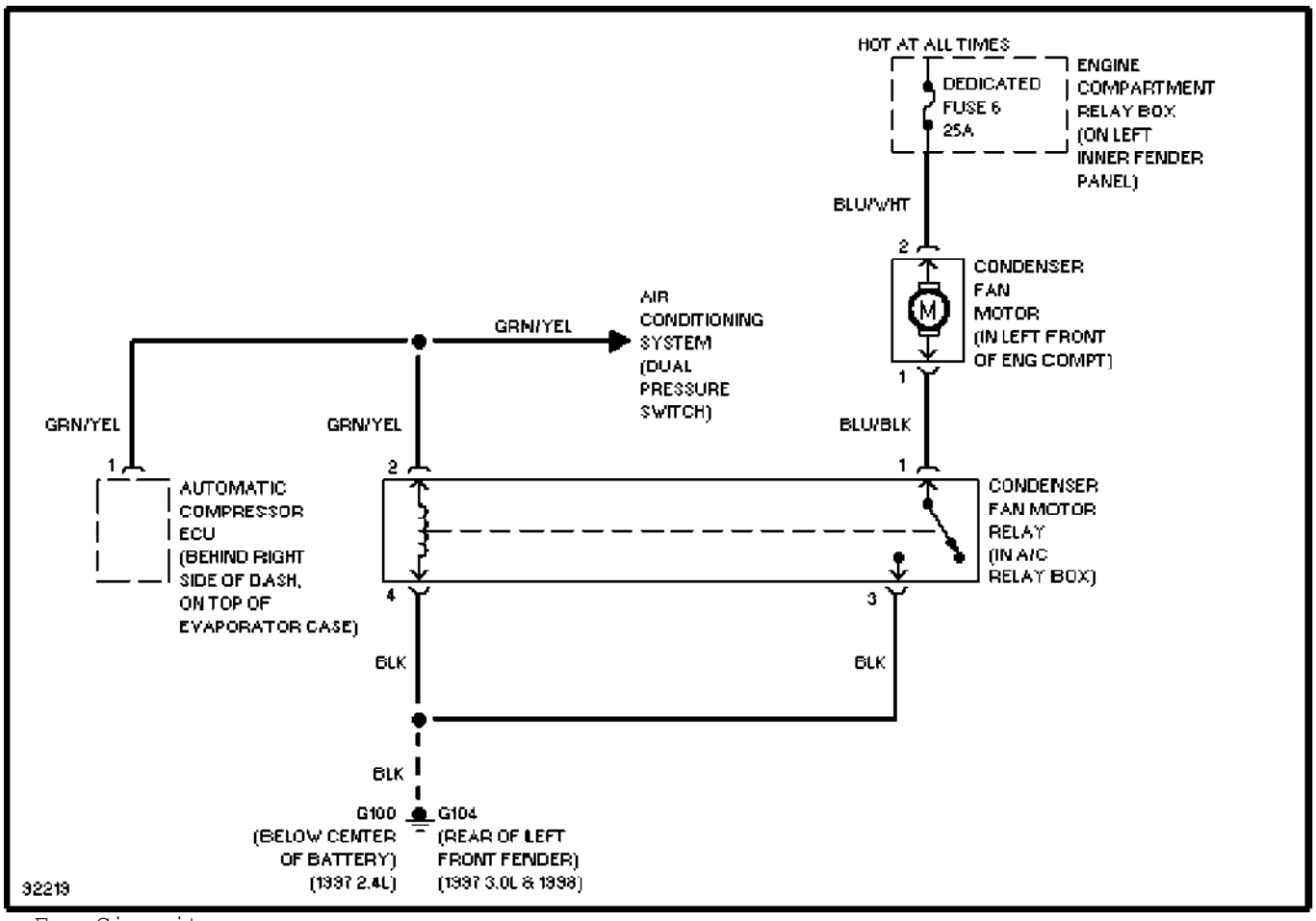
Body Computer Circuits

COMPUTER DATA LINES



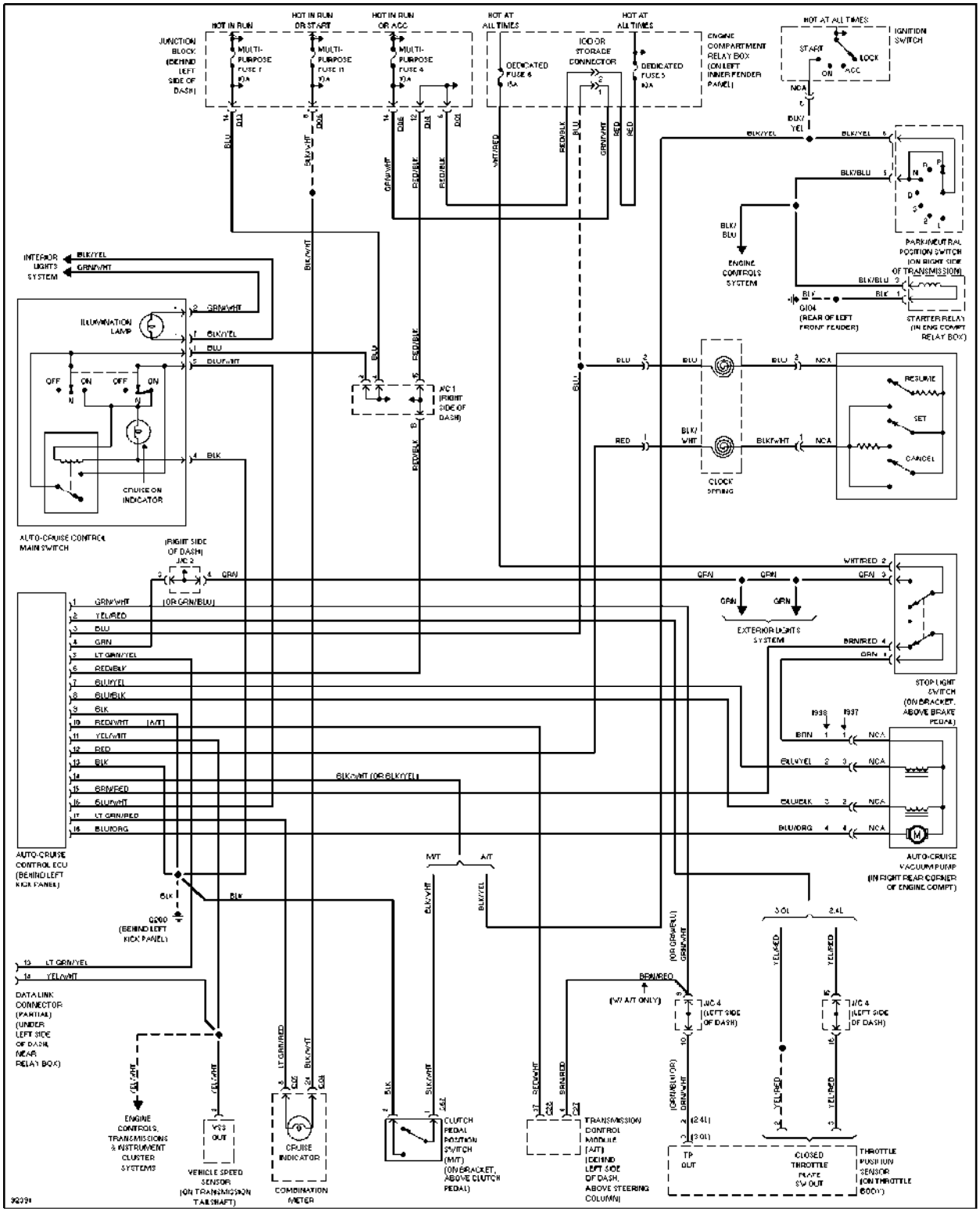
Computer Data Lines

COOLING FAN



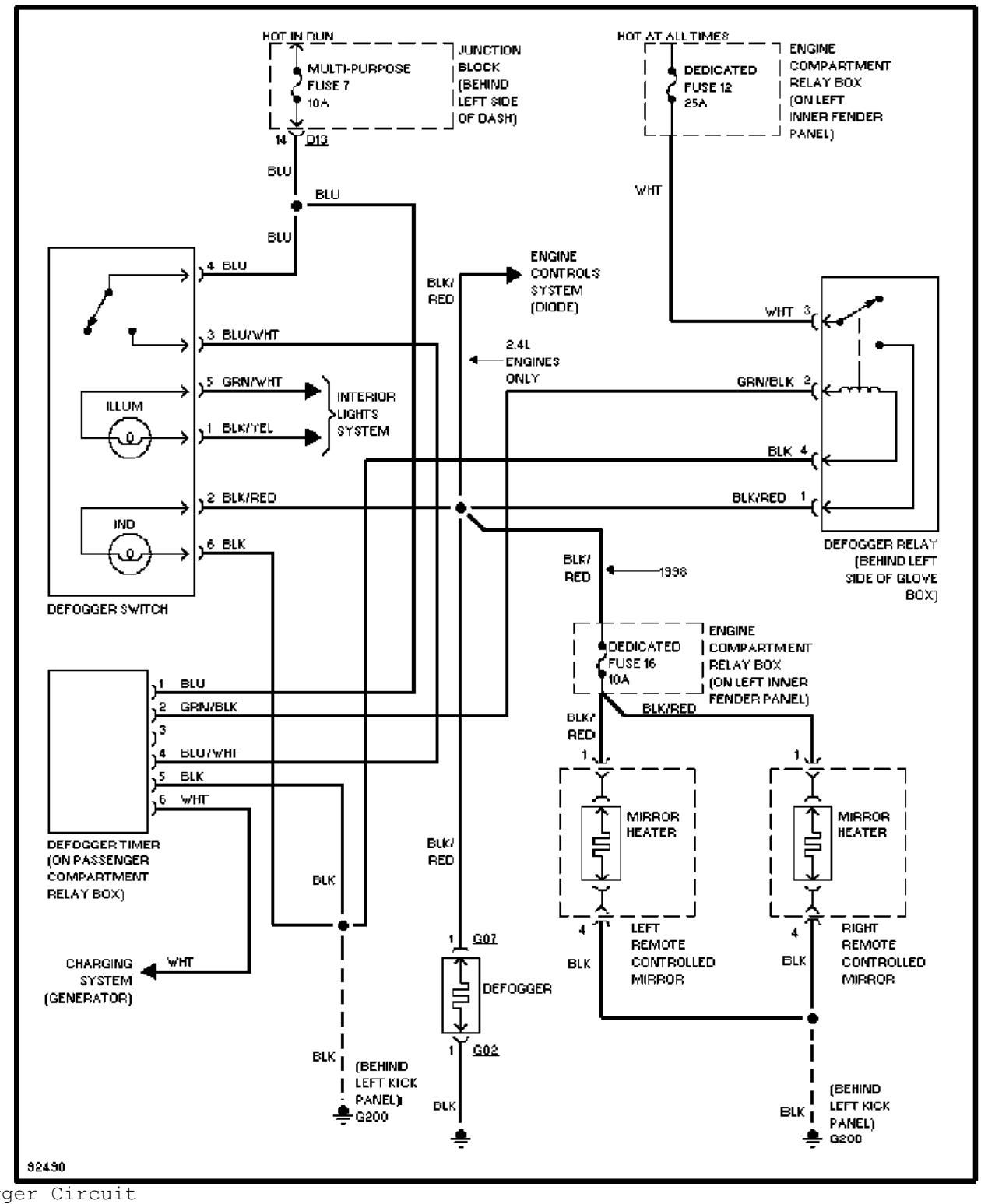
Cooling Fan Circuit

CRUISE CONTROL



Cruise Control Circuit

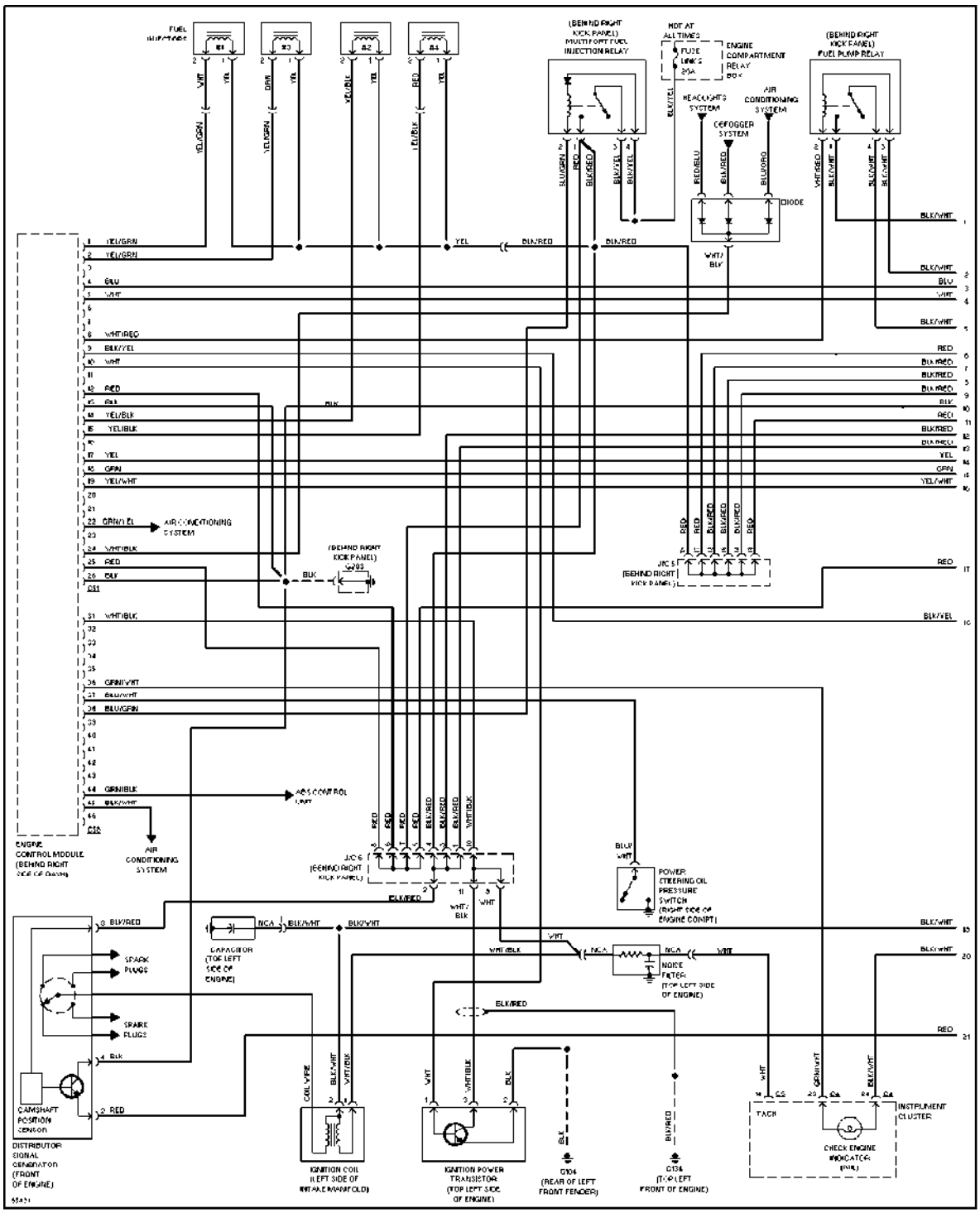
DEFOGGERS



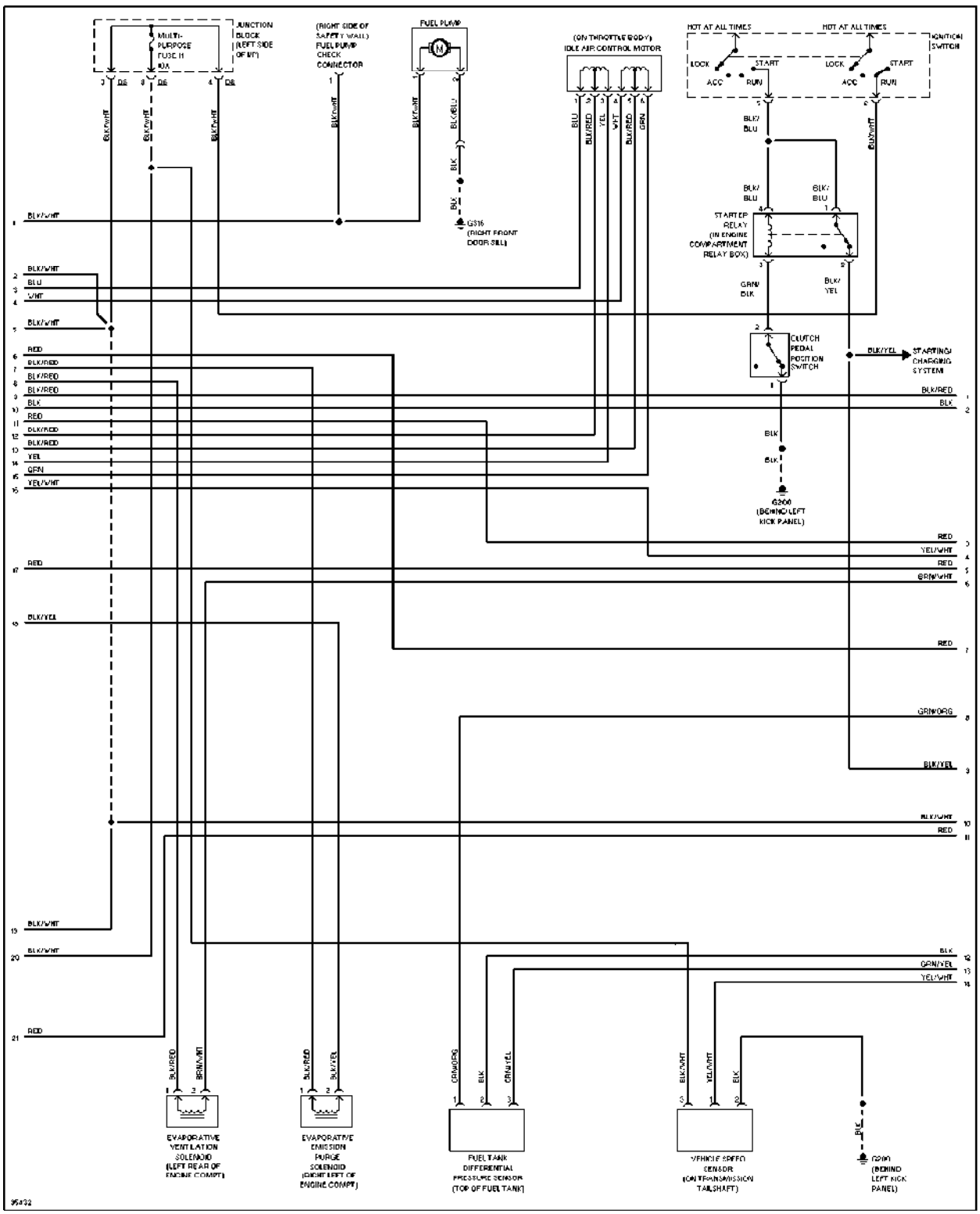
Defogger Circuit

ENGINE PERFORMANCE

2.4L



2.4L, Engine Performance Circuits, California (1 of 3)



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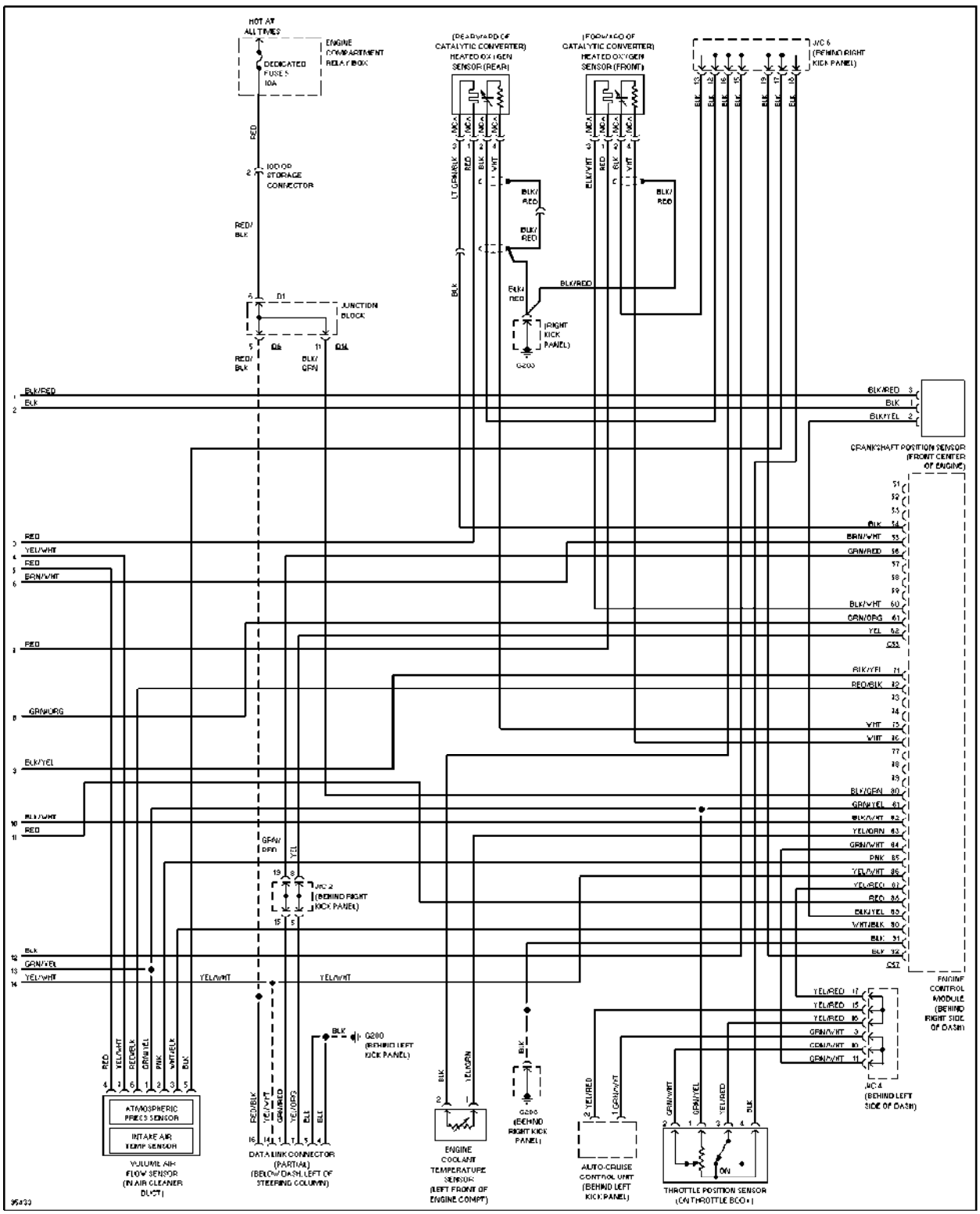
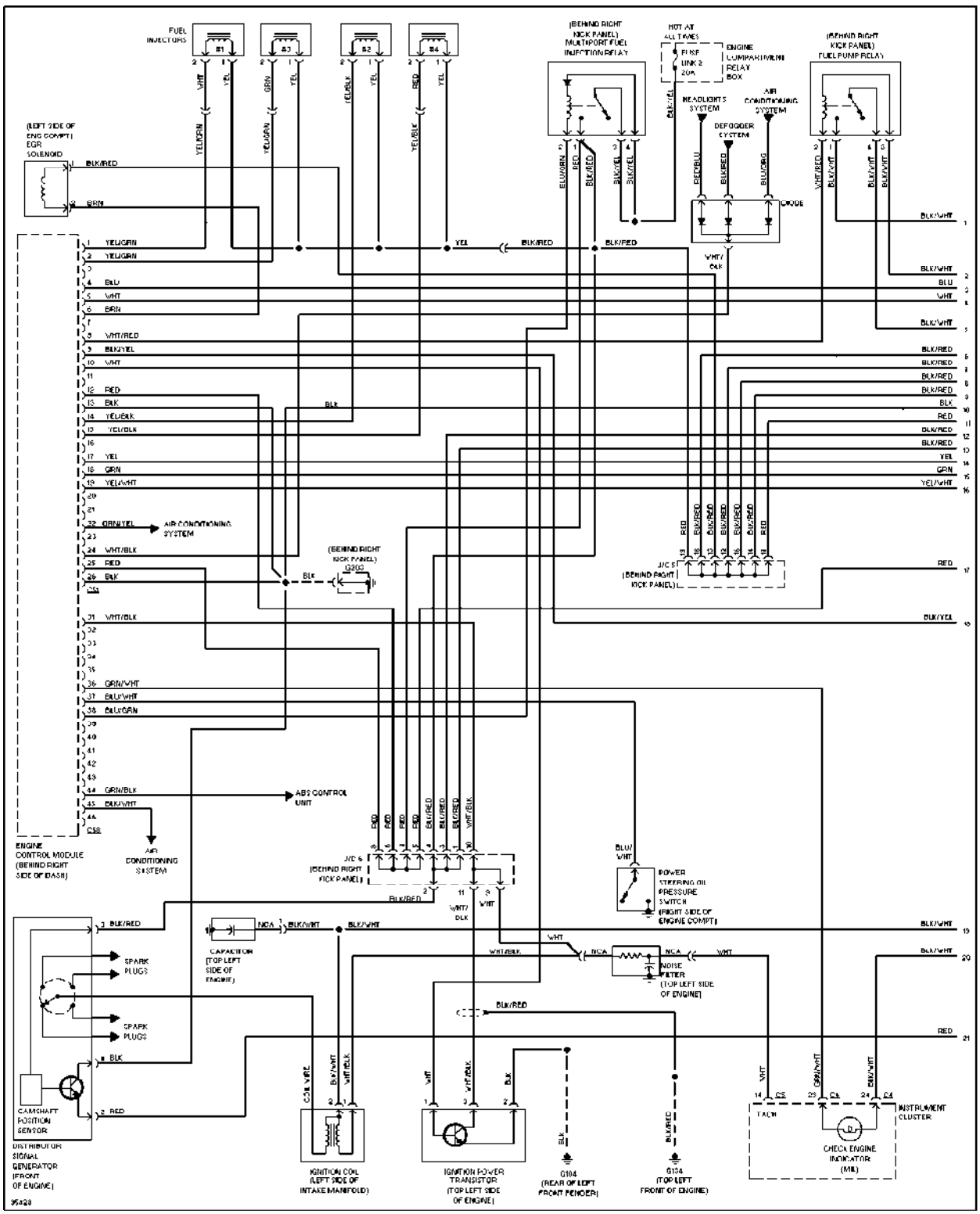


2.4L, Engine Performance Circuits, California (3 of 3)



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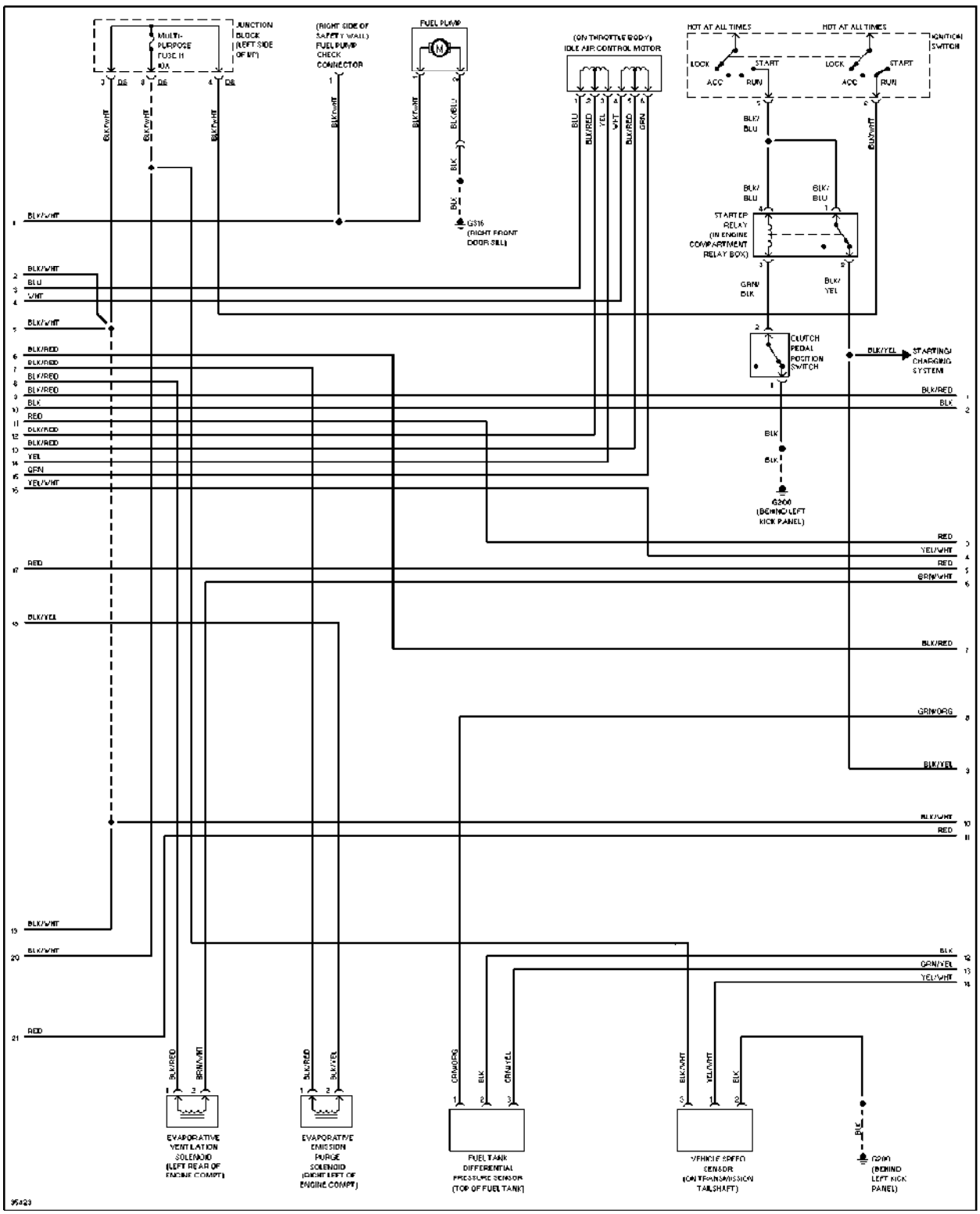

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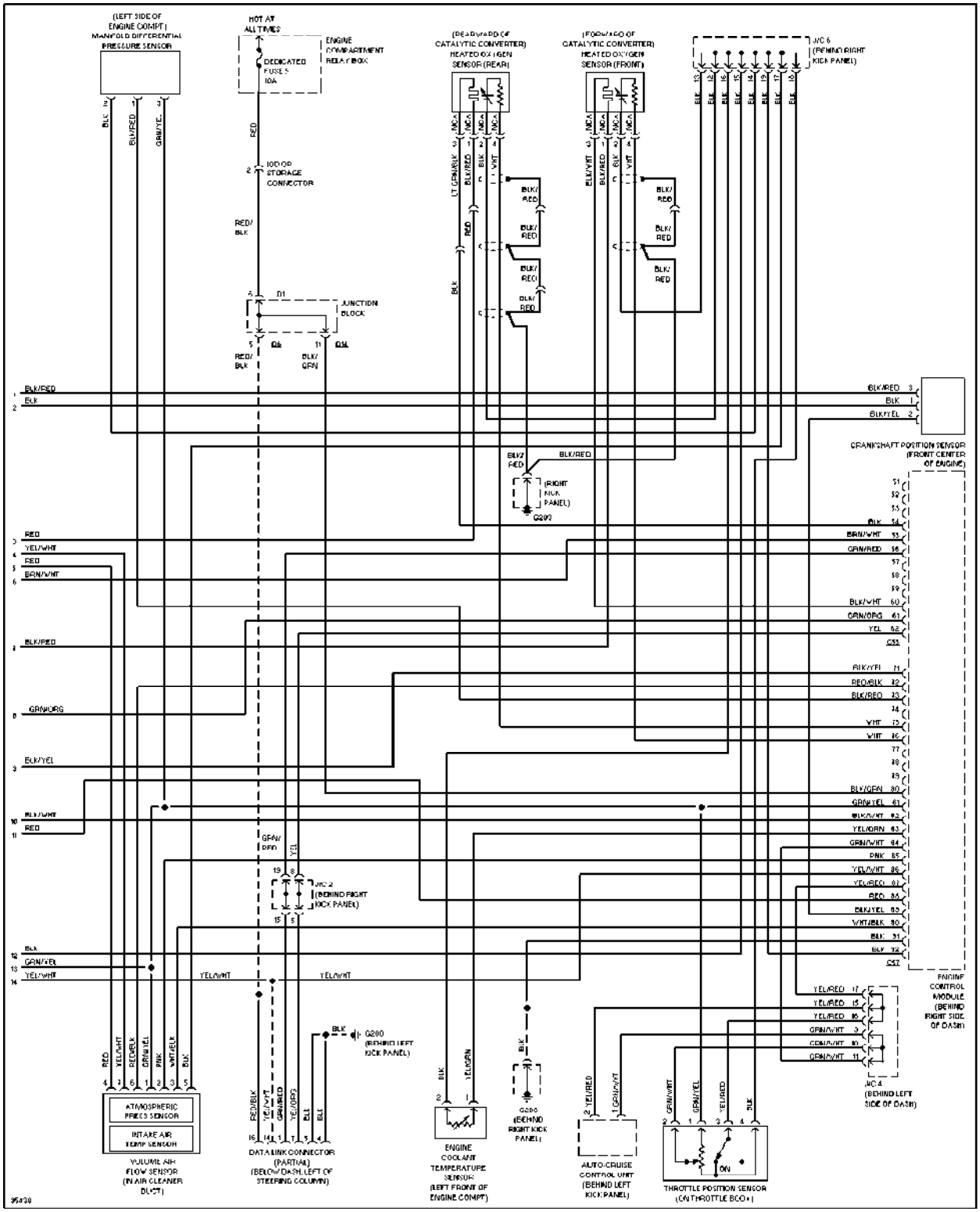
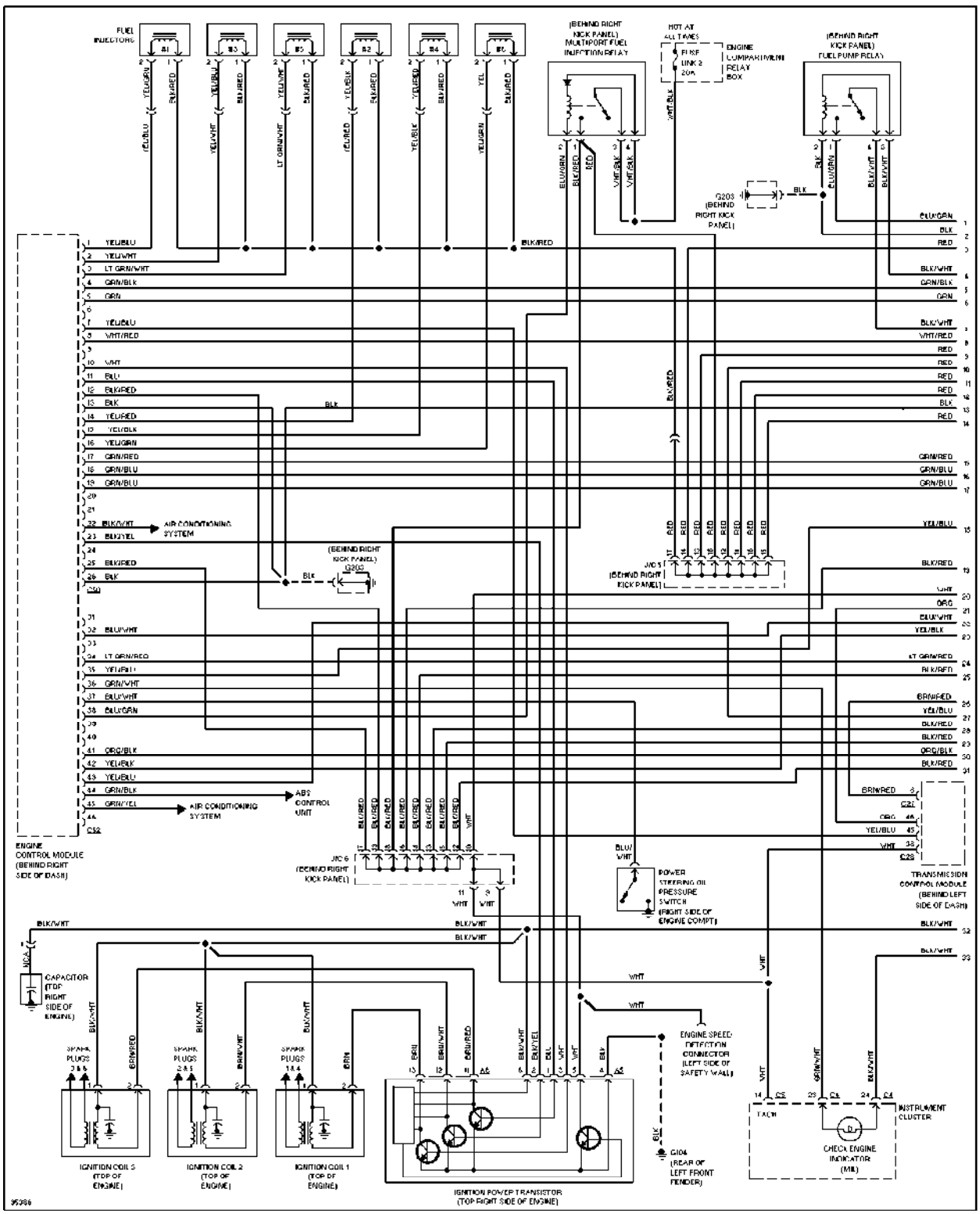


2.4L, Engine Performance Circuits, Federal (3 of 3)

3.0L



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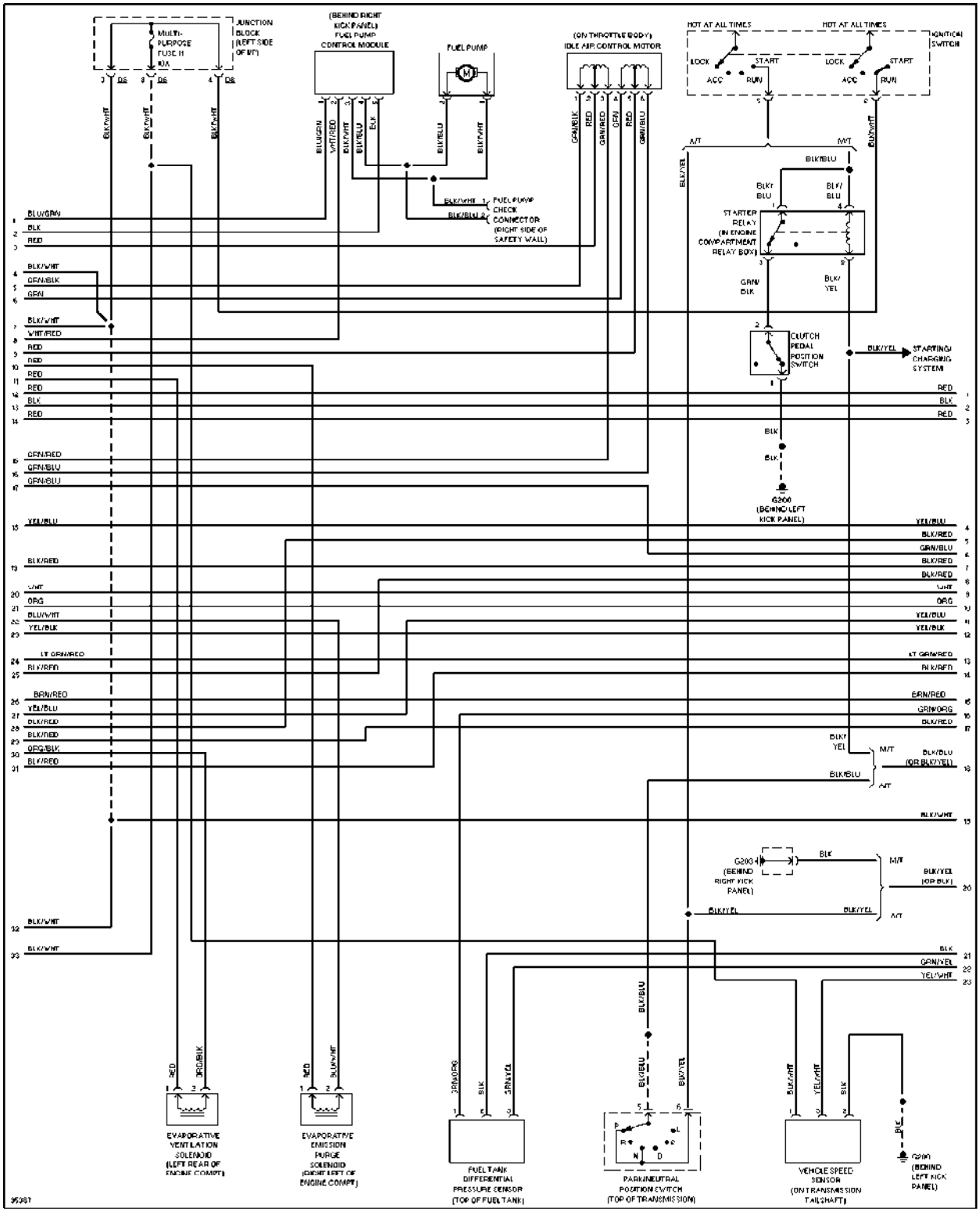

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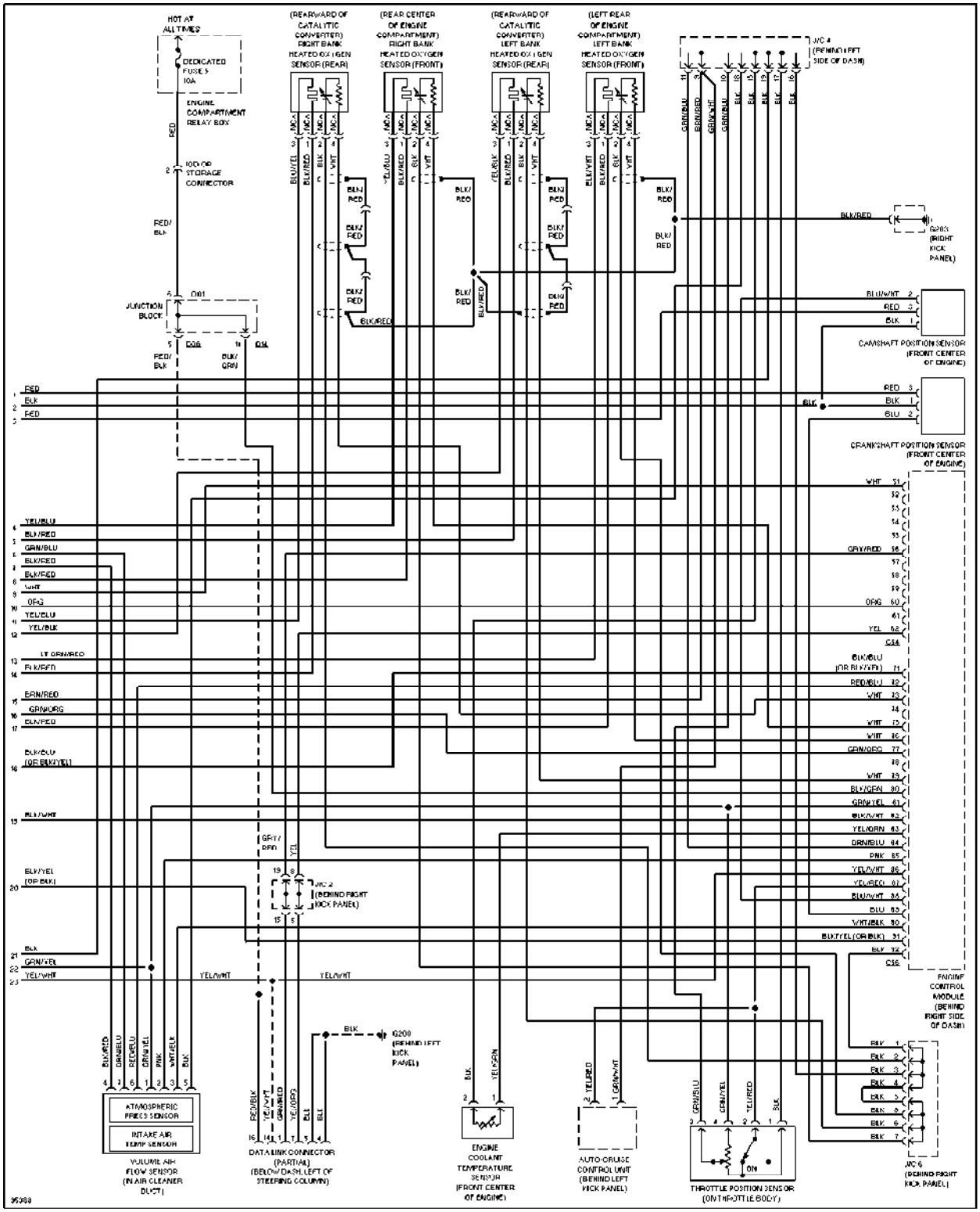

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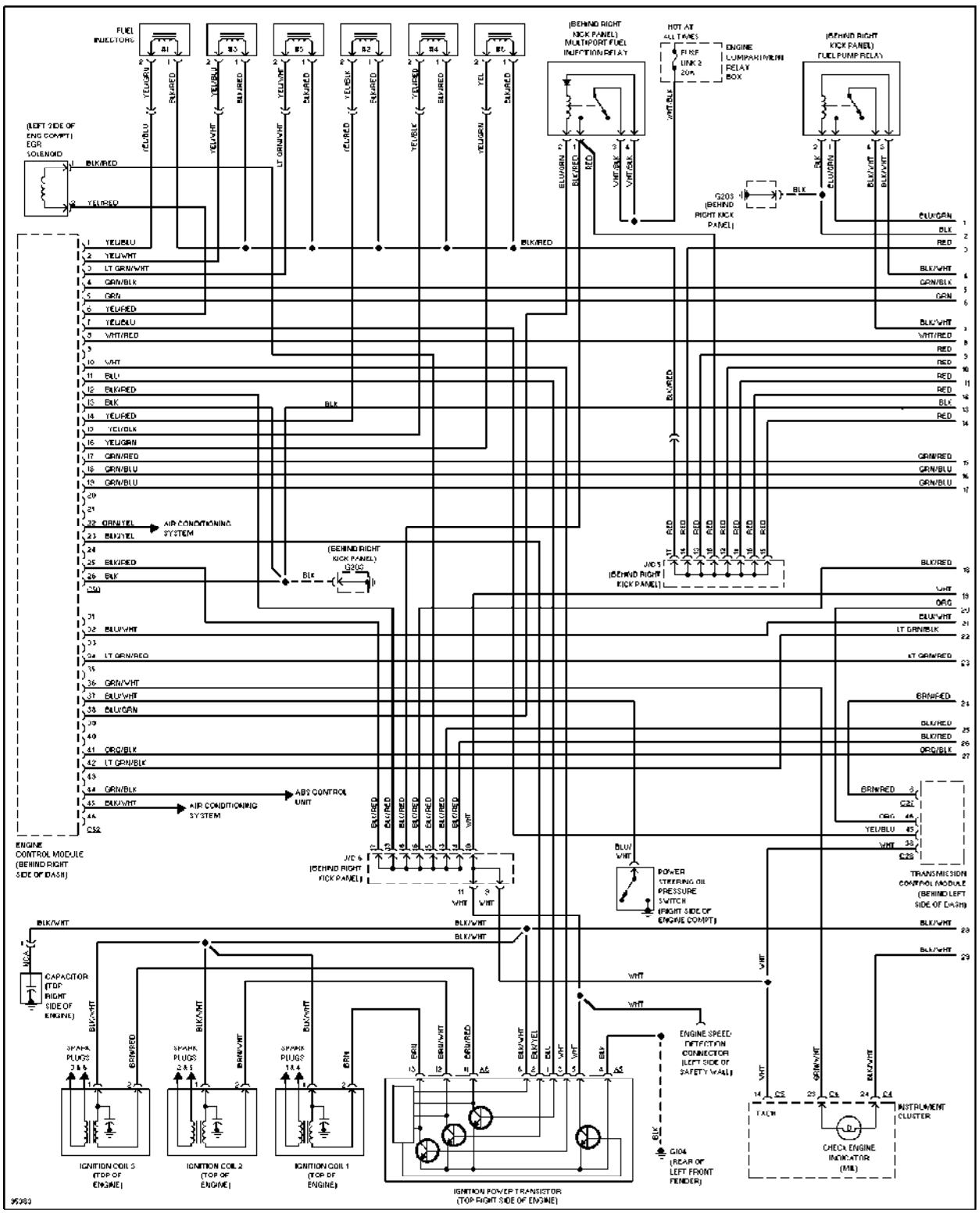
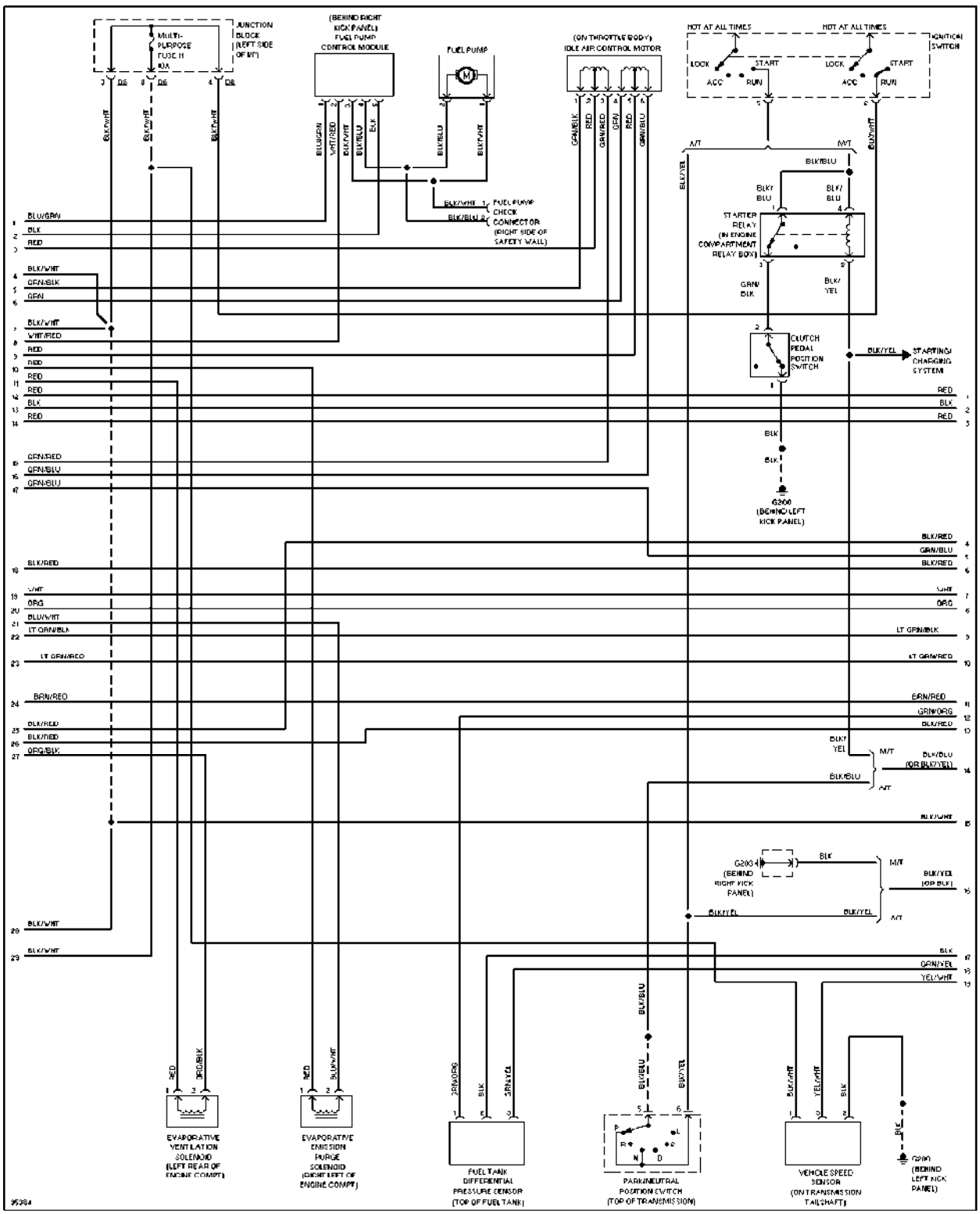
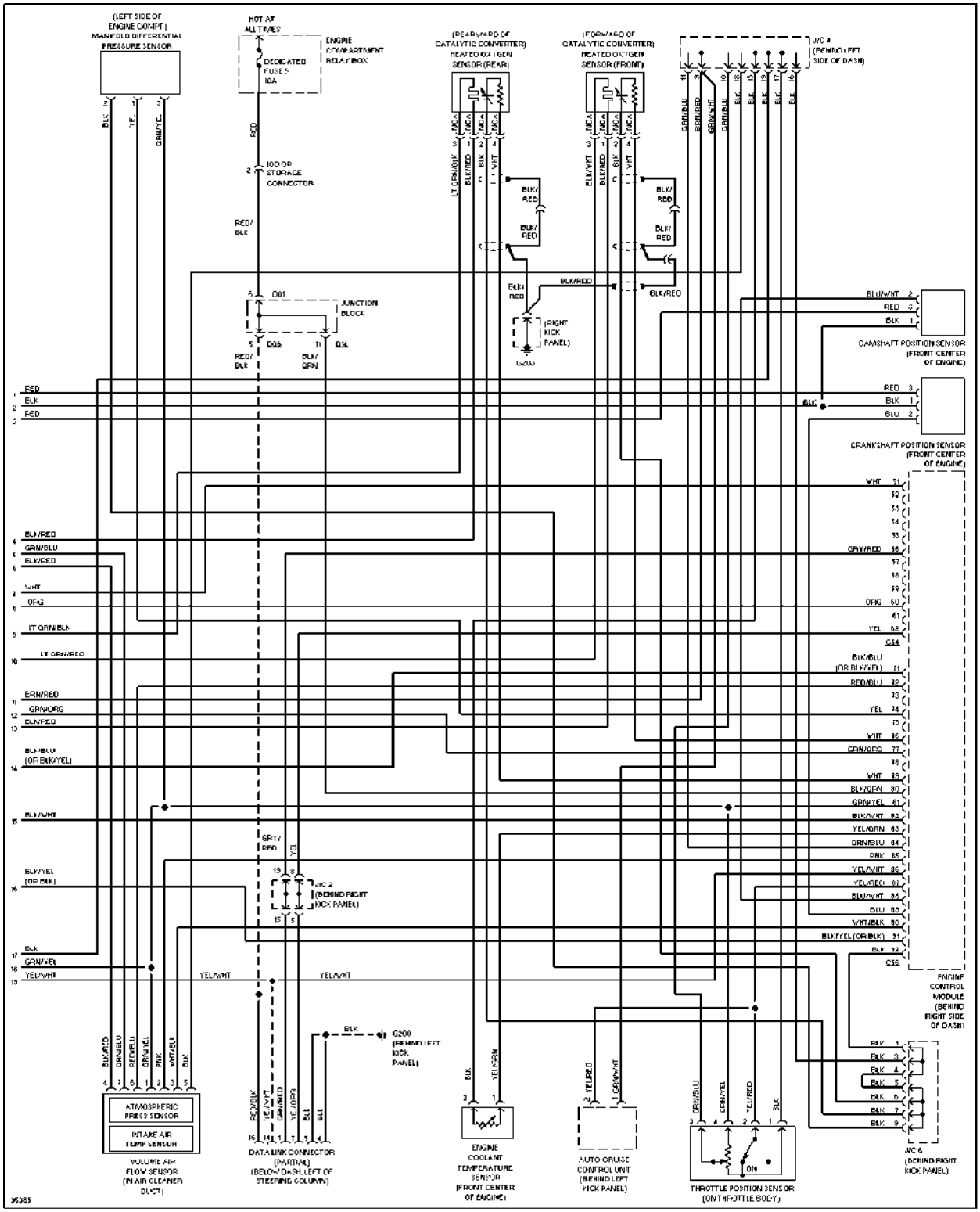


3.0L, Engine Performance Circuits, Federal (1 of 3)

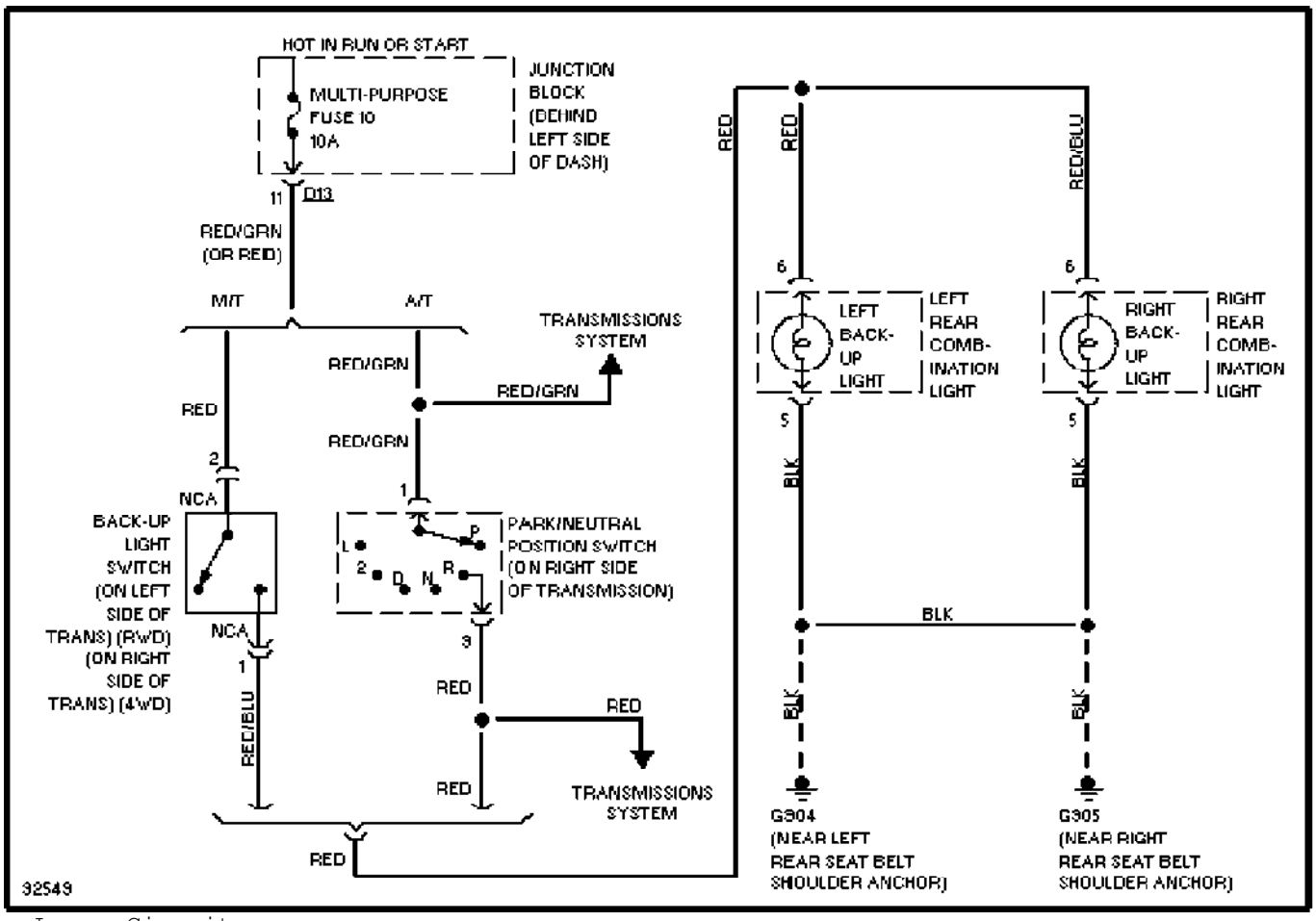


3.0L, Engine Performance Circuits, Federal (2 of 3)

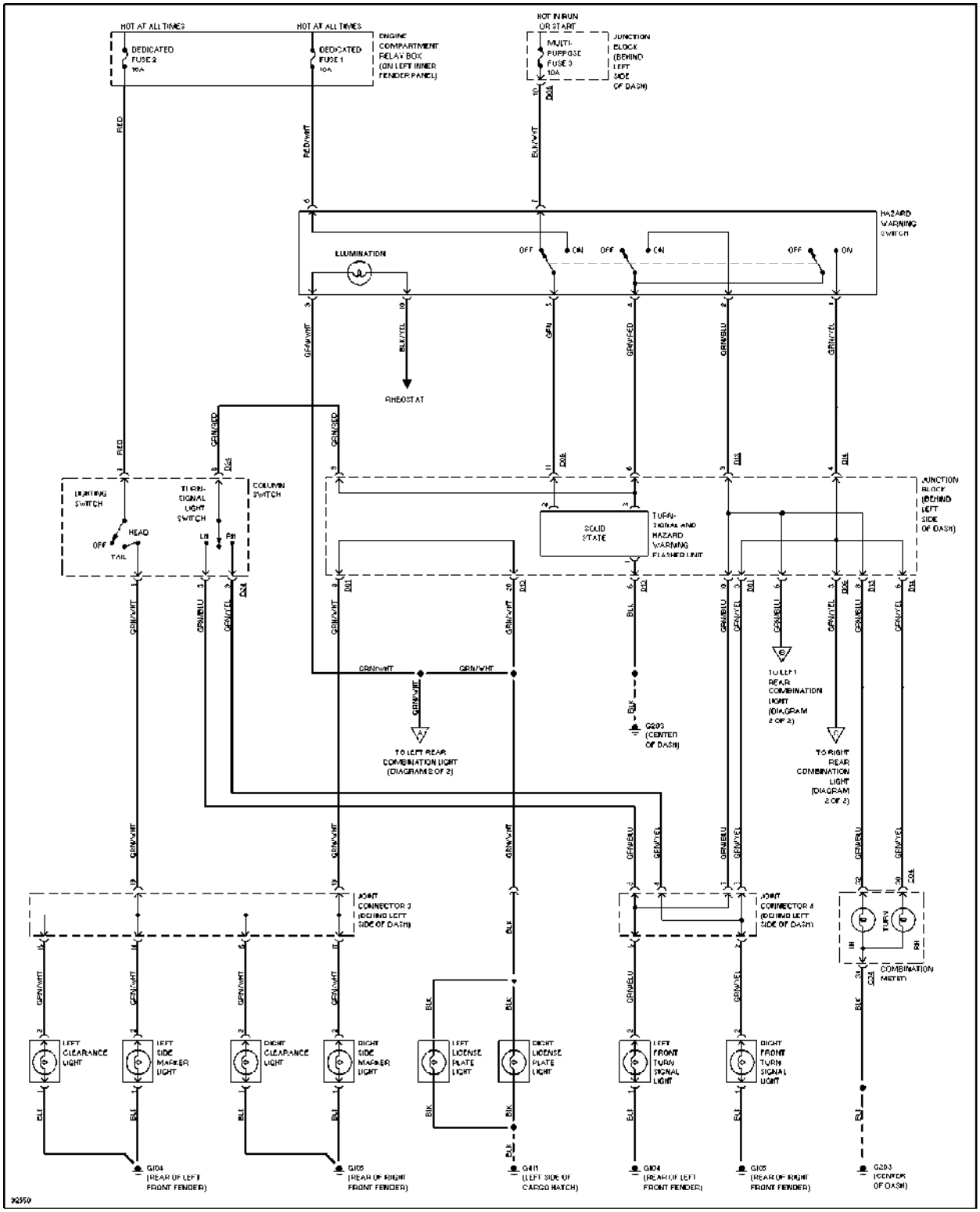


3.0L, Engine Performance Circuits, Federal (3 of 3)

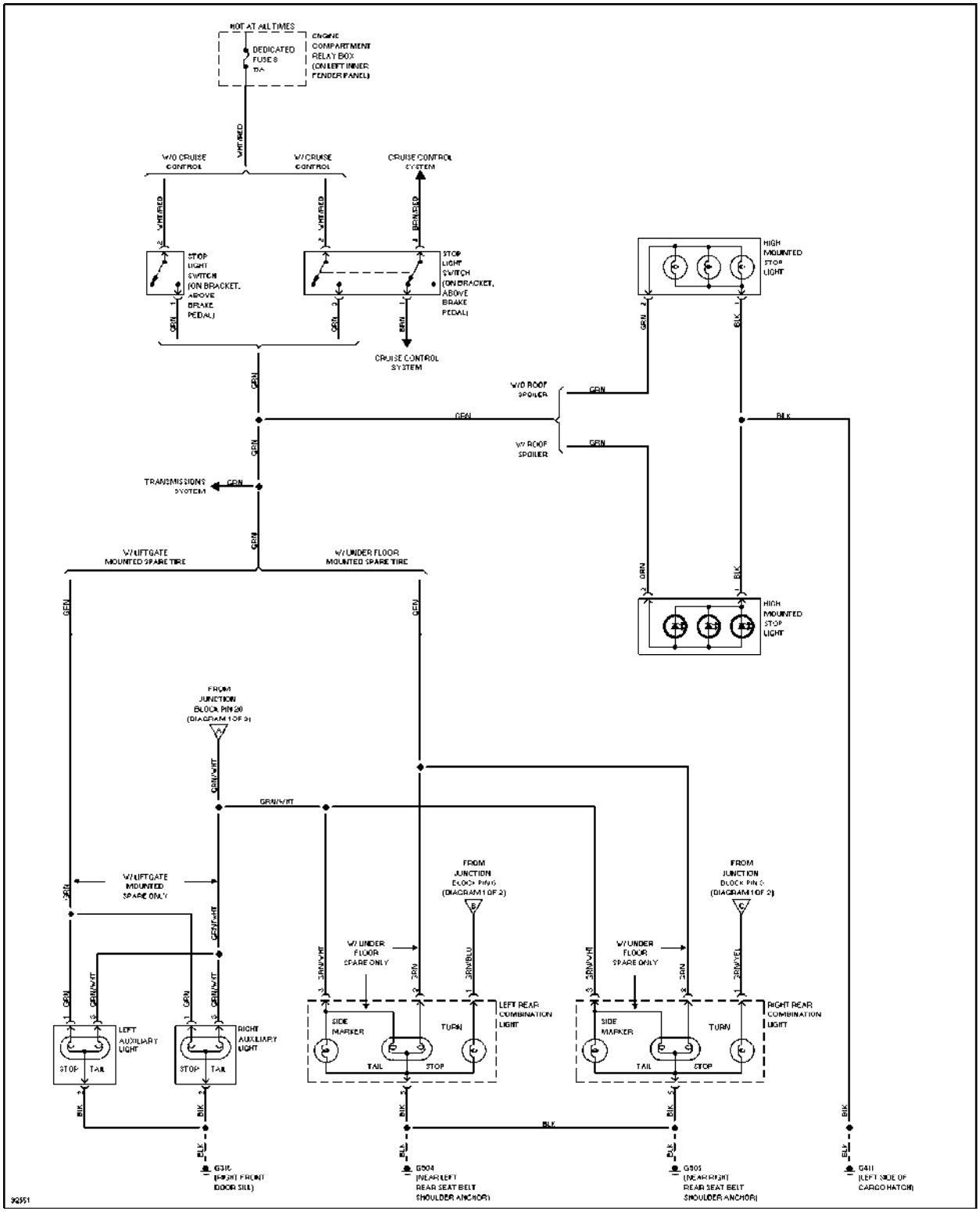
EXTERIOR LIGHTS



Back-up Lamps Circuit

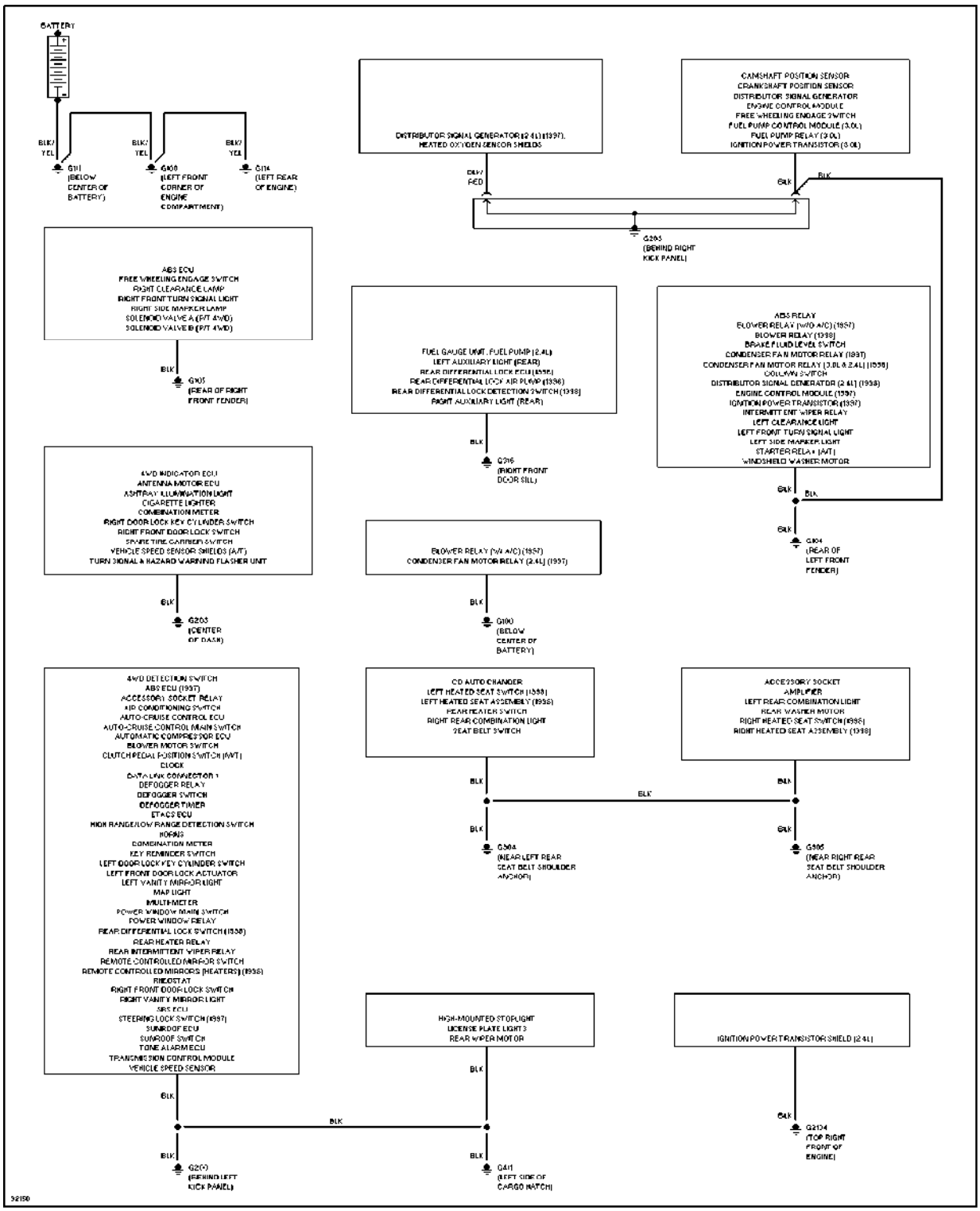


Exterior Lamps Circuit (1 of 2)



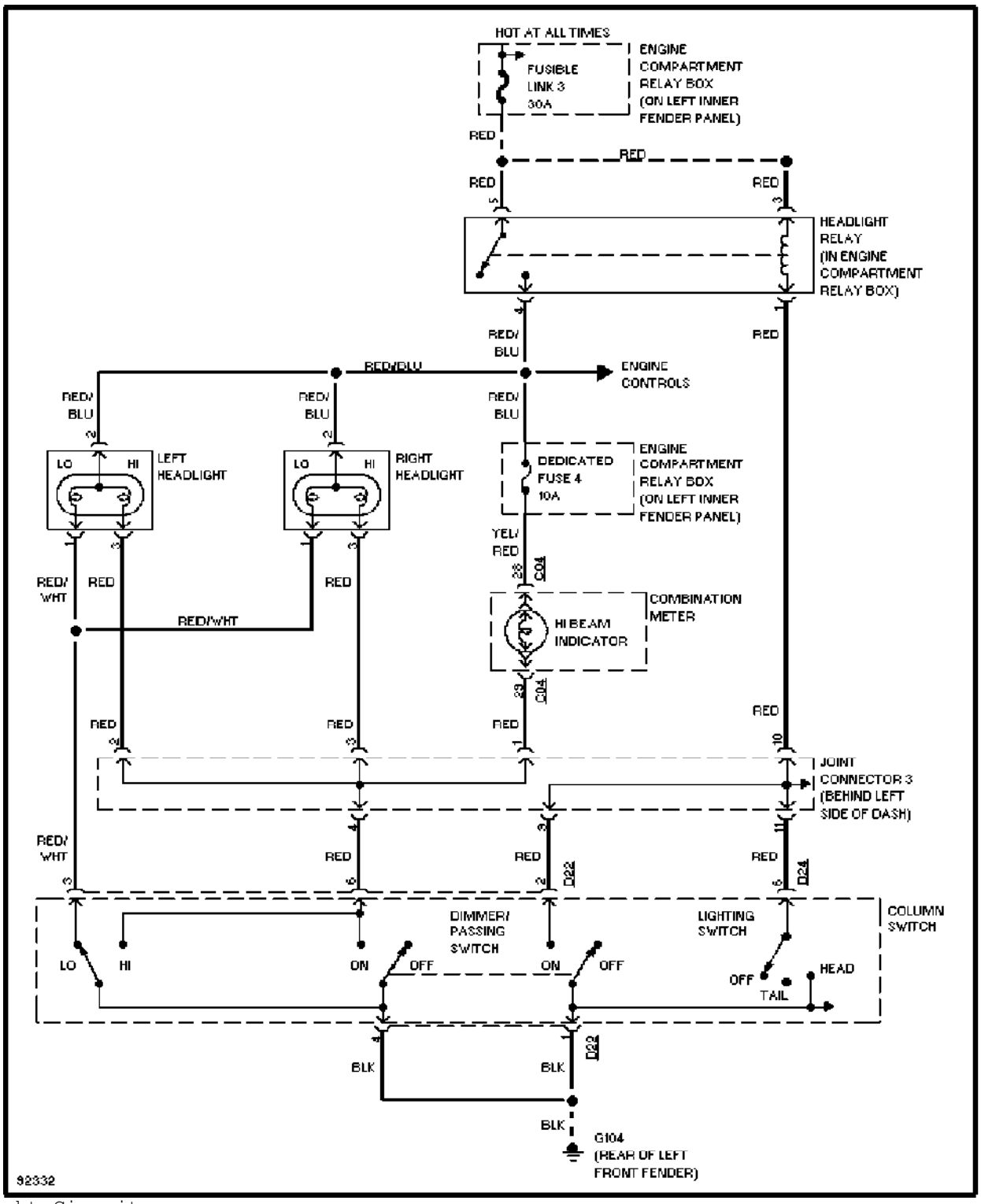
Exterior Lamps Circuit (2 of 2)

GROUND DISTRIBUTION



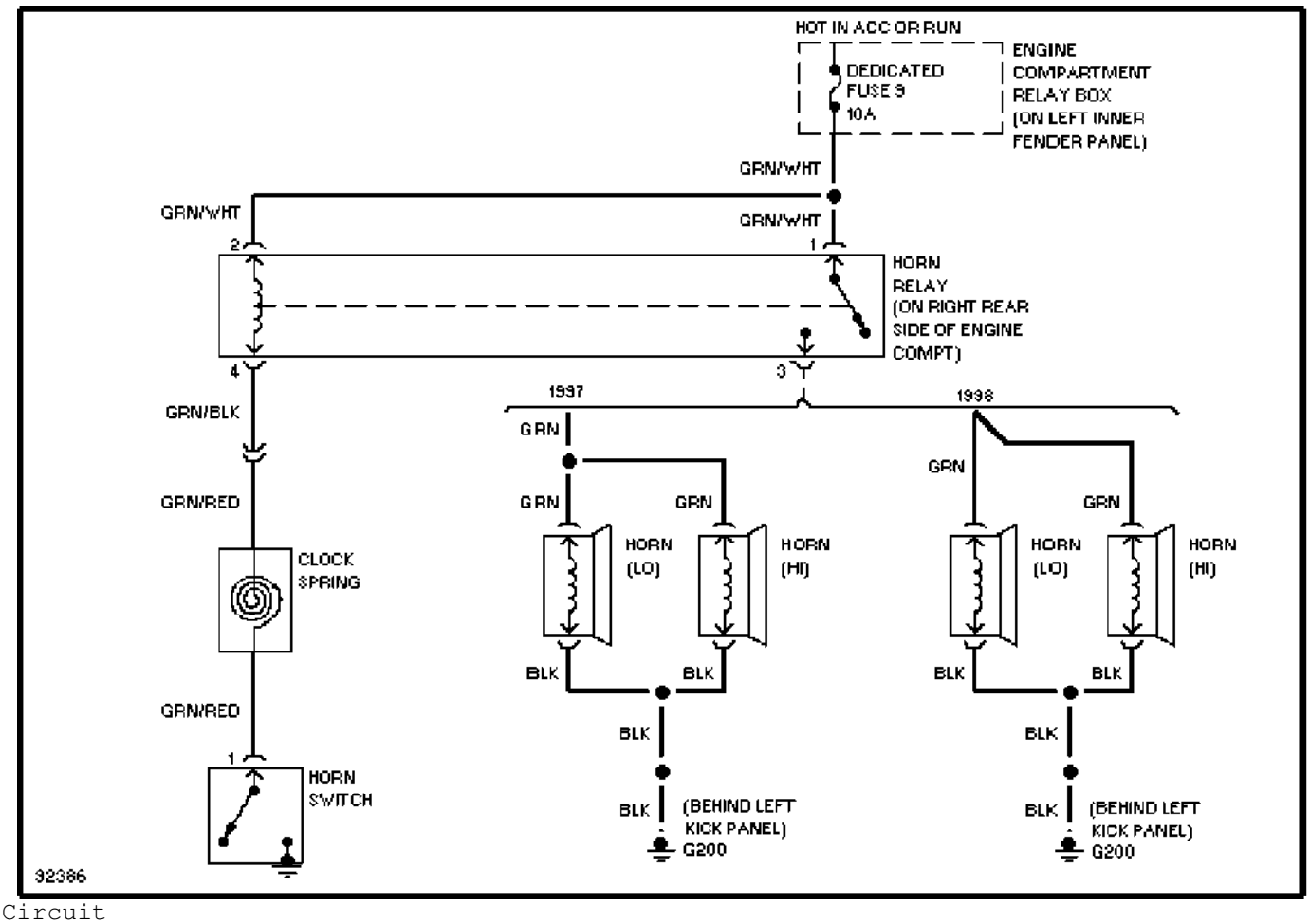
Ground Distribution Circuit

HEADLIGHTS



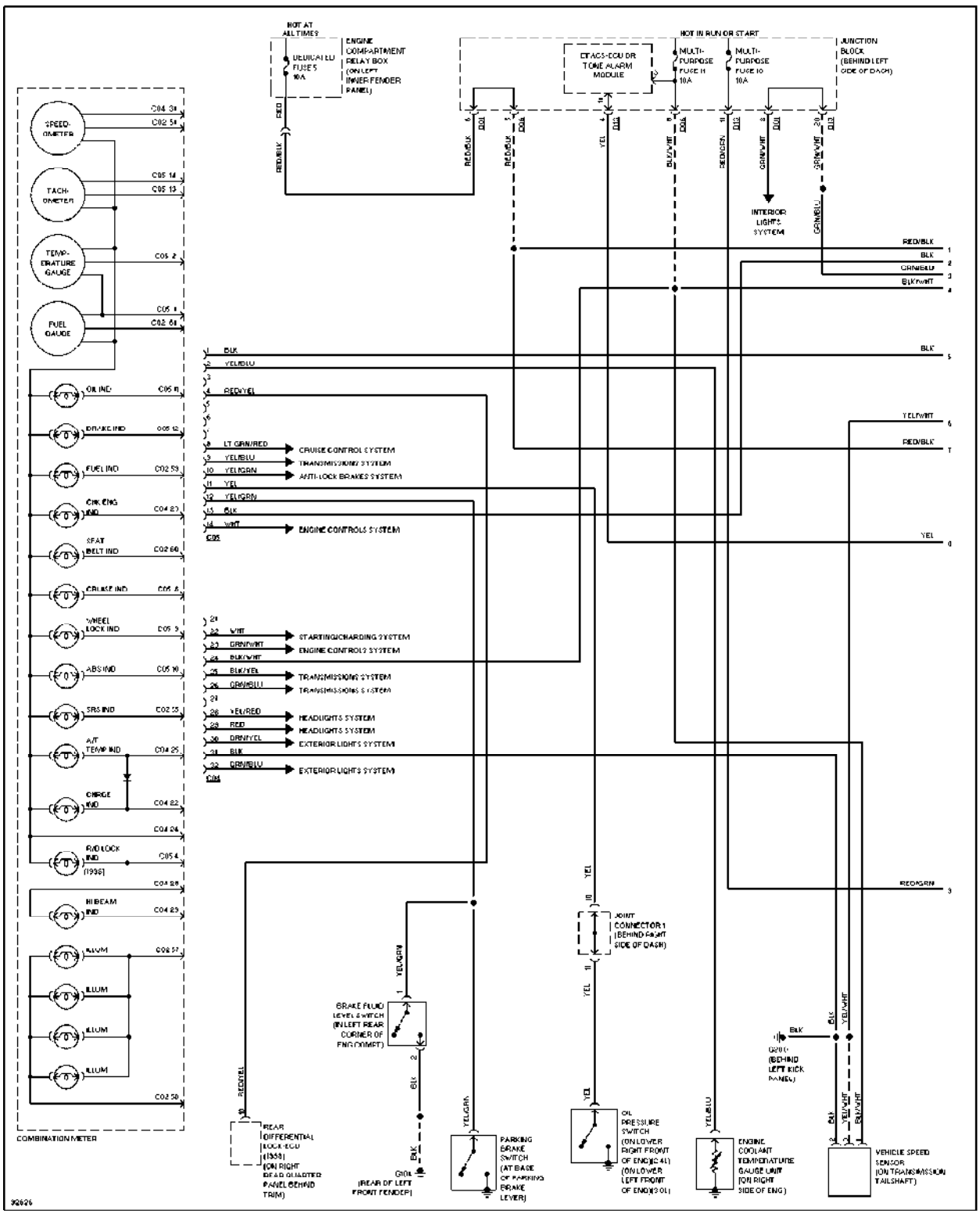
Headlight Circuit

HORN

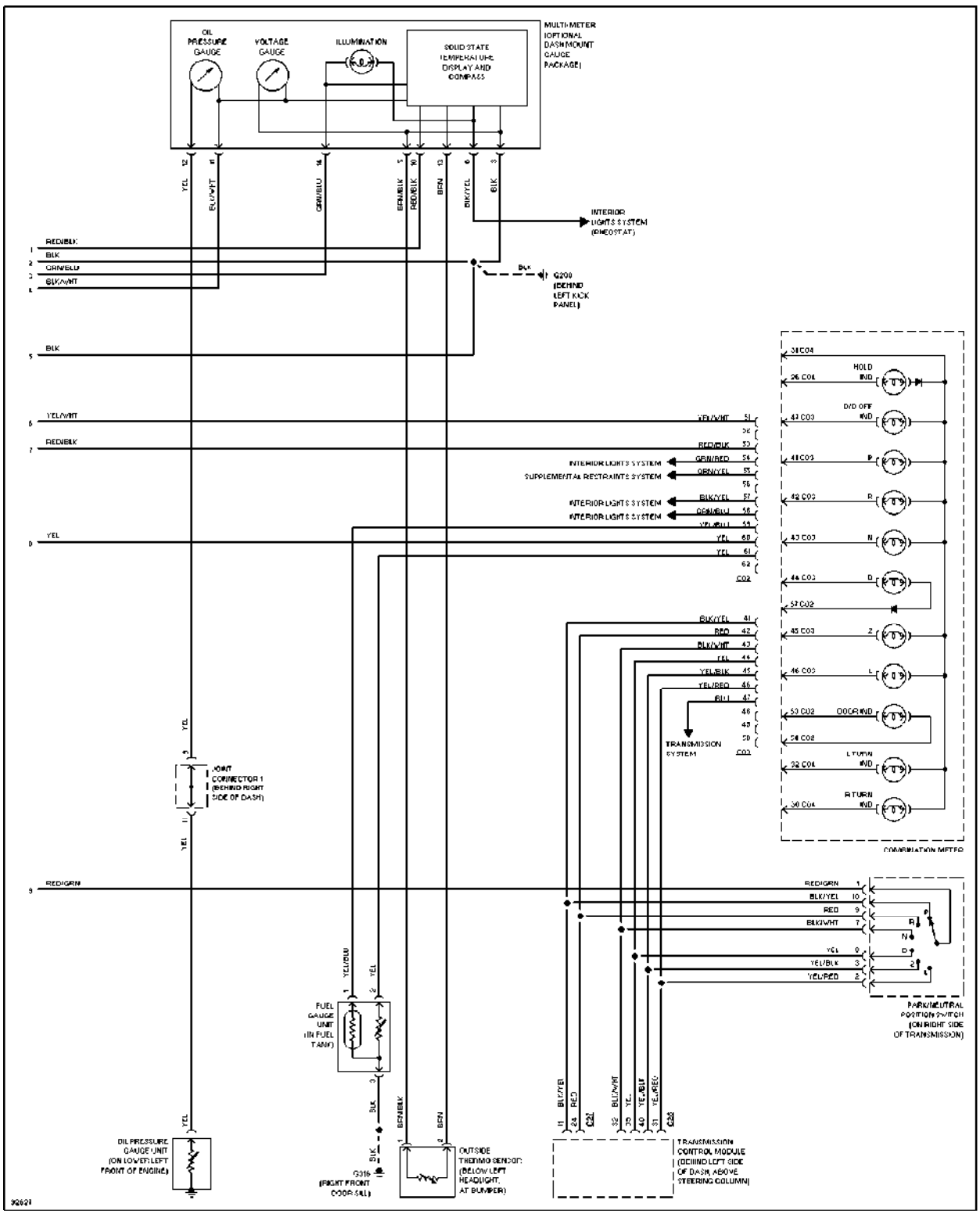


Horn Circuit

INSTRUMENT CLUSTER

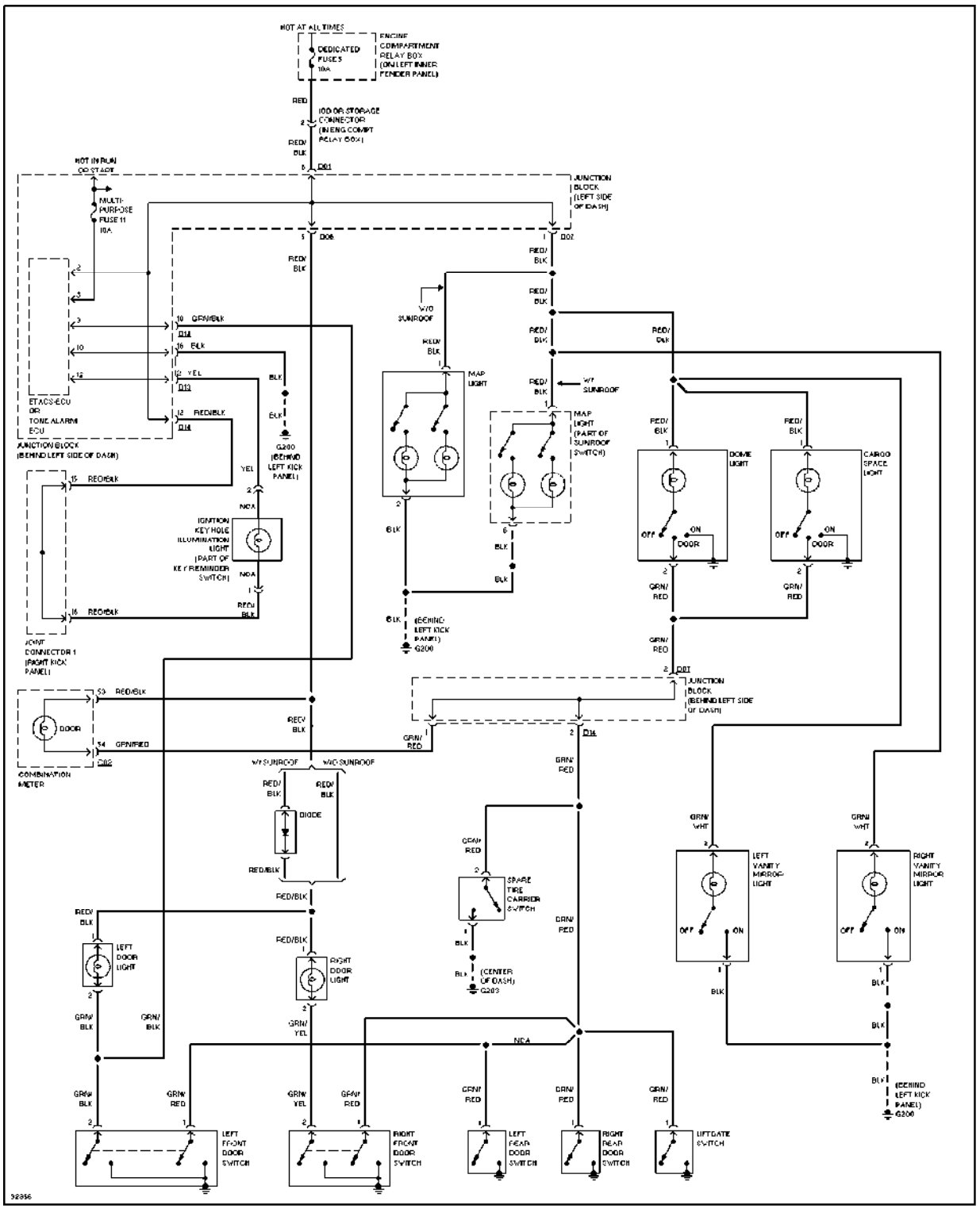


Instrument Cluster Circuit (1 of 2)

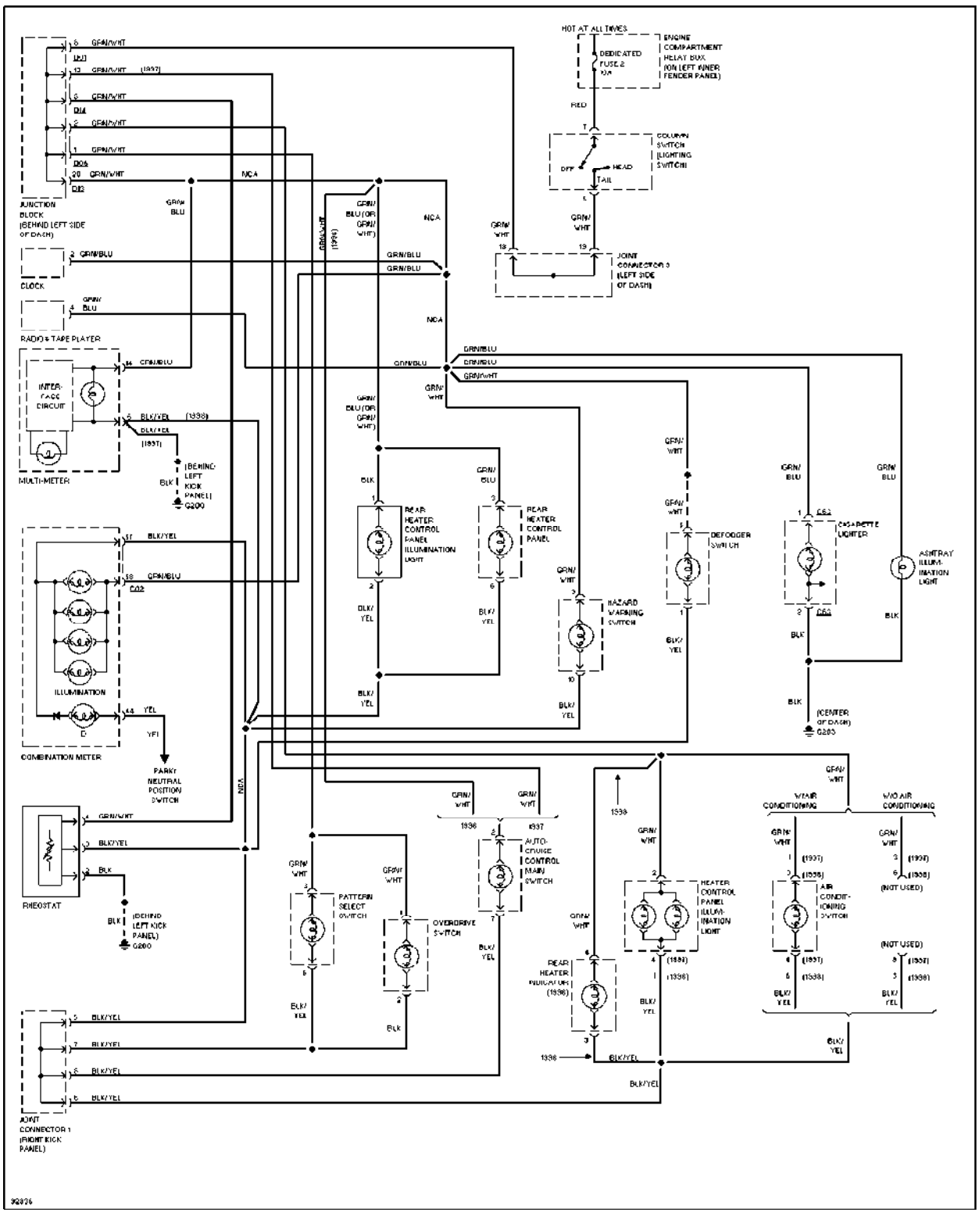


Instrument Cluster Circuit (2 of 2)

INTERIOR LIGHTS

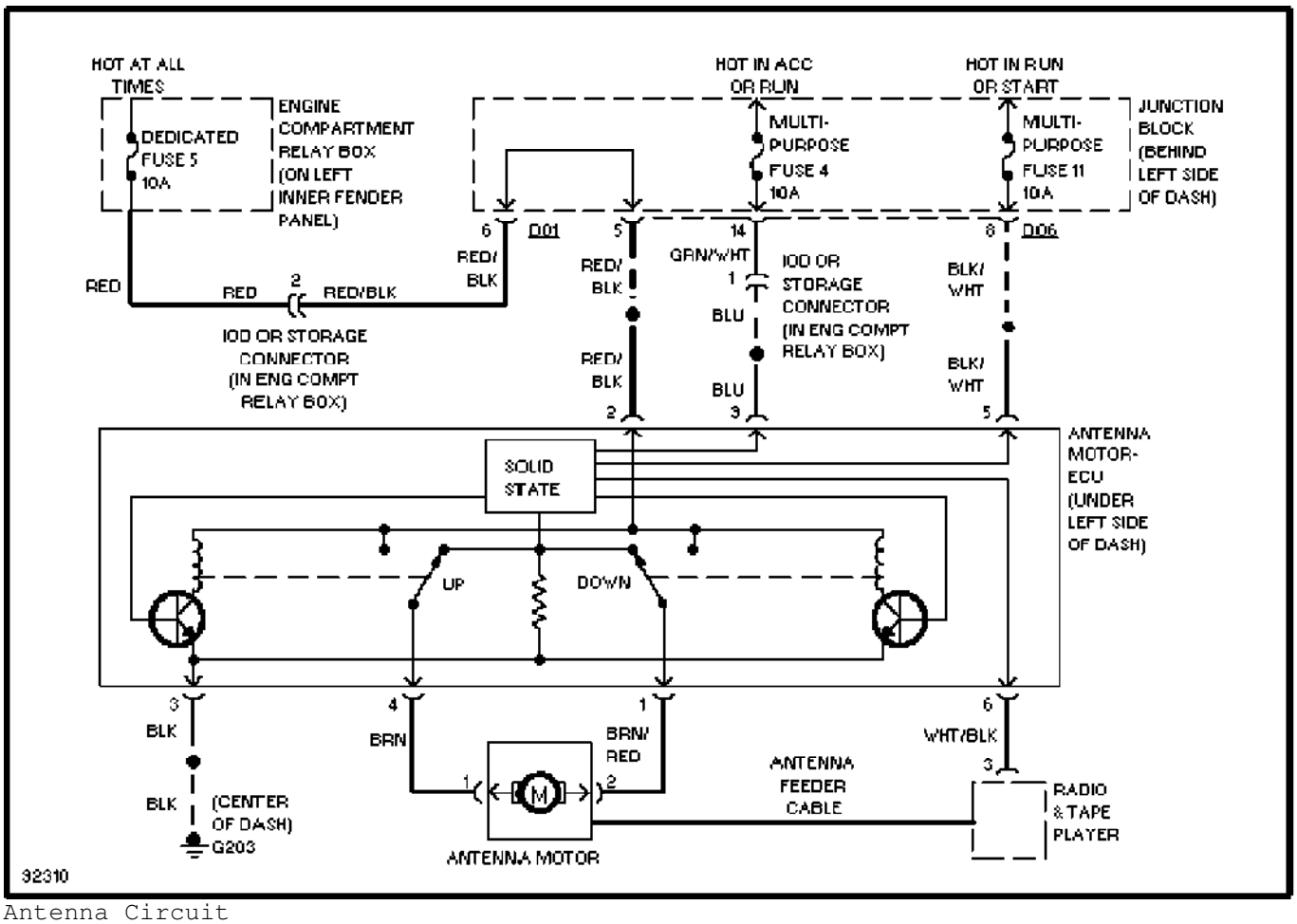


Courtesy Lamps Circuit



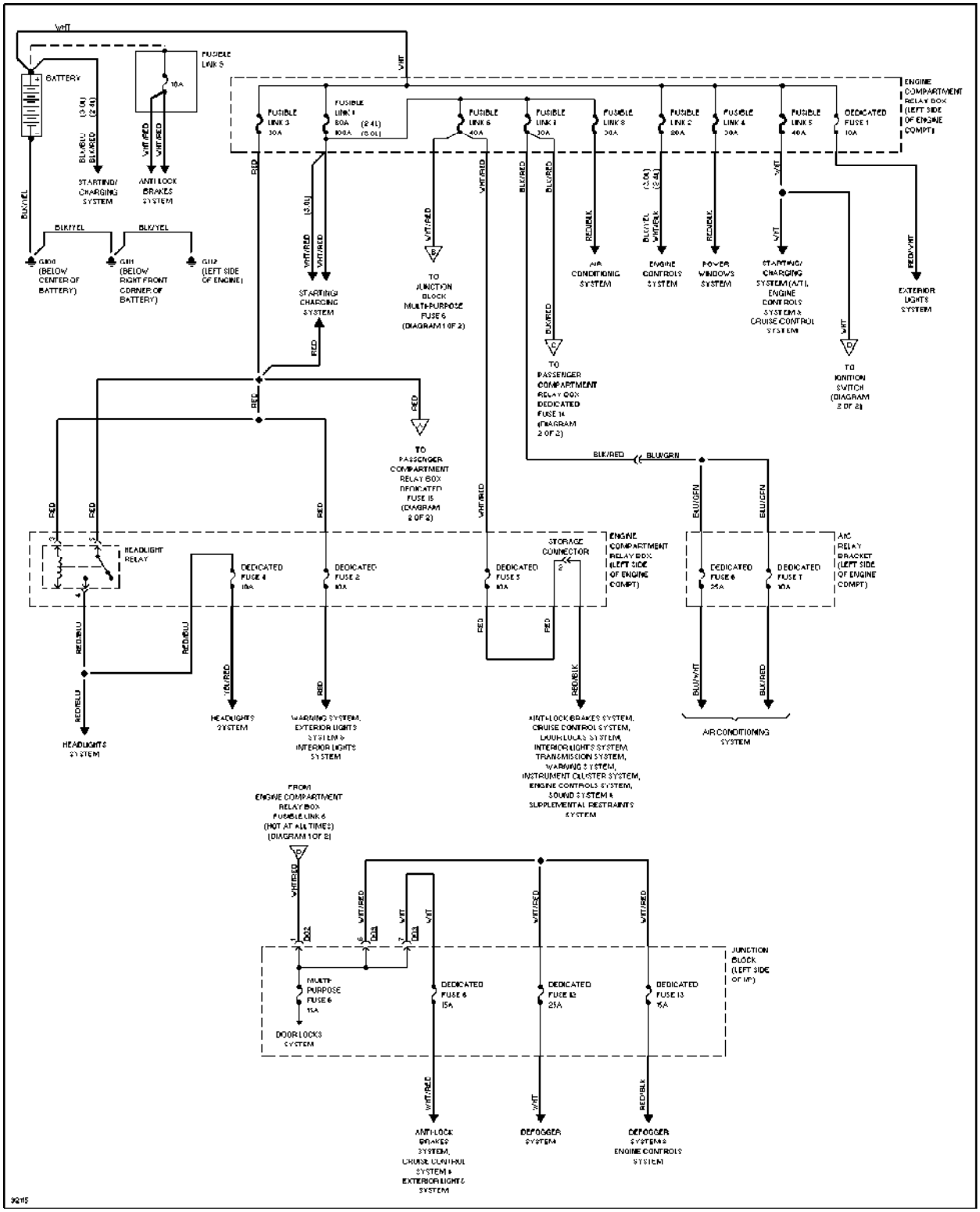
Instrument Illumination Circuit

POWER ANTENNA

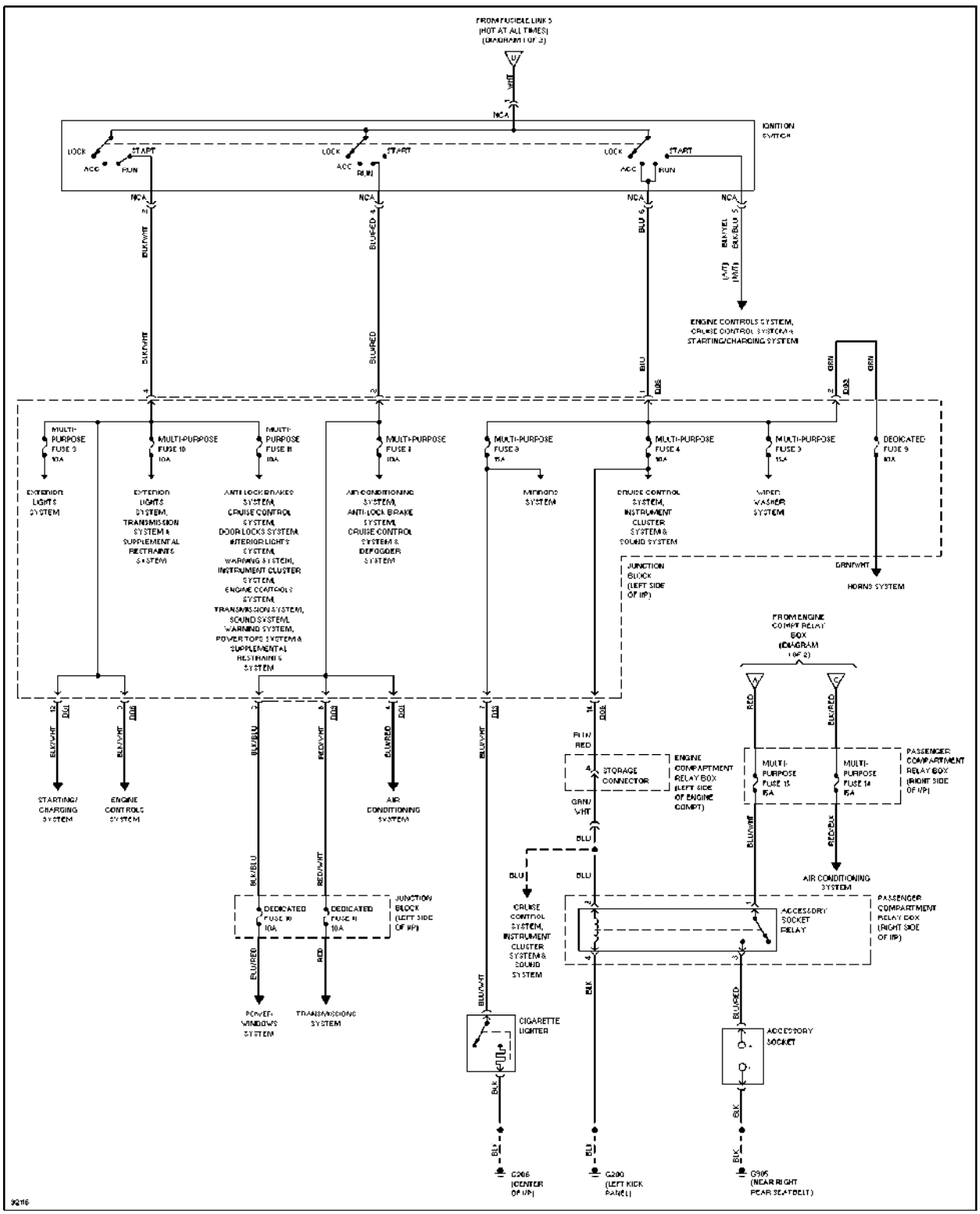


Power Antenna Circuit

POWER DISTRIBUTION

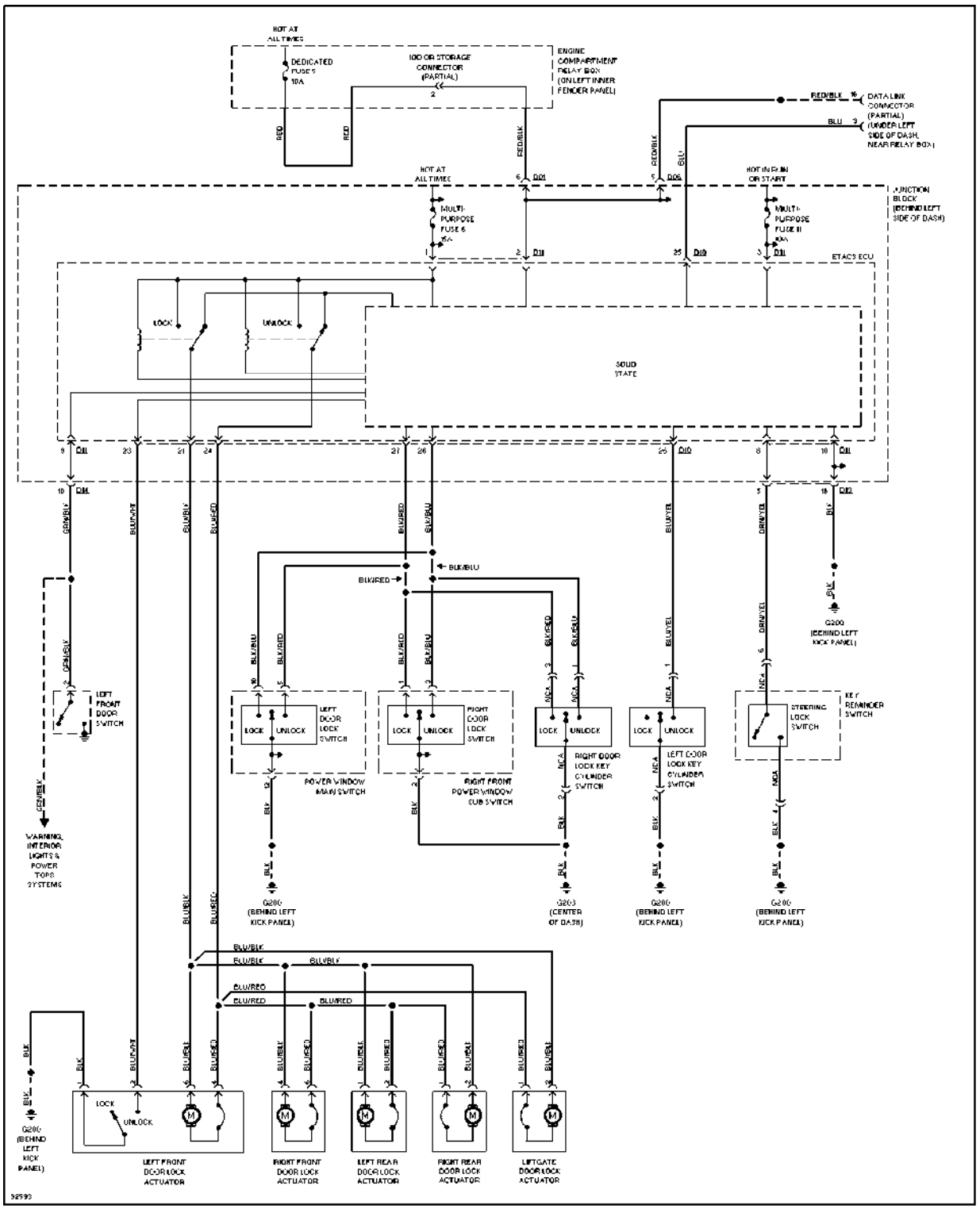


Power Distribution Circuit (1 of 2)



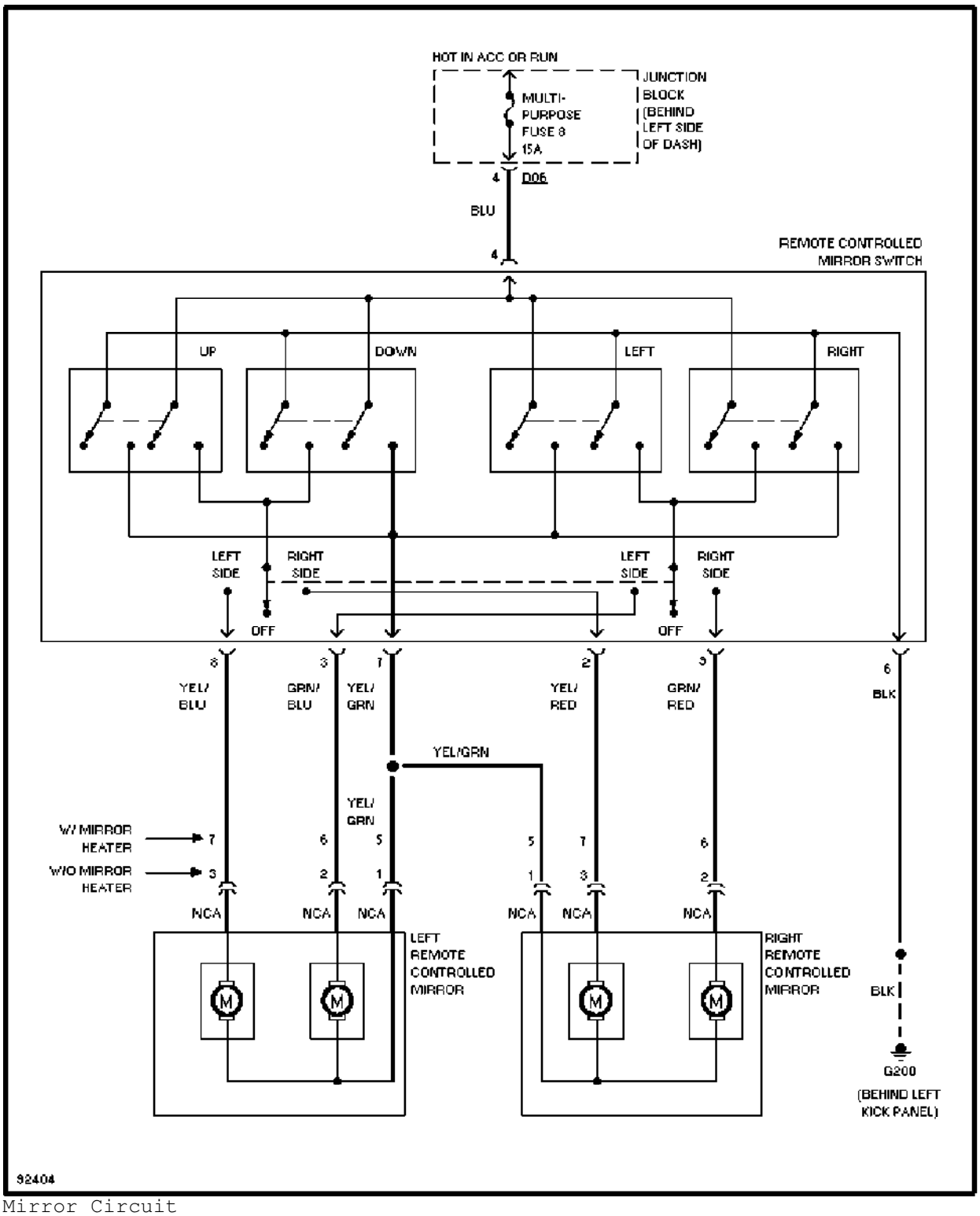
Power Distribution Circuit (2 of 2)

POWER DOOR LOCKS



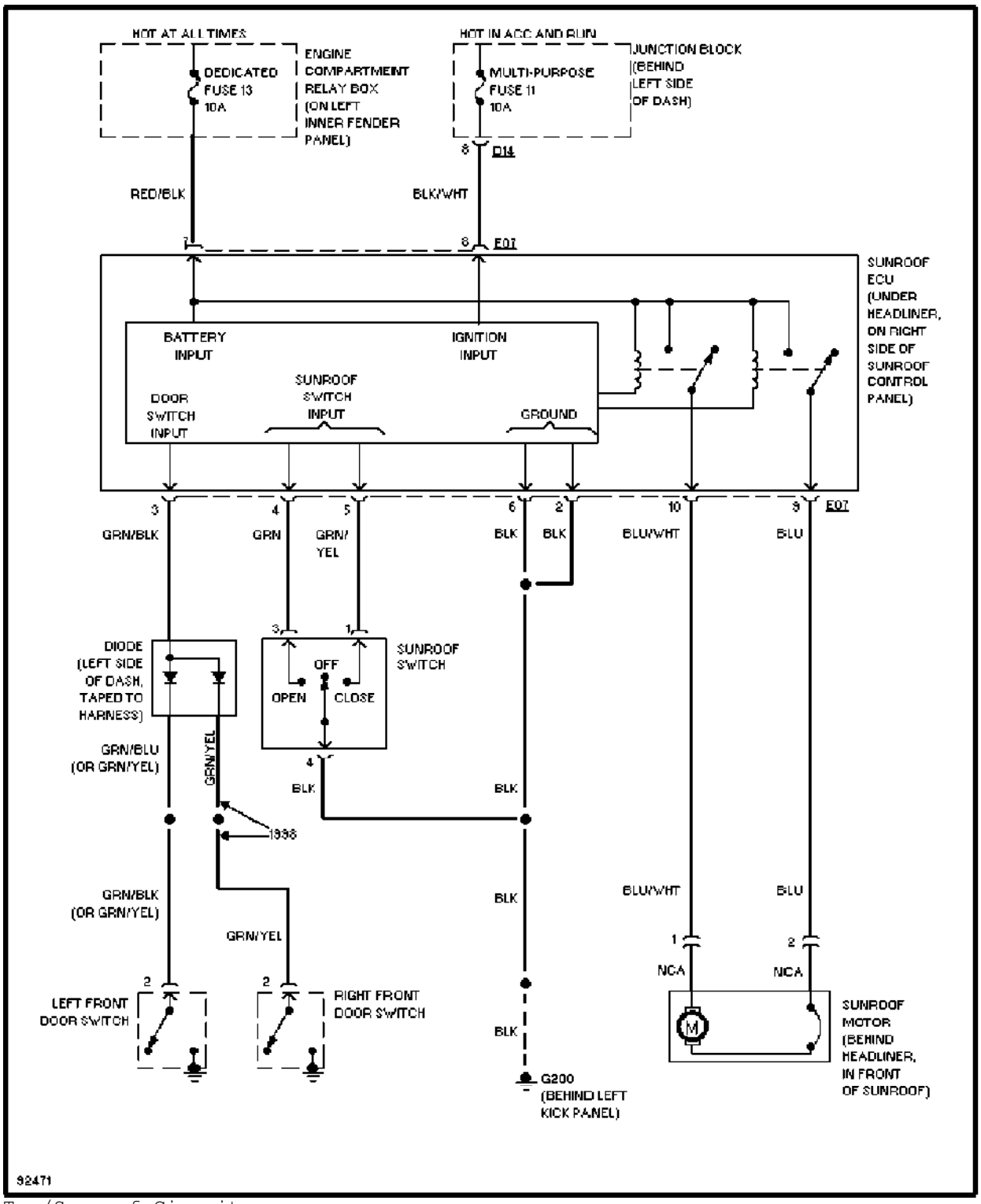
Power Door Lock Circuit

POWER MIRRORS



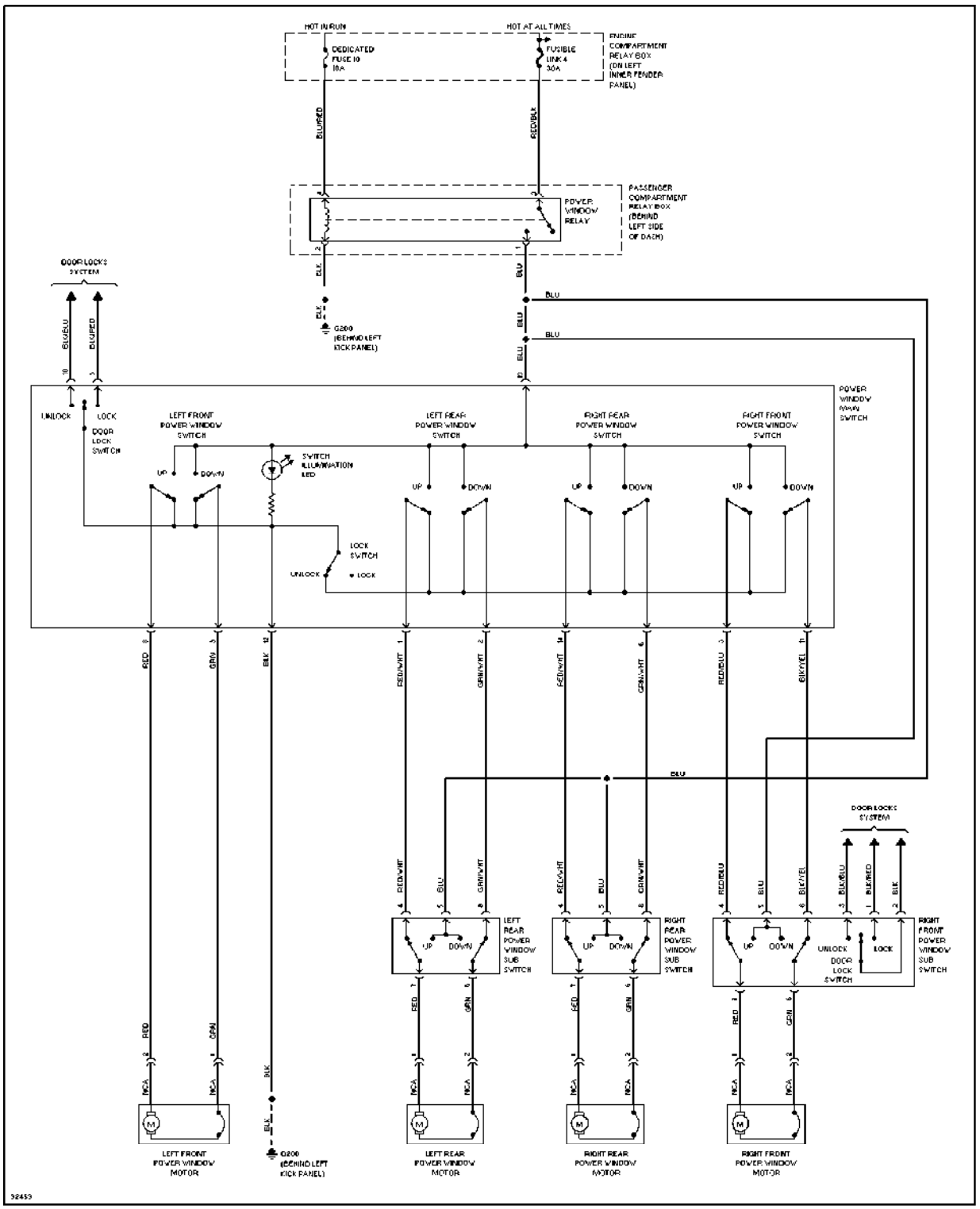
Power Mirror Circuit

POWER TOP/SUNROOF



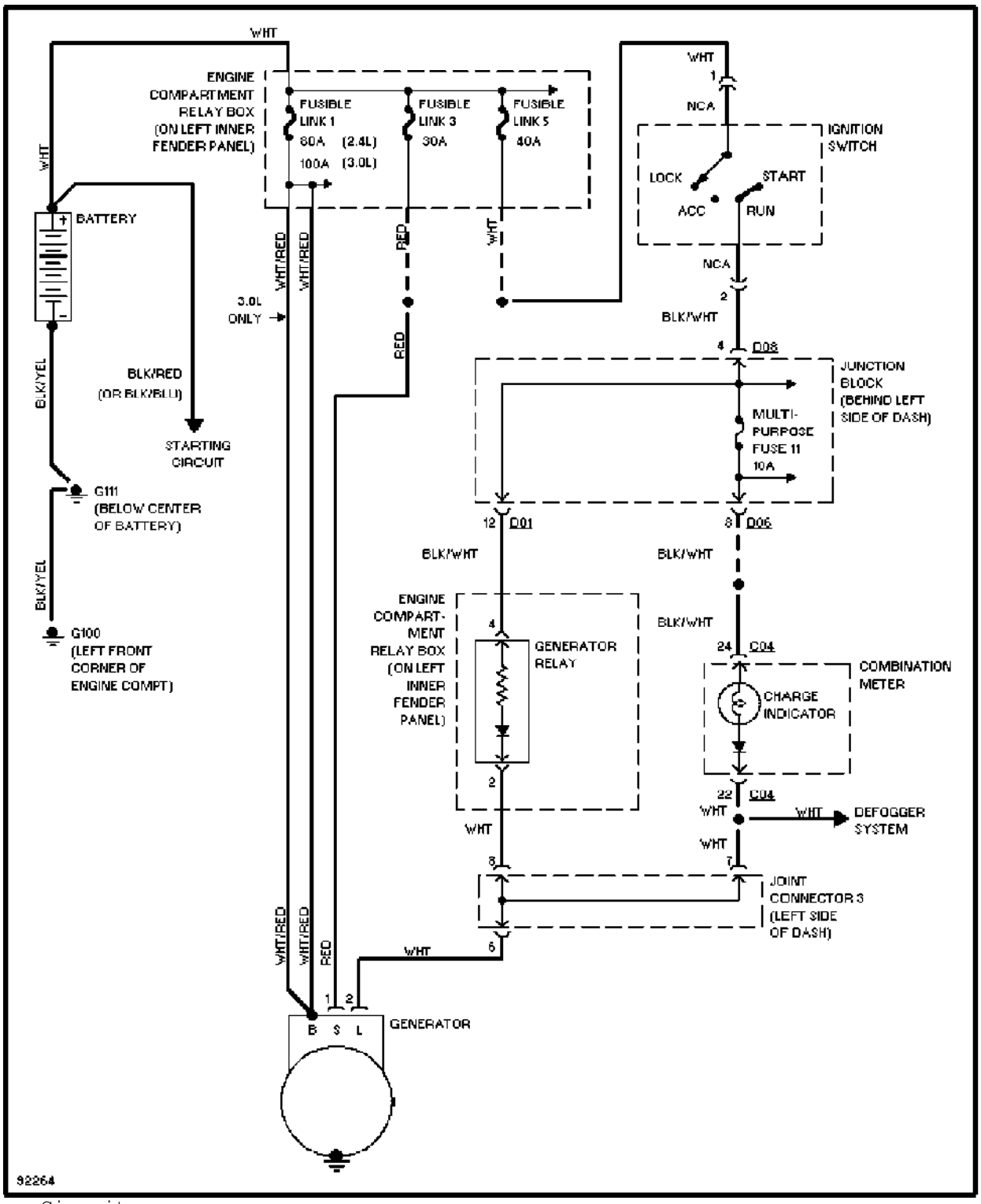
Power Top/Sunroof Circuits

POWER WINDOWS

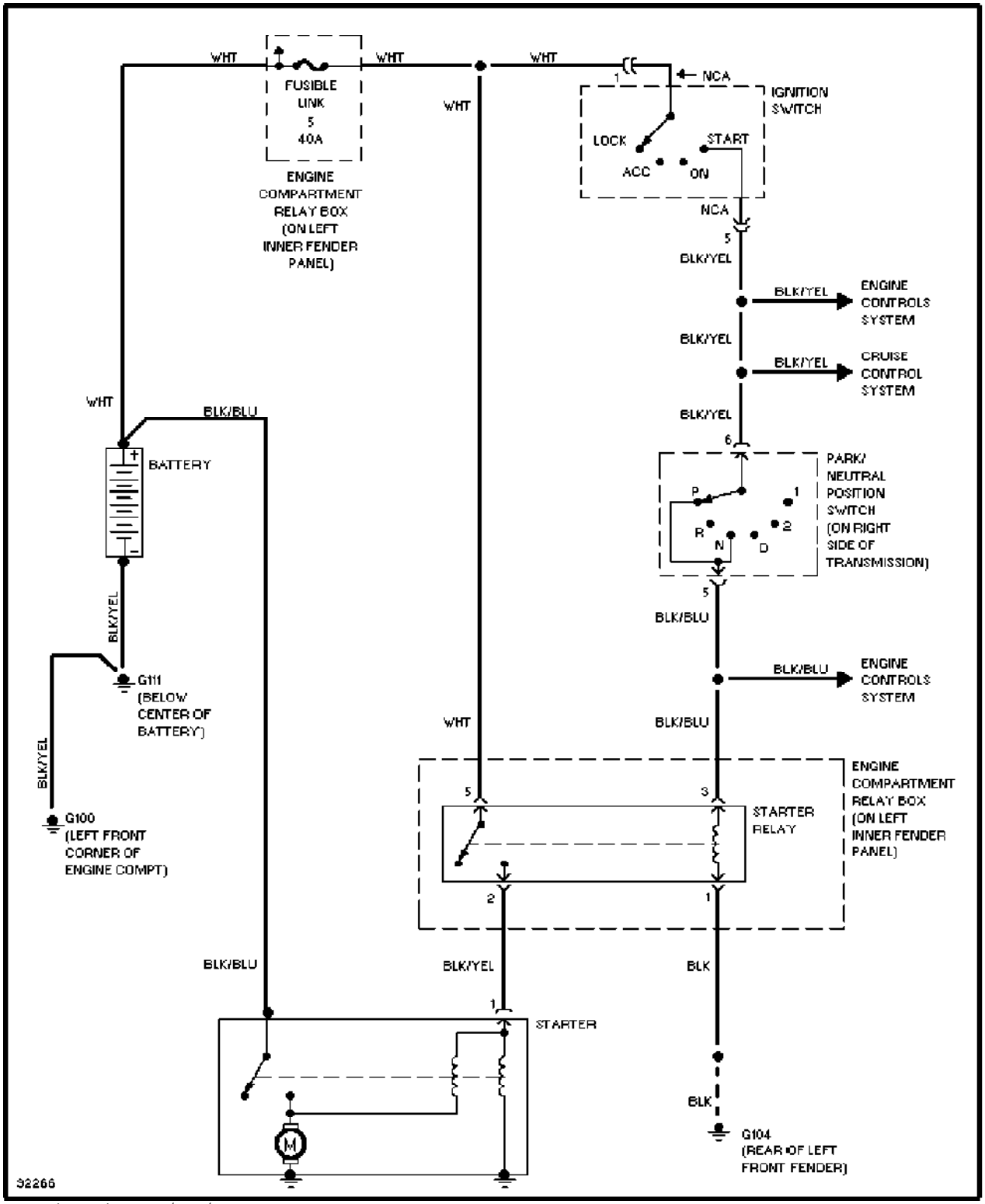


Power Window Circuit

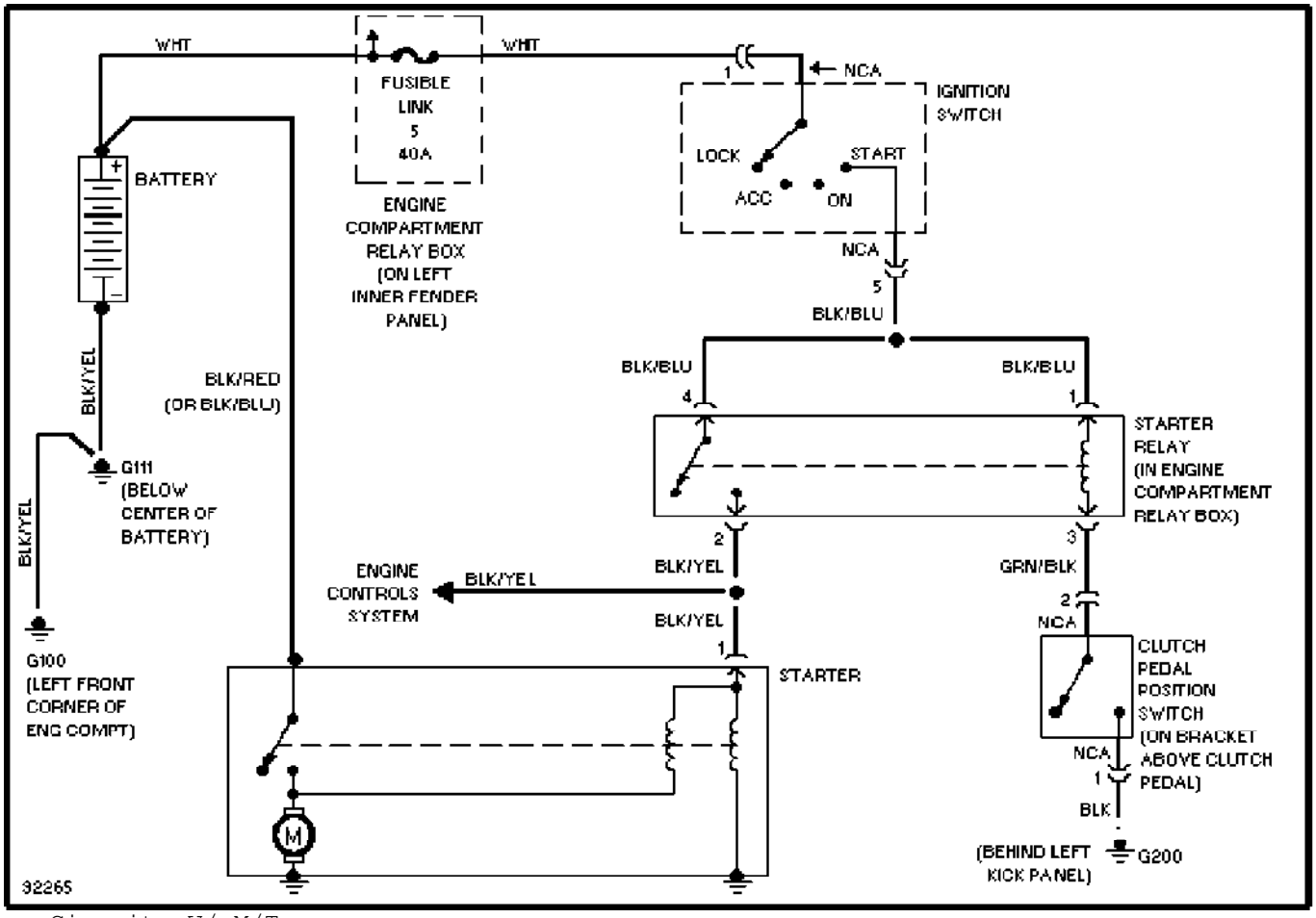
STARTING/CHARGING



Charging Circuit

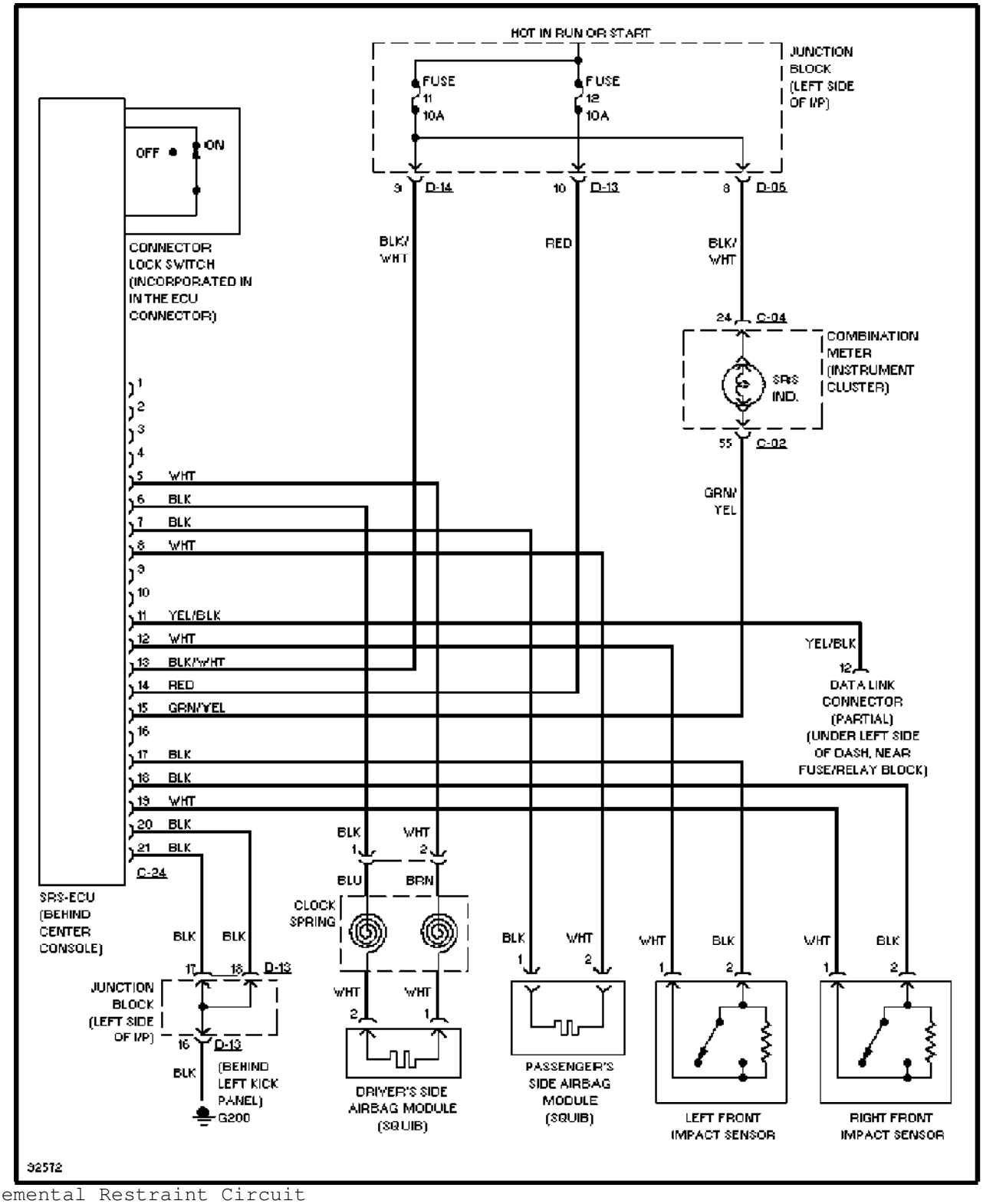


Starting Circuit, W/ A/T



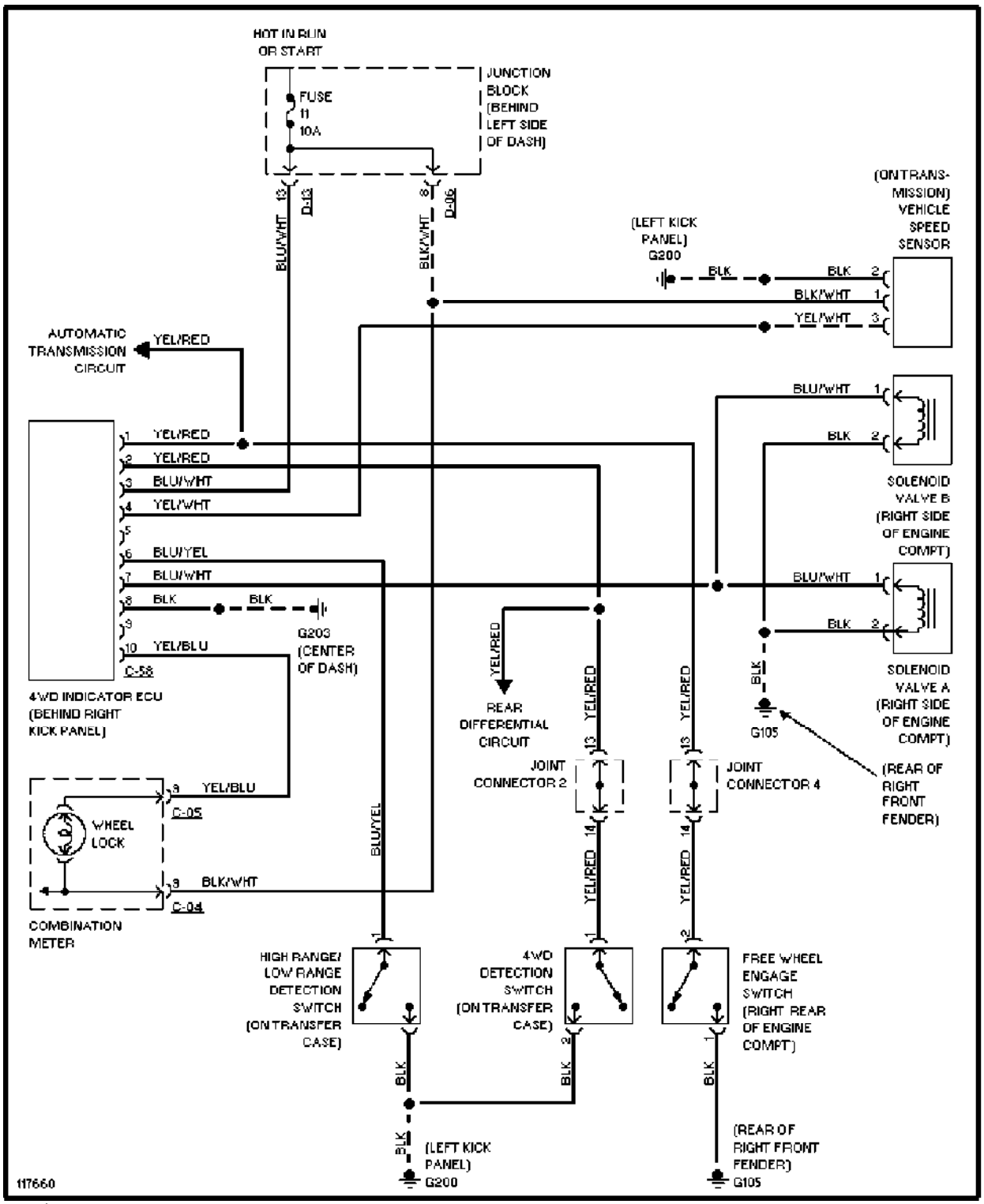
Starting Circuit, W/ M/T

SUPPLEMENTAL RESTRAINTS

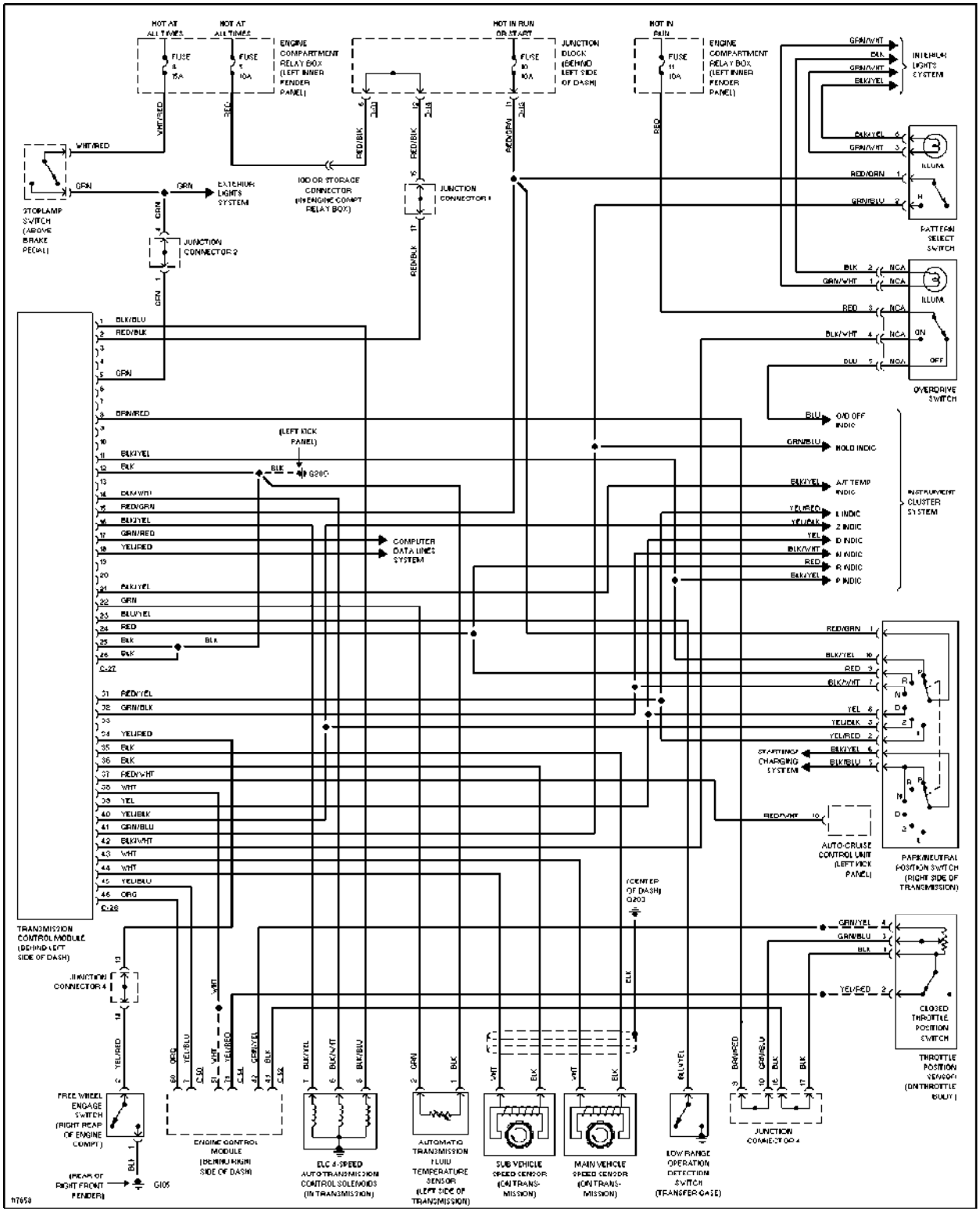


Supplemental Restraint Circuit

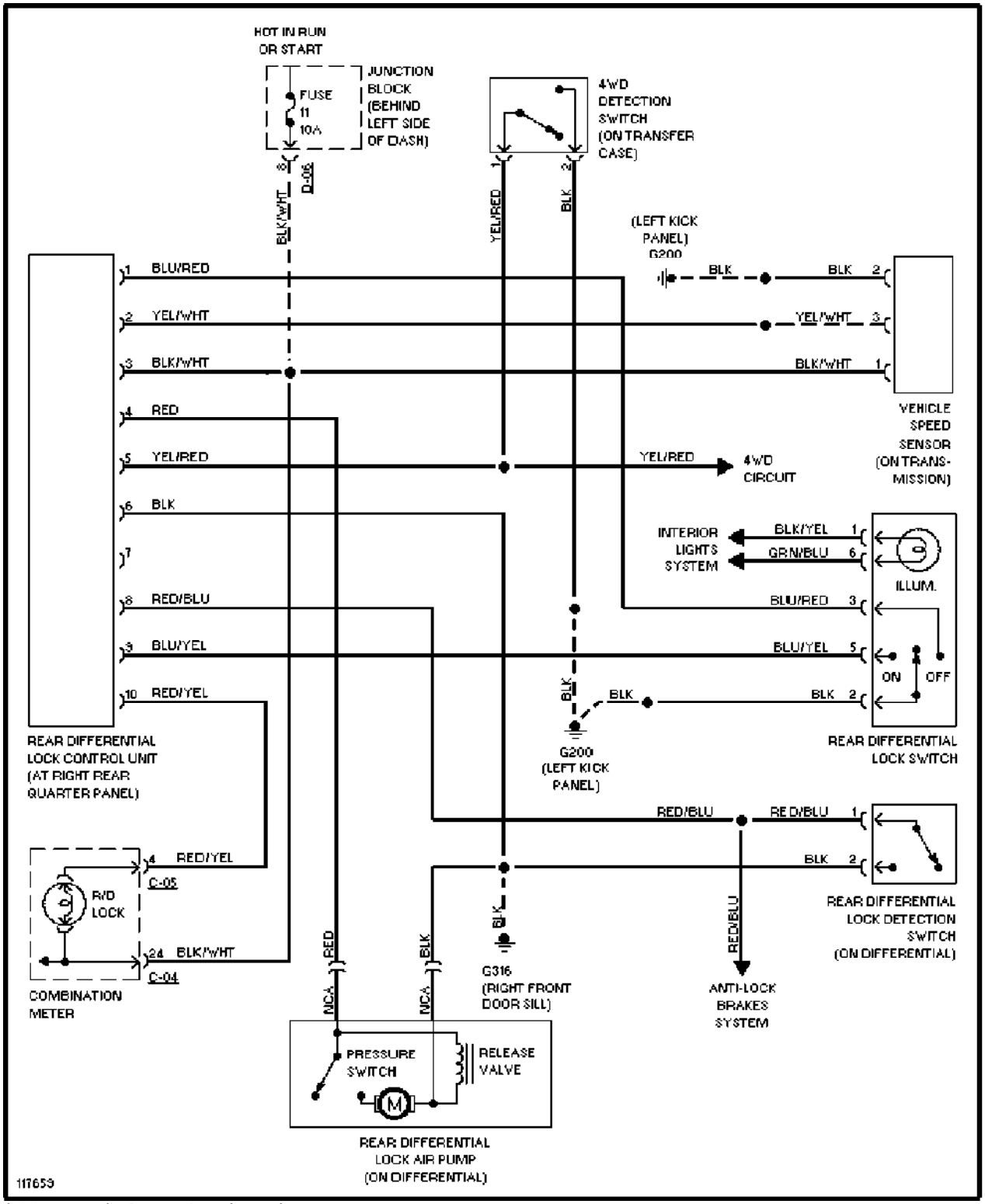
TRANSMISSION



4WD Circuit

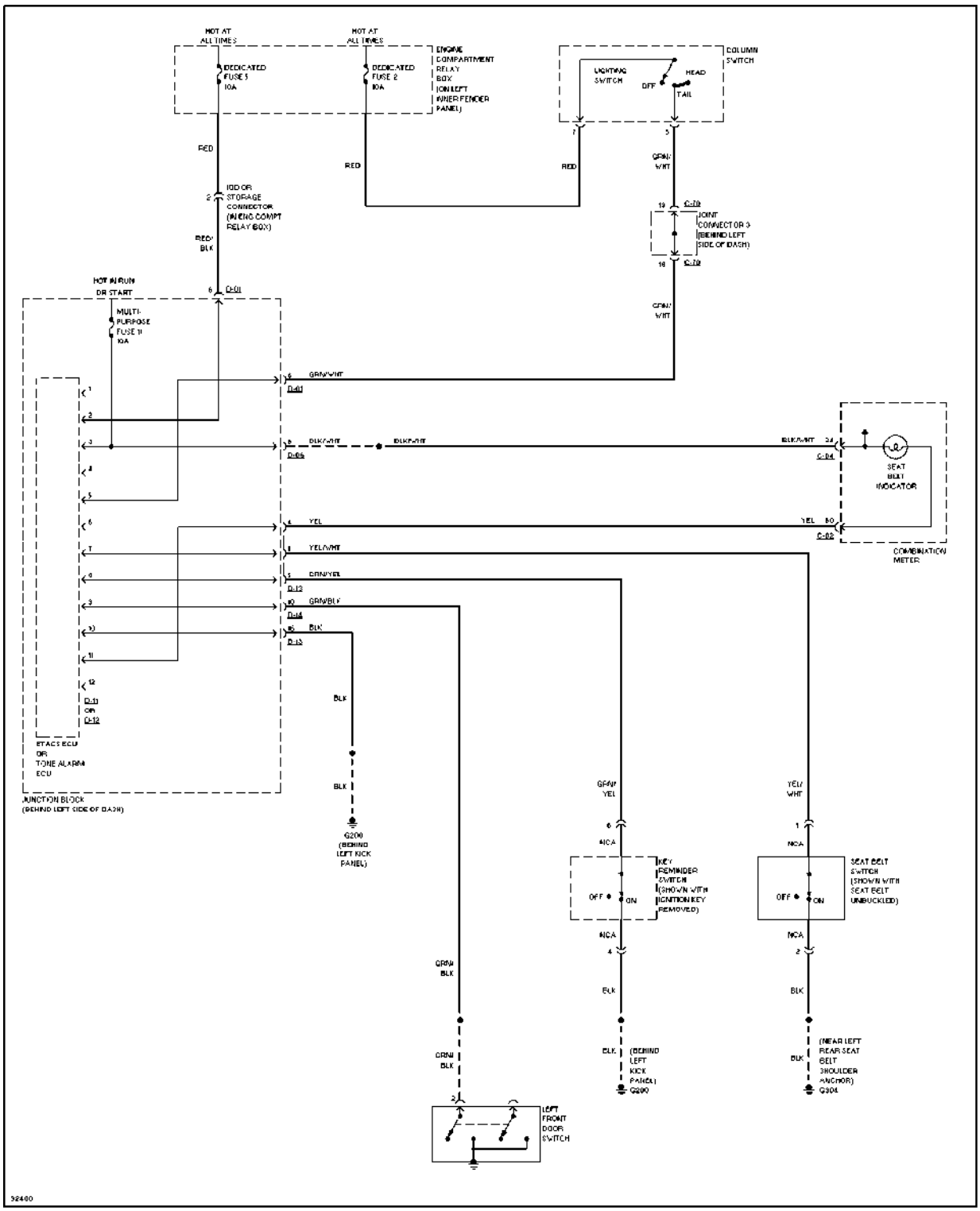


A/T Circuit



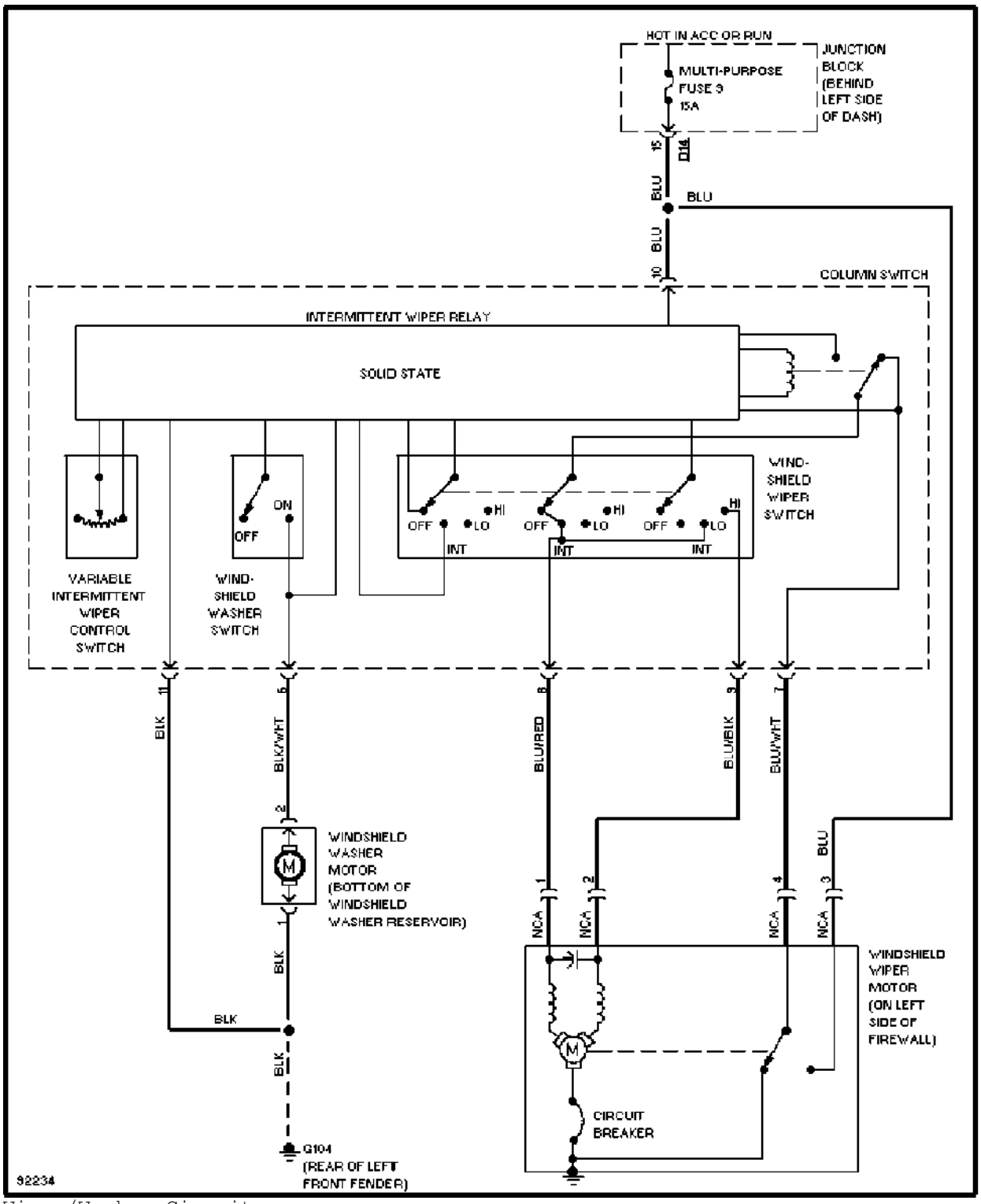
Rear Differential Lock Circuit

WARNING SYSTEMS

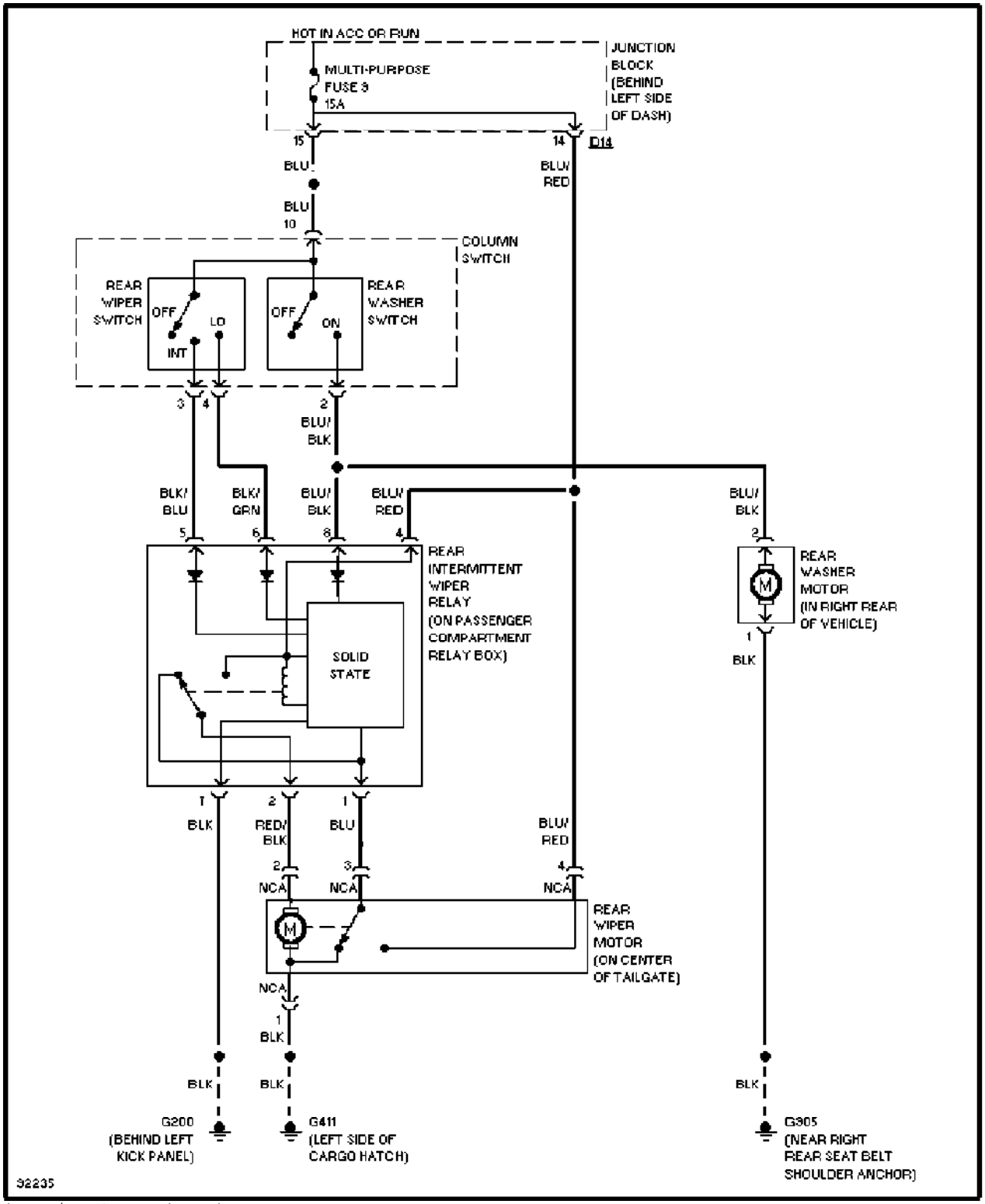


Warning System Circuits

WIPER/WASHER



Front Wiper/Washer Circuit



Rear Wiper/Washer Circuit

G - TESTS W/CODES - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Self-Diagnostics

Montero Sport - 2.4L

INTRODUCTION

NOTE: If no faults were found while performing BASIC DIAGNOSTIC PROCEDURES, proceed with self-diagnostics. If no Diagnostic Trouble Codes (DTCs) or only pass codes are present after entering self-diagnostics, proceed to diagnosis by symptom in H - TESTS W/O CODES - 2.4L article (i.e., ROUGH IDLE, NO START, etc.).

SYSTEM DIAGNOSIS

NOTE: PCM diagnostic memory is retained by direct power supply from battery. Memory is not erased by turning off ignition, but it will be erased if battery or PCM is disconnected.

System diagnosis can be accomplished using a scan tool on all models. See ENTERING ON-BOARD DIAGNOSTICS. Powertrain Control Module (PCM) monitors several different engine control system circuits. If an abnormal input signal occurs, a Diagnostic Trouble Code (DTC) is stored in PCM memory and assigned a DTC number. Each circuit has its own DTC number and message. A specific DTC indicates a particular system failure, but does not indicate that cause of failure is necessarily within system.

A DTC does not condemn any specific component; it simply points out a probable malfunctioning area. If a DTC is set, PCM will turn on MIL. System failures encountered are identified as either hard failures or intermittent failures as determined by PCM.

Hard Failures

Hard failures cause MIL to come on and remain on until failure is repaired. If MIL comes on and remains on (MIL may flash) during vehicle operation, cause of failure may be determined by using DTCs. See DIAGNOSTIC TROUBLE CODES (DTCS). If a sensor fails, PCM will use a substitute value in its calculations to continue engine operation. In this condition (limp-in mode), vehicle is functional, but loss of good driveability may result.

Intermittent Failures

Intermittent failures may cause MIL to flicker or come on and go out after intermittent DTC goes away. However, corresponding DTC will be retained in PCM memory. If related DTC does not reoccur within a certain time frame, related DTC will be erased from PCM memory. Intermittent failures may be caused by a sensor, connector or wiring problems. See INTERMITTENTS in H - TESTS W/O CODES - 2.4L article.

SELF-DIAGNOSTIC SYSTEM

SERVICE PRECAUTIONS

Before proceeding with diagnosis, following precautions must be observed:

* Ensure vehicle has a fully charged battery and functional

charging system.
* Visually inspect connectors and circuit wiring being worked on.
* DO NOT disconnect battery or PCM. This will erase any DTCs stored in PCM.
* DO NOT cause short circuits when performing electrical tests. This will set additional DTCs, making diagnosis of original problem more difficult.
* DO NOT use a test light in place of a voltmeter.
* When checking for spark, ensure coil wire is NOT more than 1/4" from chassis ground. If coil wire is more than 1/4" from chassis ground, damage to vehicle electronics and/or PCM may result.
* DO NOT prolong testing of fuel injectors. Engine may hydrostatically (liquid) lock.
* When a vehicle has multiple DTCs, always repair lowest number DTC first.

VISUAL INSPECTION

Most driveability problems in the engine control system result from faulty wiring, poor electrical connections or leaking air and vacuum hose connections. To avoid unnecessary component testing, perform a visual inspection before beginning self-diagnostic tests.

ENTERING ON-BOARD DIAGNOSTICS

NOTE: DO NOT skip any steps in self-diagnostic tests or incorrect diagnosis may result. Ensure self-diagnostic test applies to vehicle being tested.

DTCs may be retrieved by using a scan tool only. Proceed to appropriate DTC retrieval method.

NOTE: Although other scan tools are available, Mitsubishi recommends using Multi-Use Tester II (MUT II) scan tool.

Using Scan Tool

1) Refer to manufacturer's operation manual for instructions in use of scan tool. Before entering on-board diagnostics, see SERVICE PRECAUTIONS. Locate Data Link Connector (DLC) under instrument panel, near steering column.

2) Turn ignition switch to OFF position. Connect scan tool to DLC. Turn ignition switch to ON position. Read and record scan tool self-diagnostic output. Proceed to DIAGNOSTIC TROUBLE CODES (DTCS).

DIAGNOSTIC TROUBLE CODES (DTCS)

DTCS

NOTE: DTCs can only be retrieved by using a scan tool. DTCs listed below are retrieved using a generic scan tool. MUT II scan tool can be used, but it may not read all DTCs. DTCS listed are not used on all vehicles.

DTC P0100

Volume Airflow (VAF) circuit failure. Possible causes are: connector or harness, or faulty VAF sensor.

DTC P0105

Barometric (BARO) pressure circuit failure. Possible causes are: connector or harness, or faulty BARO pressure sensor.

DTC P0105
Manifold Absolute Pressure (MAP) circuit failure. Possible causes are: connector or harness, or faulty MAP sensor.

DTC P0110
Intake Air Temperature (IAT) circuit failure. Possible causes are: connector or harness, or faulty VAF sensor.

DTC P0115
Engine Coolant Temperature (ECT) circuit failure. Possible causes are: connector or harness, or faulty ECT sensor.

DTC P0120
Throttle Position (TP) circuit failure. Possible causes are: connector or harness, or faulty TP sensor.

DTC P0125
Excessive time to enter closed loop fuel control. Possible causes are: faulty front HO2S, HO2S connector or harness, or faulty fuel injector.

DTC P0130
Front Heated Oxygen Sensor (HO2S) circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0135
Front Heated Oxygen Sensor (HO2S) heater circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0136
Rear Heated Oxygen Sensor (HO2S) circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0141
Rear Heated Oxygen Sensor (HO2S) heater circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0150
Heated Oxygen Sensor (HO2S) circuit failure (bank 2, sensor 1). Possible causes are: connector or harness, or HO2S.

DTC P0155
Heated Oxygen Sensor (HO2S) heater circuit failure (bank 2, sensor 1). Possible causes are: connector or harness, or HO2S.

DTC P0156
Heated Oxygen Sensor (HO2S) circuit failure (bank 2, sensor 2). Possible causes are: connector or harness, or HO2S.

DTC P0161
Heated Oxygen Sensor (HO2S) heater circuit failure (bank 2, sensor 2). Possible causes are: connector or harness, or HO2S.

DTC P0170
Fuel trim failure (bank 1). Possible causes are: intake air leaks, cracked exhaust manifold, faulty VAF sensor frequency, HO2S, injector, fuel pressure, ECT, IAT or BARO pressure sensor.

DTC P0173
Fuel trim failure (bank 2). Possible causes are: intake air leaks, cracked exhaust manifold, faulty VAF sensor frequency, HO2S, injector, fuel pressure, ECT, IAT or BARO pressure sensor.

DTC P0201
Cylinder No. 1 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0202
Cylinder No. 2 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0203
Cylinder No. 3 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0204
Cylinder No. 4 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0205
Cylinder No. 5 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0206
Cylinder No. 6 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0300
Random misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0301
Cylinder No. 1 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0302
Cylinder No. 2 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0303
Cylinder No. 3 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0304
Cylinder No. 4 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0305
Cylinder No. 5 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0306
Cylinder No. 6 misfire detected. Possible causes are:

connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0335
Crankshaft Position (CKP) sensor circuit failure. Possible causes are: connector or harness, or faulty CKP sensor.

DTC P0340
Camshaft Position (CMP) sensor circuit failure. Possible causes are: connector or harness, or faulty CMP sensor.

DTC P0400
Exhaust Gas Recirculation (EGR) flow failure. Possible causes are: connector or harness, faulty EGR valve, EGR solenoid, EGR valve control vacuum, or manifold differential pressure sensor.

DTC P0403
Exhaust Gas Recirculation (EGR) solenoid failure. Possible causes are: connector or harness, or faulty EGR solenoid.

DTC P0420
Catalyst efficiency below threshold. Possible causes are: cracked exhaust manifold, or faulty catalytic converter.

DTC P0421
Warm-up catalyst efficiency below threshold (bank 1). Possible causes are: faulty exhaust manifold. If exhaust manifold is okay, replace catalytic converter.

DTC P0431
Warm-up catalyst efficiency below threshold (bank 2). Possible causes are: faulty exhaust manifold. If exhaust manifold is okay, replace catalytic converter.

DTC P0440
Evaporative (EVAP) emission control system failure. Possible causes are: connector or harness, improper hose routing, faulty EVAP solenoid, or EVAP purge control solenoid.

DTC P0442
Evaporative (EVAP) emission control system leak detected. Possible causes are: connector or harness, faulty EVAP purge solenoid, purge control valve, or vacuum hose routing.

DTC P0443
Evaporative (EVAP) purge control valve circuit failure. Possible causes are: connector or harness, or faulty EVAP solenoid.

DTC P0446
Evaporative (EVAP) emission control system vent control failure. Possible causes are: connector or harness, faulty EVAP vent solenoid.

DTC P0450
Evaporative (EVAP) emission control system pressure sensor failure. Possible causes are: connector or harness, or faulty fuel tank differential pressure sensor.

DTC P0500
Vehicle Speed Sensor (VSS) failure. Possible causes are: connector or harness, or faulty VSS.

DTC P0505
Idle Air Control (IAC) system failure. Possible causes are: connector or harness, or faulty IAC motor.

DTC P0510
Closed Throttle Position (TP) switch failure. Possible causes are: connector or harness, or faulty closed TP switch.

DTC P0551
Power Steering Pressure (PSP) sensor failure. Possible causes are: connector or harness, or faulty PSP sensor.

DTC P0705
Automatic transaxle/transmission range sensor circuit failure. Possible causes are: connector or harness, or faulty PNP switch.

DTC P0710
Automatic transaxle/transmission fluid sensor failure. Possible causes are: connector or harness, or faulty transaxle/transmission sensor.

DTC P0715
Automatic transaxle input/turbine speed sensor circuit failure. Possible causes are: connector or harness, or pulse generator.

DTC P0720
Automatic transaxle input/turbine speed sensor circuit failure. Possible causes are: connector or harness, or pulse generator.

DTC P0725
Engine speed input circuit failure. Possible causes are: connector or harness.

DTC P0740
Torque converter clutch system failure. Possible causes are: connector or harness, or torque converter clutch solenoid.

DTC P0750
Shift solenoid "A" failure. Possible causes are: connector or harness, or low-reverse solenoid.

DTC P0755
Shift solenoid "B" failure. Possible causes are: connector or harness, or underdrive solenoid.

DTC P0760
Shift solenoid "C" failure. Possible causes are: connector or harness, or second solenoid.

DTC P0765
Shift solenoid "D" failure. Possible causes are: connector or harness, or overdrive solenoid.

DTC P1400
Manifold Differential Pressure (MDP) sensor circuit failure. Possible causes are: connector or harness, or faulty MDP sensor.

DTC P1500
Generator FR terminal circuit failure. Possible causes are: connector or harness.

DTC P1600
Serial communication link failure. Possible causes are: connector or harness.

DTC P1715
Pulse Generator (PG) failure. Possible causes are: connector or harness, or faulty PG.

DTC P1750
Solenoid failure. Possible causes are: connector or harness, faulty converter clutch solenoid, shift control solenoid, or pressure control solenoid.

DTC P0751
Automatic transaxle control relay failure. Possible causes are: connector or harness, or automatic transaxle relay.

DTC P1791
Engine coolant temperature level input circuit (to TCM) failure. Possible causes are: connector or harness.

DTC P1795
Throttle position input circuit failure. Possible causes are: connector or harness.

CLEARING DTCS

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

To clear DTCs using a scan tool, refer to owners manual supplied with scan tool. If scan tool is not available, DTCs may also be cleared by disconnecting negative battery cable or PCM for at least 15 seconds, allowing PCM to clear DTCs. Reconnect negative battery cable and check for DTCs to confirm repair.

PCM LOCATION

PCM LOCATION

Application	Location
Montero	Right Front Kick Panel

TERMINAL IDENTIFICATION

NOTE: The following terminals are shown as viewed from component side of connector.

TERMINAL IDENTIFICATION DIRECTORY

Connector	See Figure
CKP Sensor	Fig. 1
DLC	Fig. 2
ECT Sensor	Fig. 3
Fuel Injector	Fig. 4
Fuel Pump	Fig. 5
FTDP Sensor	Fig. 6

Generator Field ..... Fig. 7
HO2S ..... Fig. 8
IAC Motor ..... Fig. 9
Ignition Coil ..... Fig. 10
KS ..... Fig. 11
MDP Sensor ..... Fig. 12
MFI Relay ..... Fig. 13
PNP Switch ..... Fig. 14
PCM ..... Fig. 15
TCM ..... Fig. 16
TP Sensor ..... Fig. 17
VAF Sensor ..... Fig. 18

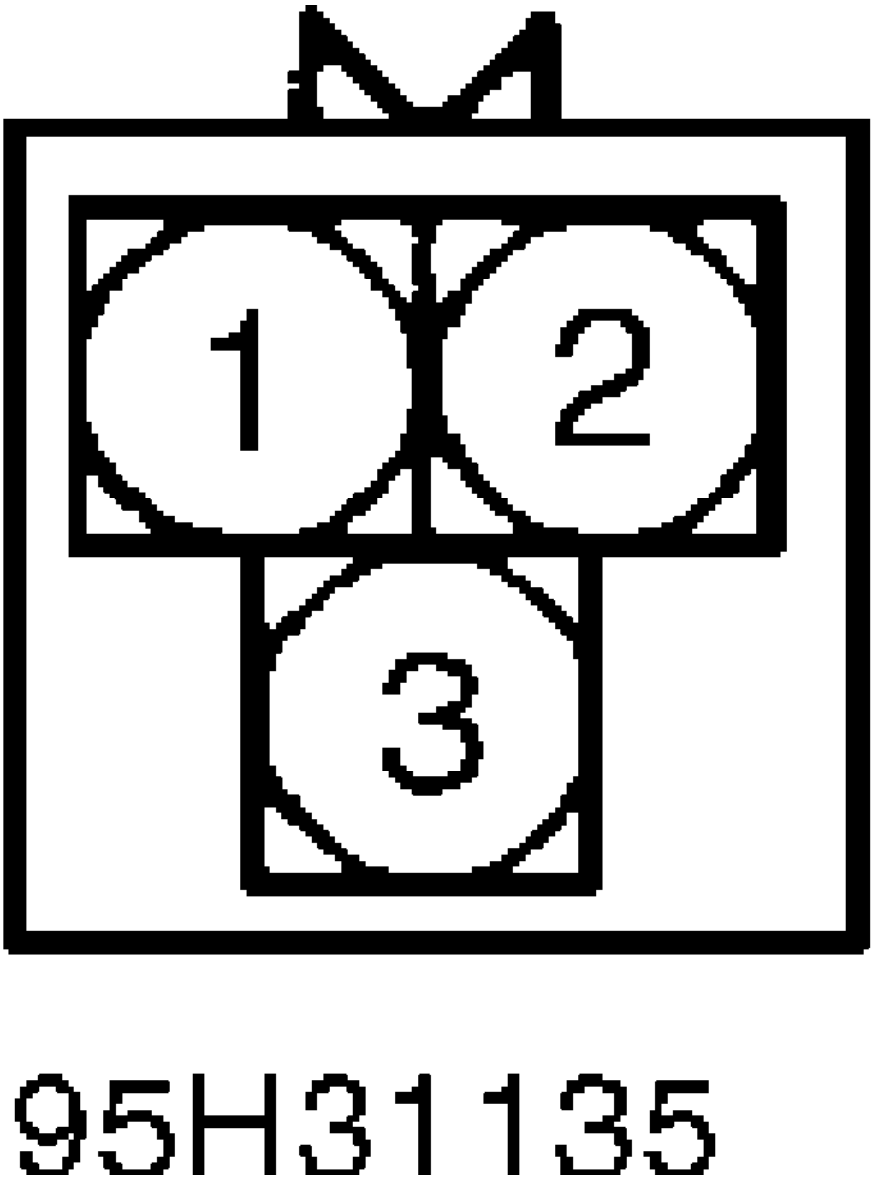


Fig. 1: Identifying CKP Terminals
Courtesy of Mitsubishi Motor Sales of America.

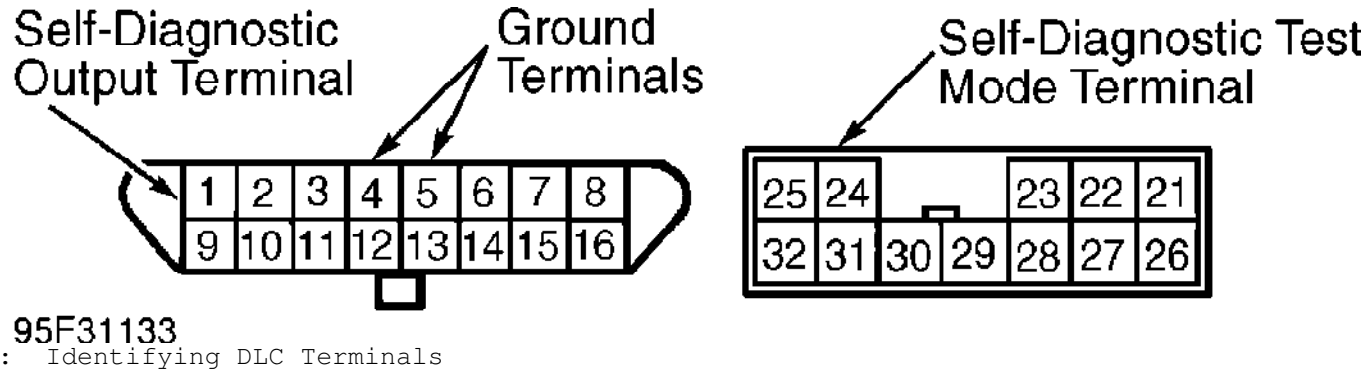


Fig. 2: Identifying DLC Terminals
Courtesy of Mitsubishi Motor Sales of America.

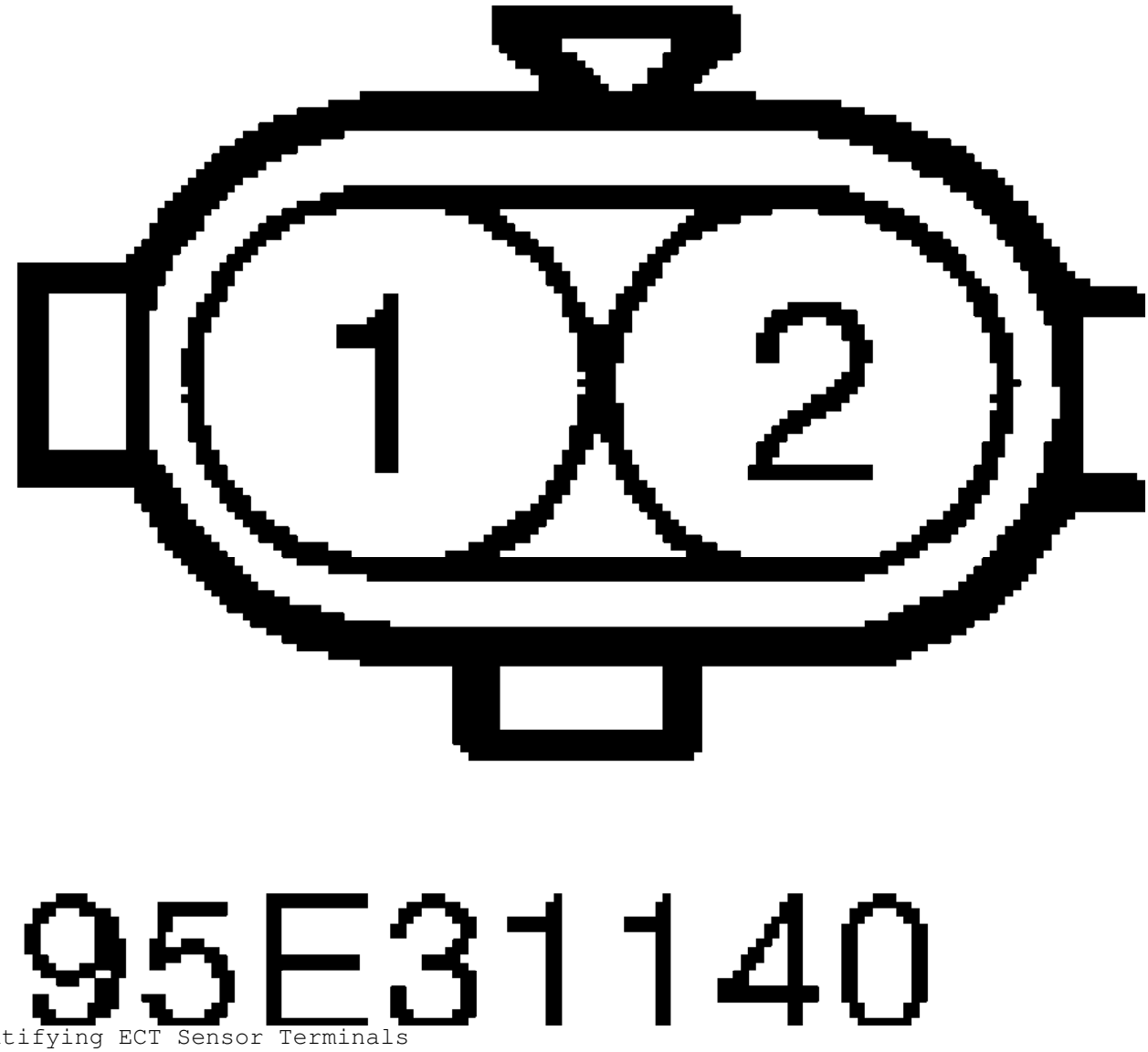


Fig. 3: Identifying ECT Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America.

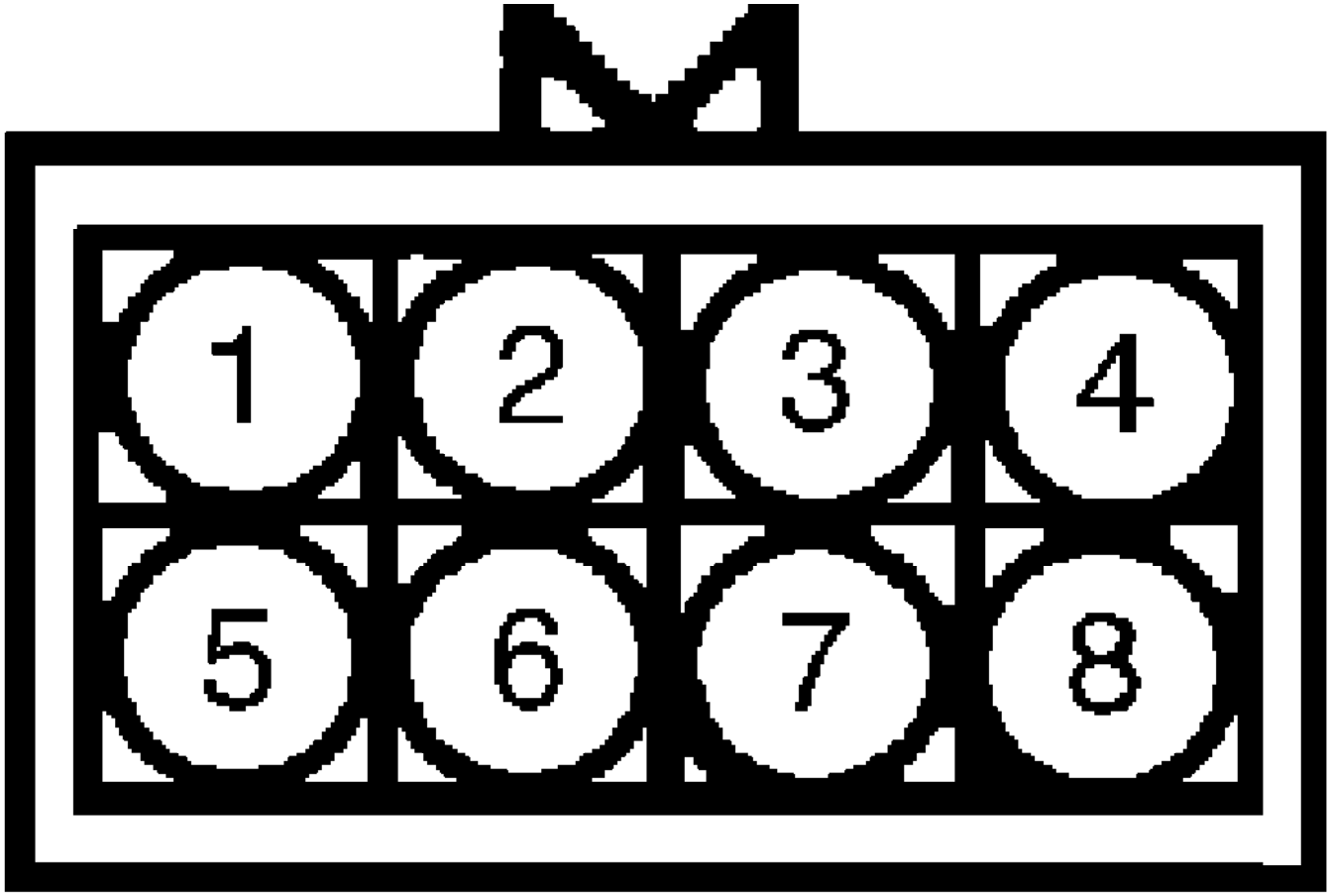


Fig. 4: Identifying Fuel Injector Terminals
Courtesy of Mitsubishi Motor Sales of America.

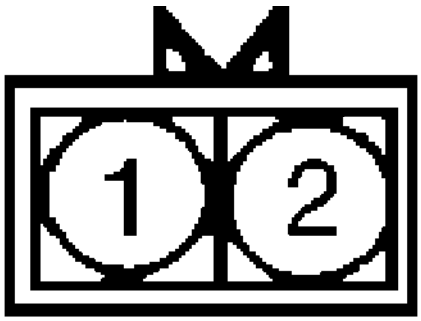


Fig. 5: Identifying Fuel Pump Terminals
Courtesy of Mitsubishi Motor Sales of America.

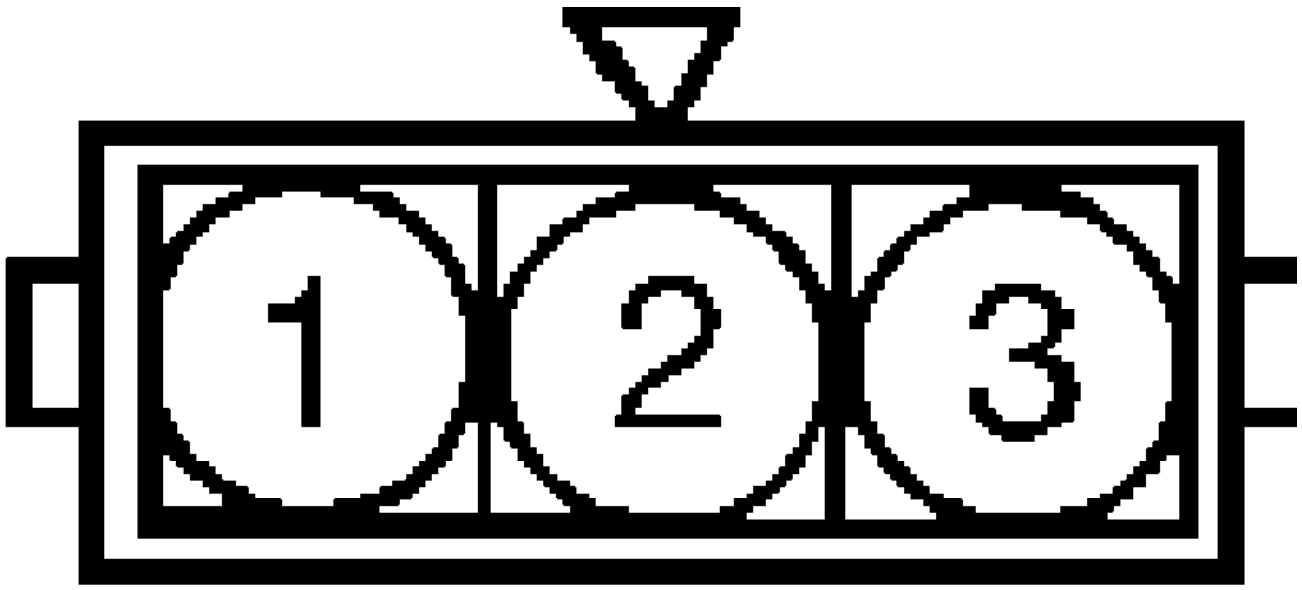


Fig. 6: Identifying FTDP Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America.

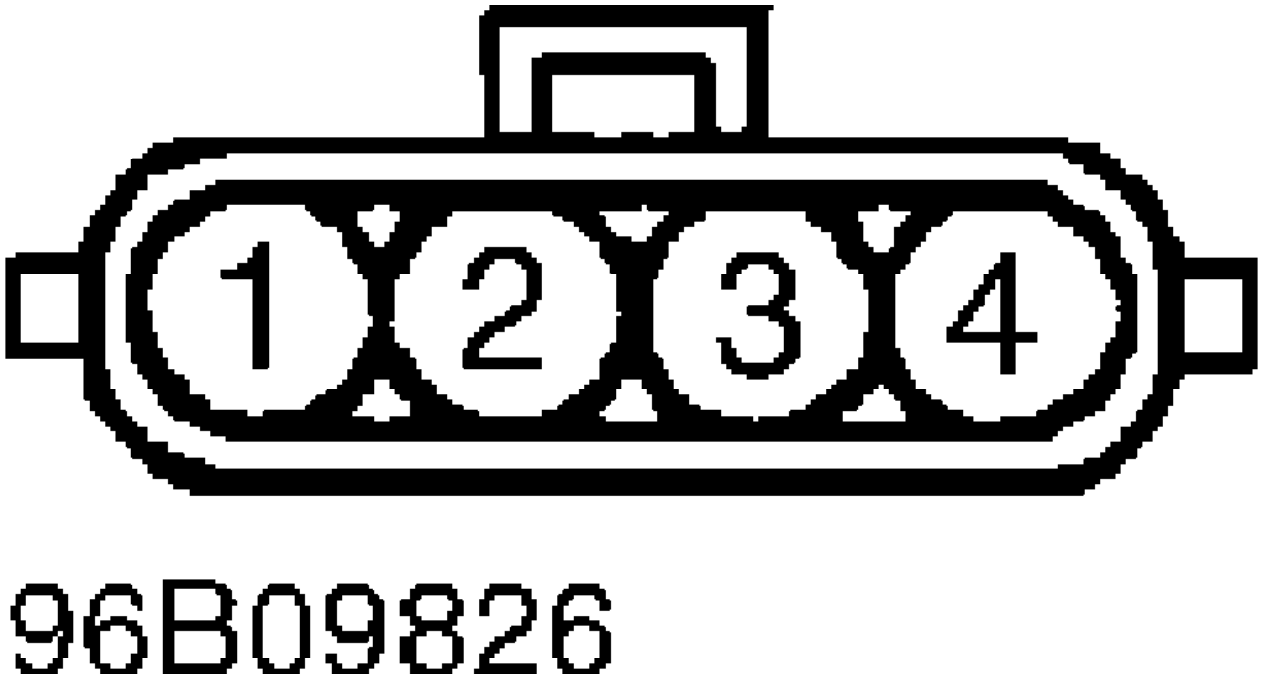


Fig. 7: Identifying Generator Field Terminals
Courtesy of Mitsubishi Motor Sales of America.

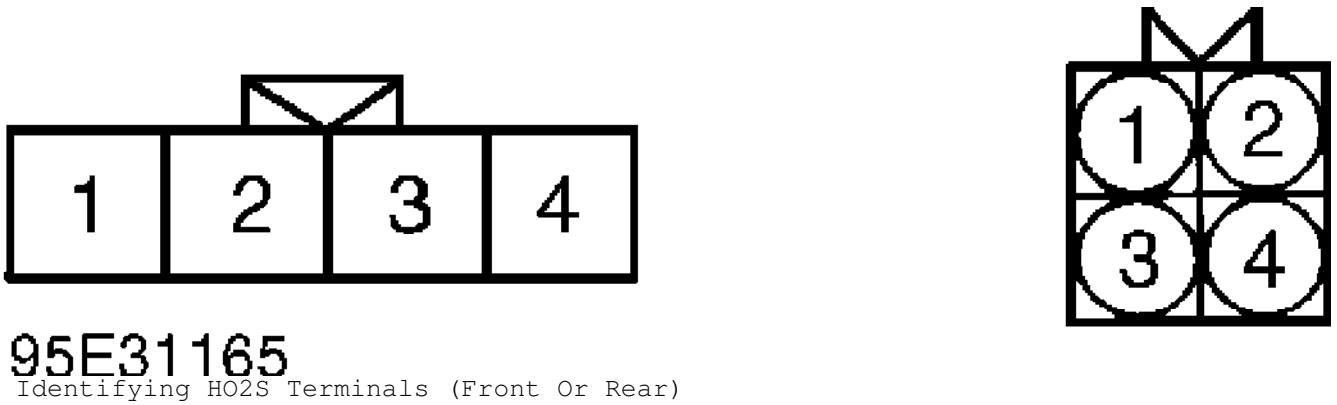


Fig. 8: Identifying HO2S Terminals (Front Or Rear)
Courtesy of Mitsubishi Motor Sales of America.

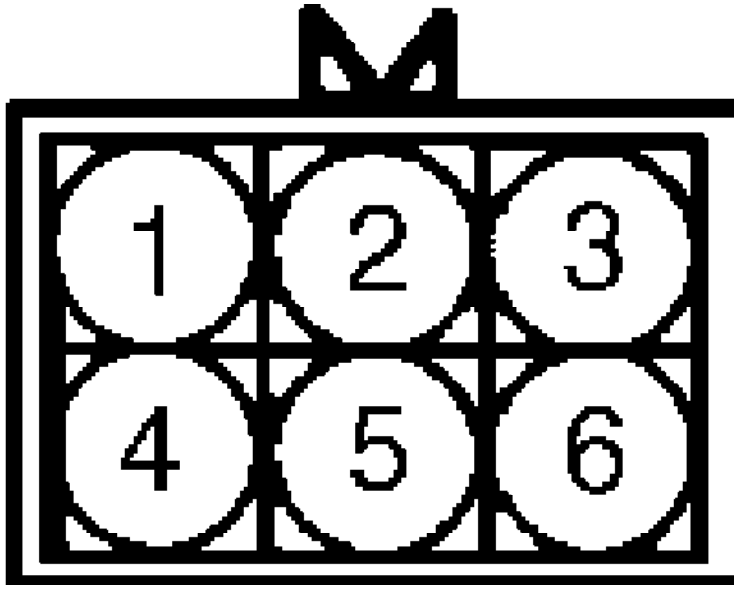


Fig. 9: Identifying IAC Motor Terminals
Courtesy of Mitsubishi Motor Sales of America.

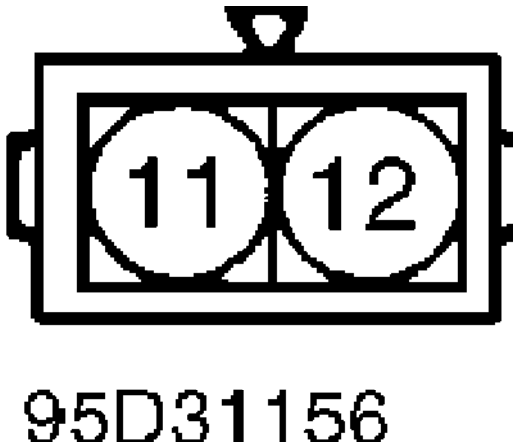
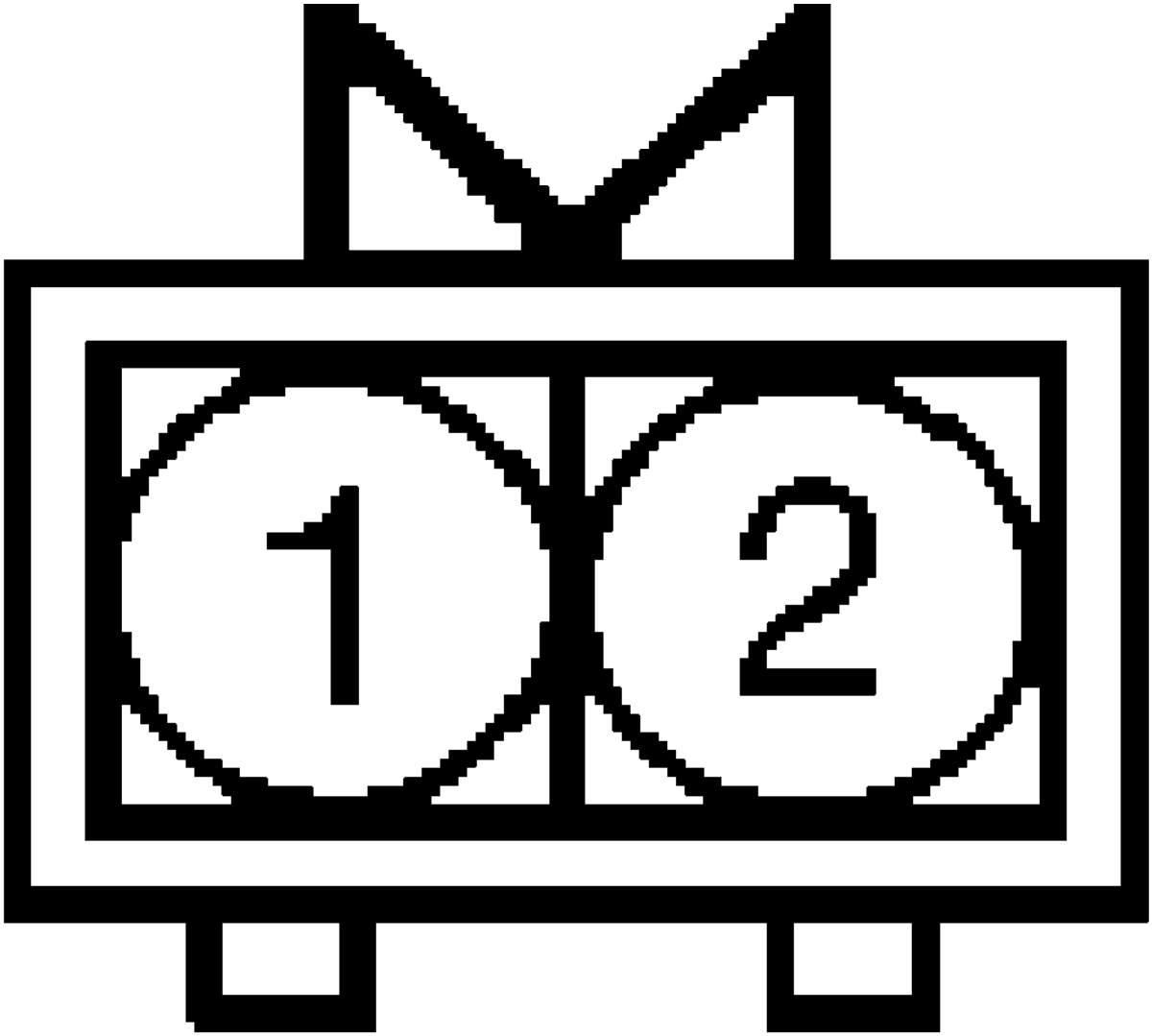


Fig. 10: Identifying Ignition Coil Terminals
Courtesy of Mitsubishi Motor Sales of America.



93180265

Fig. 11: Identifying KS Terminals
Courtesy of Mitsubishi Motor Sales of America.

Fig. 12: Identifying MDP Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America.

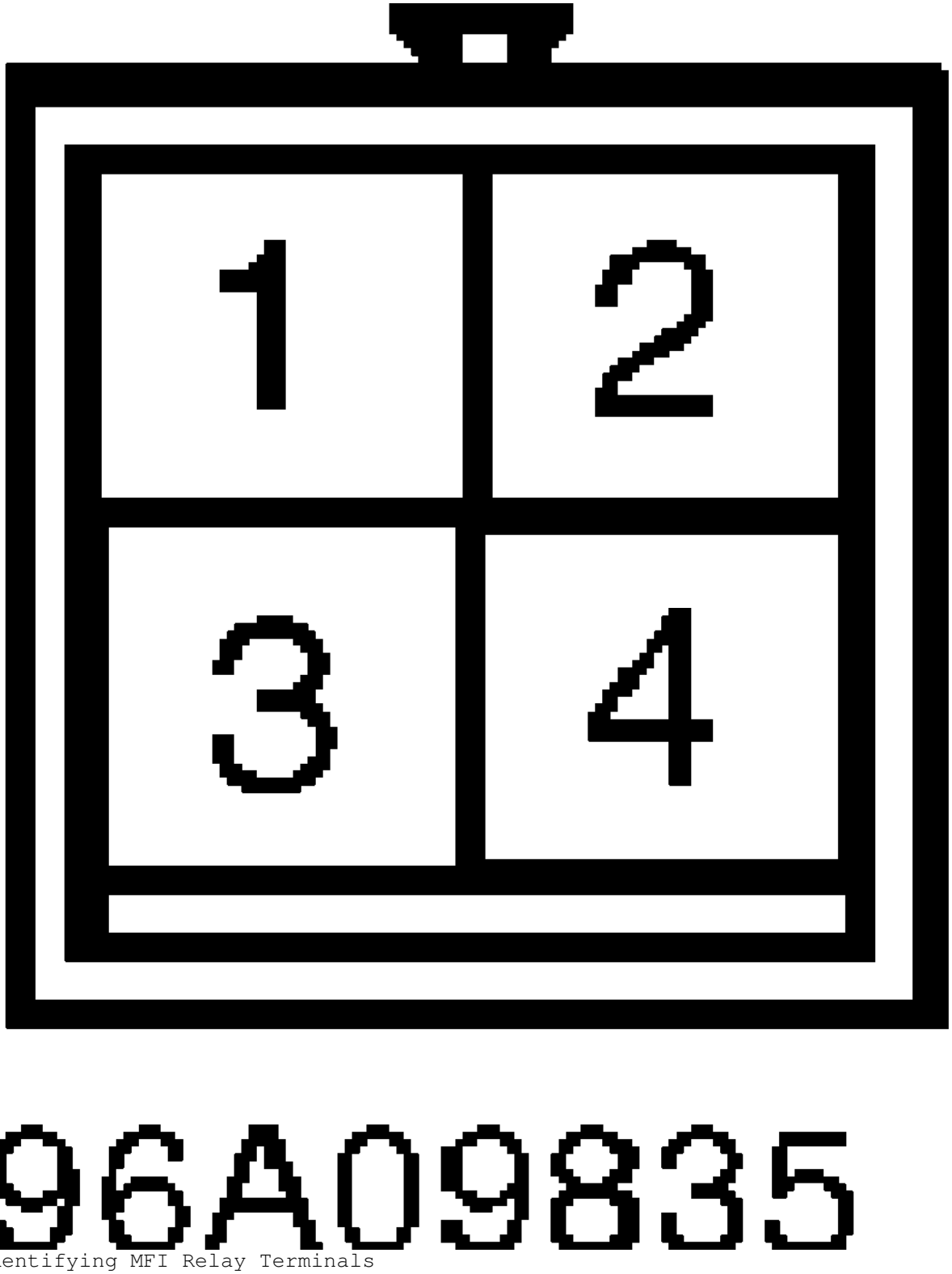


Fig. 13: Identifying MFI Relay Terminals
Courtesy of Mitsubishi Motor Sales of America.

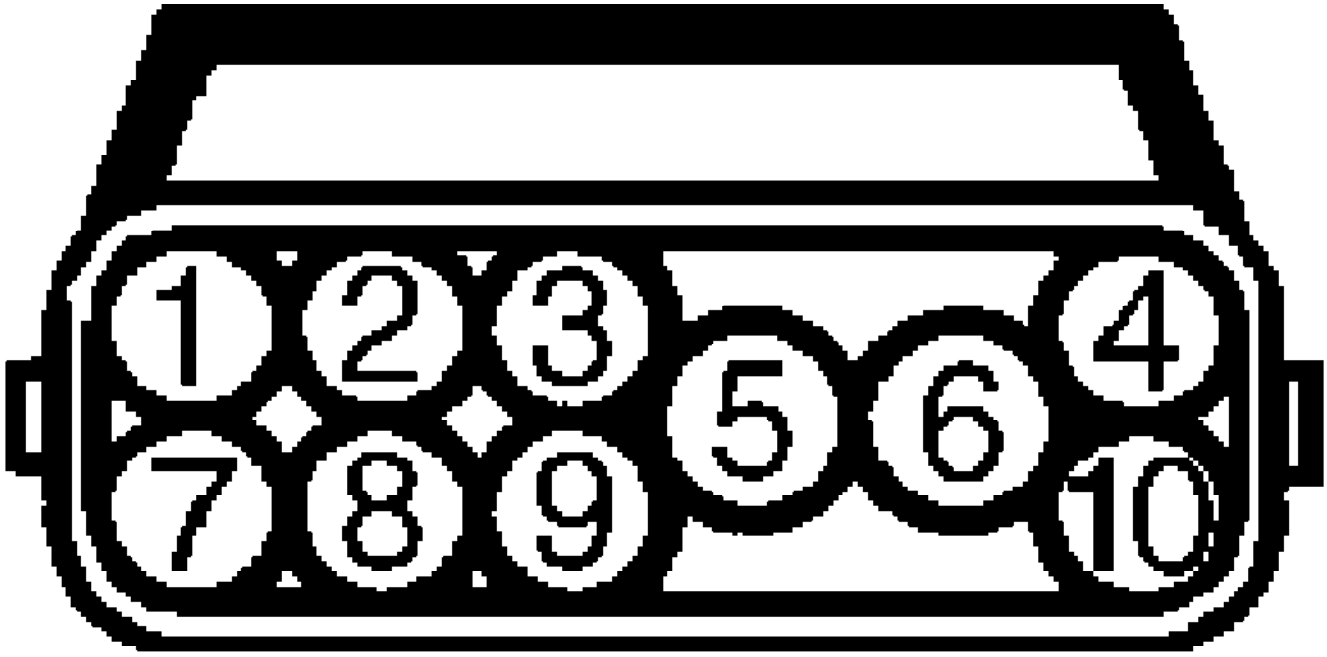


Fig. 14: Identifying PNP Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

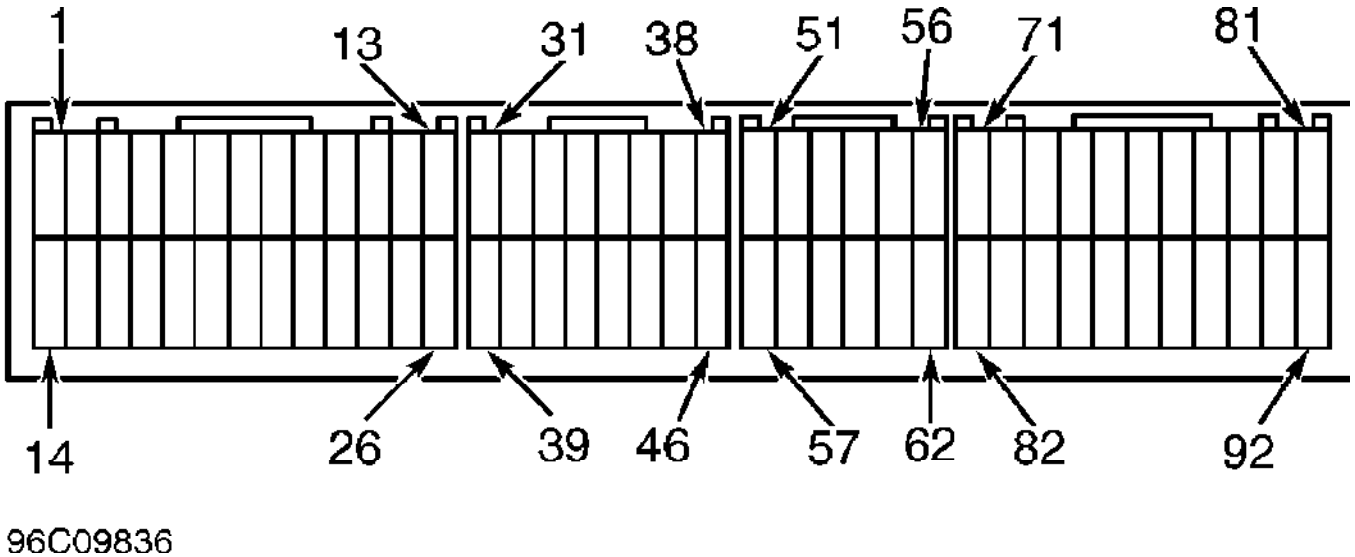
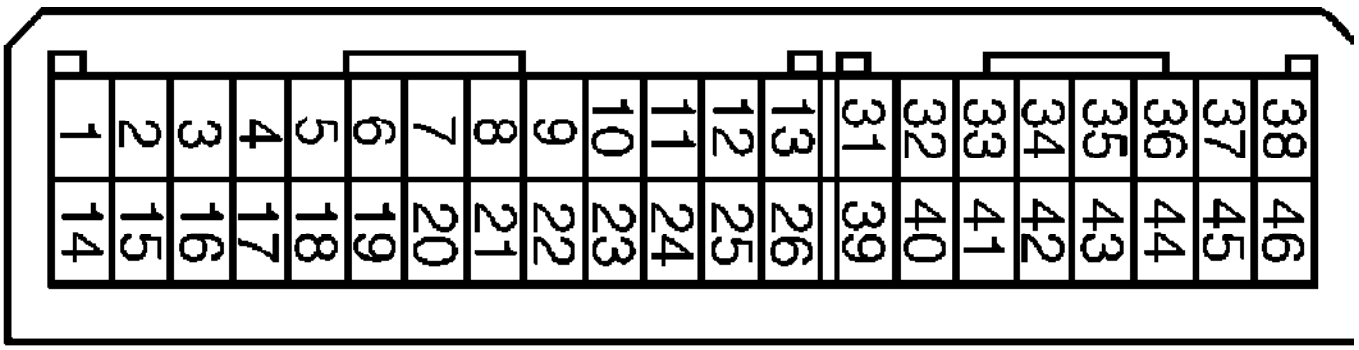
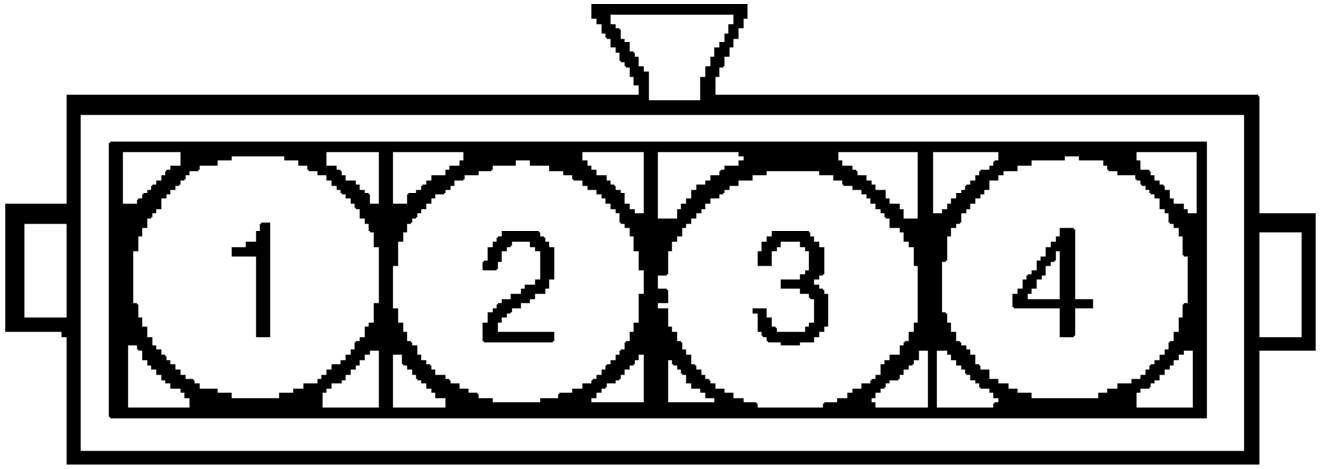


Fig. 15: Identifying PCM Terminals
Courtesy of Mitsubishi Motor Sales of America.



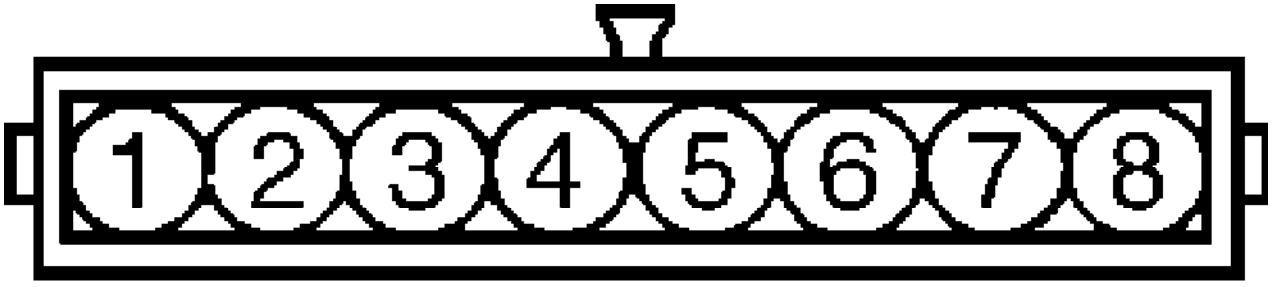
95D31537

Fig. 16: Identifying TCM Terminals
Courtesy of Mitsubishi Motor Sales of America.



95A31534

Fig. 17: Identifying TP Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America.



95G31134

Fig. 18: Identifying VAF Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America.

DIAGNOSTIC TESTS

CAUTION: Ensure ignition switch is in OFF position when disconnecting PCM or performing resistance tests.

NOTE: Perform all resistance and voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm impedance, unless stated otherwise in test procedures.

Using scan tool, display and record Diagnostic Trouble DTCs (DTCs). See ENTERING ON-BOARD DIAGNOSTICS under SELF-DIAGNOSTIC SYSTEM section. If scan tool is blank, see SCAN TOOL WILL NOT COMMUNICATE. If no DTCs are displayed, see H - TESTS W/O CODES - 2.4L article.

Clear DTCs. See CLEARING DTCS under SELF-DIAGNOSTIC SYSTEM section. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS. If one or more DTCs are displayed, repair DTCs in order, starting with lowest numbered DTC. Clear DTCs after each repair. Recheck for DTCs to confirm repair.

SCAN TOOL WILL NOT COMMUNICATE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) Using DVOM, check voltage between Data Link Connector (DLC) terminal No. 16 and chassis ground. If battery voltage does not exist, check and repair junction connectors and wiring harness between DLC and power supply.

2) If battery voltage exists, check for continuity between DLC terminal No. 4 and chassis ground, and between DLC terminal No. 5 and chassis ground. If continuity does not exist, check and repair wiring harness between DLC and chassis ground. If continuity exists, go to next step.

3) Try a different scan tool adapter cable. If scan tool does not communicate, try scan tool on a known-good vehicle. If scan tool still does not communicate, replace scan tool.

INTERMITTENT DTCS

This procedure applies if you have been sent here from diagnostic tests and have just attempted to simulate the condition that initially set DTC. The following additional checks may assist in identifying a possible intermittent problem:

* Visually inspect related wiring harness connectors for broken, bent, pushed out or corroded terminals.
* Visually inspect related wiring harness for chafed, pierced or partially broken wires.
* Check all pertinent technical service bulletins.

CIRCUIT TESTS

DTC P0100: VOLUME AIRFLOW (VAF) SENSOR CIRCUIT FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

NOTE: Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for

instructions in use of oscillo-scope.

1) If using scan tool, go to step 3). Disconnect VAF sensor connector. Install Test Harness (MB991348) between VAF sensor and connector. Using engine analyzer with oscilloscope capability, connect special patterns probe to VAF sensor connector terminal No. 3 or to PCM connector terminal No. 90.

2) Start engine. Verify waveform high frequency and low frequency patterns are of about the same length (time). Verify wavelength decreases and frequency increases as engine RPM increases. If conditions are not as specified, replace VAF sensor. If conditions are as specified, go to step 4).

3) Warm vehicle to normal operating temperature. Ensure headlights and accessories are off. Using scan tool, read VAF sensor value (frequency). See VOLUME AIRFLOW SENSOR VALUES table. Frequency should increase when engine is raced. If values are not as specified, replace VAF sensor. If values are as specified, disconnect VAF sensor connector and go to next step.

VOLUME AIRFLOW SENSOR VALUES

Application	Hz @ 700 RPM	Hz @ 2000 RPM
Montero	25-51	80-120

4) Disconnect MFI relay connector. Using DVOM, check for continuity between VAF sensor connector terminal No. 4 and MFI relay connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

6) Turn ignition switch to OFF position. Disconnect PCM connector. Ground PCM connector terminal No. 19. Using DVOM, check for continuity between chassis ground and VAF sensor connector terminal No. 7. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

7) Ground PCM connector terminal No. 90. Using DVOM, check for continuity between chassis ground and VAF sensor connector terminal No. 3. If continuity does not exist, repair wiring harness as necessary. If continuity exists, turn ignition switch to ON position and go to step 9).

9) Using DVOM, check voltage between chassis ground and VAF sensor connector terminal No. 3. If voltage is not 4.8-5.2 volts, replace PCM. If voltage is as specified, condition required to set DTC is not present at this time. Go to next step.

10) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P0105: BAROMETRIC (BARO) PRESSURE SENSOR CIRCUIT FAILURE

NOTE: BARO pressure sensor is built into Volume Airflow (VAF) sensor. For DTC P0105 test purposes, VAF sensor will be referred to as BARO pressure sensor. For terminal identification, see VAF sensor under TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) Manufacturer does not provide component testing procedure without scan tool. Turn ignition switch to ON position. Using scan tool, read BARO sensor pressure. See BARO PRESSURE SENSOR SPECIFICATIONS table. If pressure is not as specified, replace BARO pressure sensor. If pressure is as specified,

go to next step.

BARO PRESSURE SENSOR SPECIFICATIONS

Altitude: Ft. (M)	Pressure: In. Hg
0 (0)	29.92
1969 (600)	27.95
3937 (1200)	25.98
5906 (1800)	24.02

2) Disconnect BARO pressure sensor connector. Using DVOM, check for continuity between chassis ground and BARO pressure sensor connector terminal No. 5. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

3) Turn ignition switch to OFF position. With BARO pressure sensor disconnected, disconnect PCM connector. Ground PCM connector terminal No. 85. Using DVOM, check for continuity between chassis ground and BARO pressure sensor connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

4) Ground PCM connector terminal No. 81. Check for continuity between chassis ground and BARO pressure sensor connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

6) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P0110: INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT FAILURE

NOTE: IAT sensor is built into Volume Airflow (VAF) sensor. For DTC P0110 test purposes, VAF sensor will be referred to as IAT sensor. For terminal identification, see VAF sensor under TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) If using scan tool, go to step 3). Disconnect IAT sensor connector. Using a thermometer, check engine compartment ambient temperature. Using DVOM, check resistance between IAT sensor terminals No. 5 and 6. Resistance should be 6000 ohms at 32°F (0°C), 2700 ohms at 68°F (20°C) or 400 ohms at 176°F (80°C). If resistance is not as specified, replace IAT sensor. If resistance is as specified, go to next step.

2) Using a hair dryer, warm IAT sensor while monitoring DVOM. Resistance should decrease evenly as temperature rises. If resistance remains unchanged, replace IAT sensor. If resistance changes, go to step 4).

3) Turn ignition switch to ON or RUN position. Using a thermometer, check engine compartment ambient temperature. Using scan tool, read IAT sensor temperature. Compare both readings. If readings are not about the same, replace IAT sensor. If readings are about the same, disconnect IAT sensor connector and go to next step.

4) Using DVOM, check for continuity between chassis ground and IAT sensor connector terminal No. 5. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

5) Turn ignition switch to OFF position. With IAT sensor connector disconnected, disconnect PCM connector. Ground PCM connector terminal No. 72. Check for continuity between IAT sensor connector

terminal No. 6 and chassis ground. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

DTC P0115: ENGINE COOLANT TEMPERATURE (ECT) SENSOR FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) If using scan tool, go to step 2). Disconnect ECT sensor connector. Remove ECT sensor from intake manifold. Submerge temperature sensing portion of ECT sensor in hot water. Using DVOM, check resistance across ECT sensor terminals. See ECT SENSOR RESISTANCE SPECIFICATIONS table. If resistance is not as specified, replace ECT sensor. If resistance is as specified, go to step 3).

ECT SENSOR RESISTANCE SPECIFICATIONS

Water Temperature	Approximate Ohms
32°F (0°C)	5800
68°F (20°C)	2400
104°F (40°C)	1100
176°F (80°C)	300

2) Turn ignition switch to ON or RUN position. Using a thermometer, check engine compartment ambient temperature. Using scan tool, read ECT SENSOR TEMPERATURE. Compare both readings. If readings are not about the same, replace ECT sensor. If readings are about the same go to next step.

3) Disconnect ECT sensor connector. Using DVOM, check continuity between chassis ground and ECT sensor connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary.

4) Turn ignition switch to OFF position. With ECT sensor connector disconnected, disconnect PCM connector. Ground PCM connector terminal No. 83. Check continuity between chassis ground and ECT sensor connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

6) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P0120: THROTTLE POSITION (TP) SENSOR CIRCUIT FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) If using scan tool, go to step 3). Disconnect TP sensor connector. Using DVOM, check resistance between TP sensor terminals No. 1 and No. 4. If resistance is not 3500-6500 ohms, replace TP sensor. If resistance is as specified, go to next step.

2) Check resistance between TP sensor terminals No. 1 and 3. While monitoring DVOM, slowly open throttle from idle to fully open position. If resistance does not change smoothly, replace TP sensor. If resistance changes smoothly, go to step 4).

3) Turn ignition switch to ON position. Using scan tool, read TP sensor voltage value. With throttle at idle, value should read 300-

100 mV. Value should increase while slowly opening throttle. At wide open throttle, value should read 4500-5500 mV. If value is not as specified, replace TP sensor. If value is as specified, go to next step.

4) Disconnect TP sensor connector. Using DVOM, check continuity between chassis ground and TP sensor connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary.

6) Turn ignition switch to OFF position. Disconnect PCM connector. Ground specified PCM connector terminal. See TP SENSOR-TO-PCM WIRING HARNESS TERMINAL IDENTIFICATION table. Check for continuity between chassis ground and specified TP sensor connector terminal. If continuity does not exist, repair wiring harness as necessary.

TP SENSOR-TO-PCM WIRING HARNESS TERMINAL IDENTIFICATION

Application Type	TP Sensor Terminal No.	PCM Terminal No.
Montero	3	84
"	4	81

7) Reconnect PCM connector. Turn ignition switch to ON position. Check voltage between chassis ground and TP sensor connector terminal No. 4. If voltage is not 4.8-5.2 volts, replace PCM. If voltage is as specified, condition required to set DTC is not present at this time. Go to next step.

8) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P0125: EXCESSIVE TIME TO ENTER CLOSED LOOP FUEL CONTROL

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

No specific self-diagnostic test is provided by manufacturer. Check front heated oxygen sensor, fuel injectors, and related connectors and harnesses. Also, see F - BASIC TESTING - 2.4L article.

DTC P0130, DTC P0135, DTC P0150 & DTC P0155: FRONT HEATED OXYGEN SENSOR (HO2S) CIRCUIT FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) If using scan tool, go to step 3). Disconnect front HO2S connector. Install Test Harness (MB998464) between HO2S and HO2S connector. Using DVOM, check resistance between specified HO2S connector heater terminals. See FRONT HO2S CONNECTOR TERMINAL IDENTIFICATION table. HO2S resistance should be 12-20 ohms at 68°F (20°C). If resistance is not as specified, replace HO2S. If resistance is as specified, go to next step.

2) Start and warm engine to operating temperature. Using jumper wires, apply 12 volts and ground to specified HO2S connector heater terminals. See FRONT HO2S CONNECTOR TERMINAL IDENTIFICATION table. Using DVOM, check voltage between specified HO2S connector output terminals, while repeatedly racing engine. If voltage is not .

6-1.0 volt, replace HO2S. If voltage is .6-1.0 volt, go to step 5).

FRONT HO2S CONNECTOR TERMINAL IDENTIFICATION

Application Type	(1) Heater Terminals No.	Output Terminals No.
All Models	1 & 3	2 & 4

(1) - First terminal listed is positive. Second terminal listed is negative.

3) Start and warm engine to operating temperature. Using scan tool, read HO2S voltage. While monitoring scan tool, accelerate to 4000 RPM. Suddenly decelerate. Scan tool should read 0.2 volt or less. Suddenly accelerate. Scan tool should read 0.6-1.0 volt. If voltage is not as specified, replace HO2S. If voltage is as specified, go to next step.

4) While monitoring scan tool, accelerate to 2000-2500 RPM and decelerate to 700 RPM (idle). Scan tool should switch from 0.6-1.0 volt to 0.4 volt or less. If voltage is not as specified, replace HO2S. If voltage is as specified, go to next step.

5) Disconnect HO2S connector and MFI relay connector. Using DVOM, check for continuity between HO2S connector terminal No. 1 and MFI relay connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to step 7).

7) Turn ignition switch to OFF position. With HO2S connector disconnected, disconnect PCM connector. Using DVOM, check for open or short circuit between specified HO2S connector terminal and PCM connector terminal. See FRONT HO2S-TO-PCM HARNESS TERMINAL IDENTIFICATION table. If open or short circuit exists, repair wiring harness as necessary. If open or short circuit does not exist, go to next step.

FRONT HO2S-TO-PCM HARNESS TERMINAL IDENTIFICATION

Application	HO2S Terminal No.	PCM Terminal No.
Montero		
California	3	34
"	3	36
"	4	75
"	4	76
Federal	3	34
"	4	76

8) Using DVOM, check for continuity between chassis ground and HO2S connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

9) Condition required to set DTC is not present at this time. Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P0136, DTC P0141, DTC P0156 & DTC P0161: REAR HEATED OXYGEN SENSOR (HO2S) CIRCUIT FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION

section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) If using scan tool, go to next step. Disconnect rear HO2S connector. Install Test Harness (MB998464) between HO2S and HO2S connector. Using DVOM, check resistance between specified HO2S connector terminals. See REAR HO2S HEATER CONNECTOR TERMINAL IDENTIFICATION table. HO2S resistance should be 12 ohms at 68°F (20°C). If resistance is not as specified, replace HO2S. If resistance is as specified, go to step 3).

REAR HO2S HEATER CONNECTOR TERMINAL IDENTIFICATION

Application	Terminals No.
Montero	1 & 3

2) Raise and support drive wheels. Start and warm engine to operating temperature. Place A/T in Low (M/T in 2nd). Using scan tool, read HO2S voltage. While monitoring scan tool, accelerate to 3500 RPM. Scan tool should read 0.6-1.0 volt. If voltage is not as specified, replace HO2S. If voltage is as specified, go to next step.

3) Disconnect HO2S connector and MFI relay connector. Using DVOM, check for continuity between specified HO2S connector terminal and MFI relay connector terminal. See REAR HO2S-TO-MFI RELAY HARNESS TERMINAL IDENTIFICATION table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

REAR HO2S-TO-MFI RELAY HARNESS TERMINAL IDENTIFICATION

Application	HO2S Terminal No.	MFI Terminal No.
Montero	1	3

REAR HO2S-TO-PCM WIRING HARNESS TERMINAL IDENTIFICATION

Application	HO2S Terminal No.	PCM Terminal No.
Montero		
California	4	73 & 79
Federal	4	79

5) Using DVOM, check for continuity between chassis ground and specified HO2S connector terminal. See REAR HO2S CONNECTOR GROUND CIRCUIT IDENTIFICATION table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

REAR HO2S CONNECTOR GROUND CIRCUIT IDENTIFICATION

Application	Terminal No.
Montero	2

6) Condition required to set DTC is not present at this time. Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to

INTERMITTENT DTCS.

DTC P0170 & DTC P0173: FUEL TRIM FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) No specific self-diagnostic test is provided by manufacturer. Check volume airflow sensor, fuel injectors, engine coolant temperature sensor, intake air temperature sensor, barometric or manifold absolute pressure sensor, heated oxygen sensor, and related connectors and harnesses.
2) Also check fuel pressure, check for intake air leaks, and for cracked manifold. See F - BASIC TESTING - 2.4L article.

DTC P0201, DTC P0202, DTC P0203, DTC P0204, DTC P0205 & DTC P0206: FUEL INJECTOR CIRCUIT FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) If using scan tool, go to step 3). Using a stethoscope or long-bladed screwdriver, listen for clicking sound from each fuel injector while engine is running or being cranked. If no sound is heard from fuel injector(s), check fuel injector connections. Repair connections as necessary. If connections are okay, go to next step.
2) Ensure engine coolant temperature is at 68°F (20°C). Disconnect fuel injector connector. Using DVOM, check resistance between specified fuel injector terminals. See FUEL INJECTOR TERMINAL IDENTIFICATION table. If resistance is not 13-16 ohms, replace fuel injector(s). If resistance is as specified, go to step 6).

FUEL INJECTOR TERMINAL IDENTIFICATION

Application	Terminals No.
Montero (1)	8 & 1
"	8 & 2
"	8 & 3
"	8 & 5
"	8 & 6
"	8 & 7

(1) - Check resistance at intermediate fuel injector connector (component side).

INJECTOR CRANKING DRIVE TIME SPECIFICATIONS

Coolant Temperature	Drive Time (ms)
32°F (0°C)	11.0-17.0
68°F (20°C)	28.0-42.0
176°F (80°C)	7.4-11.2

INJECTOR OPERATING DRIVE TIME SPECIFICATIONS

Engine Speed	Drive Time (ms)

750 RPM	2.1-3.3
2000-2500 RPM	1.9-3.1
Suddenly Accelerated	(1) *

(1) - Drive time should increase.

6) Disconnect MFI relay connector and fuel injector connector at faulty fuel injector. Using DVOM, check for continuity between MFI relay connector terminal No. 3 and fuel injector connector terminal No. 8. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to step 9).

9) Ground specified PCM connector terminal. See INJECTOR-TO-PCM CIRCUIT IDENTIFICATION table. Using DVOM, check for continuity between chassis ground and specified fuel injector connector terminal. If continuity does not exist, repair appropriate circuit as necessary. If continuity exists, condition required to set DTC is not present at this time. Go to next step.

INJECTOR-TO-PCM CIRCUIT IDENTIFICATION

Injector No. Type	Injector Connector Terminal No.	PCM Terminal No.
1	3	1
2	2	14
3	1	2
4	7	15
5	6	3
6	5	16

10) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P0300, DTC P0301, DTC P0302, DTC P0303, DTC P0304, DTC P0305 & DTC P0306: CYLINDER MISFIRE DETECTED

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) No specific self-diagnostic test is provided by manufacturer. Check ignition coil, power transistor, spark plugs, fuel injectors, heated oxygen sensor, crankshaft position sensor, and related connectors and harnesses.

2) Also check compression pressure, timing belt, fuel pressure, and for intake air leaks. See F - BASIC TESTING - 2.4L article.

DTC P0335: CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

NOTE: Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for instructions in use of oscillo-scope.

1) If using scan tool, go to step 3). Disconnect CKP sensor connector. Install Test Harness (MB991348) between CKP sensor and connector. Using engine analyzer with oscilloscope capability, connect special patterns probe to CKP sensor connector terminal No. 2. Go to next step.

2) Start engine. Compare oscilloscope wave pattern with known-good wave pattern. See Fig. 19. Verify wavelength (time) decreases as engine RPM increases. If wave pattern fluctuates to left or right, check for loose timing belt or an abnormality in sensor pick-up disc. If a rectangular wave pattern is generated even when engine is not started, substitute known-good CKP sensor. Repeat test. If wave pattern is still abnormal, go to step 6).

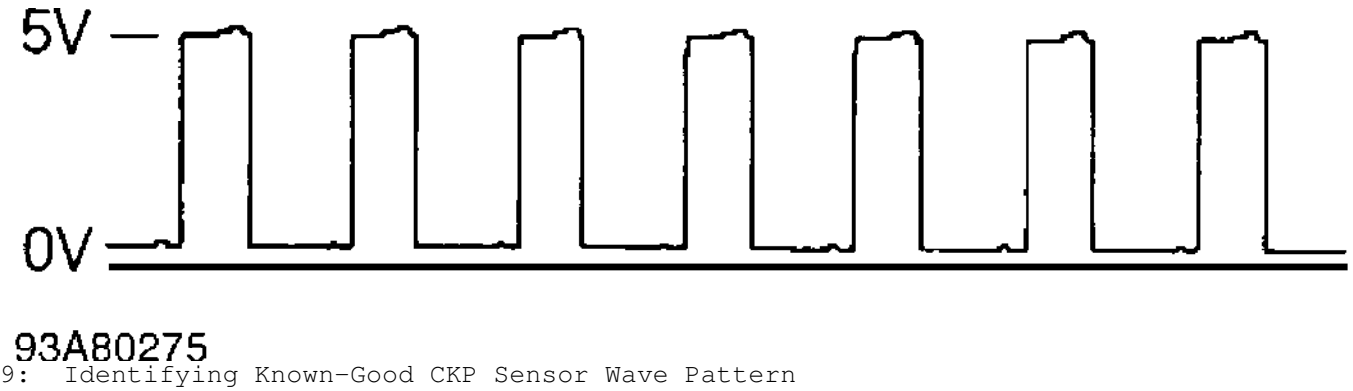


Fig. 19: Identifying Known-Good CKP Sensor Wave Pattern
Courtesy of Mitsubishi Motor Sales of America

3) Connect an engine tachometer. Crank engine. Ensure ignition coil primary current toggles on and off. Using tachometer and scan tool, compare cranking speed and scan tool RPM display. Go to next step.

4) If engine fails to start and tachometer reads zero RPM when engine is cranked, check for broken timing belt or faulty CKP sensor. If CKP sensor is suspected, substitute known-good CKP sensor. Repeat test procedure. If engine fails to start, tachometer reads zero RPM, and ignition coil primary current fails to toggle on and off, check for faulty ignition coil, ignition circuit or power transistor. If engine starts and readouts agree, go to next step.

5) Ensure A/C switch is in ON position to activate closed throttle position switch. Allow engine to idle. Using scan tool, check engine coolant temperature and read idle speed. See IDLE RPM SPECIFICATIONS table. If RPM is not to specification, check for faulty ECT sensor, basic idle speed adjustment, or idle air control motor. If RPM is within specifications, go to next step.

IDLE RPM SPECIFICATIONS

Engine Coolant Temperature	Engine RPM
-4°F (-20°C)	1300-1500
32°F (0°C)	1300-1500
68°F (20°C)	1300-1500
104°F (40°C)	1040-1240
176°F (80°C)	600-800

6) Disconnect CKP sensor connector and MFI relay connector. Using DVOM, check for continuity between CKP sensor connector terminal No. 1 and MFI relay connector terminal No. 3. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

8) Check for continuity between chassis ground and CKP sensor connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to step 10).

9) Turn ignition switch to OFF position. With CKP sensor connector disconnected, disconnect PCM connector. Check for continuity between CKP sensor connector terminal No. 2 and PCM connector terminal No. 89. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

10) With ignition switch in ON position, check for voltage between chassis ground and CKP sensor connector terminal No. 2. If 4.8-5.2 volts do not exist, replace PCM. If voltage is to specification and CKP sensor is suspected, replace CKP sensor.

DTC P0340: CAMSHAFT POSITION (CMP) SENSOR CIRCUIT FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

NOTE: Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for instructions in use of oscillo-scope. If using scan tool, go to step 3).

1) Disconnect CMP sensor connector. Install Test Harness (MB991348) between CMP sensor and connector. Using engine analyzer with oscilloscope capability, connect special patterns probe to CMP sensor connector terminal No. 2. Go to next step.

2) Start engine. Compare oscilloscope wave pattern with known-good wave pattern. See Fig. 2. Verify wavelength (time) decreases as engine RPM increases. If wave pattern fluctuates to left or right, check for loose timing belt or an abnormality in sensor pick-up disc. If a rectangular wave pattern is generated even when engine is not started, substitute known-good CMP sensor. Repeat test. If wave pattern is still abnormal, go to next step.

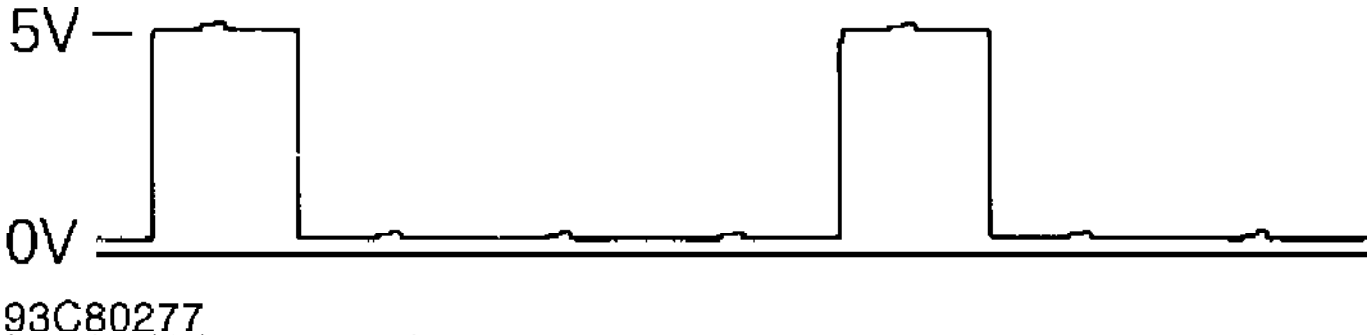


Fig. 20: Identifying Known-Good CMP Sensor Wave Pattern
Courtesy of Mitsubishi Motor Sales of America

3) Disconnect CMP sensor connector. Turn ignition switch to ON position. Check voltage between chassis ground and CMP sensor connector terminal No. 3. If battery voltage does not exist, repair wiring harness as necessary. If battery voltage exists, go to step 5).

4) Disconnect CMP sensor connector and MFI relay connector. Using DVOM, check for continuity between CMP sensor connector terminal No. 3 and MFI relay connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

5) Check for continuity between chassis ground and CMP sensor connector terminal No. 1 . If continuity does not exist, repair wiring

harness as necessary. If continuity exists, go to next step.

6) Check for continuity between PCM connector terminal No. 88 and CMP sensor connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

7) Turn ignition switch to OFF position. With CMP sensor connector disconnected, disconnect PCM connector. Check for continuity between PCM connector terminal No. 88 and CMP sensor connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

9) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P0400 & DTC P0403: EXHAUST GAS RECIRCULATION (EGR) VALVE SYSTEM FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) If using scan tool, go to step 8). Remove EGR valve. Inspect valve for sticking or carbon deposits. Clean or replace EGR valve as necessary. If EGR valve is okay, go to next step.

2) Connect a vacuum pump to EGR valve. Apply 20 in. Hg of vacuum. If vacuum does not hold, replace EGR valve. If vacuum holds, go to next step.

3) Apply 1.5 in. Hg to EGR valve. Blow air through one side of EGR valve passage. If air blows through, replace EGR valve. If air does not blow through, go to next step.

4) Apply 8 in. Hg to EGR valve. Blow air through one side of EGR valve passage. If air does not blow through, replace EGR valve. If air blows through, reinstall EGR valve and go to next step.

5) Mark and disconnect Yellow-striped and Green-striped vacuum hoses, and wiring connector from EGR solenoid. Install vacuum pump to EGR solenoid Green-striped vacuum hose port. Apply vacuum to EGR solenoid. Go to next step.

6) Apply and remove 12 volts across EGR solenoid terminals. Vacuum should hold with voltage applied. Vacuum should leak without voltage applied. If EGR solenoid does not test as specified, replace solenoid. If solenoid tests as specified, go to next step.

7) Using DVOM, check resistance across EGR solenoid terminals. If resistance is not 36-44 ohms at 68°F (20°C), replace solenoid. If resistance is as specified, go to step 9).

8) Turn ignition switch to ON position. Using scan tool, turn EGR solenoid on and off. Listen for clicking sound from EGR solenoid. If no sound is heard, replace EGR solenoid. If sound is heard, go to next step.

9) Disconnect EGR solenoid connector and MFI relay connector. Using DVOM, check continuity between EGR solenoid connector terminal No. 1 and MFI relay connector terminal No. 3. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to step 11).

11) Turn ignition switch to OFF position. Disconnect PCM connector. Ground PCM connector terminal No. 6. Using DVOM, check for continuity between chassis ground and EGR solenoid connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set DTC is not present at this time. Go to next step.

12) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed,

go to INTERMITTENT DTCS.

DTC P0420, DTC P0421 & DTC P0431: CATALYST EFFICIENCY BELOW THRESHOLD

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

No specific self-diagnostic test is provided by manufacturer. Check catalytic converter and check for cracked exhaust manifold. Also, see F - BASIC TESTING - 2.4L article.

DTC P0440, P0442, P0443, P0446 & P0450 - EVAPORATIVE (EVAP) EMISSION CONTROL SYSTEM FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) If using scan tool, go to step 4). Mark and disconnect Black and Red-striped vacuum hoses, and wiring connector from EVAP solenoid. Install vacuum pump to EVAP solenoid Red-striped vacuum hose port. Apply vacuum to EVAP solenoid. Go to next step.

2) Apply and remove 12 volts across EVAP solenoid terminals. Vacuum should leak with voltage applied. Vacuum should hold without voltage applied. If EVAP solenoid does not test as specified, replace solenoid. If solenoid tests as specified, go to next step.

3) Using DVOM, check resistance across EVAP solenoid terminals. If resistance is not 36-44 ohms at 68°F (20°C), replace solenoid. If resistance is as specified, go to step 7).

4) On Montero with California Emissions, go to step 5). Turn ignition switch to ON position. Using scan tool, actuate EVAP solenoid on then off. Listen for clicking sound from EVAP solenoid. If no sound is heard, replace EVAP solenoid. If sound is heard, go to step 6).

5) Turn ignition switch to ON position. Using scan tool, actuate EVAP solenoid No. 1 on then off. Actuate EVAP solenoid No. 2 on then off. Listen for clicking sound from EVAP solenoids. If no sound is heard, replace faulty EVAP solenoid(s). If sound is heard, go to step 9).

6) Disconnect EVAP solenoid connector and MFI relay connector. Using DVOM, check continuity between EVAP solenoid connector terminal No. 1 and MFI relay connector terminal No. 3. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to step 8).

8) Turn ignition switch to OFF position. Disconnect PCM connector. Ground PCM connector terminal No. 9. Using DVOM, check for continuity between chassis ground and EVAP solenoid connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set DTC is not present at this time. Go to step 13).

9) Disconnect EVAP solenoid No. 1 connector and MFI relay connector. Using DVOM, check continuity between EVAP solenoid No. 1 connector terminal No. 1 and MFI relay connector terminal No. 3. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

10) Turn ignition switch to OFF position. Disconnect PCM connector. Ground PCM connector terminal No. 9. Using DVOM, check for continuity between chassis ground and EVAP solenoid No. 1 connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

11) Disconnect EVAP solenoid No. 2 connector and MFI relay connector. Using DVOM, check continuity between EVAP solenoid No. 2

connector terminal No. 1 MFI relay connector terminal No. 3. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

12) Ground PCM connector terminal No. 33. Using DVOM, check for continuity between chassis ground and EVAP solenoid No. 2 connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, condition required to set DTC is not present at this time. Go to next step.

13) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P0500: VEHICLE SPEED SENSOR (VSS) CIRCUIT FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) If using scan tool, go to step 4). VSS is located in speedometer. VSS component testing procedures using DVOM require removal of instrument panel. Removal and installation of instrument panel is basically an unbolt and bolt-on procedure.

2) DO NOT disconnect connectors. Using DVOM, check continuity between indicated VSS terminals. See Fig. 21. Ensure continuity pulses on and off with speedometer shaft revolution. If continuity is not as specified, replace VSS. If continuity is as specified, go to next step.

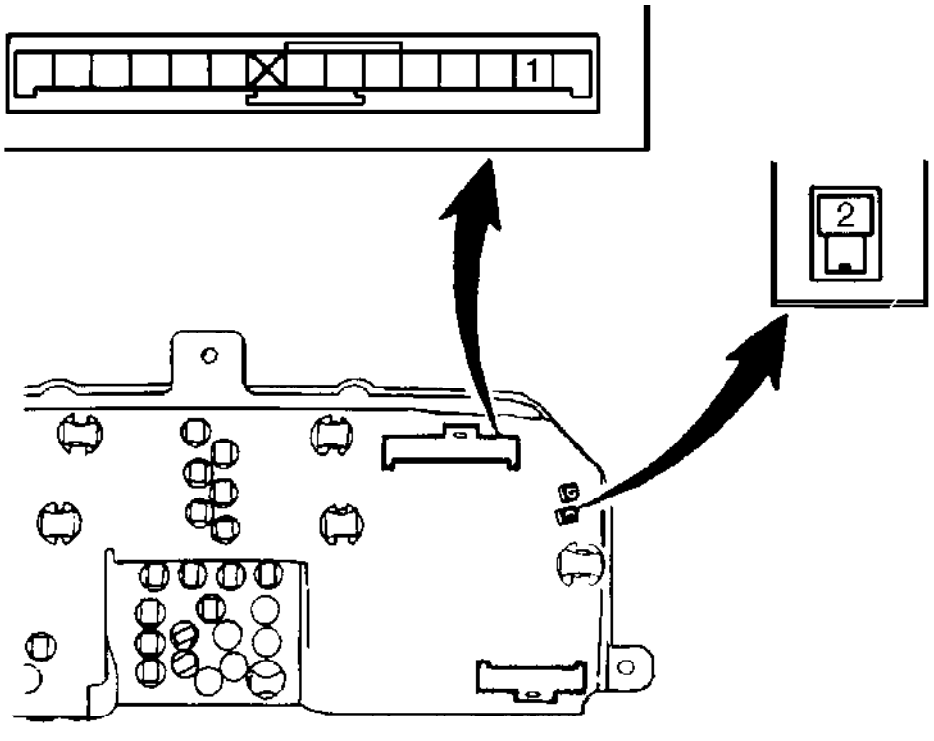


Fig. 21: Identifying VSS Test Terminals
Courtesy of Mitsubishi Motor Sales of America.

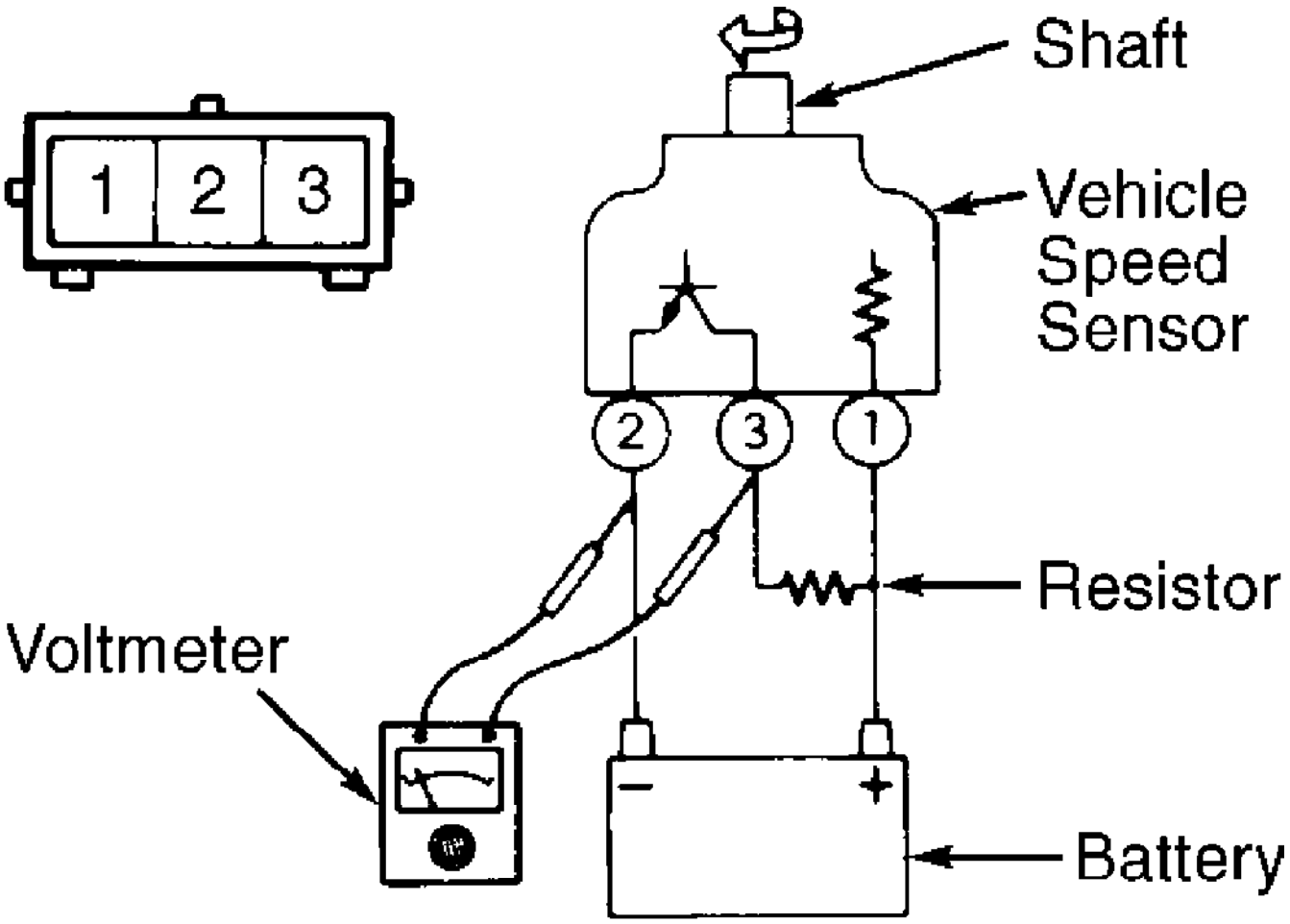


Fig. 22: Testing VSS
Courtesy of Mitsubishi Motor Sales of America

4) With an assistant, road test vehicle. Drive vehicle at 25 MPH. Using scan tool, read vehicle speed. If scan tool does not read 25 MPH, replace VSS. If scan tool reads 25 MPH, go to next step.

5) Turn ignition switch to OFF position. Disconnect PCM connector. Using DVOM, check continuity between chassis ground and PCM connector terminal No. 86. Move vehicle. Ensure continuity pulses on and off with tire revolution. If continuity is as specified, go to step 11).

6) With PCM connector disconnected, disconnect VSS connector. Ground PCM connector terminal No. 86. Using DVOM, check for continuity between chassis ground and VSS connector terminal No. 1. See Fig. 23. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

Fig. 23: Identifying VSS Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

7) Using DVOM, check for continuity between chassis ground

and VSS connector terminal No. 13. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

VSS GROUND CIRCUIT IDENTIFICATION

Application	Terminal No.
Montero	13

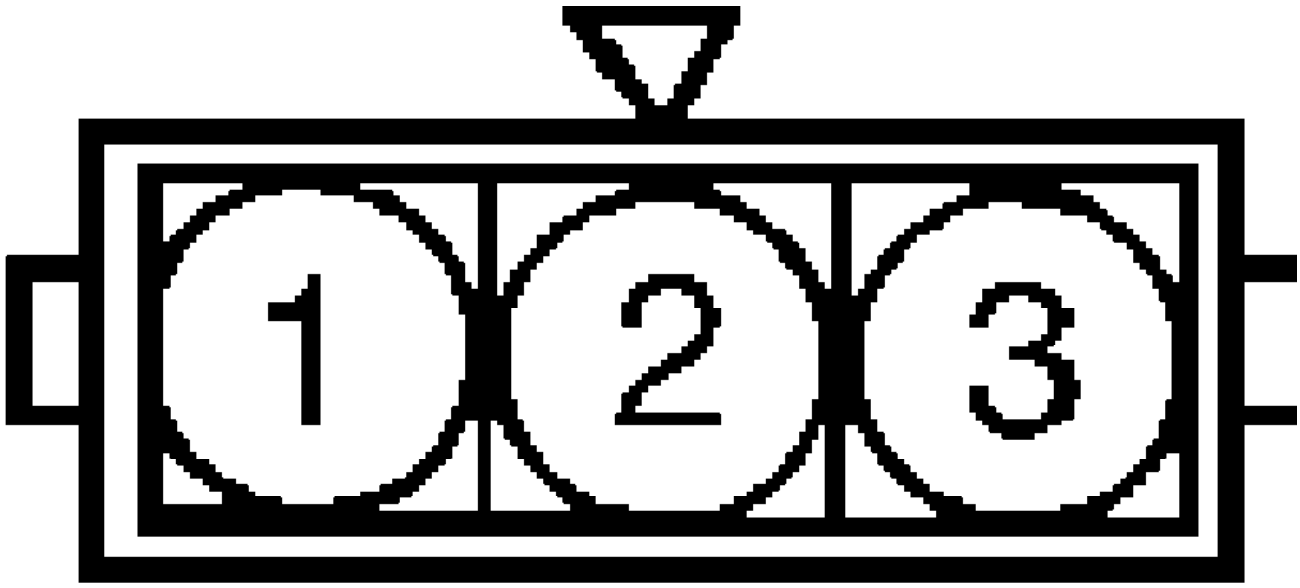


Fig. 24: Identifying VSS Connector Terminals
Courtesy of Mitsubishi Motor Sales of America.

9) With VSS connector disconnected, turn ignition switch to ON position. Using DVOM, check for voltage between chassis ground and specified VSS connector terminal No. 1. See VSS VOLTAGE FEED CIRCUIT IDENTIFICATION table. If voltage is not 4.5-4.9 volts, replace PCM. If voltage is as specified, condition required to set DTC is not present at this time. Go to next step.

VSS VOLTAGE FEED CIRCUIT IDENTIFICATION

Application	Terminal No.
Montero	1

10) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P0505: IDLE CONTROL SYSTEM FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) Manufacturer does not provide component testing procedure without using scan tool. Ensure engine coolant temperature is 185-205°F (85-95°C). Place transmission in Park (A/T) or Neutral (M/T). Turn off all accessories except A/C. Ensure A/C clutch is operating when A/C system is on. Allow engine to idle. Go to next step.

2) Using scan tool, read Idle Air Control (IAC) position sensor step. See IAC POSITION SENSOR STEP SPECIFICATIONS table. If scan tool does not read as specified, replace IAC position sensor. If readings are as specified, go to next step.

IAC POSITION SENSOR STEP SPECIFICATIONS

A/C Switch Position	Standard Step Value
Off	2-25
Off To On	Increase From 10-70
* (1)	Increase From 5-50

(1) - For A/T models. Brakes applied. A/C off on Montero.

3) Disconnect IAC motor connector and MFI relay connector. Check for continuity between IAC motor connector terminal No. 5 and MFI relay connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

4) Check for continuity between IAC motor connector terminal No. 2 and MFI relay connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

6) Turn ignition switch to OFF position. Disconnect PCM connector and IAC motor connector. Ground specified PCM connector terminal and using DVOM, check continuity between chassis ground and specified IAC motor connector terminal. See PCM-TO-IAC MOTOR HARNESS CIRCUIT IDENTIFICATION table. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

PCM-TO-IAC MOTOR HARNESS CIRCUIT IDENTIFICATION

Application	PCM Terminal No.	IAC Motor Terminal No.
All Models	4	1
"	5	4
"	17	3
"	18	6

7) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P0510: CLOSED THROTTLE POSITION (TP) SWITCH FAILURE

NOTE: Closed TP switch is built into TP sensor. For DTC P0510 test purposes, TP sensor will be referred to as closed TP switch.

For terminal identification, see TP sensor under TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) If using scan tool, go to step 3). Disconnect closed TP switch connector. Check for continuity between closed TP switch connector terminals No. 1 and 2. Go to next step.
2) Depress accelerator pedal. Continuity should not exist. Release accelerator pedal. Continuity should exist. If continuity is not as specified, replace TP sensor. If continuity is as specified, go to step 4).
3) Using scan tool, read closed TP switch state. With accelerator pedal released, scan tool should read ON. With accelerator pedal slightly depressed, scan tool should read OFF. If closed TP switch does not test as specified, replace TP sensor. If closed TP switch tests as specified, disconnect closed TP switch connector and go to next step.
4) Turn ignition switch to OFF position. Disconnect PCM connector. Ground PCM connector terminal No. 87. Using DVOM, check continuity between chassis ground and closed TP switch connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.
6) Turn ignition switch to ON position. Check voltage between chassis ground and closed TP switch connector terminal No. 2. If voltage is less than 4 volts, replace PCM. If voltage is more than 4 volts, condition required to set DTC is not present at this time. Go to next step.
7) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P0705: TRANSMISSION RANGE SENSOR CIRCUIT FAILURE

DTC P0705 is related to automatic transmission diagnostics. For diagnostic procedure, see appropriate section.

DTC P0710: TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT FAILURE

DTC P0710 is related to automatic transmission diagnostics. For diagnostic procedure, see appropriate section.

DTC P1400: MANIFOLD DIFFERENTIAL PRESSURE (MDP) SENSOR CIRCUIT FAILURE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 2.4L article.

1) Manufacturer does not provide component testing procedure without using scan tool. Warm vehicle to normal operating temperature and allow engine to idle. Go to next step.
2) Using scan tool, read intake manifold pressure. See INTAKE MANIFOLD PRESSURE SPECIFICATIONS table. If scan tool does not read as specified, replace MDP sensor. If scan tool reads as specified, go to next step.

INTAKE MANIFOLD PRESSURE SPECIFICATIONS

Application	psi (kPa)
Montero	3.0-4.9 (20.6-34.0)

3) Disconnect MDP sensor connector. Using DVOM, check continuity between chassis ground and MDP sensor connector terminal No. 2. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

4) Turn ignition switch to OFF position. With MDP sensor connector disconnected, disconnect PCM connector. Ground PCM connector terminal No. 74. Check continuity between chassis ground and MDP sensor connector terminal No. 1. If continuity does not exist, repair wiring harness as necessary. If continuity exists, go to next step.

5) Reconnect PCM connector. Turn ignition switch to ON position. Check voltage between chassis ground and MDP sensor connector terminal No. 3. If voltage is not 4.8-5.2 volts, replace PCM. If voltage is as specified, condition required to set DTC is not present at this time. Go to next step.

6) Test is complete. Intermittent problem may exist. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS.

DTC P1600: SERIAL COMMUNICATION LINK MALFUNCTION

DTC P1600 is related to automatic transmission diagnostics. For diagnostic procedure, see appropriate section.

DTC P1715: PULSE GENERATOR FAILURE

DTC P1715 is related to automatic transmission diagnostics. For diagnostic procedure, see appropriate section.

DTC P1750: SOLENOID FAILURE

DTC P1750 is related to automatic transmission diagnostics. For diagnostic procedure, see appropriate section.

DTC P1791: ENGINE COOLANT TEMPERATURE LEVEL INPUT TO TCM

DTC P1791 is related to automatic transmission diagnostics. For diagnostic procedure, see appropriate section.

SUMMARY

If no hard DTCs (or only pass DTCs) are present, driveability symptoms exist, or intermittent DTCs exist, proceed to H - TESTS W/O CODES - 2.4L article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent diagnostic procedures.

G - TESTS W/CODES - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Self-Diagnostics

Montero Sport - 3.0L

INTRODUCTION

NOTE: If no faults were found while performing BASIC DIAGNOSTIC PROCEDURES, proceed with self-diagnostics. If no Diagnostic Trouble Codes (DTCs) or only pass codes are present after entering self-diagnostics, proceed to H - TESTS W/O CODES - 3.0L article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.).

SYSTEM DIAGNOSIS

NOTE: PCM diagnostic memory is retained by direct power supply from battery. Memory is not erased by turning off ignition, but it will be erased if battery or PCM is disconnected.

System diagnosis can be accomplished using a scan tool on all models. See ENTERING ON-BOARD DIAGNOSTICS. Powertrain Control Module (PCM) monitors several different engine control system circuits. If an abnormal input signal occurs, a Diagnostic Trouble Code (DTC) is stored in PCM memory and assigned a DTC number. Each circuit has its own DTC number and message. A specific DTC indicates a particular system failure, but does not indicate that cause of failure is necessarily within system.

A DTC does not condemn any specific component; it simply points out a probable malfunctioning area. If a DTC is set, PCM will turn on MIL. System failures encountered are identified as either hard failures or intermittent failures as determined by PCM.

Hard Failures

Hard failures cause MIL to come on and remain on until failure is repaired. If MIL comes on and remains on (MIL may flash) during vehicle operation, cause of failure may be determined by using DTCs. See DIAGNOSTIC TROUBLE CODES (DTCS). If a sensor fails, PCM will use a substitute value in its calculations to continue engine operation. In this condition (limp-in mode), vehicle is functional, but loss of good driveability may result.

Intermittent Failures

Intermittent failures may cause MIL to flicker or come on and go out after intermittent DTC goes away. However, corresponding DTC will be retained in PCM memory. If related DTC does not reoccur within a certain time frame, related DTC will be erased from PCM memory. Intermittent failures may be caused by a sensor, connector or wiring problems. See INTERMITTENTS in H - TESTS W/O CODES - 3.0L article.

SELF-DIAGNOSTIC SYSTEM

SERVICE PRECAUTIONS

Before proceeding with diagnosis, following precautions must be observed:

* Ensure vehicle has a fully charged battery and functional

charging system.
* Visually inspect connectors and circuit wiring being worked on.
* DO NOT disconnect battery or PCM. This will erase any DTCs stored in PCM.
* DO NOT cause short circuits when performing electrical tests. This will set additional DTCs, making diagnosis of original problem more difficult.
* DO NOT use a test light in place of a voltmeter.
* When checking for spark, ensure coil wire is NOT more than 1/4" from chassis ground. If coil wire is more than 1/4" from chassis ground, damage to vehicle electronics and/or PCM may result.
* DO NOT prolong testing of fuel injectors. Engine may hydrostatically (liquid) lock.
* When a vehicle has multiple DTCs, always repair lowest number DTC first.

VISUAL INSPECTION

Most driveability problems in the engine control system result from faulty wiring, poor electrical connections or leaking air and vacuum hose connections. To avoid unnecessary component testing, perform a visual inspection before beginning self-diagnostic tests.

ENTERING ON-BOARD DIAGNOSTICS

NOTE: DO NOT skip any steps in self-diagnostic tests or incorrect diagnosis may result. Ensure self-diagnostic test applies to vehicle being tested.

DTCs may be retrieved by using a scan tool only. Proceed to appropriate DTC retrieval method.

NOTE: Although other scan tools are available, Mitsubishi recommends using Multi-Use Tester II (MUT II) scan tool.

Using Scan Tool

1) Refer to manufacturer's operation manual for instructions in use of scan tool. Before entering on-board diagnostics, see SERVICE PRECAUTIONS. Locate Data Link Connector (DLC) under instrument panel, near steering column.

2) Turn ignition switch to OFF position. Connect scan tool to DLC. Turn ignition switch to ON position. Read and record scan tool self-diagnostic output. Proceed to DIAGNOSTIC TROUBLE CODES (DTCS).

DIAGNOSTIC TROUBLE CODES (DTCS)

DTCS

NOTE: DTCs can only be retrieved by using a scan tool. DTCs listed below are retrieved using a generic scan tool. MUT II scan tool can be used, but it may not read all DTCs. DTCS listed are not used on all vehicles.

DTC P0100

Volume Airflow (VAF) circuit failure. Possible causes are: connector or harness, or faulty VAF sensor.

DTC P0105

Barometric (BARO) pressure circuit failure. Possible causes are: connector or harness, or faulty BARO pressure sensor.

DTC P0105
Manifold Absolute Pressure (MAP) circuit failure. Possible causes are: connector or harness, or faulty MAP sensor.

DTC P0110
Intake Air Temperature (IAT) circuit failure. Possible causes are: connector or harness, or faulty VAF sensor.

DTC P0115
Engine Coolant Temperature (ECT) circuit failure. Possible causes are: connector or harness, or faulty ECT sensor.

DTC P0120
Throttle Position (TP) circuit failure. Possible causes are: connector or harness, or faulty TP sensor.

DTC P0125
Excessive time to enter closed loop fuel control. Possible causes are: faulty front HO2S, HO2S connector or harness, or faulty fuel injector.

DTC P0130
Front Heated Oxygen Sensor (HO2S) circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0135
Front Heated Oxygen Sensor (HO2S) heater circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0136
Rear Heated Oxygen Sensor (HO2S) circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0141
Rear Heated Oxygen Sensor (HO2S) heater circuit failure. Possible causes are: connector or harness, or faulty HO2S.

DTC P0150
Heated Oxygen Sensor (HO2S) circuit failure (bank 2, sensor 1). Possible causes are: connector or harness, or HO2S.

DTC P0155
Heated Oxygen Sensor (HO2S) heater circuit failure (bank 2, sensor 1). Possible causes are: connector or harness, or HO2S.

DTC P0156
Heated Oxygen Sensor (HO2S) circuit failure (bank 2, sensor 2). Possible causes are: connector or harness, or HO2S.

DTC P0161
Heated Oxygen Sensor (HO2S) heater circuit failure (bank 2, sensor 2). Possible causes are: connector or harness, or HO2S.

DTC P0170
Fuel trim failure (bank 1). Possible causes are: intake air leaks, cracked exhaust manifold, faulty VAF sensor frequency, HO2S, injector, fuel pressure, ECT, IAT or BARO pressure sensor.

DTC P0173
Fuel trim failure (bank 2). Possible causes are: intake air leaks, cracked exhaust manifold, faulty VAF sensor frequency, HO2S, injector, fuel pressure, ECT, IAT or BARO pressure sensor.

DTC P0201
Cylinder No. 1 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0202
Cylinder No. 2 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0203
Cylinder No. 3 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0204
Cylinder No. 4 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0205
Cylinder No. 5 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0206
Cylinder No. 6 injector circuit failure. Possible causes are: connector or harness, or faulty injector.

DTC P0300
Random misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0301
Cylinder No. 1 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0302
Cylinder No. 2 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0303
Cylinder No. 3 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0304
Cylinder No. 4 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0305
Cylinder No. 5 misfire detected. Possible causes are: connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0306
Cylinder No. 6 misfire detected. Possible causes are:

connector or harness, faulty ignition coil, ignition power transistor, spark plug, ignition circuit, injector, HO2S, compression pressure, timing belt, air intake system, fuel pressure, or CKP sensor.

DTC P0325
Knock Sensor (KS) circuit failure. Possible causes are: connector or harness, or faulty KS.

DTC P0335
Crankshaft Position (CKP) sensor circuit failure. Possible causes are: connector or harness, or faulty CKP sensor.

DTC P0340
Camshaft Position (CMP) sensor circuit failure. Possible causes are: connector or harness, or faulty CMP sensor.

DTC P0400
Exhaust Gas Recirculation (EGR) flow failure. Possible causes are: connector or harness, faulty EGR valve, EGR solenoid, EGR valve control vacuum, or manifold differential pressure sensor.

DTC P0403
Exhaust Gas Recirculation (EGR) solenoid failure. Possible causes are: connector or harness, or faulty EGR solenoid.

DTC P0420
Catalyst efficiency below threshold. Possible causes are: cracked exhaust manifold, or faulty catalytic converter.

DTC P0421
Warm-up catalyst efficiency below threshold (bank 1). Possible causes are: faulty exhaust manifold. If exhaust manifold is okay, replace catalytic converter.

DTC P0431
Warm-up catalyst efficiency below threshold (bank 2). Possible causes are: faulty exhaust manifold. If exhaust manifold is okay, replace catalytic converter.

DTC P0440
Evaporative (EVAP) emission control system failure. Possible causes are: connector or harness, improper hose routing, faulty EVAP solenoid, or EVAP purge control solenoid.

DTC P0442
Evaporative (EVAP) emission control system leak detected. Possible causes are: connector or harness, faulty EVAP purge solenoid, purge control valve, or vacuum hose routing.

DTC P0443
Evaporative (EVAP) purge control valve circuit failure. Possible causes are: connector or harness, or faulty EVAP solenoid.

DTC P0446
Evaporative (EVAP) emission control system vent control failure. Possible causes are: connector or harness, faulty EVAP vent solenoid.

DTC P0450
Evaporative (EVAP) emission control system pressure sensor failure. Possible causes are: connector or harness, or faulty fuel tank differential pressure sensor.

DTC P0500
Vehicle Speed Sensor (VSS) failure. Possible causes are: connector or harness, or faulty VSS.

DTC P0505
Idle Air Control (IAC) system failure. Possible causes are: connector or harness, or faulty IAC motor.

DTC P0510
Closed Throttle Position (TP) switch failure. Possible causes are: connector or harness, or faulty closed TP switch.

DTC P0551
Power Steering Pressure (PSP) sensor failure. Possible causes are: connector or harness, or faulty PSP sensor.

DTC P0705
Automatic transaxle/transmission range sensor circuit failure. Possible causes are: connector or harness, or faulty PNP switch.

DTC P0710
Automatic transaxle/transmission fluid sensor failure. Possible causes are: connector or harness, or faulty transaxle/transmission sensor.

DTC P0715
Automatic transaxle input/turbine speed sensor circuit failure. Possible causes are: connector or harness, or pulse generator.

DTC P0720
Automatic transaxle input/turbine speed sensor circuit failure. Possible causes are: connector or harness, or pulse generator.

DTC P0725
Engine speed input circuit failure. Possible causes are: connector or harness.

DTC P0740
Torque converter clutch system failure. Possible causes are: connector or harness, or torque converter clutch solenoid.

DTC P0750
Shift solenoid "A" failure. Possible causes are: connector or harness, or low-reverse solenoid.

DTC P0755
Shift solenoid "B" failure. Possible causes are: connector or harness, or underdrive solenoid.

DTC P0760
Shift solenoid "C" failure. Possible causes are: connector or harness, or second solenoid.

DTC P0765
Shift solenoid "D" failure. Possible causes are: connector or harness, or overdrive solenoid.

DTC P1103
Turbocharger wastegate actuator failure. Possible causes are: connector or harness, faulty wastegate solenoid or actuator, or vacuum

hose routing.

DTC P1104
Turbocharger wastegate solenoid failure. Possible causes are: connector or harness, or faulty wastegate solenoid.

DTC P1105
Fuel pressure solenoid failure. Possible causes are: connector or harness, or faulty fuel pressure solenoid.

DTC P1400
Manifold Differential Pressure (MDP) sensor circuit failure. Possible causes are: connector or harness, or faulty MDP sensor.

DTC P1500
Generator FR terminal circuit failure. Possible causes are: connector or harness.

DTC P1600
Serial communication link failure. Possible causes are: connector or harness.

DTC P1715
Pulse Generator (PG) failure. Possible causes are: connector or harness, or faulty PG.

DTC P1750
Solenoid failure. Possible causes are: connector or harness, faulty converter clutch solenoid, shift control solenoid, or pressure control solenoid.

DTC P0751
Automatic transaxle control relay failure. Possible causes are: connector or harness, or automatic transaxle relay.

DTC P1791
Engine coolant temperature level input circuit (to TCM) failure. Possible causes are: connector or harness.

DTC P1795
Throttle position input circuit failure. Possible causes are: connector or harness.

CLEARING DTCS

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

To clear DTCs using a scan tool, refer to owners manual supplied with scan tool. If scan tool is not available, DTCs may also be cleared by disconnecting negative battery cable or PCM for at least 15 seconds, allowing PCM to clear DTCs. Reconnect negative battery cable and check for DTCs to confirm repair.

PCM LOCATION

PCM LOCATION

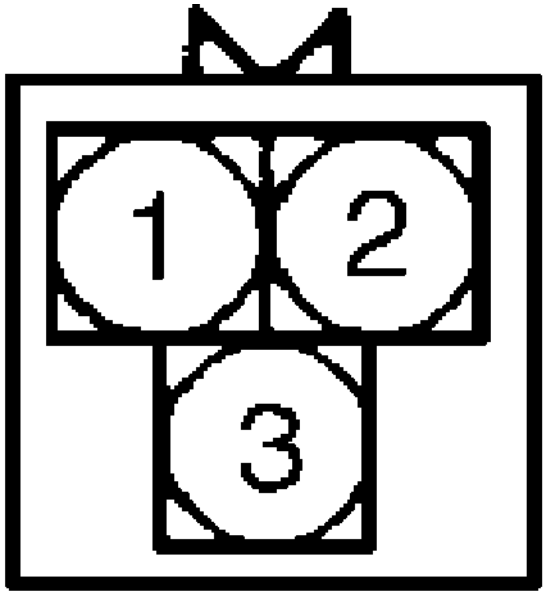
Application	Location
Montero Sport	Behind Right Side Of Instrument Panel (Glove Box)

TERMINAL IDENTIFICATION

NOTE: The following terminals are shown as viewed from component side of connector.

TERMINAL IDENTIFICATION DIRECTORY

Connector	See Figure
CKP Sensor	Fig. 1
DLC	Fig. 2
ECT Sensor	Fig. 3
Fuel Injector	Fig. 4
Fuel Pump	Fig. 5
FTDP Sensor	Fig. 6
Generator Field	Fig. 7
HO2S	Fig. 8
IAC Motor	Fig. 9
Ignition Coil	Fig. 10
KS	Fig. 11
MDP Sensor	Fig. 12
MFI Relay	Fig. 13
PNP Switch	Fig. 14
PCM	Fig. 15
TCM	Fig. 16
TP Sensor	Fig. 17
VAF Sensor	Fig. 18



95H31135

Fig. 1: Identifying CKP Terminals
Courtesy of Mitsubishi Motor Sales of America.

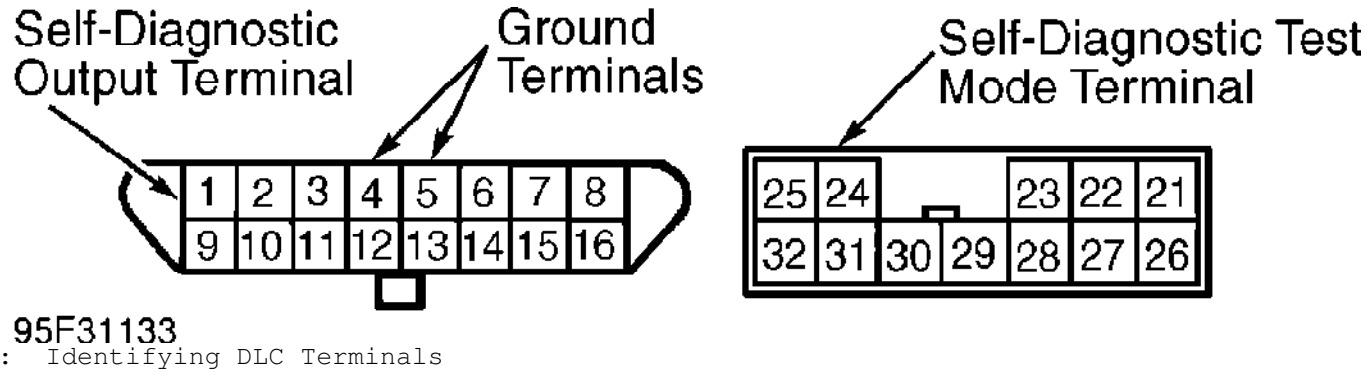


Fig. 2: Identifying DLC Terminals
Courtesy of Mitsubishi Motor Sales of America.

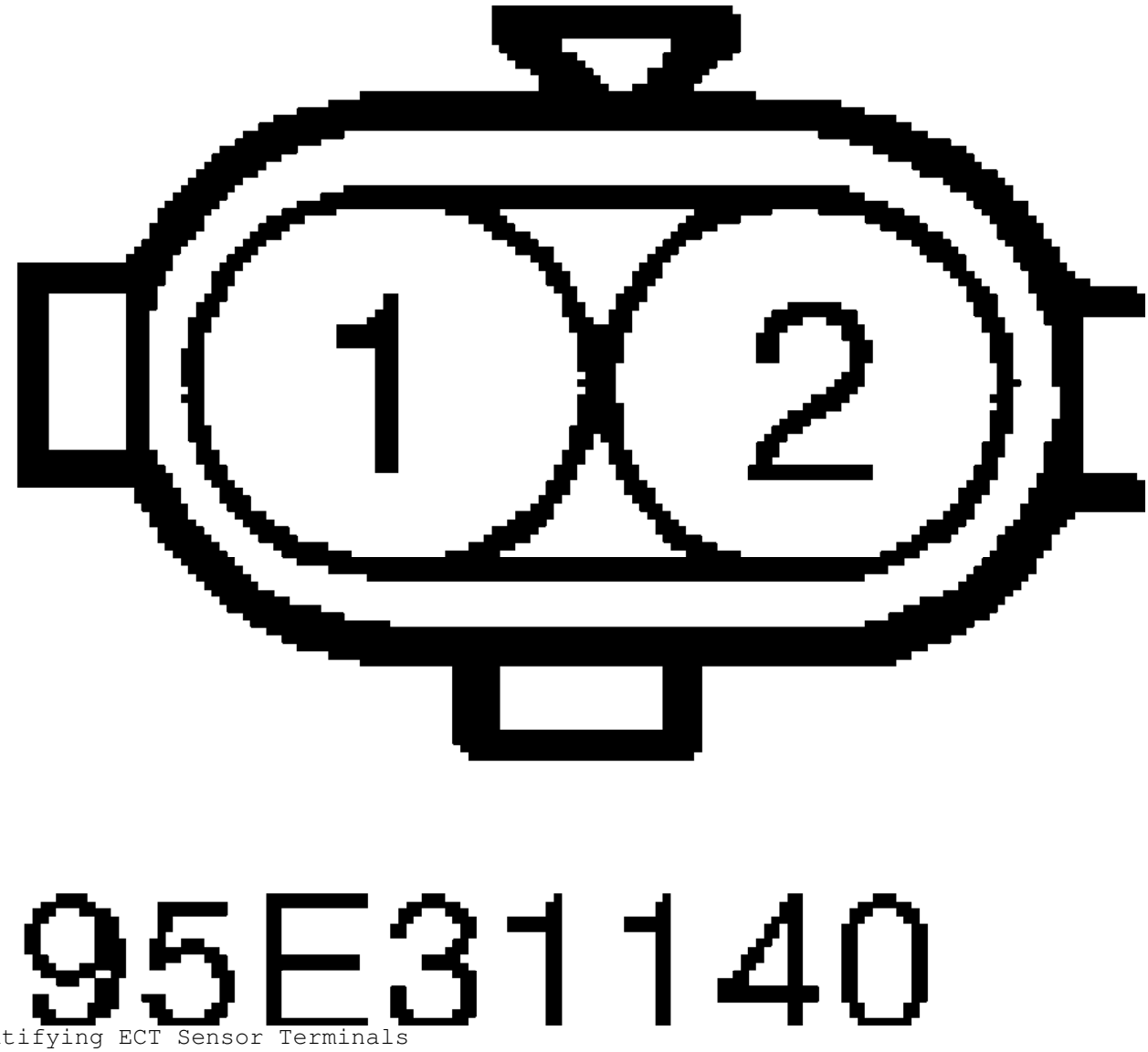


Fig. 3: Identifying ECT Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America.

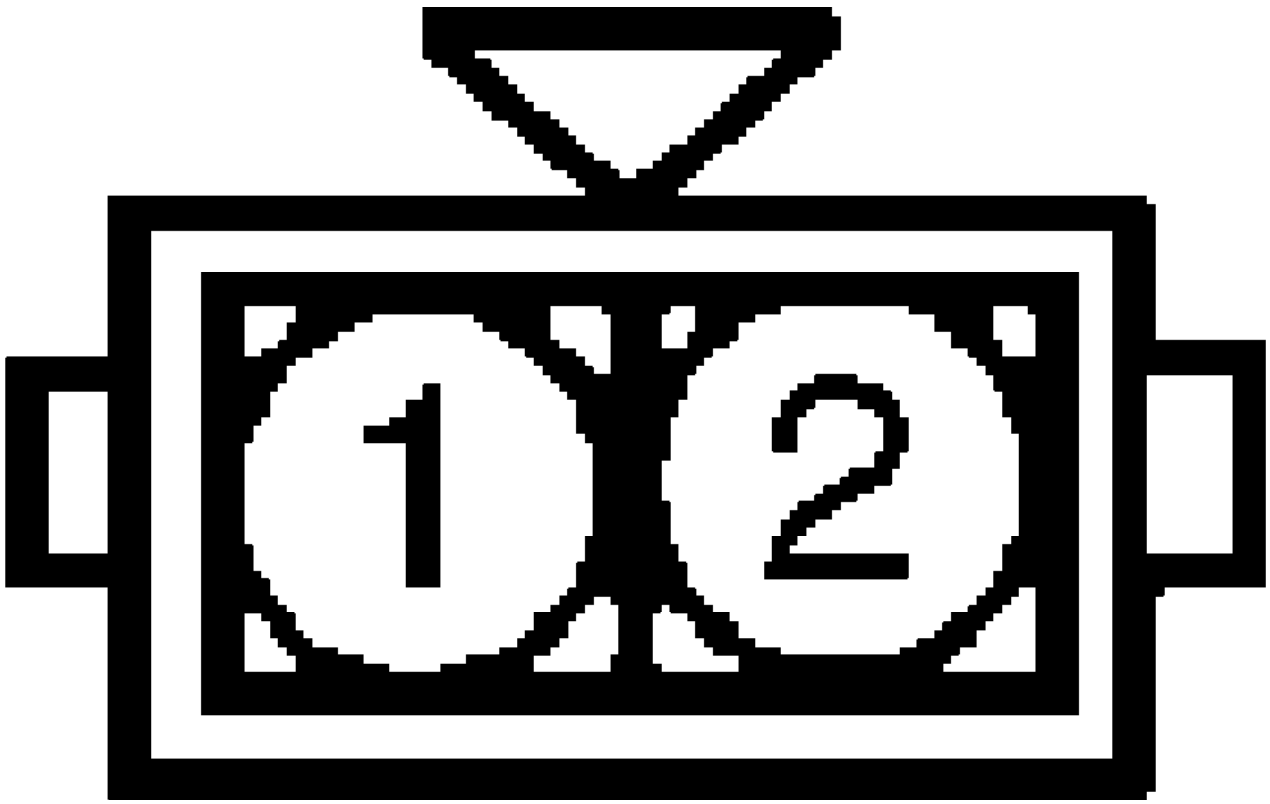


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Fig. 4: Identifying Fuel Injector Terminals
Courtesy of Mitsubishi Motor Sales of America.

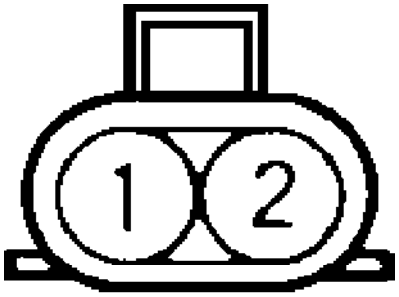

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Fig. 5: Identifying Fuel Pump Terminals
Courtesy of Mitsubishi Motor Sales of America.

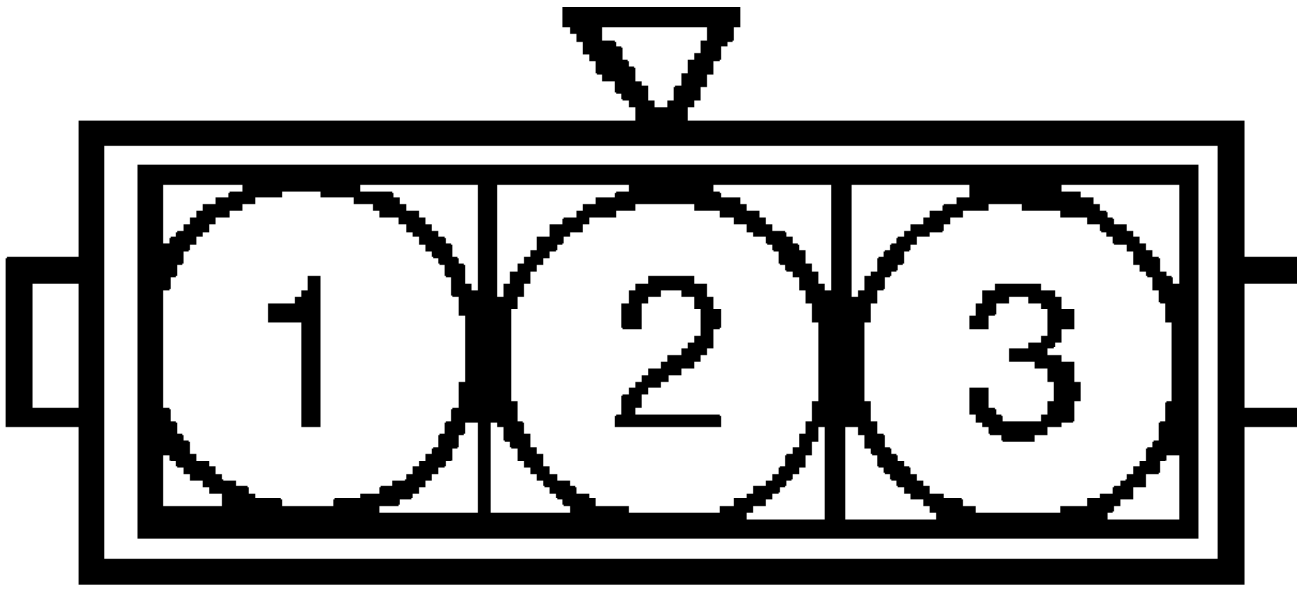


Fig. 6: Identifying FTDP Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America.

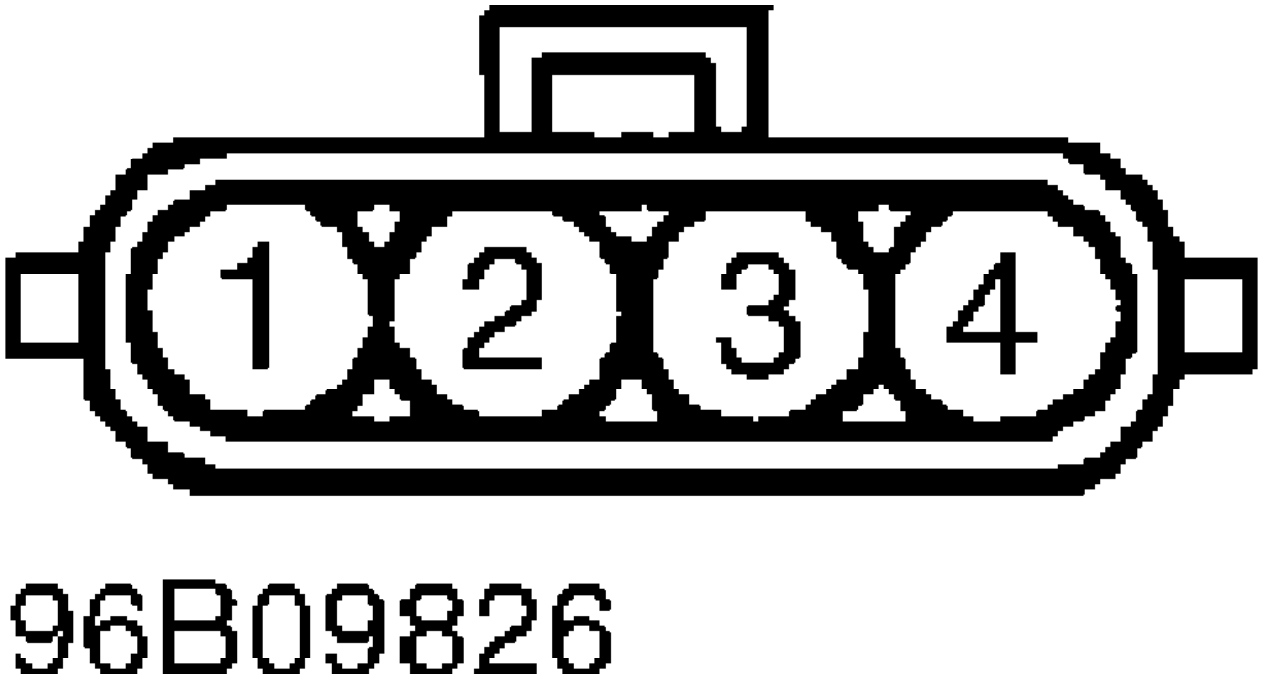


Fig. 7: Identifying Generator Field Terminals
Courtesy of Mitsubishi Motor Sales of America.

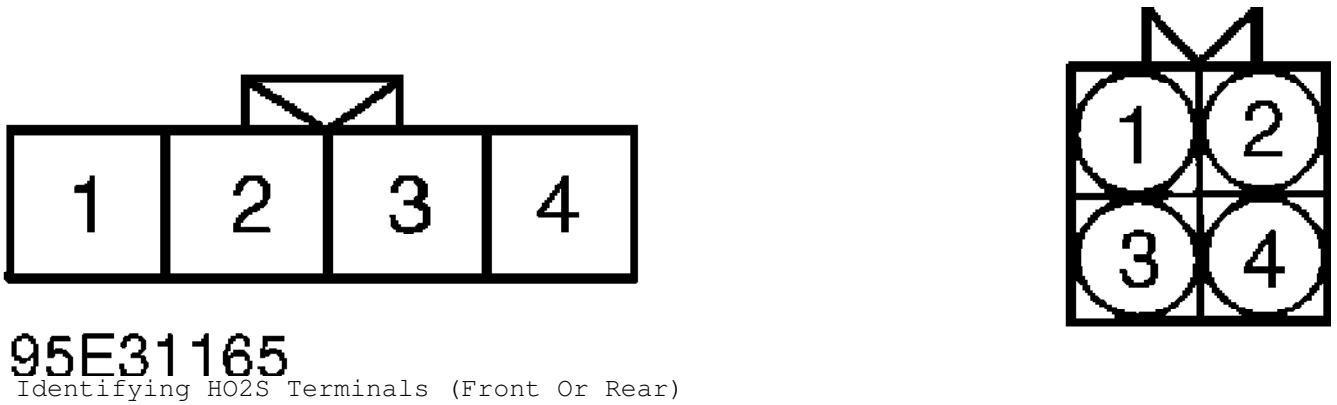


Fig. 8: Identifying HO2S Terminals (Front Or Rear)
Courtesy of Mitsubishi Motor Sales of America.

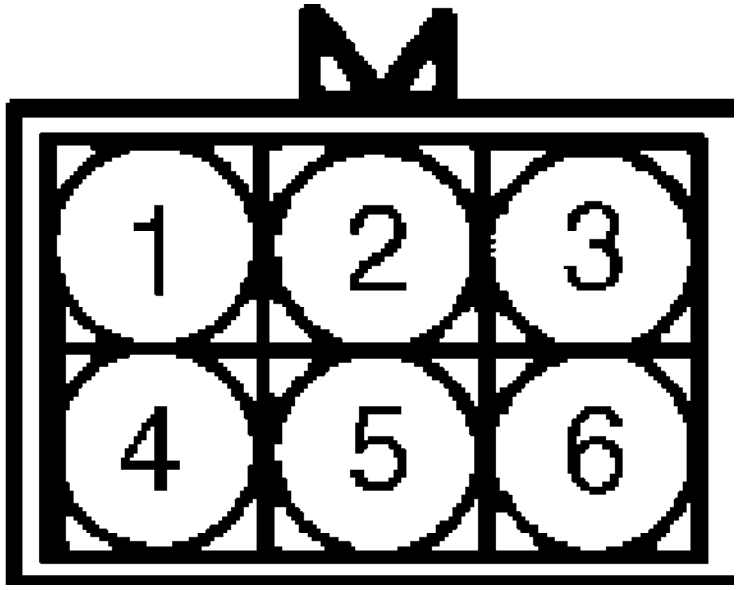


Fig. 9: Identifying IAC Motor Terminals
Courtesy of Mitsubishi Motor Sales of America.

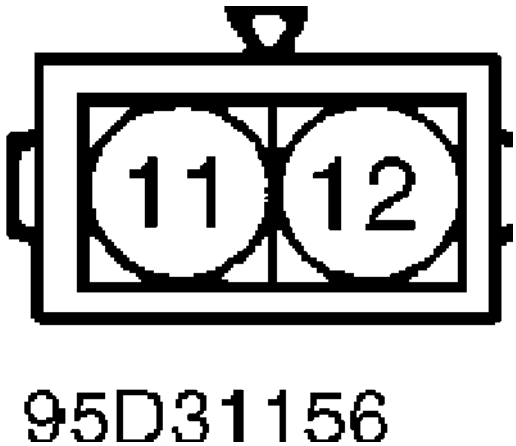
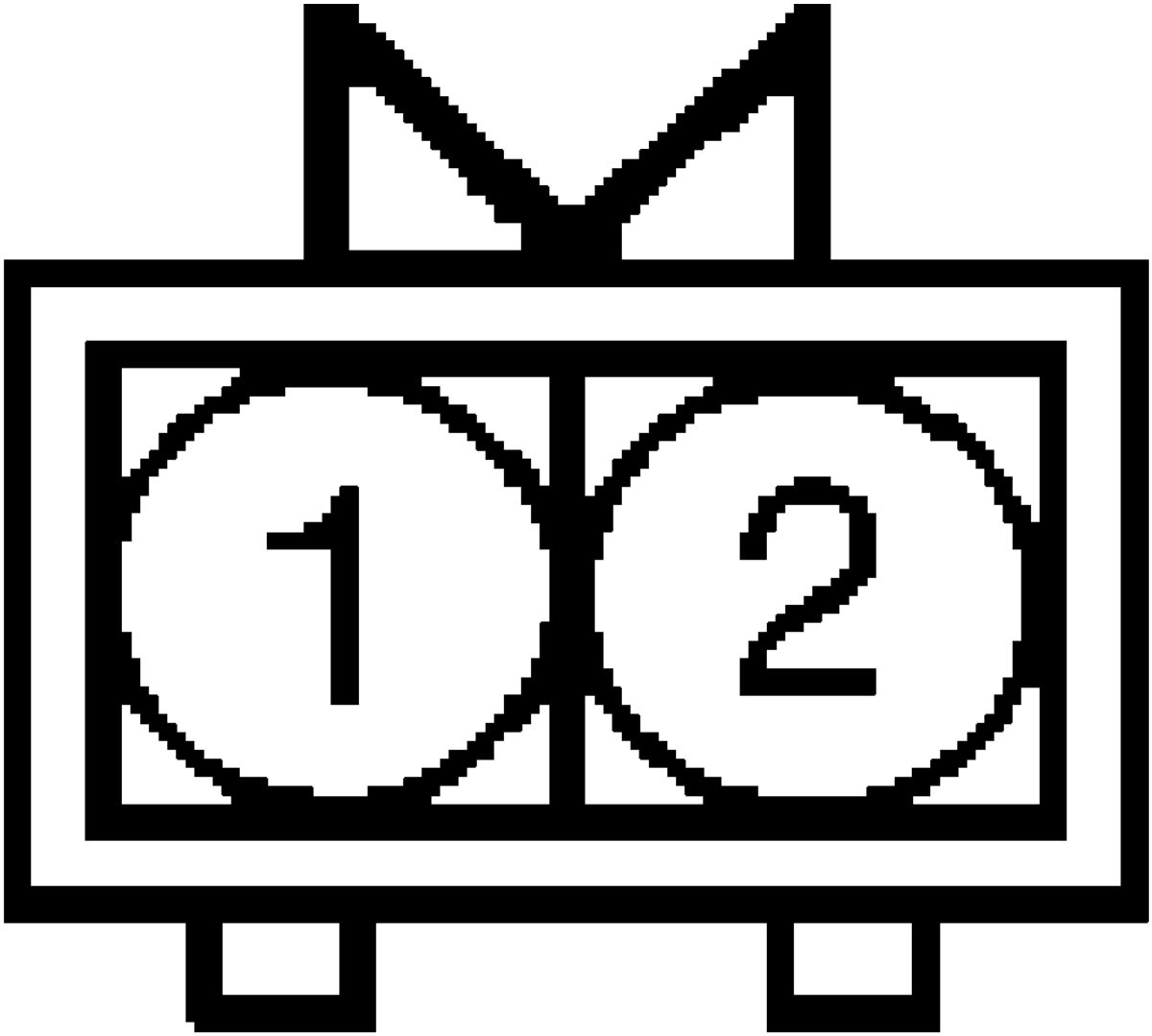


Fig. 10: Identifying Ignition Coil Terminals
Courtesy of Mitsubishi Motor Sales of America.



93180265

Fig. 11: Identifying KS Terminals
Courtesy of Mitsubishi Motor Sales of America.

Fig. 12: Identifying MDP Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America.

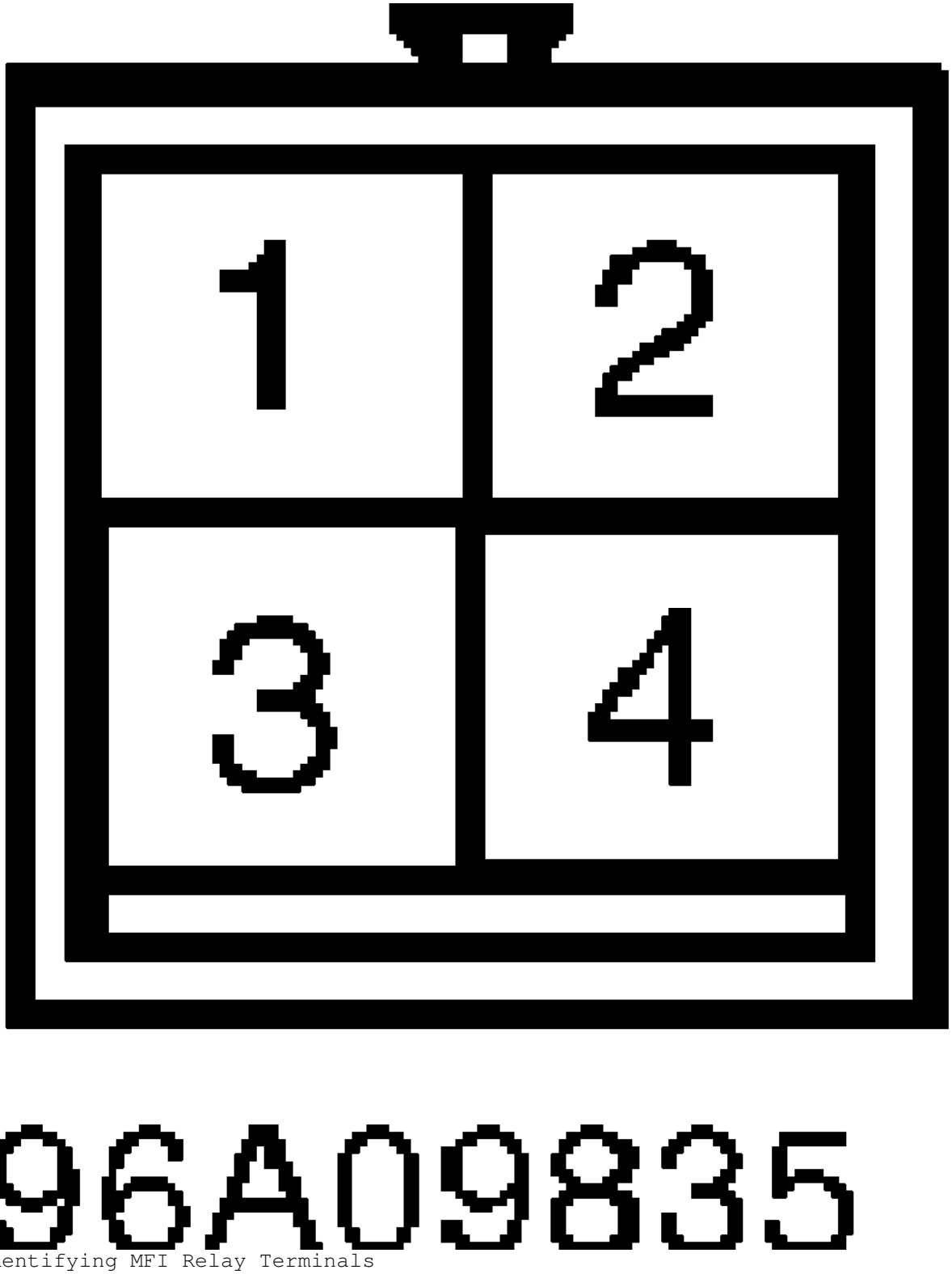


Fig. 13: Identifying MFI Relay Terminals
Courtesy of Mitsubishi Motor Sales of America.

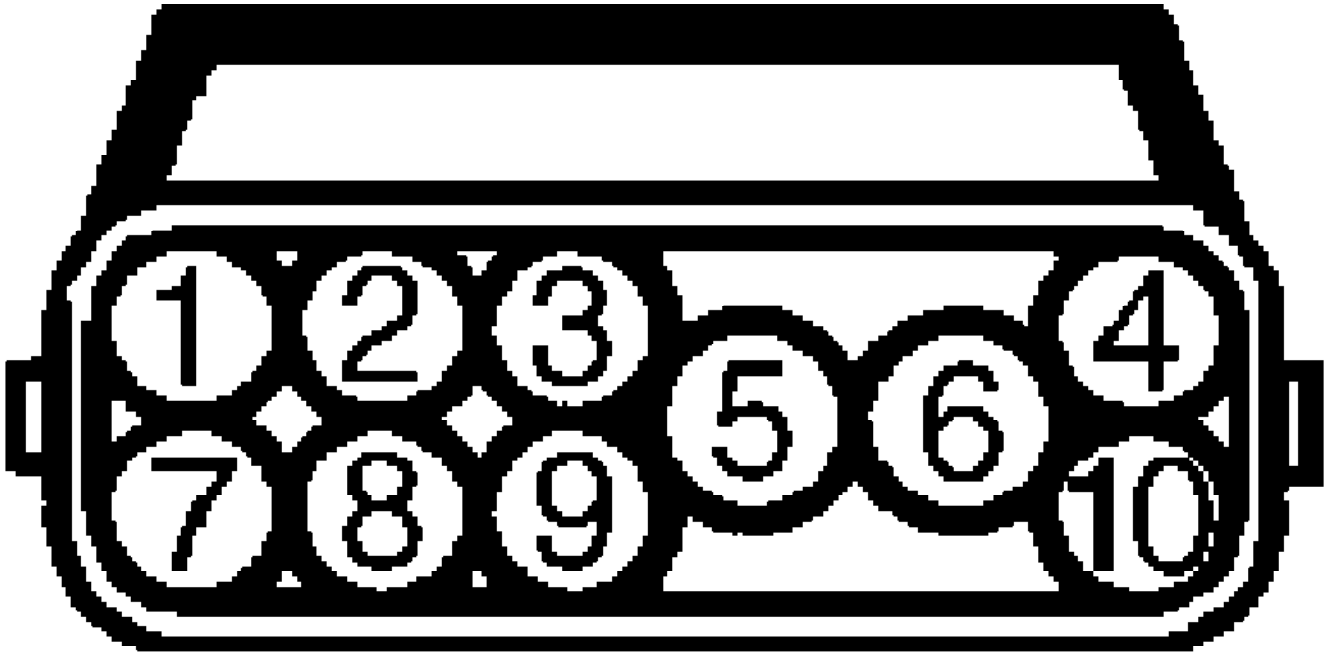


Fig. 14: Identifying PNP Switch Terminals
Courtesy of Mitsubishi Motor Sales of America.

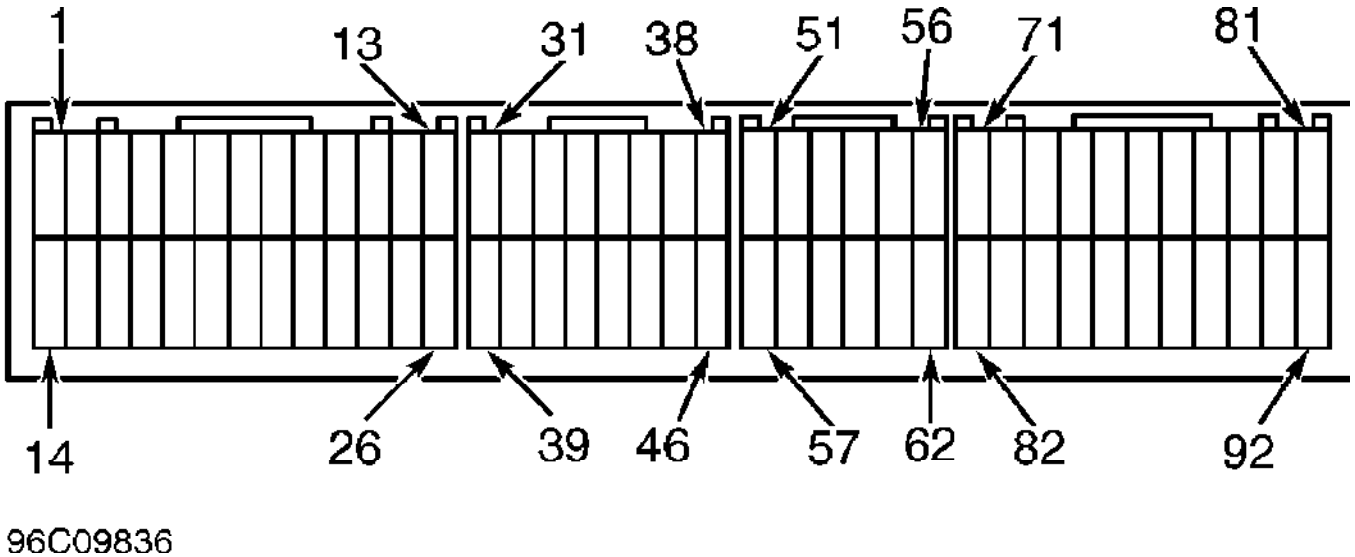
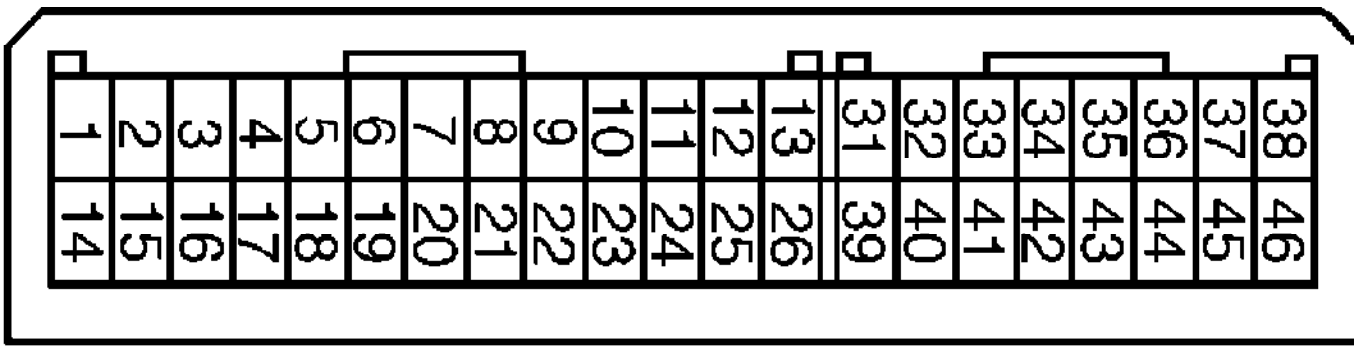
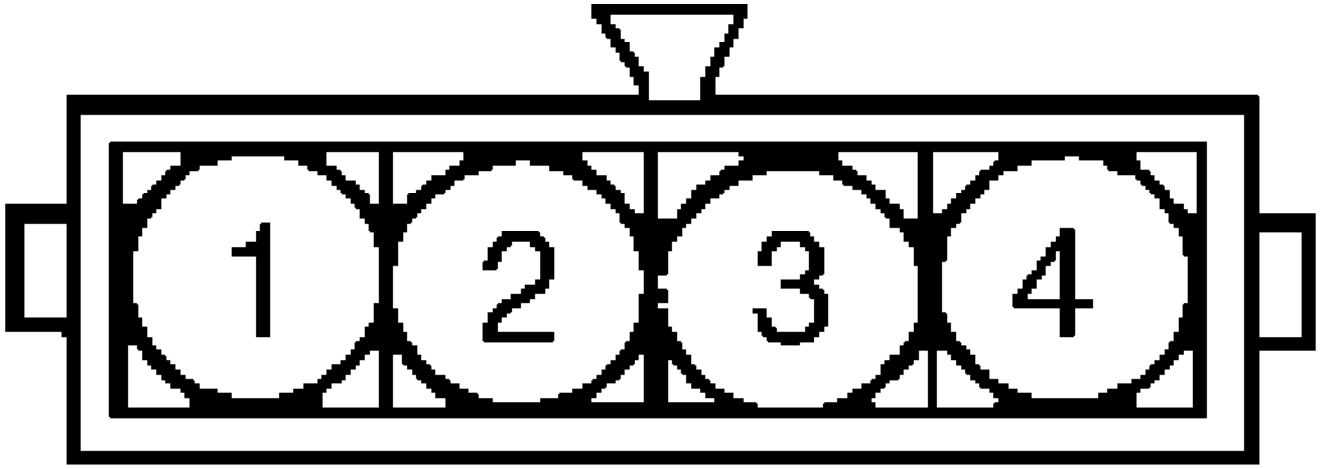


Fig. 15: Identifying PCM Terminals
Courtesy of Mitsubishi Motor Sales of America.



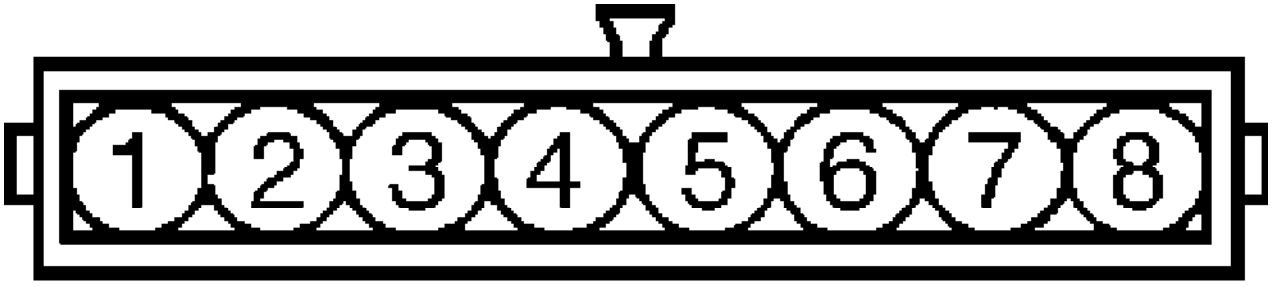
95D31537

Fig. 16: Identifying TCM Terminals
Courtesy of Mitsubishi Motor Sales of America.



95A31534

Fig. 17: Identifying TP Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America.



95G31134

Fig. 18: Identifying VAF Sensor Terminals
Courtesy of Mitsubishi Motor Sales of America.

DIAGNOSTIC TESTS

CAUTION: Ensure ignition switch is in OFF position when connecting or disconnecting scan tool or PCM connector, or when performing resistance tests.

NOTE: Perform all resistance and voltage tests using a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm impedance, unless stated otherwise in test procedures.

Using scan tool, display and record Diagnostic Trouble DTCs (DTCs). See ENTERING ON-BOARD DIAGNOSTICS under SELF-DIAGNOSTIC SYSTEM section. If scan tool is blank, see SCAN TOOL WILL NOT COMMUNICATE. If no DTCs are displayed, see H - TESTS W/O CODES - 3.0L article.

Clear DTCs. See CLEARING DTCS under SELF-DIAGNOSTIC SYSTEM section. Road test vehicle (if necessary) and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, go to INTERMITTENT DTCS. If one or more DTCs are displayed, repair DTCs in order starting with lowest numbered DTC. Clear DTCs after each repair. Recheck for DTCs to confirm repair.

SCAN TOOL WILL NOT COMMUNICATE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION see SELF-DIAGNOSTIC section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Using DVOM, check voltage between Data Link Connector (DLC) terminal No. 16 and ground. If battery voltage does not exist, check and repair junction connectors and wiring harness between DLC and power supply.

2) If battery voltage exists, check for continuity between DLC terminal No. 4 and ground, and between DLC terminal No. 5 and ground. If continuity does not exist, check and repair wiring harness between DLC and ground. If continuity exists, go to next step.

3) Try a different scan tool adapter cable. If scan tool does not communicate, try scan tool on a known-good vehicle. If scan tool still does not communicate, replace scan tool.

INTERMITTENT DTCS

This procedure applies if you have been sent here from diagnostic tests and have just attempted to simulate the condition that initially set DTC. The following additional checks may assist in identifying a possible intermittent problem:

* Visually inspect related wiring harness connectors for broken, bent, pushed out or corroded terminals.
* Visually inspect related wiring harness for chafed, pierced or partially broken wires.
* Check all pertinent technical service bulletins.

CIRCUIT TESTS

DTC P0100 - VOLUME AIRFLOW (VAF) SENSOR CIRCUIT MALFUNCTION

NOTE: For terminal identification, see TERMINAL IDENTIFICATION see SELF-DIAGNOSTIC section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

NOTE: Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for

instructions in use of oscillo-scope.

1) If using engine analyzer, go to step 3). If using scan tool, warm vehicle to normal operating temperature. Ensure headlights and accessories are off. Go to next step.
2) Using scan tool, read VAF sensor frequency (item 12). Frequency should be 10 Hz at idle. Frequency should increase when engine is raced. If frequencies are not as specified, turn ignition off and go to step 4). If frequencies are as specified, fault is intermittent. See INTERMITTENT DTCS.
3) Disconnect VAF sensor connector. Install Test Harness (MB991709) between VAF sensor and connector. Using engine analyzer with oscilloscope capability, connect special patterns probe to VAF sensor connector terminal No. 3 or to PCM connector terminal No. 90. Start engine. Compare oscilloscope wave pattern with known-good wave pattern. See Fig. 19. Turn engine off. If wave pattern is not normal, go to next step. If wave pattern is normal, fault is intermittent. See INTERMITTENT DTCS.

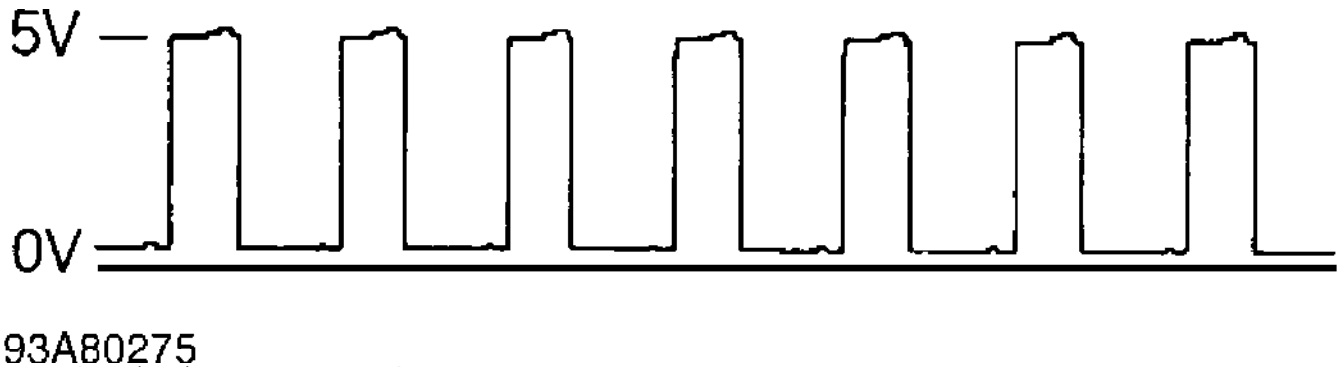


Fig. 19: Identifying Known-Good VAF Sensor Wave Pattern
Courtesy of Mitsubishi Motor Sales of America

4) Disconnect VAF sensor connector. Turn ignition on. Using DVOM, check voltage between ground and VAF sensor connector terminal No. 4. Turn ignition on. If about 12 volts exist, turn ignition off and go to next step. If about 12 volts do not exist, inspect connectors and wiring harness between MFI relay connector and VAF sensor connector. Repair as necessary. Go to step 9).
5) Turn ignition on. Using DVOM, check voltage between ground and VAF sensor connector terminal No. 3. Voltage should be 4.8-5.2 volts. Turn ignition off. Using DVOM, check for continuity between ground and VAF sensor connector terminal No. 5. Continuity should exist. If voltage is not as specified or if continuity does not exist, go to step 7). If voltage is as specified and continuity exists, go to next step.
6) Check VAF sensor connector for damage. Repair or replace connector as necessary. Go to step 9). If connector is okay, replace VAF sensor. Go to step 9).
7) Inspect connectors between VAF sensor and PCM. Repair as necessary. Go to step 9). If connectors are okay, go to next step.
8) Inspect wiring harness between VAF sensor and PCM. Repair as necessary. Go to next step. If wiring harness is okay, replace PCM. Go to next step.
9) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0105: BAROMETRIC (BARO) PRESSURE SENSOR CIRCUIT MALFUNCTION

NOTE: BARO pressure sensor is built into Volume Airflow (VAF) sensor. For DTC P0105 test purposes, VAF sensor will be referred to as BARO pressure sensor. For terminal identification, see VAF sensor under TERMINAL IDENTIFICATION section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Manufacturer does not provide component testing procedure without scan tool. Turn ignition on. Using scan tool, read BARO sensor pressure (item 25). See BARO PRESSURE SENSOR SPECIFICATIONS table. If pressure is not as specified, go to next step. If pressure is as specified, fault is intermittent. See INTERMITTENT DTCS.

BARO PRESSURE SENSOR SPECIFICATIONS

Altitude: Ft. (M)	Pressure: In. Hg
0 (0)	14.65
1969 (600)	13.78
3937 (1200)	12.76
5906 (1800)	11.75

2) Disconnect BARO pressure sensor connector. Turn ignition on. Using DVOM, check for voltage between ground and BARO pressure sensor connector terminal No. 1. Voltage should be 4.8-5.2 volts. Turn ignition off. Check for continuity between ground and BARO pressure sensor connector terminal No. 5. Continuity should exist. If voltage is not as specified or if continuity does not exist, go to step 6). If voltage is as specified and continuity exists, go to next step.

3) Inspect wiring harness between BARO sensor and PCM. Repair as necessary. Go to step 8). If wiring harness is okay, go to next step.

4) Check BARO sensor connector for damage. Repair or replace connector as necessary. Go to step 8). If connector is okay, replace VAF sensor. Go to next step.

5) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0105 is displayed, go to next step. If no DTCs are displayed, test is complete.

6) Inspect connectors and wiring harness between BARO sensor and PCM. Repair as necessary. Go to step 8). If connectors and wiring harness are okay, go to next step.

7) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

8) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0110 - INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT MALFUNCTION

NOTE: IAT sensor is built into Volume Airflow (VAF) sensor. For DTC P0110 test purposes, VAF sensor will be referred to as IAT sensor. For terminal identification, see VAF sensor under TERMINAL IDENTIFICATION in SELF-DIAGNOSTIC section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Using a thermometer, check engine compartment ambient temperature. Using scan tool, read IAT sensor temperature (item 13). Compare both readings. If readings are not about the same, go to next

step. If readings are about the same, fault is intermittent. See INTERMITTENT DTCS.

2) Disconnect IAT sensor connector. Using DVOM, check resistance between IAT sensor terminals No. 5 and 6. Resistance should be 2300-3000 ohms at 68°F (20°C) or 300-420 ohms at 176°F (80°C). Using a hair dryer, warm IAT sensor while monitoring DVOM. Resistance should decrease evenly as temperature rises. If resistance is as specified, go to next step. If resistance is not as specified, go to step 6).

3) Turn ignition on. Using DVOM, check voltage between ground and IAT sensor connector terminal No. 6. Voltage should be 4.5-4.9 volts. Turn ignition off. Using DVOM, check for continuity between ground and IAT sensor connector terminal No. 5. Continuity should exist. If voltage is as specified and continuity exists, go to next step. If voltage is not as specified or continuity does not exist, repair or replace IAT sensor connector. Go to step 6).

4) Inspect connectors and wiring harness between IAT sensor and PCM. Repair as necessary. Go to step 6). If connectors and wiring harness are okay, go to next step.

5) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

6) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0115 - ENGINE COOLANT TEMPERATURE (ECT) SENSOR

MALFUNCTION

NOTE: For terminal identification, see TERMINAL IDENTIFICATION see SELF-DIAGNOSTIC section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Using a thermometer, check engine compartment ambient temperature. Using scan tool, read ECT sensor temperature (item 21). Compare both readings. If readings are not about the same, go to next step. If readings are about the same, fault is intermittent. See INTERMITTENT DTCS.

2) Disconnect ECT sensor connector. Remove ECT sensor. Submerge temperature sensing portion of ECT sensor in hot water. Using DVOM, check resistance across ECT sensor terminals. See ECT SENSOR RESISTANCE SPECIFICATIONS table. If resistance is not as specified, replace ECT sensor. Go to step 6). If resistance is as specified, go to next step.

ECT SENSOR RESISTANCE SPECIFICATIONS

Water Temperature	Approximate Ohms
68°F (20°C)	2100-2700
176°F (80°C)	260-360

3) Disconnect ECT sensor connector. Turn ignition on. Using DVOM, check voltage between ground and ECT sensor connector terminal No. 1. Voltage should be 4.5-4.9 volts. Turn ignition off. Using DVOM, check for continuity between ground and ECT sensor connector terminal No. 2. Continuity should exist. If voltage is as specified and continuity exists, go to next step. If voltage is not as specified or continuity does not exist, repair or replace ECT sensor connector. Go to step 6).

4) Inspect connectors and wiring harness between ECT sensor and PCM. Repair as necessary. Go to step 6). If connectors and wiring

harness are okay, go to next step.
5) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.
6) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0120 - THROTTLE POSITION (TP) SENSOR CIRCUIT MALFUNCTION

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Turn ignition on. Using scan tool, read closed TP switch state (item 26). With throttle at idle, scan tool should display ON. With throttle slightly open, scan tool should display OFF. If closed TP switch tests as specified, go to next step. If switch does not test as specified, go to DTC P0510 test.
2) Using scan tool, read TP sensor voltage (item 14). Turn ignition on, engine off. With throttle at idle, voltage should be 0.3-1.0 volt. With throttle fully open, voltage should be 4.5-5.5 volts. Turn ignition off. If TP sensor does not test as specified, go to next step. If sensor tests as specified, fault is intermittent. See INTERMITTENT DTCS.
3) Disconnect TP sensor connector. Using DVOM, check resistance between TP sensor terminals No. 1 and 4. Resistance should be 3500-6500 ohms. Check resistance between TP sensor terminals No. 2 and 4 on 2.4L or 1 and 3 on 3.0L. While monitoring DVOM, slowly open throttle from idle to fully open position. Resistance should change smoothly as throttle opens. If TP sensor tests as specified, go to next step. If sensor does not test as specified, replace sensor. Go tostep 9).
4) Disconnect TP sensor connector. Turn ignition on. Using DVOM, check voltage between ground and TP sensor connector terminal No. 1 on 2.4L or 4 on 3.0L. Voltage should be 4.8-5.2 volts. Turn ignition off. Using DVOM, check for continuity between ground and TP sensor connector terminal No. 4 on 2.4L or 1 on 3.0L. Continuity should exist. If voltage is as specified and continuity exists, go to next step. If voltage is not as specified or continuity does not exist, go to step 7).
5) Inspect connectors and wiring harness between TP sensor and PCM. Repair as necessary. Go to step 9). If connectors and wiring harness are okay, go to next step.
6) Inspect TP sensor connector for damage. Repair or replace connector as necessary. Go to step 9). If connector is okay, go tostep 8).
7) Inspect connectors and wiring harness between TP sensor and PCM. Repair as necessary. Go to step 9). If connectors and wiring harness are okay, go to next step.
8) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.
9) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0125 - EXCESSIVE TIME TO ENTER CLOSED LOOP FUEL CONTROL (EXCEPT 3.0L WITH CALIFORNIA EMISSIONS)

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOST section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Check front Heated Oxygen Sensor (HO2S). Go to appropriate DTC P0130 test. Replace front HO2S if necessary. Go to step 9). If front HO2S is okay, go to next step.

2) Inspect wiring harness between front HO2S and PCM. Repair wiring harness as necessary. Go to step 9). If wiring harness is okay, go to next step.

3) Inspect front HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 9). If connectors are okay, go to next step.

4) Ensure engine coolant temperature is at 68°F (20°C). Disconnect each fuel injector connector. Using DVOM, check resistance across fuel injector terminals. If resistance is not 13-16 ohms replace fuel injector(s). Go to step 9). If resistance is as specified, go to next step.

5) Inspect wiring harness between each fuel injector and PCM. Repair wiring harness as necessary. Go to step 9). If wiring harness is okay, go to next step.

6) Inspect each fuel injector and PCM connector for damage. Repair or replace connectors as necessary. Go to step 9). If connectors are okay, go to next step.

7) Check fuel pressure. See FUEL PRESSURE under FUEL SYSTEM in F - BASIC TESTING - 3.0L article. Repair fuel system as necessary. Go to step 9). If fuel pressure is okay, go to next step.

8) Inspect following items:

* Check intake system for vacuum leak.
* Check exhaust system for leaks at HO2S, exhaust manifold, front pipe etc.
* Check fuel filter and fuel line for clogging.
* Check fuel pump performance. See FUEL PUMP PERFORMANCE table under FUEL SYSTEM in F - BASIC TESTING - 3.0L article. Repair or replace item(s) as necessary. Go to next step. If no faults are found, replace PCM. Go to next step.

9) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0125 - EXCESSIVE TIME TO ENTER CLOSED LOOP FUEL CONTROL (3.0L WITH CALIFORNIA EMISSIONS)

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTIC section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Check both front Heated Oxygen Sensors (HO2Ss). Go to DTC P0130 and DTC P0150 tests. Replace front HO2S(s) if necessary. Go to step 11). If front HO2Ss are okay, go to next step.

2) Inspect wiring harness between right front HO2S and PCM. Repair wiring harness as necessary. Go to step 11). If wiring harness is okay, go to next step.

3) Inspect right front HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 11). If connectors are okay, go to next step.

4) Inspect wiring harness between left front HO2S and PCM. Repair wiring harness as necessary. Go to step 11). If wiring harness is okay, go to next step.

5) Inspect left front HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 11). If connectors are okay, go to next step.

6) Ensure engine coolant temperature is at 68°F (20°C). Disconnect each fuel injector connector. Using DVOM, check resistance

across fuel injector terminals. If resistance is not 13-16 ohms replace fuel injector(s). Go to step 11). If resistance is as specified, go to next step.

7) Inspect wiring harness between each fuel injector and PCM. Repair wiring harness as necessary. Go to step 11). If wiring harness is okay, go to next step.

8) Inspect each fuel injector and PCM connector for damage. Repair or replace connectors as necessary. Go to step 11). If connectors are okay, go to next step.

9) Check fuel pressure. See FUEL PRESSURE under FUEL SYSTEM in F - BASIC TESTING - 3.0L article. Repair fuel system as necessary. Go to step 11). If fuel pressure is okay, go to next step.

10) Inspect following items:

* Check intake system for vacuum leak.
* Check exhaust system for leaks at HO2S, exhaust manifold, front pipe etc.
* Check fuel filter and fuel line for clogging.
* Check fuel pump performance. See FUEL PUMP PERFORMANCE table under FUEL SYSTEM in F - BASIC TESTING - 3.0L article.

Repair or replace item(s) as necessary. Go to next step. If no faults are found, replace PCM. Go to next step.

11) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0130 - FRONT HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION (2.4L)

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Start and warm engine to operating temperature. Using scan tool, read front HO2S voltage (item 11). While monitoring scan tool, suddenly accelerate. Scan tool should read 0.6-1.0 volt. While monitoring scan tool, accelerate to 2000 RPM. Voltage should switch between less than 0.5 volt and more than 0.5 volt 5 or more times within 10 seconds. If HO2S does not test as specified, go to next step. If HO2S tests as specified, fault is intermittent. See INTERMITTENT DTCS.

2) Disconnect front HO2S connector. Install Test Harness (MB998464) between HO2S and HO2S connector. Using DVOM, check resistance between test harness terminals No. 1 (Red clip) and 3 (Blue clip). Resistance should be 7-40 ohms at 68°F (20°C). If resistance is not as specified, replace HO2S. Go to step 7). If resistance is as specified, go to next step.

3) Using jumper wires, apply 12 volts to test harness terminal No. 1 and ground test harness terminal No. 3. Using DVOM, check voltage between test harness terminals No. 2 (Black clip) and 4 (White clip), while repeatedly racing engine. If voltage is not .6-1.0 volt, replace HO2S. Go to step 7). If voltage is as specified, go to next step.

4) Inspect wiring harness between front HO2S and PCM. Repair wiring harness as necessary. Go to step 7). If wiring harness is okay, go to next step.

5) Inspect front HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 7). If connectors are okay, go to next step.

6) Replace front HO2S. Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0130 is displayed, go to next step. If no DTCs are displayed,

test is complete.
7) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0130 - FRONT HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION (3.0L)

NOTE: On vehicles equipped with California emissions, this test applies to right front HO2S. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOST section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Start and warm engine to operating temperature. Using scan tool, read front HO2S voltage (item 11). While monitoring scan tool, suddenly accelerate. Scan tool should read 0.6-1.0 volt. While monitoring scan tool, accelerate to 2000 RPM. Voltage should switch between less than 0.5 volt and more than 0.5 volt 5 or more times within 10 seconds. If HO2S does not test as specified, go to next step. If HO2S tests as specified, fault is intermittent. See INTERMITTENT DTCS.
2) Disconnect front HO2S connector. Install Test Harness (MB998464) between HO2S and HO2S connector. Using DVOM, check resistance between test harness terminals No. 1 (Red clip) and 3 (Blue clip). Resistance should be 7-40 ohms at 68°F (20°C). If resistance is not as specified, replace HO2S. Go to step 7). If resistance is as specified, go to next step.
3) Using jumper wires, apply 12 volts to test harness terminal No. 1 and ground test harness terminal No. 3. Using DVOM, check voltage between test harness terminals No. 2 (Black clip) and 4 (White clip), while repeatedly racing engine. If voltage is not .6-1.0 volt, replace HO2S. Go to step 7). If voltage is as specified, go to next step.
4) Inspect wiring harness between front HO2S and PCM. Repair wiring harness as necessary. Go to step 7). If wiring harness is okay, go to next step.
5) Inspect front HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 7). If connectors are okay, go to next step.
6) Replace front HO2S. Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0130 is displayed, go to next step. If no DTCs are displayed, test is complete.
7) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0135 - FRONT HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION (2.4L)

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Disconnect front HO2S connector. Install Test Harness (MB998464) between HO2S and HO2S connector. Using DVOM, check resistance between test harness terminals No. 1 (Red clip) and 3 (Blue clip). Resistance should be 7-40 ohms at 68°F (20°C). If resistance is not as specified, replace HO2S. Go to step 6). If resistance is as specified, go to next step.
2) Start and warm engine to operating temperature. Using jumper wires, apply 12 volts to test harness terminal No. 1 and ground

test harness terminal No. 3. Using DVOM, check voltage between test harness terminals No. 2 (Black clip) and 4 (White clip), while repeatedly racing engine. If voltage is not .6-1.0 volt, replace HO2S. Go to step 6). If voltage is as specified, go to next step.

3) Disconnect front HO2S connector. Turn ignition on. Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and HO2S connector terminal No. 1. Connect other DVOM lead to ground. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between HO2S and MFI relay. Repair or replace connectors as necessary. Go to step 6). If connectors are okay, Repair wiring harness between HO2S and MFI relay as necessary. Go to step 6).

4) Inspect wiring harness between front HO2S and PCM. Repair wiring harness as necessary. Go to step 6). If wiring harness is okay, go to next step.

5) Inspect front HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to next step. If connectors are okay, replace PCM. Go to next step.

6) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0135 - FRONT HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION (3.0L)

NOTE: On vehicles equipped with California emissions, this test applies to right front HO2S. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Disconnect front HO2S connector. Install Test Harness (MB998464) between HO2S and HO2S connector. Using DVOM, check resistance between test harness terminals No. 1 (Red clip) and 3 (Blue clip). Resistance should be 7-40 ohms at 68°F (20°C). If resistance is not as specified, replace HO2S. Go to step 6). If resistance is as specified, go to next step.

2) Start and warm engine to operating temperature. Using jumper wires, apply 12 volts to test harness terminal No. 1 and ground test harness terminal No. 3. Using DVOM, check voltage between test harness terminals No. 2 (Black clip) and 4 (White clip), while repeatedly racing engine. If voltage is not .6-1.0 volt, replace HO2S. Go to step 6). If voltage is as specified, go to next step.

3) Disconnect front HO2S connector. Turn ignition on. Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and HO2S connector terminal No. 1. Connect other DVOM lead to ground. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between HO2S and MFI relay. Repair or replace connectors as necessary. Go to step 6). If connectors are okay, Repair wiring harness between HO2S and MFI relay as necessary. Go to step 6).

4) Inspect wiring harness between front HO2S and PCM. Repair wiring harness as necessary. Go to step 6). If wiring harness is okay, go to next step.

5) Inspect front HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to next step. If connectors are okay, replace PCM. Go to next step.

6) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0136 - REAR HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION (2.4L)

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Start and warm engine to operating temperature. Using scan tool, read rear HO2S voltage (item 59). While monitoring scan tool, accelerate to wide open throttle. Voltage should switch between 0.6 volt or more. If HO2S does not test as specified, go to next step. If HO2S tests as specified, fault is intermittent. See INTERMITTENT DTCS.
2) Inspect wiring harness between rear HO2S and PCM. Repair wiring harness as necessary. Go to step 5). If wiring harness is okay, go to next step.
3) Inspect rear HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 5). If connectors are okay, go to next step.
4) Replace rear HO2S. Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0136 is displayed, go to next step. If no DTCs are displayed, test is complete.
5) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0136 - REAR HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION (3.0L)

NOTE: On vehicles equipped with California emissions, this test applies to right rear HO2S. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS in section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Start and warm engine to operating temperature. Using scan tool, read rear HO2S voltage (item 59). While monitoring scan tool, accelerate to wide open throttle. Voltage should switch between 0.6 volt or more. If HO2S does not test as specified, go to next step. If HO2S tests as specified, fault is intermittent. See INTERMITTENT DTCS.
2) Inspect wiring harness between rear HO2S and PCM. Repair wiring harness as necessary. Go to step 5). If wiring harness is okay, go to next step.
3) Inspect rear HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 5). If connectors are okay, go to next step.
4) Replace rear HO2S. Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0136 is displayed, go to next step. If no DTCs are displayed, test is complete.
5) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0141 - REAR HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION (2.4L)

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Disconnect rear HO2S connector. Using DVOM, check resistance between HO2S terminals No. 1 and 3. Resistance should be 7-40 ohms. If resistance is not as specified, replace HO2S. Go to step 5). If resistance is as specified, go to next step.

2) Disconnect rear HO2S connector. Turn ignition on. Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and HO2S connector terminal No. 1. Connect other DVOM lead to ground. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between HO2S and MFI relay. Repair or replace connectors as necessary. Go to step 5). If connectors are okay, Repair wiring harness between HO2S and MFI relay as necessary. Go to step 5).

3) Inspect wiring harness between rear HO2S and PCM. Repair wiring harness as necessary. Go to step 5). If wiring harness is okay, go to next step.

4) Inspect rear HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to next step. If connectors are okay, replace PCM. Go to next step.

5) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0141 - REAR HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION (3.0L)

NOTE: On vehicles equipped with California emissions, this test applies to right rear HO2S. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICSICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Disconnect rear HO2S connector. Using DVOM, check resistance between HO2S terminals No. 1 and 3. Resistance should be 7-40 ohms. If resistance is not as specified, replace HO2S. Go to step 5). If resistance is as specified, go to next step.

2) Disconnect rear HO2S connector. Turn ignition on. Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and HO2S connector terminal No. 1. Connect other DVOM lead to ground. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between HO2S and MFI relay. Repair or replace connectors as necessary. Go to step 5). If connectors are okay, Repair wiring harness between HO2S and MFI relay as necessary. Go to step 5).

3) Inspect wiring harness between rear HO2S and PCM. Repair wiring harness as necessary. Go to step 5). If wiring harness is okay, go to next step.

4) Inspect rear HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to next step. If connectors are okay, replace PCM. Go to next step.

5) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0150 - LEFT FRONT HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION

NOTE: This test applies to 3.0L vehicles equipped with California emissions only. For terminal identification, see TERMINAL IDENTIFICTION in SELF-DIAGNOSTICSICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Start and warm engine to operating temperature. Using scan tool, read left front HO2S voltage (item 39). While monitoring scan tool, suddenly accelerate. Scan tool should read 0.6-1.0 volt. While monitoring scan tool, accelerate to 2000 RPM. Voltage should switch between less than 0.5 volt and more than 0.5 volt 5 or more times

within 10 seconds. If HO2S does not test as specified, go to next step. If HO2S tests as specified, fault is intermittent. See INTERMITTENT DTCS.

2) Disconnect left front HO2S connector. Install Test Harness (MB991316) between HO2S and HO2S connector. Using DVOM, check resistance between test harness terminals No. 1 (Red clip) and 3 (Blue clip). Resistance should be 7-40 ohms at 68°F (20°C). If resistance is not as specified, replace HO2S. Go to step 7). If resistance is as specified, go to next step.

3) Using jumper wires, apply 12 volts to test harness terminal No. 1 and ground test harness terminal No. 3. Using DVOM, check voltage between test harness terminals No. 2 (Black clip) and 4 (White clip), while repeatedly racing engine. If voltage is not .6-1.0 volt, replace HO2S. Go to step 7). If voltage is as specified, go to next step.

4) Inspect wiring harness between left front HO2S and PCM. Repair wiring harness as necessary. Go to step 7). If wiring harness is okay, go to next step.

5) Inspect left front HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 7). If connectors are okay, go to next step.

6) Replace left front HO2S. Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0150 is displayed, go to next step. If no DTCs are displayed, test is complete.

7) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0155 - LEFT FRONT HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION

NOTE: This test applies to 3.0L vehicles equipped with California emissions only. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICSICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Disconnect left front HO2S connector. Install Test Harness (MB991316) between HO2S and HO2S connector. Using DVOM, check resistance between test harness terminals No. 1 (Red clip) and 3 (Blue clip). Resistance should be 7-40 ohms at 68°F (20°C). If resistance is not as specified, replace HO2S. Go to step 6). If resistance is as specified, go to next step.

2) Start and warm engine to operating temperature. Using jumper wires, apply 12 volts to test harness terminal No. 1 and ground test harness terminal No. 3. Using DVOM, check voltage between test harness terminals No. 2 (Black clip) and 4 (White clip), while repeatedly racing engine. If voltage is not .6-1.0 volt, replace HO2S. Go to step 6). If voltage is as specified, go to next step.

3) Disconnect left front HO2S connector. Turn ignition on. Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and HO2S connector terminal No. 1. Connect other DVOM lead to ground. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between left front HO2S and MFI relay. Repair or replace connectors as necessary. Go to step 6). If connectors are okay, Repair wiring harness between left front HO2S and MFI relay as necessary. Go to step 6).

4) Inspect wiring harness between front left front HO2S and PCM. Repair wiring harness as necessary. Go to step 6). If wiring harness is okay, go to next step.

5) Inspect left front HO2S and PCM connectors for damage.

Repair or replace connectors as necessary. Go to next step. If connectors are okay, replace PCM. Go to next step.

6) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0156 - LEFT REAR HEATED OXYGEN SENSOR (HO2S) CIRCUIT MALFUNCTION

NOTE: This test applies to 3.0L vehicles equipped with California emissions only. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICSICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Start and warm engine to operating temperature. Using scan tool, read rear HO2S voltage (item 69). While monitoring scan tool, accelerate to wide open throttle. Voltage should switch between 0.6 volt or more. If HO2S does not test as specified, go to next step. If HO2S tests as specified, fault is intermittent. See INTERMITTENT DTCS.

2) Inspect wiring harness between left rear HO2S and PCM. Repair wiring harness as necessary. Go to step 5). If wiring harness is okay, go to next step.

3) Inspect left rear HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 5). If connectors are okay, go to next step.

4) Replace left rear HO2S. Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0156 is displayed, go to next step. If no DTCs are displayed, test is complete.

5) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0161 - LEFT REAR HEATED OXYGEN SENSOR (HO2S) HEATER CIRCUIT MALFUNCTION

NOTE: This test applies to 3.0L vehicles equipped with California emissions only. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICSICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Disconnect left rear HO2S connector. Using DVOM, check resistance between HO2S terminals No. 1 and 3. Resistance should be 7-40 ohms. If resistance is not as specified, replace HO2S. Go to step 5). If resistance is as specified, go to next step.

2) Disconnect left rear HO2S connector. Turn ignition on. Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and HO2S connector terminal No. 1. Connect other DVOM lead to ground. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between left rear HO2S and MFI relay. Repair or replace connectors as necessary. Go to step 5). If connectors are okay, Repair wiring harness between left rear HO2S and MFI relay as necessary. Go to step 5).

3) Inspect wiring harness between left rear HO2S and PCM. Repair wiring harness as necessary. Go to step 5). If wiring harness is okay, go to next step.

4) Inspect left rear HO2S and PCM connectors for damage. Repair or replace connectors as necessary. Go to next step. If connectors are okay, replace PCM. Go to next step.

5) Road test vehicle and attempt to duplicate conditions that

caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0170 - FUEL TRIM MALFUNCTION

NOTE: On vehicles equipped with California emissions, this test applies to right bank DIAGNOSTICSics only. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Using a thermometer, check engine compartment ambient temperature. Using scan tool, read IAT sensor temperature (item 13). Compare both readings. If readings are not about the same, go to DTC P0110 test. If readings are about the same, go to next step.
2) Using a thermometer, check engine compartment ambient temperature. Using scan tool, read ECT sensor temperature (item 21). Compare both readings. If readings are not about the same, go to DTC P0115 test. If readings are about the same, go to next step.
3) Using scan tool, read BARO sensor pressure (item 25). See BARO PRESSURE SENSOR SPECIFICATIONS table. If pressure is not as specified, go to DTC P0105 test. If pressure is as specified, go to next step.

BARO PRESSURE SENSOR SPECIFICATIONS

Altitude: Ft. (M)	Pressure: In. Hg
0 (0)	14.65
1969 (600)	13.78
3937 (1200)	12.76
5906 (1800)	11.75

4) Ensure engine coolant temperature is at 68°F (20°C). Disconnect each fuel injector connector. Using DVOM, check resistance across fuel injector terminals. If resistance is not 13-16 ohms replace fuel injector(s). Go to step 14). If resistance is as specified, go to next step.
5) Inspect wiring harness between each fuel injector and PCM. Repair wiring harness as necessary. Go to step 14). If wiring harness is okay, go to next step.
6) Inspect each fuel injector and PCM connector for damage. Repair or replace connectors as necessary. Go to step 14). If connectors are okay, go to next step.
7) Check fuel pressure. See FUEL PRESSURE under FUEL SYSTEM in F - BASIC TESTING - 3.0L article. Repair fuel system as necessary. Go to step 14). If fuel pressure is okay, go to next step.
8) Using scan tool, read long term fuel trim (item 81). If fuel trim value is more than zero, go next step. If fuel trim value is less than zero, go to step 12).
9) Check airflow into intake system. Repair or replace intake system components as necessary. Go to step 14). If airflow is okay, go to next step.
10) Using scan tool, read VAF sensor frequency (item 12). Frequency should be 25-51 Hz at idle. Frequency at 2500 RPM should be 80-120 Hz on 2.4L or 74-114 Hz on 3.0L. If frequencies are not as specified, replace VAF sensor. Go to step 14). If frequencies are as specified, go to next step.
11) Inspect following items:

* Check injectors for clogging.
* Check fuel filter and fuel lines for clogging.

* Check fuel pump performance. See FUEL PUMP PERFORMANCE table under FUEL SYSTEM in F - BASIC TESTING - 3.0L article.
* Check exhaust system for leaks at HO2S, exhaust manifold, front pipe etc.
* Check fuel for contamination.

Repair or replace item(s) as necessary. Go to step 14). If no faults are found, replace PCM. Go to step 14).

12) Using scan tool, read VAF sensor frequency (item 12). Frequency should be 25-51 Hz at idle. Frequency at 2500 RPM should be 80-120 Hz on 2.4L or 74-114 Hz on 3.0L. If frequencies are not as specified, replace VAF sensor. Go to step 14). If frequencies are as specified, go to next step.

13) Inspect following items:

* Check fuel injectors for leaks.
* Check fuel for contamination.

Repair or replace item(s) as necessary. Go to next step. If no faults are found, replace PCM. Go to next step.

14) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0173 - FUEL TRIM MALFUNCTION

NOTE: This test applies to left bank DIAGNOSTICSics on 3.0L vehicles equipped with California emissions only. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Using a thermometer, check engine compartment ambient temperature. Using scan tool, read IAT sensor temperature (item 13). Compare both readings. If readings are not about the same, go to DTC P0110 test. If readings are about the same, go to next step.

2) Using a thermometer, check engine compartment ambient temperature. Using scan tool, read ECT sensor temperature (item 21). Compare both readings. If readings are not about the same, go to DTC P0115 test. If readings are about the same, go to next step.

3) Using scan tool, read BARO sensor pressure (item 25). See BARO PRESSURE SENSOR SPECIFICATIONS table. If pressure is not as specified, go to DTC P0105 test. If pressure is as specified, go to next step.

BARO PRESSURE SENSOR SPECIFICATIONS

Altitude: Ft. (M)	Pressure: In. Hg
0 (0)	14.65
1969 (600)	13.78
3937 (1200)	12.76
5906 (1800)	11.75

4) Ensure engine coolant temperature is at 68°F (20°C). Disconnect each fuel injector connector. Using DVOM, check resistance across fuel injector terminals. If resistance is not 13-16 ohms replace fuel injector(s). Go to step 14). If resistance is as specified, go to next step.

5) Inspect wiring harness between each fuel injector and PCM. Repair wiring harness as necessary. Go to step 14). If wiring harness is okay, go to next step.

6) Inspect each fuel injector and PCM connector for damage. Repair or replace connectors as necessary. Go to step 14). If connectors are okay, go to next step.

7) Check fuel pressure. See FUEL PRESSURE under FUEL SYSTEM in F - BASIC TESTING - 3.0L article. Repair fuel system as necessary. Go to step 14). If fuel pressure is okay, go to next step.

8) Using scan tool, read long term fuel trim (item 81). If fuel trim value is more than zero, go next step. If fuel trim value is less than zero, go to step 12).

9) Check airflow into intake system. Repair or replace intake system components as necessary. Go to step 14). If airflow is okay, go to next step.

10) Using scan tool, read VAF sensor frequency (item 12). Frequency should be 25-51 Hz at idle. Frequency at 2500 RPM should be 74-114 Hz. If frequencies are not as specified, replace VAF sensor. Go tostep 14). If frequencies are as specified, go to next step.

11) Inspect following items:

* Check injectors for clogging.
* Check fuel filter and fuel lines for clogging.
* Check fuel pump performance. See FUEL PUMP PERFORMANCE table under FUEL SYSTEM in F - BASIC TESTING - 3.0L article.
* Check exhaust system for leaks at HO2S, exhaust manifold, front pipe etc.
* Check fuel for contamination.

Repair or replace item(s) as necessary. Go to step 14). If no faults are found, replace PCM. Go to step 14).

12) Using scan tool, read VAF sensor frequency (item 12). Frequency should be 25-51 Hz at idle or 74-114 Hz at 2500 RPM. If frequencies are not as specified, replace VAF sensor. Go to step 14). If frequencies are as specified, go to next step.

13) Inspect following items:

* Check fuel injectors for leaks.
* Check fuel for contamination.

Repair or replace item(s) as necessary. Go to next step. If no faults are found, replace PCM. Go to next step.

14) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0201, DTC P0202, DTC P0203 & DTC P0204 - FUEL INJECTOR CIRCUIT MALFUNCTION (2.4L)

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Disconnect all fuel injector connectors. Install Test Harness (MB991348) between fuel injectors and connectors. Using engine analyzer with oscilloscope capability, connect special patterns probe in sequence to each fuel injector connector terminal No. 2 or specified PCM terminal. See FUEL INJECTOR-TO-PCM POWER CIRCUIT IDENTIFICATION table. Start engine and allow it to idle. Compare oscilloscope wave pattern with known-good wave pattern. See Fig. 2. If wave pattern is not normal, go to next step. If wave pattern is normal, fault is intermittent. See INTERMITTENT DTCS.

FUEL INJECTOR-TO-PCM POWER CIRCUIT IDENTIFICATION

Injector No.	PCM Terminal No.
1	1
2	14
3	2
4	15

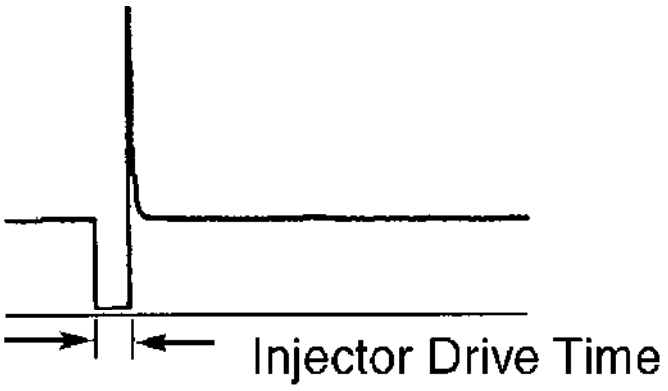
2) Ensure engine coolant temperature is at 68°F (20°C). Disconnect each fuel injector connector. Using DVOM, check resistance across fuel injector terminals. If resistance is not 13-16 ohms replace fuel injector(s). Go to step 6). If resistance is as specified, go to next step.

3) Disconnect each fuel injector connector. Turn ignition on. Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and fuel injector connector terminal No. 1. Connect other DVOM lead to ground. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between fuel injector and MFI relay. Repair or replace connectors as necessary. Go to step 6). If connectors are okay, Repair wiring harness between fuel injector and MFI relay as necessary. Go to step 6).

4) Disconnect PCM connector. Using a jumper wire, ground PCM connector terminal No. 38. Using scan tool, actuate MFI relay. Turn ignition on. Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and appropriate fuel injector connector terminal. See FUEL INJECTOR-TO-PCM POWER CIRCUIT IDENTIFICATION table. Connect other DVOM lead to ground. DVOM should read 0.3 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between fuel injector, MFI relay and PCM. Repair or replace connectors as necessary. Go to step 6). If connectors are okay, Repair wiring harness between fuel injector, MFI relay and PCM as necessary. Go to step 6).

5) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connectors is okay, go to next step.

6) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.



97A06403

Fig. 20: Identifying Known-Good Injector Drive Time Wave Pattern
Courtesy of Mitsubishi Motor Sales of America

DTC P0201, DTC P0202, DTC P0203, DTC P0204, DTC P0205 & DTC P0206 - FUEL INJECTOR CIRCUIT MALFUNCTION (3.0L)

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Disconnect fuel injector intermediate connectors. Install Test Harness (MB998474) between intermediate connectors. Using engine analyzer with oscilloscope capability, connect special patterns probe in sequence to each specified test harness clip or PCM terminal. See FUEL INJECTOR POWER CIRCUIT IDENTIFICATION table. Start engine and allow it to idle. Compare oscilloscope wave pattern with known-good wave pattern. See Fig. 2. If wave pattern is not normal, go to next step. If wave pattern is normal, fault is intermittent. See INTERMITTENT DTCS.

FUEL INJECTOR POWER CIRCUIT IDENTIFICATION

Injector No.	PCM Terminal No.	Test Harness Clip Color
1	1	Green
2	14	White
3	2	Blue
4	15	Yellow
5	3	Red
6	16	Black

2) Ensure engine coolant temperature is at 68°F (20°C). Disconnect each fuel injector connector. Using DVOM, check resistance across fuel injector terminals. If resistance is not 13-16 ohms replace fuel injector(s). Go to step 6). If resistance is as specified, go to next step.

3) Disconnect each fuel injector connector. Turn ignition on. Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and fuel injector connector terminal No. 1. Connect other DVOM lead to ground. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between fuel injector and MFI relay. Repair or replace connectors as necessary. Go to step 6). If connectors are okay, Repair wiring harness between fuel injector and MFI relay as necessary. Go to step 6).

4) Disconnect PCM connector. Using a jumper wire, ground PCM connector terminal No. 38. Using scan tool, actuate MFI relay. Turn ignition on. Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and appropriate fuel injector connector terminal. See FUEL INJECTOR POWER CIRCUIT IDENTIFICATION table. Connect other DVOM lead to ground. DVOM should read 0.3 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between fuel injector, MFI relay and PCM. Repair or replace connectors as necessary. Go to step 6). If connectors are okay, Repair wiring harness between fuel injector, MFI relay and PCM as necessary. Go to step 6).

5) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connectors is okay, go to next step.

6) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0300 - RANDOM MISFIRE DETECTED

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Using scan tool, check Crankshaft Position (CKP) sensor pulse width (item 22) while maintaining a constant RPM. If pulse width is constant, go to next step. If pulse width is not constant, go to step 5).
2) Check wiring harness between CKP sensor and PCM. Repair wiring harness as necessary. Go to step 12). If wiring harness is okay, go to next step.
3) Check CKP sensor and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 12). If connectors are okay, go to next step.
4) Ensure CKP sensor and sensing plate are properly installed. Correct installation as necessary. Go to step 12). If CKP sensor and sensing plate are installed properly, replace CKP sensor. Go tostep 12).
5) Ensure engine coolant temperature is at 68°F (20°C). Disconnect each fuel injector connector. Using DVOM, check resistance across fuel injector terminals. If resistance is not 13-16 ohms replace fuel injector(s). Go to step 12). If resistance is as specified, go to next step.
6) Inspect wiring harness between each fuel injector and PCM. Repair wiring harness as necessary. Go to step 12). If wiring harness is okay, go to next step.
7) Inspect fuel injectors and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 12). If connectors are okay, go to next step.
8) Using scan tool, check long-term fuel compensation (item 81). Long-term fuel trim value should be -12.5-12.5 at 2500 RPM after engine is warmed up. If value is as specified, go to next step. If value is not as specified, go to DTC P0170 and DTC P0173 tests.
9) Using scan tool, check short-term fuel compensation (item 82). Short-term fuel trim value at 2500 RPM should be -10.0-10.0 on 2.4L or -30-25 on 3.0L after engine is warmed up. If value is as specified, go to next step. If value is not as specified, go to DTC P0170 and DTC P0173 tests.
10) Using a thermometer, check engine compartment ambient temperature. Using scan tool, read ECT sensor temperature (item 21). Compare both readings. If readings are not about the same, go to DTC P0115 test. If readings are about the same, go to next step.
11) Inspect following items:

* Check ignition coil, spark plugs and spark plug cables.
* Check engine compression.
* Check for skipped timing belt.
* Check EGR valve (Federal vehicles). Go to DTC P0400 test.

Repair or replace item(s) as necessary. Go to next step. If no faults are found, go to next step.
12) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0301, DTC P0302, DTC P0303, DTC P0304, DTC P0305 & DTC P0306 - CYLINDER MISFIRE DETECTED

NOTE: DTCs P0305 and P0306 apply to 3.0L engine only. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Ensure engine coolant temperature is at 68°F (20°C). Disconnect each fuel injector connector. Using DVOM, check resistance across fuel injector terminals. If resistance is not 13-16 ohms replace fuel injector(s). Go to step 5). If resistance is as specified, go to next step.

2) Inspect wiring harness between each fuel injector and PCM. Repair wiring harness as necessary. Go to step 5). If wiring harness is okay, go to next step.

3) Inspect fuel injectors and PCM connectors for damage. Repair or replace connectors as necessary. Go to step 5). If connectors are okay, go to next step.

4) Inspect following items:

* Check spark plugs and spark plug cables.
* Check engine compression.

Repair or replace item(s) as necessary. Go to next step. If no faults are found, go to next step.

5) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0335 - CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT MALFUNCTION

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for instructions in use of oscilloscope. If using engine analyzer, go to step 3). If using scan tool, go to next step.

2) Using scan tool, check Crankshaft Position (CKP) sensor (item 22). Connect an engine tachometer. Crank engine. Compare tachometer reading with scan tool reading. If readings are not about the same, go to step 4). If readings are about the same, fault is intermittent. See INTERMITTENT DTCS.

3) Disconnect CKP sensor connector. Install Test Harness (MB998478) between CKP sensor and connector. Using engine analyzer with oscilloscope capability, connect special patterns probe to CKP sensor connector terminal No. 2 (Black clip on test harness) or PCM terminal No. 89. Start engine and allow it to idle. Compare oscilloscope wave pattern with known-good wave pattern. See Fig. 21. Turn engine off. If wave pattern is not normal, go to next step. If wave pattern is normal, fault is intermittent. See INTERMITTENT DTCS.

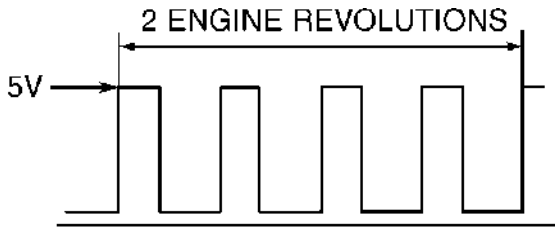


Fig. 21: Identifying Known-Good CKP Sensor Wave Pattern
Courtesy of Mitsubishi Motor Sales of America

4) Disconnect CKP sensor connector. Turn ignition on. Using DVOM, check voltage between ground and CKP sensor connector terminal

No. 3. Voltage should be about 12 volts. Turn ignition off. If voltage is as specified, go to next step. If voltage is not as specified, inspect connectors between CKP sensor and MFI relay. Repair connectors as necessary. Go to step 10). If connectors are okay, repair wiring harness between CKP sensor and MFI relay. Go to step 10).

5) Using DVOM, check for continuity between ground and CKP sensor connector terminal No. 1. If continuity does not exist, repair wiring harness between CKP sensor and ground as necessary. Go to step 10). If continuity exists, go to next step.

6) With CKP sensor connector disconnected, turn ignition on. Using DVOM, check for voltage between ground and CKP sensor connector terminal No. 2. Voltage should be 4.8-5.2 volts. Turn ignition off. If voltage is as specified, go to next step. If voltage is not as specified, go to step 8).

7) Check CKP sensor connector for damage. Repair or replace connector as necessary. Go to step 10). If connector is okay, replace CKP sensor. Go to step 10).

8) Inspect wiring harness between CKP sensor and PCM. Repair wiring harness as necessary. Go to step 10). If wiring harness is okay, go to next step.

9) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

10) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0340 - CAMSHAFT POSITION (CMP) SENSOR CIRCUIT

MALFUNCTION

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

NOTE: Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for instructions in use of oscillo-scope.

1) Disconnect CMP sensor connector. Install Test Harness (MB991348) between CMP sensor and connector. Using engine analyzer with oscilloscope capability, connect special patterns probe to CMP sensor connector terminal No. 2 (Black clip on test harness) or PCM terminal No. 88. Start engine and allow it to idle. Compare oscilloscope wave pattern with known-good wave pattern. See Fig. 22. Turn engine off. If wave pattern is not normal, go to next step. If wave pattern is normal, fault is intermittent. See INTERMITTENT DTCS.

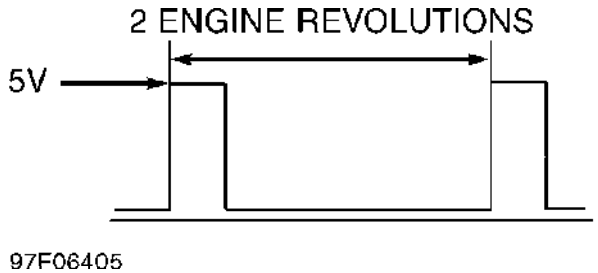


Fig. 22: Identifying Known-Good CMP Sensor Wave Pattern
Courtesy of Mitsubishi Motor Sales of America

2) Disconnect CMP sensor connector. Turn ignition on. Using DVOM, check voltage between ground and CMP sensor connector terminal

No. 3. Voltage should be about 12 volts. Turn ignition off. If voltage is as specified, go to next step. If voltage is not as specified, inspect connectors between CMP sensor and MFI relay. Repair connectors as necessary. Go to step 8). If connectors are okay, repair wiring harness between CMP sensor and MFI relay. Go to step 8).

3) Using DVOM, check for continuity between ground and CMP sensor connector terminal No. 4 on 2.4L or 1 on 3.0L. If continuity does not exist, repair wiring harness between CMP sensor and ground as necessary. Go to step 8). If continuity exists, go to next step.

4) With CMP sensor connector disconnected, turn ignition on. Using DVOM, check for voltage between ground and CMP sensor connector terminal No. 2. Voltage should be 4.8-5.2 volts. Turn ignition off. If voltage is as specified, go to next step. If voltage is not as specified, go to step 6).

5) Check CMP sensor connector for damage. Repair or replace connector as necessary. Go to step 8). If connector is okay, replace CMP sensor. Go to step 8).

6) Inspect wiring harness between CMP sensor and PCM. Repair wiring harness as necessary. Go to step 8). If wiring harness is okay, go to next step.

7) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

8) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0400 - EXHAUST GAS RECIRCULATION (EGR) FLOW MALFUNCTION

NOTE: This test applies to vehicles equipped with Federal emissions only. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICSICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Mark and disconnect Green-striped or Black vacuum hose from EGR valved. Install a "T" fitting between vacuum hose and EGR valve. Connect hand vacuum pump to "T" fitting. Start engine. Monitor vacuum while racing engine. If engine coolant temperature is 68°F (20°C) or less, vacuum should not exist. If engine coolant temperature is 176°F (80°C) or more, vacuum should momentarily rise over 3.9 in. Hg. Go to next step.

2) If vacuum is as specified, go to next step. If vacuum is not as specified, remove "T" fitting. Connect hand vacuum pump to directly to EGR valve. Start engine and allow it to idle. Apply at least 8.7 in. Hg. If idle does not become unsteady when vacuum is applied, replace EGR valve. Go to step 4). If idle becomes unsteady, go to next step.

3) Using scan tool, read Manifold Differential Pressure (MDP) sensor (item 95) pressure. With engine at idle, pressure should be 62.0-76.0 psi on 2.4L or 20.6-34.0 psi on 3.4L. If pressure is not as specified, go to DTC P1400 test. If pressure is as specified, clean EGR valve and EGR passage. Go to next step.

4) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0403 - EXHAUST GAS RECIRCULATION (EGR) SOLENOID MALFUNCTION

NOTE: This test applies to vehicles equipped with Federal emissions only. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICSICS section. For circuit

and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Using scan tool, turn EGR solenoid on and off (item 10). Listen for clicking sound from EGR solenoid. If no sound is heard, go to next step. If sound is heard, fault is intermittent. See INTERMITTENT DTCS.
2) Mark and disconnect Yellow-striped and Green-striped vacuum hoses, and wiring connector from EGR solenoid. Install vacuum pump to EGR solenoid Green-striped vacuum hose port. Apply vacuum to EGR solenoid. Go to next step.
3) Apply and remove 12 volts across EGR solenoid terminals. Vacuum should hold with voltage applied. Vacuum should leak without voltage applied. If EGR solenoid does not test as specified, replace solenoid. Go to step 8). If solenoid tests as specified, go to next step.
4) Using DVOM, check resistance across EGR solenoid terminals. If resistance is not 36-44 ohms at 68°F (20°C), replace solenoid. Go to step 8). If resistance is as specified, go to next step.
5) Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and EGR solenoid connector terminal No. 1. Connect other DVOM lead to ground. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between EGR solenoid and MFI relay. If connectors are okay, repair wiring harness between EGR solenoid and MFI relay as necessary. Go to step 8). Repair or replace connectors as necessary. Go to step 8).
6) Turn ignition off. Disconnect PCM connector. Ground PCM connector terminal No. 38. Turn ignition on. Momentarily ground PCM connector terminal No. 6. Listen for clicking sound from EGR solenoid. If sound is heard, turn ignition off and go to next step. If no sound is heard, repair wiring harness between EGR solenoid and PCM as necessary. Go to step 8).
7) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.
8) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0420 (FEDERAL) & DTC P0421 (CALIFORNIA) - CATALYST EFFICIENCY BELOW THRESHOLD

NOTE: On 3.0L vehicles equipped with California emissions, this test applies to right bank DIAGNOSTICSics. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Check manifold and front pipe for cracks. Repair exhaust system as necessary. Go to step 7). If exhaust system is okay, go to next step.
2) Using scan tool, read rear Heated Oxygen Sensor (HO2S) voltage (item 59). With engine at normal operating temperature, vehicle in 2nd gear and at wide open throttle, voltage should be 0.6-1.0 volt. If voltage is as specified, go to next step. If voltage is not as specified, go to appropriate DTC P0136 test.
3) Using scan tool, read front Heated Oxygen Sensor (HO2S) voltage (item 11). With engine at wide open throttle, voltage should be 0.6-1.0 volt. If voltage is as specified, go to next step. If voltage is not as specified, go to appropriate DTC P0130 test.
4) Using scan tool, read front Heated Oxygen Sensor (HO2S)

voltage (item 11). With engine at 2000 RPM, voltage should switch between 0-0.4 and 0.6-1.0 volt 15 times or more within 10 seconds. If voltage is as specified, go to next step. If voltage is not as specified, replace front HO2S. Go to step 7).

5) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0420 or P0421 is displayed, replace catalytic converter. Go to next step. If no DTCs are displayed, test is complete.

6) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0420 or P0421 is displayed, replace PCM. Go to next step. If no DTCs are displayed, test is complete.

7) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0431 - CATALYST EFFICIENCY BELOW THRESHOLD

NOTE: This test applies to left bank DIAGNOSTICSics on 3.0L vehicles equipped with California emissions only. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Check manifold and front pipe for cracks. Repair exhaust system as necessary. Go to step 7). If exhaust system is okay, go to next step.

2) Using scan tool, read left rear Heated Oxygen Sensor (HO2S) voltage (item 69). With engine at normal operating temperature, vehicle in 2nd gear and at wide open throttle, voltage should be 0.6-1.0 volt. If voltage is as specified, go to next step. If voltage is not as specified, go to DTC P0156 test.

3) Using scan tool, read left front Heated Oxygen Sensor (HO2S) voltage (item 39). With engine at wide open throttle, voltage should be 0.6-1.0 volt. If voltage is as specified, go to next step. If voltage is not as specified, go to DTC P0150 test.

4) Using scan tool, read left front Heated Oxygen Sensor (HO2S) voltage (item 39). With engine at 2000 RPM, voltage should switch between 0-0.4 and 0.6-1.0 volt 15 times or more within 10 seconds. If voltage is as specified, go to next step. If voltage is not as specified, replace front HO2S. Go to step 7).

5) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0431 is displayed, replace catalytic converter. Go to next step. If no DTCs are displayed, test is complete.

6) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0431 is displayed, replace PCM. Go to next step. If no DTCs are displayed, test is complete.

7) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0442 - EVAPORATIVE (EVAP) EMISSION CONTROL SYSTEM LEAK DETECTED

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Tighten fuel cap. Loosen fuel cap 1/4 turn. If fuel cap comes off, replace fuel tank filler tube. Go to step 10). If fuel cap does not come off, tighten fuel cap and go to next step.

2) Check fuel tank vent valve. Replace vent valve as necessary. Go to step 10). If vent valve is okay, go to next step.

3) Using scan tool, turn EVAP purge solenoid on and off (item 08). Listen for clicking sound from EVAP purge solenoid. If no sound is heard, go to DTC P0443 test. If sound is heard, go to next step.

4) Using scan tool, turn EVAP vent solenoid on and off (item 29). Listen for clicking sound from EVAP vent solenoid. If no sound is heard, go to DTC P0446 test. If sound is heard, go to next step.

5) Remove fuel cap. Using scan tool, check Fuel Tank Differential Pressure (FTDP) sensor pressure (item 73). Pressure should be -0.48-0.48 psi. If pressure is as specified, go to next step. If pressure is not as specified, go to DTC P0450 test.

6) Using scan tool, read Engine Coolant Temperature (ECT) sensor temperature (item 21). Compare scan tool reading with temperature gauge reading. If readings match, go to next step. If readings do not match, go to DTC P0115 test.

7) Using a thermometer, check engine compartment ambient temperature. Using scan tool, read Intake Air Temperature (IAT) sensor temperature (item 13). Compare both readings. with temperature gauge reading. If readings are not about the same, go to DTC P 0110 test. If readings are about the same, go to next step.

8) Using scan tool, read Power Steering Pressure (PSP) switch status (item 27). Switch status should read ON when steering wheel is turned. If switch status is as specified, go to next step. If switch status is not as specified, go to DTC P0551 test.

9) Check fuel for contamination. Check for seal defects in fuel tank, purge line or vapor line. Repair or replace parts as needed. Go to next step. 10) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0443 - EVAPORATIVE (EVAP) EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT MALFUNCTION

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Using scan tool, turn EVAP purge solenoid on and off (item 08). Listen for clicking sound from EVAP purge solenoid. If no sound is heard, go to next step. If sound is heard, fault is intermittent. See INTERMITTENT DTCS.

2) Mark and disconnect Black and Black/Red vacuum hoses, and wiring connector from EVAP purge solenoid. Install vacuum pump to EVAP purge solenoid Black/Red vacuum hose port. Apply vacuum to EVAP purge solenoid. Go to next step.

3) Apply and remove 12 volts across EVAP purge solenoid terminals. Vacuum should hold without voltage applied. Vacuum should leak with voltage applied. If EVAP purge solenoid does not test as specified, replace solenoid. Go to step 8). If solenoid tests as specified, go to next step.

4) Using DVOM, check resistance across EVAP purge solenoid terminals. If resistance is not 36-44 ohms at 68°F (20°C), replace solenoid. Go to step 8). If resistance is as specified, go to next step.

5) Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and EVAP purge solenoid connector terminal No. 1. Connect other DVOM lead to ground. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between EVAP purge solenoid and MFI relay. Repair or replace connectors as necessary. Go to step 8). If connectors are okay, Repair wiring harness between EVAP purge solenoid and MFI relay as necessary. Go to

step 8).

6) Turn ignition off. Disconnect PCM connector. Ground PCM connector terminal No. 38. Turn ignition on. Momentarily ground PCM connector terminal No. 9 on 2.4L or 32 on 3.0L. Listen for clicking sound from EVAP purge solenoid. If sound is heard, turn ignition off and go to next step. If no sound is heard, repair wiring harness between EVAP purge solenoid and PCM as necessary. Go to step 8).

7) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

8) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0446 - EVAPORATIVE (EVAP) EMISSION CONTROL SYSTEM VENT CONTROL MALFUNCTION

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Using scan tool, turn EVAP vent solenoid on and off (item 29). Listen for clicking sound from EVAP purge solenoid. If no sound is heard, go to next step. If sound is heard, fault is intermittent. See INTERMITTENT DTCS.

2) Mark and disconnect vacuum hose from EVAP vent solenoid nipple "A". See Fig. 23. Disconnect wiring connector from EVAP vent solenoid. Install vacuum pump to EVAP vent solenoid nipple "A". Apply vacuum to EVAP vent solenoid. Go to next step.

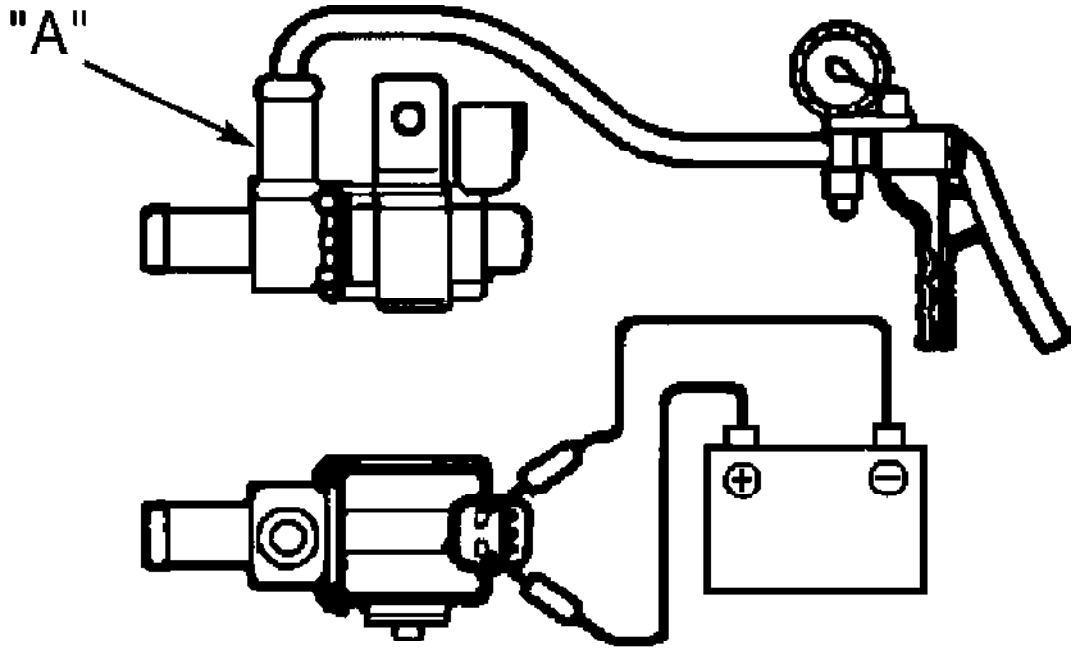


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Fig. 23: Testing EVAP Vent Solenoid
Courtesy of Mitsubishi Motor Sales of America.

3) Apply and remove 12 volts across EVAP vent solenoid terminals. Vacuum should hold with voltage applied. Vacuum should leak

without voltage applied. If EVAP vent solenoid does not test as specified, replace solenoid. Go to step 8). If solenoid tests as specified, go to next step.

4) Using DVOM, check resistance across EVAP vent solenoid terminals. If resistance is not 17-21 ohms at 68°F (20°C), replace solenoid. Go to step 8). If resistance is as specified, go to next step.

5) Using DVOM in Amps scale, connect a 20 ohm resistor between one DVOM lead and EVAP vent solenoid connector terminal No. 1. Connect other DVOM lead to ground. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between EVAP vent solenoid and MFI relay. Repair or replace connectors as necessary. Go to step 8). If connectors are okay, Repair wiring harness between EVAP vent solenoid and MFI relay as necessary. Go to step 8).

6) Turn ignition off. Disconnect PCM connector. Ground PCM connector terminal No. 38. Turn ignition on. Momentarily ground PCM connector terminal No. 55 on 2.4L or 41 on 3.0L. Listen for clicking sound from EVAP vent solenoid. If sound is heard, turn ignition off and go to next step. If no sound is heard, repair wiring harness between EVAP vent solenoid and PCM as necessary. Go to step 8).

7) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

8) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0450 - EVAPORATIVE (EVAP) EMISSION CONTROL SYSTEM PRESSURE SENSOR MALFUNCTION

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Remove fuel cap. Using scan tool, check Fuel Tank Differential Pressure (FTDP) sensor pressure (item 73). Pressure should be -0.48-0.48 psi. If pressure is as specified, fault is intermittent. See INTERMITTENT DTCS. If pressure is not as specified, go to next step.

2) Disconnect FTDP connector. Turn ignition on. Using DVOM, check voltage between ground and FTDP sensor connector terminal No. 3. Voltage should be 4.8-5.2 volts. Turn ignition off. Using DVOM, check for continuity between ground and FTDP sensor connector terminal No. 2. Continuity should exist. If voltage is not as specified or if continuity does not exist, go to step 6). If voltage is as specified and continuity exists, go to next step.

3) Inspect connectors between FTDP sensor and PCM. Repair as necessary. Go to step 8). If connectors are okay, inspect wiring harness between FTDP sensor and PCM. Repair as necessary. Go to step 8). If wiring harness is okay, go to next step.

4) Check FTDP sensor connector for damage. Repair or replace connector as necessary. Go to step 8). If connector is okay, replace FTDP sensor. Go to next step.

5) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P0450 is displayed, go to step 7). If no DTCs are displayed, test is complete.

6) Inspect connectors and wiring harness between FTDP sensor and PCM. Repair as necessary. Go to step 8). If connectors and wiring harness are okay, go to next step.

7) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

8) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0500 - VEHICLE SPEED SENSOR (VSS) CIRCUIT MALFUNCTION

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) VSS is located at end of speedometer cable at transmission. Connect battery, resistor (3-10 ohms) and voltmeter to indicated terminals. See Fig. 6. Ensure voltage pulses 4 times per speedometer shaft revolution. If voltage is not as specified, replace VSS. Go to step 8). If voltage is as specified, go to next step

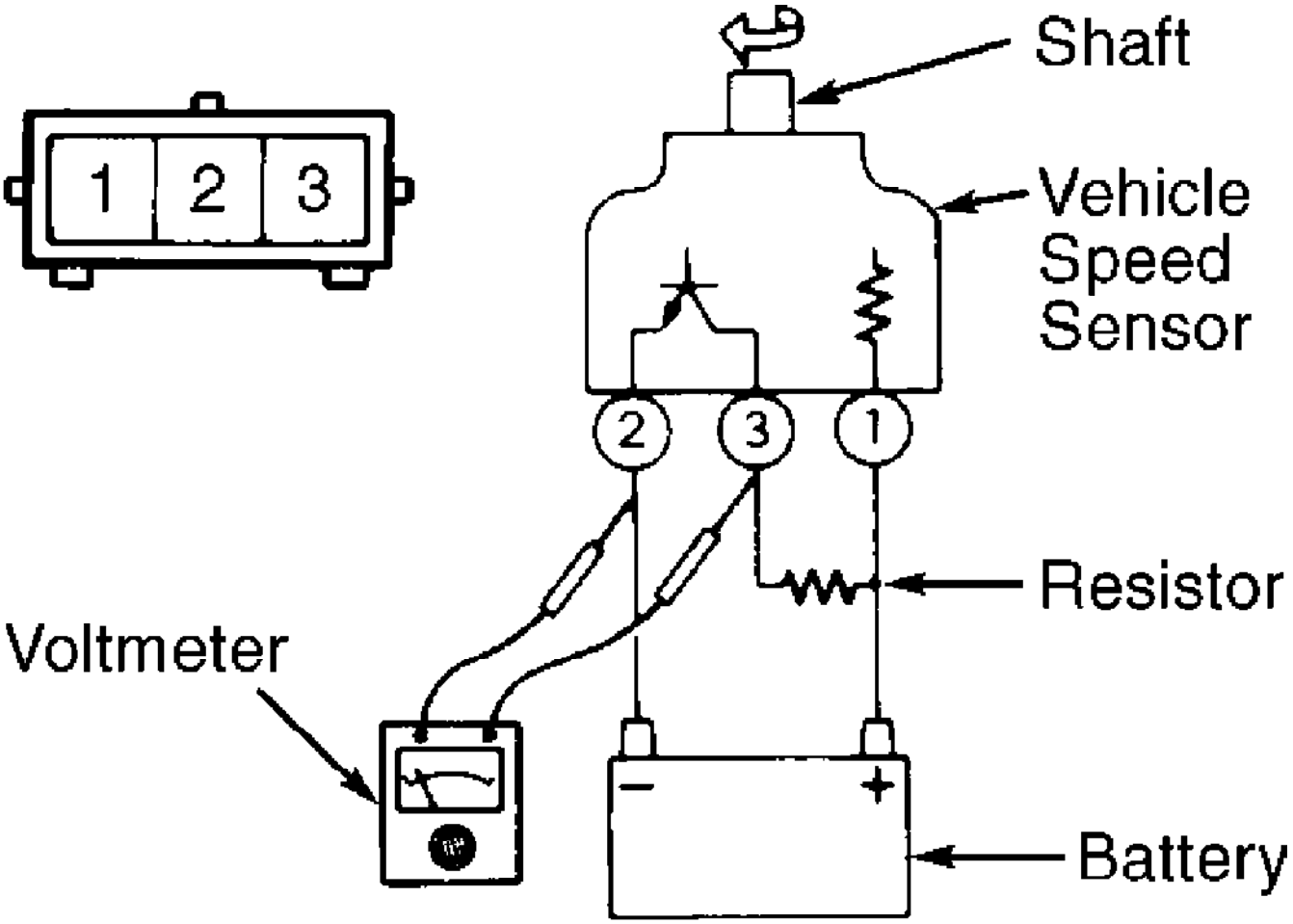


Fig. 24: Testing VSS
Courtesy of Mitsubishi Motor Sales of America

2) Disconnect VSS connector. Turn ignition on. Using DVOM, check for voltage between ground and VSS connector terminal No. 1. If battery voltage does not exist, turn ignition off. Repair wiring harness between VSS and ignition switch as necessary. Go to step 8). If battery voltage exists, go to next step.

3) Using DVOM, check for continuity between ground and VSS connector terminal No. 2. Continuity should exist. If continuity does not exist, inspect connectors between VSS and PCM. Repair connectors as necessary. Go to step 8). If connectors are okay, repair wiring harness between VSS and ground. Go to step 8). If continuity exists, go to next step.

4) Disconnect VSS connector. Turn ignition on. Using DVOM, check for voltage between ground and VSS connector terminal No. 3. Voltage should be 4.8-5.2 volts. Turn ignition off. If voltage is not as specified, go to step 6). If voltage is as specified, go to next step.

5) Check VSS connector for damage. Repair or replace connector as necessary. Go to step 8). If connector is okay, replace PCM. Go to step 8).

6) Inspect wiring harness between VSS and PCM. Repair as necessary. Go to step 8). If wiring harness is okay, go to next step.

7) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

8) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0505 - IDLE CONTROL SYSTEM MALFUNCTION (2.4L)

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for instructions in use of oscilloscope. If using engine analyzer, go to step 3). If using scan tool, go to next step.

2) Using scan tool or tachometer, check engine idle speed with A/C off. Idle speed should be 650-750 RPM. Check engine idle speed with A/C on. Idle speed should be 800-1000 RPM. If idle speeds are not as specified, go to step 4). If idle speed readings are as specified, fault is intermittent. See INTERMITTENT DTCS.

NOTE: Check wave pattern when idle speed increases when A/C is turned on. Wave pattern display lasts less than one second.

3) Disconnect IAC motor connector. Install Test Harness (MB998463) between IAC motor and connector. Using engine analyzer with oscilloscope capability, connect special patterns probe in sequence to test harness terminals No. 1 (Red clip), 3 (Blue clip), 4 (Black clip) and 6 (Yellow clip) or PCM terminals No. 4, 5, 17 and 18 respectively. Start engine and allow it to idle. Turn A/C on. Compare oscilloscope wave pattern with known-good wave pattern. See Fig. 7. Turn engine off. If wave pattern is not normal, go to next step. If wave pattern is normal, fault is intermittent. See INTERMITTENT DTCS.

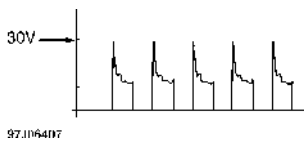


Fig. 25: Identifying Know-Good IAC Motor Wave Pattern
Courtesy of Mitsubishi Motor Sales of America.

4) Disconnect IAC motor connector. Leave test harness connected to IAC motor. Using DVOM, check resistance between test

harness terminals No. 2 (White clip) and either 1 (Red clip) or 3 (Blue clip), and between test harness terminals No. 5 (Green clip) and either 4 (Black clip) or 6 (Yellow clip). Resistance should be 28-33 ohms at 68°F (20°C). If resistance is as specified, go to next step. If resistance is not as specified, replace IAC motor. Go to step 10).

5) Turn ignition on. Using DVOM in Amps scale, connect one DVOM lead to ground. Connect a 20 ohm resistor between other DVOM lead and IAC motor connector terminals No. 2 and then 5. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between IAC motor and MFI relay. Repair or replace connectors as necessary. Go to step 10). If connectors are okay, Repair wiring harness between IAC motor and MFI relay as necessary. Go tostep 10).

6) Disconnect PCM connector. Ground PCM connector terminal No. 38. Using scan tool, actuate MFI relay. Turn ignition on. Using DVOM in Amps scale, connect one DVOM lead to ground. Connect a 20 ohm resistor between other DVOM lead and in sequence IAC motor connector terminals No. 4, 5, 17 and 18. DVOM should read 0.3 amp or more. Turn ignition off. If DVOM does not read as specified, go to next step. If DVOM reads as specified, go to step 8).

7) Inspect IAC motor connector for damage. Repair or replace connector as necessary. Go to step 10). If connector is okay, repair wiring harness between IAC motor and PCM as necessary. Go to step 10).

8) Start engine and allow it to reach normal operating temperature. Turn engine off. Using DVOM, check voltage between ground and PCM connector terminals No. 4, 5, 17 and 18 in sequence immediately after starting engine. Start engine. Voltage should switch between battery voltage and 0-3 volts. Turn ignition off. If voltage is not as specified, go to next step. If voltage is as specified, replace throttle body assembly. Go to step 10).

9) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

10) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0505 - IDLE CONTROL SYSTEM MALFUNCTION (3.0L)

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Procedures are provided by manufacturer for component testing using an engine analyzer with oscilloscope capability. Refer to manufacturer's operation manual for instructions in use of oscilloscope. If using engine analyzer, go to step 3). If using scan tool, go to next step.

2) Using scan tool or tachometer, check engine idle speed with A/C off. Idle speed should be 600-800 RPM. Check engine idle speed with A/C on. Idle speed should be 800-1000 RPM. If idle speeds are not as specified, go to step 4). If idle speed readings are as specified, fault is intermittent. See INTERMITTENT DTCS.

NOTE: Check wave pattern when idle speed increases when A/C is turned on. Wave pattern display lasts less than one second.

3) Disconnect IAC motor connector. Install Test Harness (MB998463) between IAC motor and connector. Using engine analyzer with oscilloscope capability, connect special patterns probe in sequence to test harness terminals No. 1 (Red clip), 3 (Blue clip), 4 (Black clip) and 6 (Yellow clip) or PCM terminals No. 4, 5, 17 and 18 respectively. Start engine and allow it to idle. Turn A/C on. Compare oscilloscope

wave pattern with known-good wave pattern. See Fig. 7. Turn engine off. If wave pattern is not normal, go to next step. If wave pattern is normal, fault is intermittent. See INTERMITTENT DTCS.

4) Disconnect IAC motor connector. Leave test harness connected to IAC motor. Using DVOM, check resistance between test harness terminals No. 2 (White clip) and either 1 (Red clip) or 3 (Blue clip), and between test harness terminals No. 5 (Green clip) and either 4 (Black clip) or 6 (Yellow clip). Resistance should be 28-33 ohms at 68°F (20°C). If resistance is as specified, go to next step. If resistance is not as specified, replace IAC motor. Go to step 10).

5) Remove test harness from IAC motor connector. Remove IAC motor. Install test harness to IAC motor. Connect positive terminal of a 6-volt supply to test harness White and Green clips. Check for IAC motor vibration while momentarily connecting, in sequence, negative terminal of 6-volt supply to following combinations of test harness clips:

* Red and Black
* Blue and Black
* Blue and Yellow
* Red and Yellow
* Red and Black
* Red and Black
* Red and Yellow
* Blue and Yellow
* Blue and Black
* Red and Black

If vibration is felt while applying voltage at each combination, IAC motor is okay, go to next step. If vibration is not felt, replace IAC motor. Go to step 10).

6) Turn ignition on. Using DVOM in Amps scale, connect one DVOM lead to ground. Connect a 20 ohm resistor between other DVOM lead and IAC motor connector terminals No. 2 and then 5. DVOM should read 0.5 amp or more. Turn ignition off. If DVOM reads as specified, go to next step. If DVOM does not read as specified, inspect connectors between IAC motor and MFI relay. Repair or replace connectors as necessary. Go to step 10). If connectors are okay, Repair wiring harness between IAC motor and MFI relay as necessary. Go tostep 10).

7) Disconnect PCM connector. Ground PCM connector terminal No. 38. Using scan tool, actuate MFI relay. Turn ignition on. Using DVOM in Amps scale, connect one DVOM lead to ground. Connect a 20 ohm resistor between other DVOM lead and in sequence IAC motor connector terminals No. 4, 5, 17 and 18. DVOM should read 0.3 amp or more. Turn ignition off. If DVOM does not read as specified, go to next step. If DVOM reads as specified, go to step 9).

8) Inspect IAC motor connector for damage. Repair or replace connector as necessary. Go to step 10). If connector is okay, repair wiring harness between IAC motor and PCM as necessary. Go tostep 10).

9) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

10) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0510 - CLOSED THROTTLE POSITION (TP) SWITCH MALFUNCTION

NOTE: Closed TP switch is built into TP sensor. For DTC P0510 test purposes, TP sensor will be referred to as closed TP switch. For terminal identification, see TP sensor under TERMINAL IDENTIFICATION in SELF-DIAGNOSTICSICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L

article.

1) Using scan tool, read closed TP switch state (item 26). With accelerator pedal released, scan tool should read ON. With accelerator pedal slightly depressed, scan tool should read OFF. If closed TP switch does not test as specified, go to next step. If closed TP switch tests as specified, fault is intermittent. See INTERMITTENT DTCS.

2) Disconnect closed TP switch connector. Using DVOM, check for continuity between closed TP switch connector terminals No. 3 and 4 on 2.4L or 1 and 2 on 3.0L. Depress accelerator pedal. Continuity should not exist. Release accelerator pedal. Continuity should exist. If continuity is not as specified, replace TP sensor. Go to step 6). If continuity is as specified, go to next step.

3) Using DVOM, check voltage between ground and closed TP switch connector terminal No. 3 on 2.4L or 2 on 3.0L. Voltage should be 4 volts or more. Turn ignition off. Using DVOM, check continuity, between ground and closed TP switch connector terminal No. 4 on 2.4L or 1 on 3.0L. Continuity should exist. If closed TP switch connector tests as specified, repair or replace closed TP switch connector. Go to step 6). If connector does not test as specified, go to next step.

4) Check connectors between closed TP switch and PCM. Repair or replace connectors as necessary. Go to step 6). If connectors are okay, check wiring harness between closed TP switch and PCM. Repair wiring harness as necessary. Go to step 6). If wiring harness is okay, go to next step.

5) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

6) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P0551 - POWER STEERING PRESSURE (PSP) SENSOR CIRCUIT PERFORMANCE

NOTE: For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Disconnect pressure hose from oil pump. See Fig. 26. Install Adapter (MB990993 or MB991217) on oil pump. Install Adapter (MB990994) on disconnected hose. Connect Pressure Gauge (MB990662) and shutoff valve between adapters. Open shutoff valve. Bleed steering hydraulic system. See HYDRAULIC SYSTEM BLEEDING in appropriate STEERING ARTICLE in appropriate section.

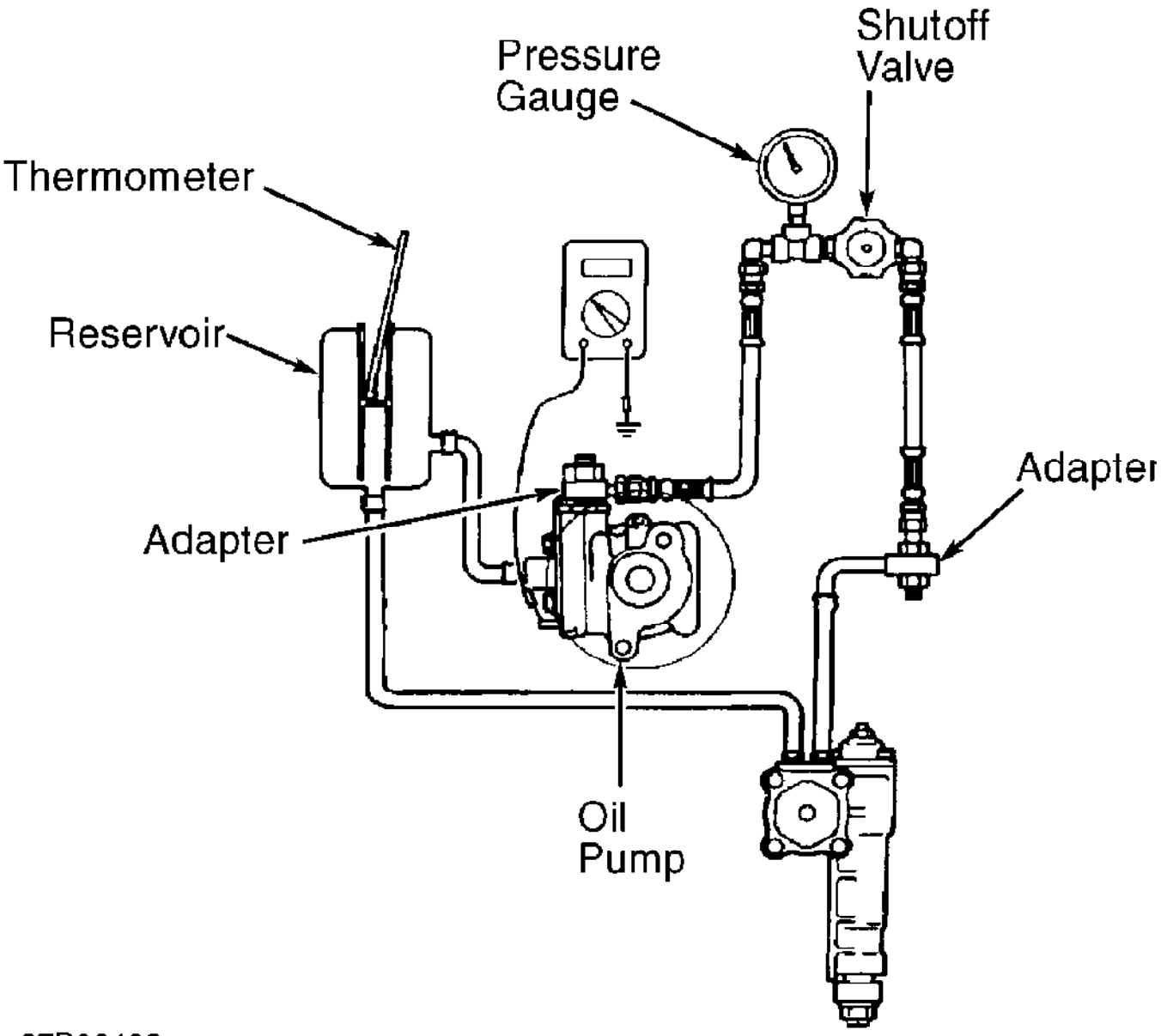


Fig. 26: Testing PSP Sensor Circuit
Courtesy of Mitsubishi Motor Sales of America.

2) Install a thermometer in fluid reservoir. Start engine and allow it to idle. Turn steering wheel several times until fluid temperature reaches 122-140°F (50-60°C). Disconnect PSP switch connector. Install a DVOM between ground and PSP switch terminal. See Fig. 26. Note continuity reading on DVOM. Go to next step.

3) With engine idling, gradually close shutoff valve to increase power steering system pressure. Check pressure when PSP switch is actuated by watching for a change in continuity. PSP switch should be actuated when pressure is 218-290 psi. Gradually open shutoff valve to decrease pressure. Check pressure when PSP switch is de-actuated. PSP switch should de-actuate at 102-174 psi. Turn engine off. If PSP operates as specified, go to next step. If PSP does not operate as specified, replace PSP switch. Go to step 7).

4) Disconnect PSP switch connector. Turn ignition on. Using

DVOM, check voltage between ground and PSP switch connector terminal No. 1. If battery voltage exists, repair or replace PSP switch connector as necessary. Go to step 7). If battery voltage does not exist, go to next step.

5) Check wiring harness between PSP switch and PCM. Repair wiring harness as necessary. Go to step 7). If wiring harness is okay, go to next step.

6) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

7) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P1400 - MANIFOLD DIFFERENTIAL PRESSURE (MDP) SENSOR CIRCUIT MALFUNCTION

NOTE: This test applies to vehicles equipped with Federal emissions only. For terminal identification, see TERMINAL IDENTIFICATION in SELF-DIAGNOSTICSICS section. For circuit and wire color identification, see L - WIRING DIAGRAMS - 3.0L article.

1) Using scan tool, read Manifold Differential Pressure (MDP) sensor pressure (item 95) pressure should be 9-11 psi on 2.4L or 3-5 psi on 3.0L. If scan tool does not read as specified, go to next step. If scan tool reads as specified, fault is intermittent. See INTERMITTENT DTCS.

2) Disconnect MDP sensor connector. Turn ignition on. Using DVOM, check voltage between ground and MDP sensor connector terminal No. 3. Voltage should be 4.8-5.2 volts. Turn ignition off. Using DVOM, check for continuity between ground and MDP sensor connector terminal No. 2. Continuity should exist. If voltage is not as specified or if continuity does not exist, go to step 6). If voltage is as specified and continuity exists, go to next step.

3) Inspect connectors between MDP sensor and PCM. Repair as necessary. Go to step 8). If connectors are okay, inspect wiring harness between MDP sensor and PCM. Repair as necessary. Go to step 8). If wiring harness is okay, go to next step.

4) Check MDP sensor connector for damage. Repair or replace connector as necessary. Go to step 8). If connector is okay, replace MDP sensor. Go to next step.

5) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If DTC P1400 is displayed, go to next step. If no DTCs are displayed, test is complete.

6) Inspect connectors and wiring harness between MDP sensor and PCM. Repair as necessary. Go to step 8). If connectors and wiring harness are okay, go to next step.

7) Inspect PCM connector for damage. Repair or replace connector as necessary. Go to next step. If connector is okay, replace PCM. Go to next step.

8) Road test vehicle and attempt to duplicate conditions that caused original complaint. Recheck for DTCs. If no DTCs are displayed, test is complete.

DTC P1600 - SERIAL COMMUNICATION LINK MALFUNCTION

DTC P1600 is related to automatic transmission DIAGNOSTICSics. For DIAGNOSTICSic procedure, see appropriate section.

DTC P1715 - PULSE GENERATOR MALFUNCTION

DTC P1715 is related to automatic transmission DIAGNOSTICSics. For DIAGNOSTICSic procedure, see appropriate section.

DTC P1750 - SOLENOID MALFUNCTION

DTC P1750 is related to automatic transmission DIAGNOSTICSics. For DIAGNOSTICSic procedure, see appropriate section.

DTC P1791 - ENGINE COOLANT TEMPERATURE LEVEL INPUT TO TCM

DTC P1791 is related to automatic transmission DIAGNOSTICSics. For DIAGNOSTICSic procedure, see appropriate section.

SUMMARY

If no hard DTCs (or only pass DTCs) are present, driveability symptoms exist, or intermittent DTCs exist, proceed to H - TESTS W/O CODES - 3.0L article for diagnosis by symptom (i.e., ROUGH IDLE, NO START, etc.) or intermittent DIAGNOSTICSic procedures.

H - TESTS W/O CODES - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Trouble Shooting - No Codes

Montero Sport - 2.4L

INTRODUCTION

Before diagnosing symptoms or intermittent faults, perform steps in BASIC DIAGNOSTIC PROCEDURES and G - TESTS W/CODES - 2.4L articles. Use this article to diagnose driveability problems existing when a hard Diagnostic Trouble Code (DTC) is not present.

NOTE: Some driveability problems may have been corrected by manufacturer with a revised Powertrain Control Module (PCM). Check with manufacturer for latest PCM.

Symptom checks can direct technician to malfunctioning component(s) for further diagnosis. A symptom should lead to a specific component, system test or adjustment.

Use intermittent test procedures to locate driveability problems that DO NOT occur when vehicle is being tested. These test procedures should also be used if an intermittent DTC was present, but no problem was found during self-diagnostic testing.

NOTE: For specific testing procedures, see appropriate G - TESTS W/CODES - 2.4L article. For specifications, see D - ADJUSTMENTS - 2.4L or C - SPECIFICATIONS - 2.4L article.

SYMPTOMS

SYMPTOM DIAGNOSIS

Symptom checks cannot be used unless problem occurs while vehicle is being tested. To reduce diagnostic time, ensure steps in BASIC DIAGNOSTIC PROCEDURES and G - TESTS W/CODES - 2.4L articles were performed before diagnosing a symptom. Following symptoms are available for diagnosis.

* Difficult To Start/No Start (Cranks Okay)
* Rough Or Unstable Idle
* Engine Hesitates Or Poor Acceleration
* Engine Surges
* Detonation Or Knocking
* Poor Fuel Mileage

DIFFICULT TO START/NO START (CRANKS OKAY)

* Check idle air control (DC) motor (if applicable).
* Check idle air control (stepper) motor (if applicable).
* Check ignition switch.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check park/neutral position switch (A/T).
* Check volume airflow sensor.
* Check engine coolant temperature sensor.
* Check power supply to PCM.
* Check fuel pressure.

* Check ignition timing.
* Check for disconnected or damaged vacuum hoses.
* Check for control relay malfunction.
* Check for MFI system malfunction.
* Check for fuel pump drive control system malfunction.
* Check for ignition coil malfunction.
* Check for power transistor malfunction.
* Check for fuel injector malfunction.
* Check for PCM malfunction.
* Ensure electrical harness, connectors and wires are not broken, bent or loose.

ROUGH OR UNSTABLE IDLE

* Check intake air temperature sensor.
* Check EVAP purge control solenoid valve (if applicable).
* Check vehicle speed sensor.
* Check engine coolant temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition switch.
* Check throttle position sensor.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check power steering oil pressure switch.
* Check A/C switch and power relay (if applicable).
* Check park/neutral position switch (A/T).
* Check heated oxygen sensor.
* Check volume airflow sensor.
* Check fuel pressure.
* Check for disconnected or damaged vacuum hoses.
* Check for MFI system malfunction.
* Check for idle air control motor malfunction.
* Check for fuel injector malfunction.
* Check for power transistor malfunction.
* Check for vehicle speed sensor malfunction.
* Check for PCM malfunction.
* Ensure electrical harness, connectors and wires are not broken, bent or loose.

ENGINE HESITATES OR POOR ACCELERATION

* Check intake air temperature sensor.
* Check engine coolant temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition switch.
* Check ignition coil.
* Check EGR control solenoid valve (if applicable).
* Check throttle position sensor.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check power steering oil pressure switch.
* Check A/C switch (if applicable).
* Check park/neutral position switch (A/T).
* Check heated oxygen sensor.
* Check volume airflow sensor.
* Check fuel pressure.
* Check for disconnected or damaged vacuum hoses.
* Check for MFI system malfunction.
* Check for idle air control motor malfunction.
* Check for fuel injector malfunction.
* Check for power transistor malfunction.

* Check for A/C power relay control system malfunction.
* Check for PCM malfunction.
* Ensure electrical harness, connectors and wires are not broken, bent or loose.

ENGINE SURGES

* Check engine coolant temperature sensor.
* Check EGR control solenoid valve (if applicable).
* Check fuel pressure.
* Check for fuel injector malfunction.

DETONATION OR KNOCKING

* Check for knock sensor malfunction (if applicable).
* Check volume airflow sensor.
* Check for engine cooling system problems.
* Check fuel quality.
* Check intake air temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition coil.
* Check power transistor.
* Check for EGR system malfunction.

POOR FUEL MILEAGE

* Check intake air temperature sensor.
* Check engine coolant temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition switch.
* Check throttle position sensor.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check power steering oil pressure switch.
* Check A/C switch (if applicable).
* Check park/neutral position switch (A/T).
* Check heated oxygen sensor.
* Check volume airflow sensor.
* Check fuel pressure.
* Check for MFI system malfunction.
* Check for idle air control motor malfunction.
* Check for fuel injector malfunction.
* Check for power transistor malfunction.

INTERMITTENTS

INTERMITTENT PROBLEM DIAGNOSIS

Intermittent fault testing requires duplicating circuit or component failure to identify problem. These procedures may lead to computer setting a Diagnostic Trouble Code (DTC) which may help in diagnosis.

If problem vehicle does not produce DTCs, monitor voltage or resistance values using a DVOM while attempting to reproduce conditions causing intermittent fault. A status change on DVOM indicates a fault has been located.

Use a DVOM to pinpoint faults. See J - PIN VOLTAGE CHARTS - 2.4L article. When monitoring voltage, ensure ignition switch is in ON position or engine is running. Ensure ignition switch is in OFF position when monitoring circuit resistance.

Status changes on DVOM during test procedures indicate area of fault.

TEST PROCEDURES

Intermittent Simulation

To reproduce conditions creating an intermittent fault, use following methods:

* Lightly vibrate component.
* Heat component.
* Wiggle or bend wiring harness.
* Spray component with water mist.
* Remove/apply vacuum source.

Monitor circuit/component voltage or resistance while simulating intermittent fault. If engine is running, monitor for diagnostic trouble codes. Use test results to identify a faulty component or circuit.

H - TESTS W/O CODES - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Trouble Shooting - No Codes

Montero Sport - 3.0L

INTRODUCTION

Before diagnosing symptoms or intermittent faults, perform steps in BASIC DIAGNOSTIC PROCEDURES and G - TESTS W/CODES - 3.0L articles. Use this article to diagnose driveability problems existing when a hard Diagnostic Trouble Code (DTC) is not present.

NOTE: Some driveability problems may have been corrected by manufacturer with a revised Powertrain Control Module (PCM). Check with manufacturer for latest PCM.

Symptom checks can direct technician to malfunctioning component(s) for further diagnosis. A symptom should lead to a specific component, system test or adjustment.

Use intermittent test procedures to locate driveability problems that DO NOT occur when vehicle is being tested. These test procedures should also be used if an intermittent DTC was present, but no problem was found during self-diagnostic testing.

NOTE: For specific testing procedures, see appropriate G - TESTS W/CODES - 3.0L article. For specifications, see D - ADJUSTMENTS - 3.0L or C - SPECIFICATIONS - 3.0L article.

SYMPTOMS

SYMPTOM DIAGNOSIS

Symptom checks cannot be used unless problem occurs while vehicle is being tested. To reduce diagnostic time, ensure steps in BASIC DIAGNOSTIC PROCEDURES and G - TESTS W/CODES - 3.0L articles were performed before diagnosing a symptom. Following symptoms are available for diagnosis.

* Difficult To Start/No Start (Cranks Okay)
* Rough Or Unstable Idle
* Engine Hesitates Or Poor Acceleration
* Engine Surges
* Detonation Or Knocking
* Poor Fuel Mileage

DIFFICULT TO START/NO START (CRANKS OKAY)

* Check idle air control (DC) motor (if applicable).
* Check idle air control (stepper) motor (if applicable).
* Check ignition switch.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check park/neutral position switch (A/T).
* Check volume airflow sensor.
* Check engine coolant temperature sensor.
* Check power supply to PCM.
* Check fuel pressure.

* Check ignition timing.
* Check for disconnected or damaged vacuum hoses.
* Check for control relay malfunction.
* Check for MFI system malfunction.
* Check for fuel pump drive control system malfunction.
* Check for ignition coil malfunction.
* Check for power transistor malfunction.
* Check for fuel injector malfunction.
* Check for PCM malfunction.
* Ensure electrical harness, connectors and wires are not broken, bent or loose.

ROUGH OR UNSTABLE IDLE

* Check intake air temperature sensor.
* Check EVAP purge control solenoid valve (if applicable).
* Check vehicle speed sensor.
* Check engine coolant temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition switch.
* Check throttle position sensor.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check power steering oil pressure switch.
* Check A/C switch and power relay (if applicable).
* Check park/neutral position switch (A/T).
* Check heated oxygen sensor.
* Check volume airflow sensor.
* Check fuel pressure.
* Check for disconnected or damaged vacuum hoses.
* Check for MFI system malfunction.
* Check for idle air control motor malfunction.
* Check for fuel injector malfunction.
* Check for power transistor malfunction.
* Check for vehicle speed sensor malfunction.
* Check for PCM malfunction.
* Ensure electrical harness, connectors and wires are not broken, bent or loose.

ENGINE HESITATES OR POOR ACCELERATION

* Check intake air temperature sensor.
* Check engine coolant temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition switch.
* Check ignition coil.
* Check EGR control solenoid valve (if applicable).
* Check throttle position sensor.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check power steering oil pressure switch.
* Check A/C switch (if applicable).
* Check park/neutral position switch (A/T).
* Check heated oxygen sensor.
* Check volume airflow sensor.
* Check fuel pressure.
* Check for disconnected or damaged vacuum hoses.
* Check for MFI system malfunction.
* Check for idle air control motor malfunction.
* Check for fuel injector malfunction.
* Check for power transistor malfunction.

* Check for A/C power relay control system malfunction.
* Check for PCM malfunction.
* Ensure electrical harness, connectors and wires are not broken, bent or loose.

ENGINE SURGES

* Check engine coolant temperature sensor.
* Check EGR control solenoid valve (if applicable).
* Check fuel pressure.
* Check for fuel injector malfunction.

DETONATION OR KNOCKING

* Check for knock sensor malfunction (if applicable).
* Check volume airflow sensor.
* Check for engine cooling system problems.
* Check fuel quality.
* Check intake air temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition coil.
* Check power transistor.
* Check for EGR system malfunction.

POOR FUEL MILEAGE

* Check intake air temperature sensor.
* Check engine coolant temperature sensor.
* Check barometric pressure sensor (if applicable).
* Check manifold absolute pressure sensor (if applicable).
* Check ignition switch.
* Check throttle position sensor.
* Check camshaft position sensor.
* Check crankshaft position sensor.
* Check power steering oil pressure switch.
* Check A/C switch (if applicable).
* Check park/neutral position switch (A/T).
* Check heated oxygen sensor.
* Check volume airflow sensor.
* Check fuel pressure.
* Check for MFI system malfunction.
* Check for idle air control motor malfunction.
* Check for fuel injector malfunction.
* Check for power transistor malfunction.

INTERMITTENTS

INTERMITTENT PROBLEM DIAGNOSIS

Intermittent fault testing requires duplicating circuit or component failure to identify problem. These procedures may lead to computer setting a Diagnostic Trouble Code (DTC) which may help in diagnosis.

If problem vehicle does not produce DTCs, monitor voltage or resistance values using a DVOM while attempting to reproduce conditions causing intermittent fault. A status change on DVOM indicates a fault has been located.

Use a DVOM to pinpoint faults. See J - PIN VOLTAGE CHARTS - 3.0L article. When monitoring voltage, ensure ignition switch is in ON position or engine is running. Ensure ignition switch is in OFF position when monitoring circuit resistance.

Status changes on DVOM during test procedures indicate area of fault.

TEST PROCEDURES

Intermittent Simulation

To reproduce conditions creating an intermittent fault, use following methods:

* Lightly vibrate component.
* Heat component.
* Wiggle or bend wiring harness.
* Spray component with water mist.
* Remove/apply vacuum source.

Monitor circuit/component voltage or resistance while simulating intermittent fault. If engine is running, monitor for diagnostic trouble codes. Use test results to identify a faulty component or circuit.

E - THEORY/OPERATION - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Theory & Operation

Montero Sport - 2.4L

INTRODUCTION

This article covers basic description and operation of engine performance-related systems and components. Read this article before diagnosing vehicles or systems with which you are not completely familiar.

AIR INDUCTION SYSTEM

NON-TURBOCHARGED ENGINES

This model uses same basic air induction system; remote air filter (with VAF sensor) is connected to a plenum-mounted throttle body.

TURBOCHARGED ENGINES

In addition to basic air induction system, turbocharging system components include turbocharger(s), charge air cooler(s), air by-pass valve(s), wastegate actuator(s), wastegate control solenoid valve(s) and intake duct(s).

Wastegate Control Solenoid Valve(s)
Powertrain Control Module (PCM) energizes solenoid valve(s), controlling leakage rate of turbocharger pressure to wastegate actuator(s).

COMPUTERIZED ENGINE CONTROLS

Multi-Port Fuel Injection (MFI) is a computerized engine control system, which controls fuel injection, ignition timing, idle speed and emission control systems.

POWERTRAIN CONTROL MODULE (PCM)

PCM, also known as Engine Control Module (ECM), receives and processes signals from input devices. Operating conditions such as cold starting, altitude, acceleration and deceleration affect input device signals. Based on signals received, PCM sends signals to various components, which control fuel injection, ignition timing, idle speed and emission control systems. For PCM location, see PCM LOCATION table.

PCM LOCATION TABLE

Application	Location
Montero Sport	Behind Right Side Of Instrument Panel (Glove Box)

NOTE: Components are grouped into 2 categories. The first category

covers INPUT DEVICES, which control or produce voltage signals monitored by Powertrain Control Module (PCM). The second category covers OUTPUT SIGNALS, which are components controlled by PCM.

INPUT DEVICES

Vehicles are equipped with different combinations of input devices. Not all input devices are used on all models. To determine input device usage on specific models, see appropriate wiring diagram in L - WIRING DIAGRAMS - 2.4L article. The following are available input devices.

Air Conditioning Switch

When A/C is turned on, signal is sent to PCM. With engine at idle, PCM increases idle speed through Idle Air Control (IAC) motor.

Airflow Sensor Assembly

Assembly is mounted inside air cleaner, and incorporates barometric pressure sensor, intake air temperature sensor and volume airflow sensor.

Barometric (BARO) Pressure Sensor

Sensor is incorporated in airflow sensor assembly. Sensor converts barometric pressure to electrical signal, which is sent to PCM. PCM adjusts air/fuel ratio and ignition timing according to altitude.

Camshaft Position (CMP) Sensor

On SOHC engines equipped with a distributor, CMP sensor is located in distributor. On DOHC V6 engines, sensor is located beside camshaft in front of engine. On all other engines, CMP sensor is a separate unit mounted in place of distributor. PCM determines TDC based on pulse signals received from sensor and then controls MFI timing.

Closed Throttle Position (CTP) Switch

CTP switch is located in the Throttle Position (TP) sensor. PCM senses whether accelerator pedal is depressed or not. High voltage (open) or low voltage (closed) signal is input to PCM, which then controls Idle Air Control (IAC) motor based on input signal.

Crankshaft Position (CKP) Sensor

On DOHC 4-cylinder engines with California emissions, CKP sensor is located beside crankshaft in front of engine. PCM determines crankshaft position on pulse signals received from sensor and then controls MFI timing and ignition timing.

Engine Coolant Temperature (ECT) Sensor

ECT sensor converts coolant temperature to electrical signal for use by PCM. PCM uses coolant temperature information to control fuel enrichment when engine is cold.

Heated Oxygen Sensor (HO2S)

HO2S detects oxygen content in exhaust gas and sends this information to PCM. PCM uses input signals from HO2S to vary duration of fuel injection. HO2S heater stabilizes sensor temperature regardless of exhaust gas temperature to allow for more accurate exhaust oxygen content readings.

Idle Air Control (IAC) Valve Position Sensor

Sensor is incorporated in IAC motor. Sensor senses IAC motor plunger position and sends electrical signal to PCM.

Ignition Timing Adjustment Terminal
Used for adjusting base ignition timing. When terminal is grounded, PCM timing control function is by-passed, allowing base timing to be adjusted.

Intake Air Temperature (IAT) Sensor
IAT sensor is incorporated in airflow sensor assembly. This resistor-based sensor measures temperature of incoming air and supplies air density information to PCM.

Knock Sensor (KS)
KS is located in cylinder block and senses engine vibration during detonation (knock). KS converts vibration into electrical signal. PCM retards ignition timing based on this signal.

Manifold Differential Pressure (MDP) Sensor
MDP sensor converts negative air pressure in intake manifold plenum into voltage signals sent to PCM. PCM monitors Exhaust Gas Recirculation (EGR) system using these signals.

Park/Neutral Position (PNP) Switch (Automatic Transmission)
PNP switch senses position of transmission select lever, indicating engine load due to automatic transmission engagement. Based on this signal, PCM commands IAC motor to increase throttle angle, maintaining optimum idle speed.

Power Steering Oil Pressure Switch
Switch detects increase in power steering oil pressure. When power steering oil pressure increases, switch contacts close, signaling PCM. PCM commands IAC motor, raising idle speed to compensate for drop in engine RPM due to power steering load.

Throttle Position (TP) Sensor
TP sensor is a variable resistor mounted on throttle body. PCM uses voltage signal from TP sensor to determine throttle plate angle.

Vehicle Speed Sensor (VSS)
Mounted on transaxle/transmission, VSS sends a pulsing signal to PCM for vehicle speed calculation. PCM uses this calculation for cruise control and fuel cut-off.

Volume Airflow (VAF) Sensor
Incorporated in airflow sensor assembly, VAF sensor measures intake airflow rate. Intake air flows through tunnel in airflow sensor assembly. VAF sensor sends frequency signal to PCM. PCM uses signal to adjust fuel injection rate.

OUTPUT SIGNALS

NOTE: Vehicles are equipped with various combinations of computer-controlled components. Not all components listed below are used on every vehicle. For theory and operation on each output component, refer to system indicated after component.

Data Link Connector (DLC)
See SELF-DIAGNOSTIC SYSTEM.

EGR Control Solenoid Valve
See EXHAUST GAS RECIRCULATION (EGR) CONTROL under EMISSION SYSTEMS.

Fuel Injectors
See FUEL CONTROL under FUEL SYSTEM.

Fuel Pressure Control Solenoid Valve (Turbo)
See FUEL DELIVERY under FUEL SYSTEM.

Fuel Pressure Regulator
See FUEL DELIVERY under FUEL SYSTEM.

Idle Air Control (IAC) Motor
See IDLE SPEED under FUEL SYSTEM.

Malfunction Indicator Light
See SELF-DIAGNOSTIC SYSTEM.

Power Transistor(s) & Ignition Coils
See IGNITION SYSTEMS.

Purge Control Solenoid Valve
See EVAPORATIVE CONTROL under EMISSION SYSTEMS.

Wastegate Control Solenoid Valve
See TURBOCHARGED ENGINES under AIR INDUCTION SYSTEM.

FUEL SYSTEM

FUEL DELIVERY

Electric fuel pump, located in gas tank, feeds fuel through in-tank fuel filter, external fuel filter (located in engine compartment) and fuel injector rail.

Fuel Pump
Fuel pump consists of a motor-driven impeller. Pump has an internal check valve to maintain system pressure, and a relief valve to protect fuel pressure circuit. Pump receives voltage supply from MFI control relay.

Fuel Pressure Control Solenoid Valve (Turbo)
Valve prevents rough idle due to fuel percolation. On engine restart, if engine coolant or intake air temperature reaches a preset value, PCM applies voltage to fuel pressure control solenoid valve for 2 minutes after enginerestart. Valve will open, allowing atmospheric pressure to be applied to fuel pressure regulator diaphragm. This allows maximum available fuel pressure at injectors, enriching fuel mixture and maintaining stable idle at high engine temperatures.

Fuel Pressure Regulator
Located on fuel injector rail, this diaphragm-operated relief valve adjusts fuel pressure according to engine manifold vacuum.
As engine manifold vacuum increases (closed throttle), fuel pressure regulator diaphragm opens relief valve, allowing pressure to bleed off through fuel return line, reducing fuel pressure.
As engine manifold vacuum decreases (open throttle), fuel pressure regulator diaphragm closes valve, preventing pressure from bleeding off through fuel return line, increasing fuel pressure.

FUEL CONTROL

Fuel Injectors
Fuel is supplied to engine through electronically pulsed

(timed) injector valves located on fuel rail(s). PCM controls amount of fuel metered through injectors based on information received from sensors.

IDLE SPEED

Air Conditioning (A/C) Relay

When A/C is turned on with engine at idle, PCM signals IAC motor to increase idle speed. To prevent A/C compressor from switching on before idle speed has increased, PCM momentarily opens A/C relay circuit.

Idle Air Control (IAC) Motor

Motor controls pintle-type air valve to regulate volume of intake air at idle.

During start mode, PCM controls idle intake air volume according to Engine Coolant Temperature (ECT) sensor input. After starting, with idle position switch activated (throttle closed), fast idle speed is controlled by IAC motor and fast idle air control valve (if equipped).

When idle switch is deactivated (throttle open), IAC motor moves to a preset position in accordance with ECT sensor input.

PCM signals IAC motor to increase engine RPM in the following situations: A/T (if applicable) is shifted from Neutral to Drive, A/C is turned on, or power steering pressure reaches a preset value.

IGNITION SYSTEMS

DIRECT IGNITION SYSTEM (DIS)

Depending on number of cylinders, ignition system is a 2 or 3-coil distributorless ignition system. On DOHC V6 engines, Camshaft Position (CMP) sensor is located beside camshaft in front of engine. On all other engines equipped with DIS, CMP sensor is a separate unit mounted in place of distributor. On DOHC 4-cylinder, DOHC V6 and 1.8L 4-cylinder engines with California emissions, Crankshaft Position (CKP) sensor is located beside crankshaft in front of engine. PCM determines TDC based on pulse signals received from sensors and then controls MFI and ignition timing.

Power Transistors & Ignition Coils

Based on crankshaft position and CMP sensor inputs, PCM controls timing and directly activates each power transistor to fire coils. On 4-cylinder engines, power transistor "A" controls primary current of ignition coil "A" to fire spark plugs on cylinders No. 1 and No. 4 at the same time. Power transistor "B" controls primary current of ignition coil "B" to fire spark plugs on cylinders No. 2 and No. 3 at the same time. On V6 engines, companion cylinders No. 1 and 4, 2 and 5, and 3 and 6 are fired together.

On all models, although each coil fires 2 plugs at the same time, ignition takes place in only one cylinder, since the other cylinder is on its exhaust stroke when plug fires.

HALL EFFECT IGNITION SYSTEM

This system is equipped with a Hall Effect distributor. Shutter(s) attached to distributor shaft rotate through distributor Hall Effect switch, also referred to as a Camshaft Position (CMP) sensor, which contains a distributor pick-up (a Hall Effect device and magnet). As shutter blade(s) pass through pick-up, magnetic field is interrupted and voltage is toggled between high and low. PCM uses this data along with Crankshaft Position (CKP) sensor data to control

ignition timing and injector pulse width to maintain optimum driveability.

Power Transistor & Ignition Coil

Power transistor is mounted inside distributor with disc and optical sensing unit. When ignition is on, ignition coil primary circuit is energized. As distributor shaft rotates, disc rotates, triggering optical sensing unit. PCM receives signals from optical sensing unit. Signals are converted and sent to power transistor, interrupting primary current flow and inducing secondary voltage.

IGNITION TIMING CONTROL SYSTEM

Ignition timing is controlled by PCM. PCM adjusts timing based on various conditions such as engine temperature, altitude and detonation.

EMISSION SYSTEMS

EXHAUST GAS RECIRCULATION (EGR) CONTROL

Federal Emissions (Non-Turbo)

To lower oxides of nitrogen (NOx) exhaust emissions, a non-computer controlled exhaust gas recirculation system is used. EGR operation is controlled by throttle body ported vacuum. Vacuum is routed through vacuum control valve to prevent EGR operation at low engine temperatures.

Spring pressure holds EGR valve closed during low vacuum conditions (engine idling or wide open throttle). When vacuum pressure increases and overcomes EGR spring pressure, EGR valve is lifted to allow exhaust gases to flow into intake manifold for combustion.

California Emissions & Turbo

PCM controls EGR operation by activating EGR control solenoid valve according to engine load. When engine is cold, PCM signals EGR control solenoid valve to deactivate EGR.

EGR Control Solenoid Valve

Valve denies or allows vacuum supply to EGR valve based on PCM commands.

EVAPORATIVE CONTROL

Fuel evaporation system prevents fuel vapor from entering atmosphere. System consists of the following: special fuel tank with vapor separator tanks (if equipped), vacuum relief filler cap, overfill limiter(2-way valve), fuel check valve, thermovalve (if equipped), charcoal canister, purge control valve, purge control solenoid valve, and connecting lines and hoses.

Purge Control Solenoid Valve

When engine is off, fuel vapors are vented into charcoal canister. When engine is warmed to normal operating temperature and running at speeds greater than idle, PCM energizes purge control solenoid valve, allowing vacuum to purge valve.

Canister vapors are then drawn through purge valve into intake manifold for burning. Purge control solenoid valve remains closed during idle and engine warm-up to reduce HC (hydrocarbons) and CO (carbon monoxide) emissions.

POSITIVE CRANKCASE VENTILATION (PCV) VALVE

PCV valve operates in closed crankcase ventilation system. Closed crankcase ventilation system consists of PCV valve, oil separator, breather and ventilation hoses.

PCV valve is a one-way check valve located in valve cover. When engine is running, manifold vacuum pulls PCV valve open, allowing crankcase fumes to enter intake manifold. If engine backfires through intake manifold, PCV valve closes to prevent crankcase combustion.

SELF-DIAGNOSTIC SYSTEM

NOTE: PCM diagnostic memory is retained by direct power supply from battery. Memory is not erased by turning off ignition, but it will be erased if battery or PCM is disconnected.

Self-diagnostic system monitors input and output signals through the Data Link Connector (DLC). Diagnostic Trouble Codes (DTCs) can only be read using a scan tester. For additional information, see appropriate G - TESTS W/CODES - 2.4L article.

Malfunction Indicator Light (MIL)

MIL (CHECK ENGINE light) comes on when ignition is turned on. MIL remains on for several seconds after engine has started. If an abnormal input signal occurs, MIL comes on and code is stored in memory. If an abnormal input signal returns to normal, PCM turns MIL off, but code remains stored in memory until it is cleared. If ignition is turned on again, MIL will not come on until PCM detects malfunction during system operation.

E - THEORY/OPERATION - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Theory & Operation

Montero Sport - 3.0L

INTRODUCTION

This article covers basic description and operation of engine performance-related systems and components. Read this article before diagnosing vehicles or systems with which you are not completely familiar.

AIR INDUCTION SYSTEM

NON-TURBOCHARGED ENGINES

This model uses same basic air induction system; remote air filter (with VAF sensor) is connected to a plenum-mounted throttle body.

TURBOCHARGED ENGINES

In addition to basic air induction system, turbocharging system components include turbocharger(s), charge air cooler(s), air by-pass valve(s), wastegate actuator(s), wastegate control solenoid valve(s) and intake duct(s).

Wastegate Control Solenoid Valve(s)
Powertrain Control Module (PCM) energizes solenoid valve(s), controlling leakage rate of turbocharger pressure to wastegate actuator(s).

COMPUTERIZED ENGINE CONTROLS

Multi-Port Fuel Injection (MFI) is a computerized engine control system, which controls fuel injection, ignition timing, idle speed and emission control systems.

POWERTRAIN CONTROL MODULE (PCM)

PCM, also known as Engine Control Module (ECM), receives and processes signals from input devices. Operating conditions such as cold starting, altitude, acceleration and deceleration affect input device signals. Based on signals received, PCM sends signals to various components, which control fuel injection, ignition timing, idle speed and emission control systems. For PCM location, see PCM LOCATION table.

PCM LOCATION TABLE

Application	Location
Montero Sport	Behind Right Side Of Instrument Panel (Glove Box)

NOTE: Components are grouped into 2 categories. The first category

covers INPUT DEVICES, which control or produce voltage signals monitored by Powertrain Control Module (PCM). The second category covers OUTPUT SIGNALS, which are components controlled by PCM.

INPUT DEVICES

Vehicles are equipped with different combinations of input devices. Not all input devices are used on all models. To determine input device usage on specific models, see appropriate wiring diagram in L - WIRING DIAGRAMS - 3.0L article. The following are available input devices.

Air Conditioning Switch

When A/C is turned on, signal is sent to PCM. With engine at idle, PCM increases idle speed through Idle Air Control (IAC) motor.

Airflow Sensor Assembly

Assembly is mounted inside air cleaner, and incorporates barometric pressure sensor, intake air temperature sensor and volume airflow sensor.

Barometric (BARO) Pressure Sensor

Sensor is incorporated in airflow sensor assembly. Sensor converts barometric pressure to electrical signal, which is sent to PCM. PCM adjusts air/fuel ratio and ignition timing according to altitude.

Camshaft Position (CMP) Sensor

On SOHC engines equipped with a distributor, CMP sensor is located in distributor. On DOHC V6 engines, sensor is located beside camshaft in front of engine. On all other engines, CMP sensor is a separate unit mounted in place of distributor. PCM determines TDC based on pulse signals received from sensor and then controls MFI timing.

Closed Throttle Position (CTP) Switch

CTP switch is located in the Throttle Position (TP) sensor. PCM senses whether accelerator pedal is depressed or not. High voltage (open) or low voltage (closed) signal is input to PCM, which then controls Idle Air Control (IAC) motor based on input signal.

Crankshaft Position (CKP) Sensor

On DOHC 4-cylinder engines with California emissions, CKP sensor is located beside crankshaft in front of engine. PCM determines crankshaft position on pulse signals received from sensor and then controls MFI timing and ignition timing.

Engine Coolant Temperature (ECT) Sensor

ECT sensor converts coolant temperature to electrical signal for use by PCM. PCM uses coolant temperature information to control fuel enrichment when engine is cold.

Heated Oxygen Sensor (HO2S)

HO2S detects oxygen content in exhaust gas and sends this information to PCM. PCM uses input signals from HO2S to vary duration of fuel injection. HO2S heater stabilizes sensor temperature regardless of exhaust gas temperature to allow for more accurate exhaust oxygen content readings.

Idle Air Control (IAC) Valve Position Sensor

Sensor is incorporated in IAC motor. Sensor senses IAC motor plunger position and sends electrical signal to PCM.

Ignition Timing Adjustment Terminal
Used for adjusting base ignition timing. When terminal is grounded, PCM timing control function is by-passed, allowing base timing to be adjusted.

Intake Air Temperature (IAT) Sensor
IAT sensor is incorporated in airflow sensor assembly. This resistor-based sensor measures temperature of incoming air and supplies air density information to PCM.

Knock Sensor (KS)
KS is located in cylinder block and senses engine vibration during detonation (knock). KS converts vibration into electrical signal. PCM retards ignition timing based on this signal.

Manifold Differential Pressure (MDP) Sensor
MDP sensor converts negative air pressure in intake manifold plenum into voltage signals sent to PCM. PCM monitors Exhaust Gas Recirculation (EGR) system using these signals.

Park/Neutral Position (PNP) Switch (Automatic Transmission)
PNP switch senses position of transmission select lever, indicating engine load due to automatic transmission engagement. Based on this signal, PCM commands IAC motor to increase throttle angle, maintaining optimum idle speed.

Power Steering Oil Pressure Switch
Switch detects increase in power steering oil pressure. When power steering oil pressure increases, switch contacts close, signaling PCM. PCM commands IAC motor, raising idle speed to compensate for drop in engine RPM due to power steering load.

Throttle Position (TP) Sensor
TP sensor is a variable resistor mounted on throttle body. PCM uses voltage signal from TP sensor to determine throttle plate angle.

Vehicle Speed Sensor (VSS)
Mounted on transaxle/transmission, VSS sends a pulsing signal to PCM for vehicle speed calculation. PCM uses this calculation for cruise control and fuel cut-off.

Volume Airflow (VAF) Sensor
Incorporated in airflow sensor assembly, VAF sensor measures intake airflow rate. Intake air flows through tunnel in airflow sensor assembly. VAF sensor sends frequency signal to PCM. PCM uses signal to adjust fuel injection rate.

OUTPUT SIGNALS

NOTE: Vehicles are equipped with various combinations of computer-controlled components. Not all components listed below are used on every vehicle. For theory and operation on each output component, refer to system indicated after component.

Data Link Connector (DLC)
See SELF-DIAGNOSTIC SYSTEM.

EGR Control Solenoid Valve
See EXHAUST GAS RECIRCULATION (EGR) CONTROL under EMISSION SYSTEMS.

Fuel Injectors
See FUEL CONTROL under FUEL SYSTEM.

Fuel Pressure Control Solenoid Valve (Turbo)
See FUEL DELIVERY under FUEL SYSTEM.

Fuel Pressure Regulator
See FUEL DELIVERY under FUEL SYSTEM.

Idle Air Control (IAC) Motor
See IDLE SPEED under FUEL SYSTEM.

Malfunction Indicator Light
See SELF-DIAGNOSTIC SYSTEM.

Power Transistor(s) & Ignition Coils
See IGNITION SYSTEMS.

Purge Control Solenoid Valve
See EVAPORATIVE CONTROL under EMISSION SYSTEMS.

Wastegate Control Solenoid Valve
See TURBOCHARGED ENGINES under AIR INDUCTION SYSTEM.

FUEL SYSTEM

FUEL DELIVERY

Electric fuel pump, located in gas tank, feeds fuel through in-tank fuel filter, external fuel filter (located in engine compartment) and fuel injector rail.

Fuel Pump
Fuel pump consists of a motor-driven impeller. Pump has an internal check valve to maintain system pressure, and a relief valve to protect fuel pressure circuit. Pump receives voltage supply from MFI control relay.

Fuel Pressure Control Solenoid Valve (Turbo)
Valve prevents rough idle due to fuel percolation. On engine restart, if engine coolant or intake air temperature reaches a preset value, PCM applies voltage to fuel pressure control solenoid valve for 2 minutes after enginerestart. Valve will open, allowing atmospheric pressure to be applied to fuel pressure regulator diaphragm. This allows maximum available fuel pressure at injectors, enriching fuel mixture and maintaining stable idle at high engine temperatures.

Fuel Pressure Regulator
Located on fuel injector rail, this diaphragm-operated relief valve adjusts fuel pressure according to engine manifold vacuum.
As engine manifold vacuum increases (closed throttle), fuel pressure regulator diaphragm opens relief valve, allowing pressure to bleed off through fuel return line, reducing fuel pressure.
As engine manifold vacuum decreases (open throttle), fuel pressure regulator diaphragm closes valve, preventing pressure from bleeding off through fuel return line, increasing fuel pressure.

FUEL CONTROL

Fuel Injectors
Fuel is supplied to engine through electronically pulsed

(timed) injector valves located on fuel rail(s). PCM controls amount of fuel metered through injectors based on information received from sensors.

IDLE SPEED

Air Conditioning (A/C) Relay

When A/C is turned on with engine at idle, PCM signals IAC motor to increase idle speed. To prevent A/C compressor from switching on before idle speed has increased, PCM momentarily opens A/C relay circuit.

Idle Air Control (IAC) Motor

Motor controls pintle-type air valve to regulate volume of intake air at idle.

During start mode, PCM controls idle intake air volume according to Engine Coolant Temperature (ECT) sensor input. After starting, with idle position switch activated (throttle closed), fast idle speed is controlled by IAC motor and fast idle air control valve (if equipped).

When idle switch is deactivated (throttle open), IAC motor moves to a preset position in accordance with ECT sensor input.

PCM signals IAC motor to increase engine RPM in the following situations: A/T (if applicable) is shifted from Neutral to Drive, A/C is turned on, or power steering pressure reaches a preset value.

IGNITION SYSTEMS

DIRECT IGNITION SYSTEM (DIS)

Depending on number of cylinders, ignition system is a 2 or 3-coil distributorless ignition system. On DOHC V6 engines, Camshaft Position (CMP) sensor is located beside camshaft in front of engine. On all other engines equipped with DIS, CMP sensor is a separate unit mounted in place of distributor. On DOHC 4-cylinder, DOHC V6 and 1.8L 4-cylinder engines with California emissions, Crankshaft Position (CKP) sensor is located beside crankshaft in front of engine. PCM determines TDC based on pulse signals received from sensors and then controls MFI and ignition timing.

Power Transistors & Ignition Coils

Based on crankshaft position and CMP sensor inputs, PCM controls timing and directly activates each power transistor to fire coils. On 4-cylinder engines, power transistor "A" controls primary current of ignition coil "A" to fire spark plugs on cylinders No. 1 and No. 4 at the same time. Power transistor "B" controls primary current of ignition coil "B" to fire spark plugs on cylinders No. 2 and No. 3 at the same time. On V6 engines, companion cylinders No. 1 and 4, 2 and 5, and 3 and 6 are fired together.

On all models, although each coil fires 2 plugs at the same time, ignition takes place in only one cylinder, since the other cylinder is on its exhaust stroke when plug fires.

HALL EFFECT IGNITION SYSTEM

This system is equipped with a Hall Effect distributor. Shutter(s) attached to distributor shaft rotate through distributor Hall Effect switch, also referred to as a Camshaft Position (CMP) sensor, which contains a distributor pick-up (a Hall Effect device and magnet). As shutter blade(s) pass through pick-up, magnetic field is interrupted and voltage is toggled between high and low. PCM uses this data along with Crankshaft Position (CKP) sensor data to control

ignition timing and injector pulse width to maintain optimum driveability.

Power Transistor & Ignition Coil

Power transistor is mounted inside distributor with disc and optical sensing unit. When ignition is on, ignition coil primary circuit is energized. As distributor shaft rotates, disc rotates, triggering optical sensing unit. PCM receives signals from optical sensing unit. Signals are converted and sent to power transistor, interrupting primary current flow and inducing secondary voltage.

IGNITION TIMING CONTROL SYSTEM

Ignition timing is controlled by PCM. PCM adjusts timing based on various conditions such as engine temperature, altitude and detonation.

EMISSION SYSTEMS

EXHAUST GAS RECIRCULATION (EGR) CONTROL

Federal Emissions (Non-Turbo)

To lower oxides of nitrogen (NOx) exhaust emissions, a non-computer controlled exhaust gas recirculation system is used. EGR operation is controlled by throttle body ported vacuum. Vacuum is routed through vacuum control valve to prevent EGR operation at low engine temperatures.

Spring pressure holds EGR valve closed during low vacuum conditions (engine idling or wide open throttle). When vacuum pressure increases and overcomes EGR spring pressure, EGR valve is lifted to allow exhaust gases to flow into intake manifold for combustion.

California Emissions & Turbo

PCM controls EGR operation by activating EGR control solenoid valve according to engine load. When engine is cold, PCM signals EGR control solenoid valve to deactivate EGR.

EGR Control Solenoid Valve

Valve denies or allows vacuum supply to EGR valve based on PCM commands.

EVAPORATIVE CONTROL

Fuel evaporation system prevents fuel vapor from entering atmosphere. System consists of the following: special fuel tank with vapor separator tanks (if equipped), vacuum relief filler cap, overfill limiter(2-way valve), fuel check valve, thermovalve (if equipped), charcoal canister, purge control valve, purge control solenoid valve, and connecting lines and hoses.

Purge Control Solenoid Valve

When engine is off, fuel vapors are vented into charcoal canister. When engine is warmed to normal operating temperature and running at speeds greater than idle, PCM energizes purge control solenoid valve, allowing vacuum to purge valve.

Canister vapors are then drawn through purge valve into intake manifold for burning. Purge control solenoid valve remains closed during idle and engine warm-up to reduce HC (hydrocarbons) and CO (carbon monoxide) emissions.

POSITIVE CRANKCASE VENTILATION (PCV) VALVE

PCV valve operates in closed crankcase ventilation system. Closed crankcase ventilation system consists of PCV valve, oil separator, breather and ventilation hoses.

PCV valve is a one-way check valve located in valve cover. When engine is running, manifold vacuum pulls PCV valve open, allowing crankcase fumes to enter intake manifold. If engine backfires through intake manifold, PCV valve closes to prevent crankcase combustion.

SELF-DIAGNOSTIC SYSTEM

NOTE: PCM diagnostic memory is retained by direct power supply from battery. Memory is not erased by turning off ignition, but it will be erased if battery or PCM is disconnected.

Self-diagnostic system monitors input and output signals through the Data Link Connector (DLC). Diagnostic Trouble Codes (DTCs) can only be read using a scan tester. For additional information, see appropriate G - TESTS W/CODES - 3.0L article.

Malfunction Indicator Light (MIL)

MIL (CHECK ENGINE light) comes on when ignition is turned on. MIL remains on for several seconds after engine has started. If an abnormal input signal occurs, MIL comes on and code is stored in memory. If an abnormal input signal returns to normal, PCM turns MIL off, but code remains stored in memory until it is cleared. If ignition is turned on again, MIL will not come on until PCM detects malfunction during system operation.

TRANSFER CASE

1997-99 Mitsubishi Montero Sport

1997-99 TRANSFER CASES
Mitsubishi

Montero Sport

APPLICATION

TRANSFER CASE APPLICATION

Application & Model	Transfer Case Model
1997-98 Montero Sport	V5MT1

DESCRIPTION & OPERATION

Transfer case is a part-time, 2-speed unit with a 3-piece aluminum case. Transfer case has a floor-mounted shifter and integral speedometer gear.

WARNING: When battery is disconnected, vehicles equipped with computers may lose memory data. When battery power is restored, driveability problems may exist on some vehicles. These vehicles may require a relearn procedure. See COMPUTER RELEARN PROCEDURES in APPLICATIONS & IDENTIFICATION.

LUBRICATION

Capacity of transfer case is 2.4 qts. (2.3L). Use SAE 75W/90 or 75W/85 API GL-4 gear oil.

TESTING

4WD INDICATOR CONTROL UNIT

Remove right front kick panel to access 4WD indicator control unit. Measure voltage with control unit and harness still connected. Ground terminal No. 8, then measure voltage and responses as shown. See Figs. 1 and 2.

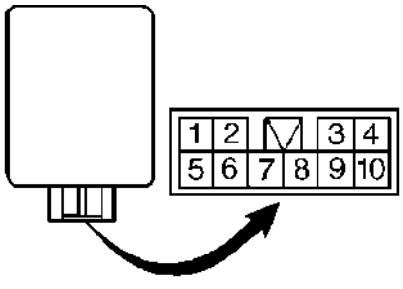


Fig. 1: 4WD Indicator Control Unit Pin Numbers
Courtesy of Mitsubishi Motor Sales of America.

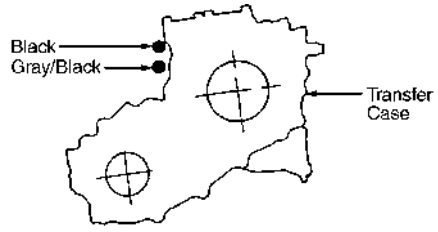
TERMINAL NO.	INSPECTION ITEM	INSPECTION CONDITION 1: IGNITION SWITCH	INSPECTION CONDITION 2: TRANSFER LEVER POSITION	TERMINAL VOLTAGE
1	Free-wheel engage switch	ON	2H	System voltage
			4H [1]	0V
2	4WD detection switch	ON	2H	System voltage
			4H, 4L	0V
3	Ignition switch	OFF	–	0V
		ON	–	System voltage
6	High/low detection switch	ON	Shifting from 4H to 4L or vice versa	System voltage
			2H, 4H, 4L	0V
7	Free-wheel clutch changeover solenoid valve	ON	4H, 4L	0V
			2H [2]	System voltage
10	4WD indicator light	ON	2H	0V
			4H, 4L	System voltage

NOTE
1: When vehicle has been moved once.
2: Shift the lever from 4H, to 2H, and then turn the ignition switch to OFF and then back to ON.

98J07930
Fig. 2: 4WD Indicator Control Unit Test Chart
Courtesy of Mitsubishi Motor Sales of America.

4WD DETECTION SWITCH & H-L DETECTION SWITCH

Check continuity between Black connector terminals No. 1 and 2 on side of transfer case. In 2H position, there should be no continuity. In 4H position, there should be continuity. Check continuity between the Gray/Black connector terminals No. 1 and 2 on side of transfer case. In 4H position, there should be continuity. Between 4H position and 4L position, there should be no continuity. In 4L position, there should be continuity. See Fig. 3.



99B04273
Fig. 3: Location Of Detection Switch Connectors On Transfer Case
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

TRANSFER CASE

Removal

1) Remove negative battery cable. Remove transfer case skid plate, if equipped. Scribe alignment marks and remove both drive shafts. Drain transfer case oil. Disconnect wiring harness from backup light switch, all 4WD switches, and other electrical connectors.

2) Disconnect speedometer cable from drive. Unclip cable from case. Place transfer case in 2H position and transmission in Neutral position. Remove bolts holding control lever assembly. Remove control lever assembly and gasket. Remove transfer case mount. Remove case-to-adapter bolts and remove transfer case.

Installation

To install, reverse removal procedure. Tighten transfer case-to-adapter bolts and nuts to 30 ft. lbs. (40 N.m).

TRANSFER CASE DISASSEMBLY

Disassembly (V5MT1-2)

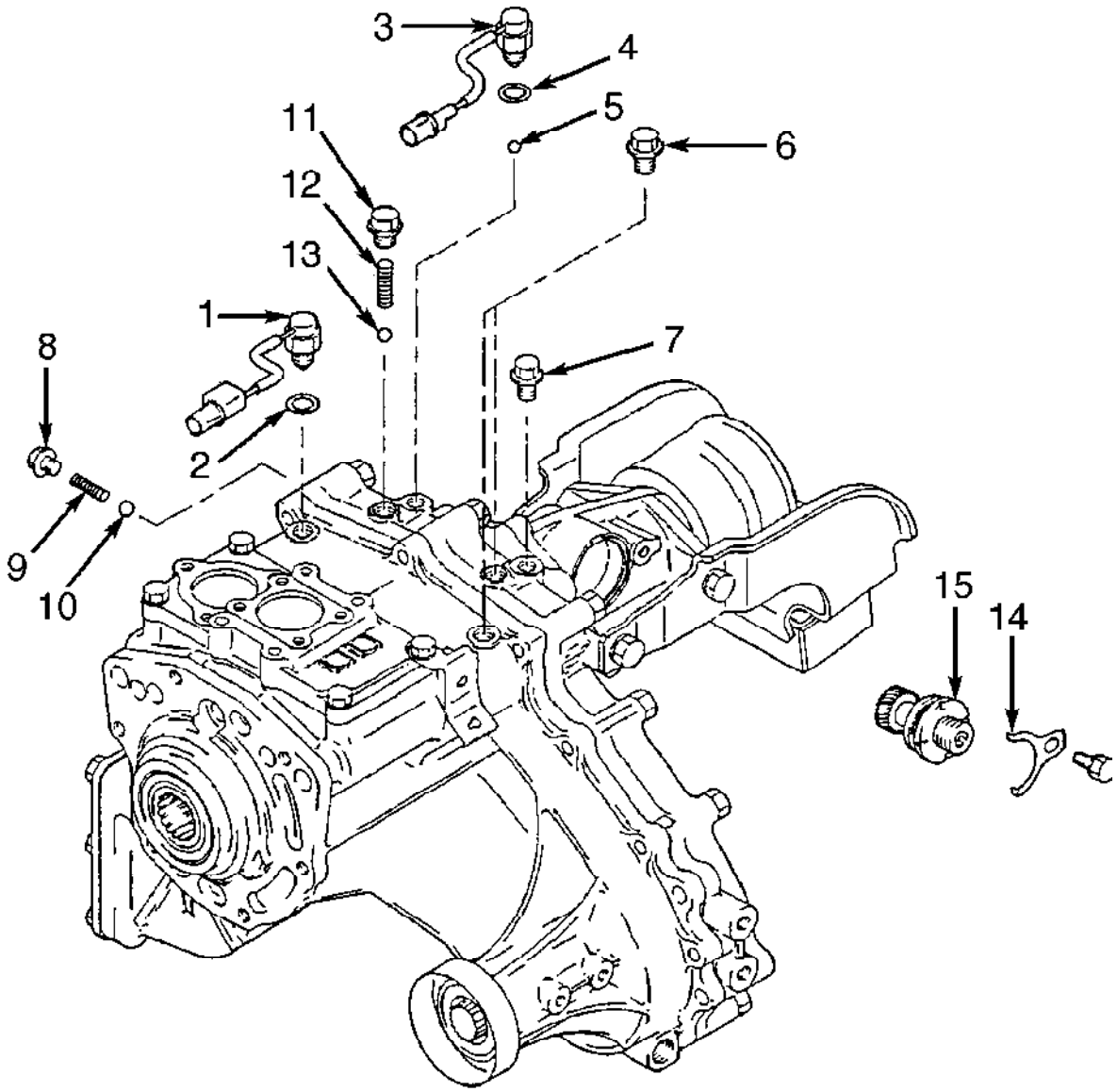
1) Remove 2-4WD detection switch and gasket. Remove H-L detection switch and gasket. Remove steel ball. Remove 3 plugs from top of transfer case (one plug has spring and steel ball). Remove plug, spring and steel ball from side of transfer case. Remove speedometer sleeve clamp and speedometer gear. See Fig. 4.

2) Remove plug from rear of transfer case, near dynamic damper. Remove both H-L shift rail plugs. Remove dynamic damper. Remove cord fastener, control housing cover and stopper bracket. Remove rear cover, spacer, snap ring, dust seal guard and oil seal. Remove rear cover from transfer case, with spacer and wave spring. See Fig. 5.

3) Place 2-4WD shift rail at 4WD position, remove chain cover, then remove spring pin and H-L shift rail assembly. See Fig. 6. Remove interlock plunger from shift rail assembly. Remove side cover and gasket. Remove counter gear bolt and lock plate. Remove counter gear shaft, toward transmission case side, and remove "O" ring. Remove counter gear, thrust washer, needle bearings and spacer. Remove snap ring from end of shift rail assembly, near 2-4WD shift fork. Remove spring and seats.

4) Remove spring pin near front end of shift rail, then remove 2-4WD shift rail, distance piece and 2-4WD shift lug. Remove rear output shaft assembly, chain, and front output shaft together. Note position and rotation direction of chain for proper reinstallation.

5) Remove 2-4WD shift fork and H-L shift fork. Remove H-L clutch sleeve and needle bearing from rear output shaft location in housing. Remove snap ring and input gear from transfer case housing. See Fig. 7. Remove oil seal, baffle plate, dust seal guard and 2 oil seals from front of transfer case housing.



1. 4WD Detection Switch
2. Gasket
3. L-H Detection Switch
4. Gasket
5. Steel Ball
6. Plug
7. Plug
8. Plug
9. Spring
10. Steel Ball
11. Plug
12. Spring
13. Steel Ball
14. Speedometer Sleeve Clamp
15. Speedometer Gear

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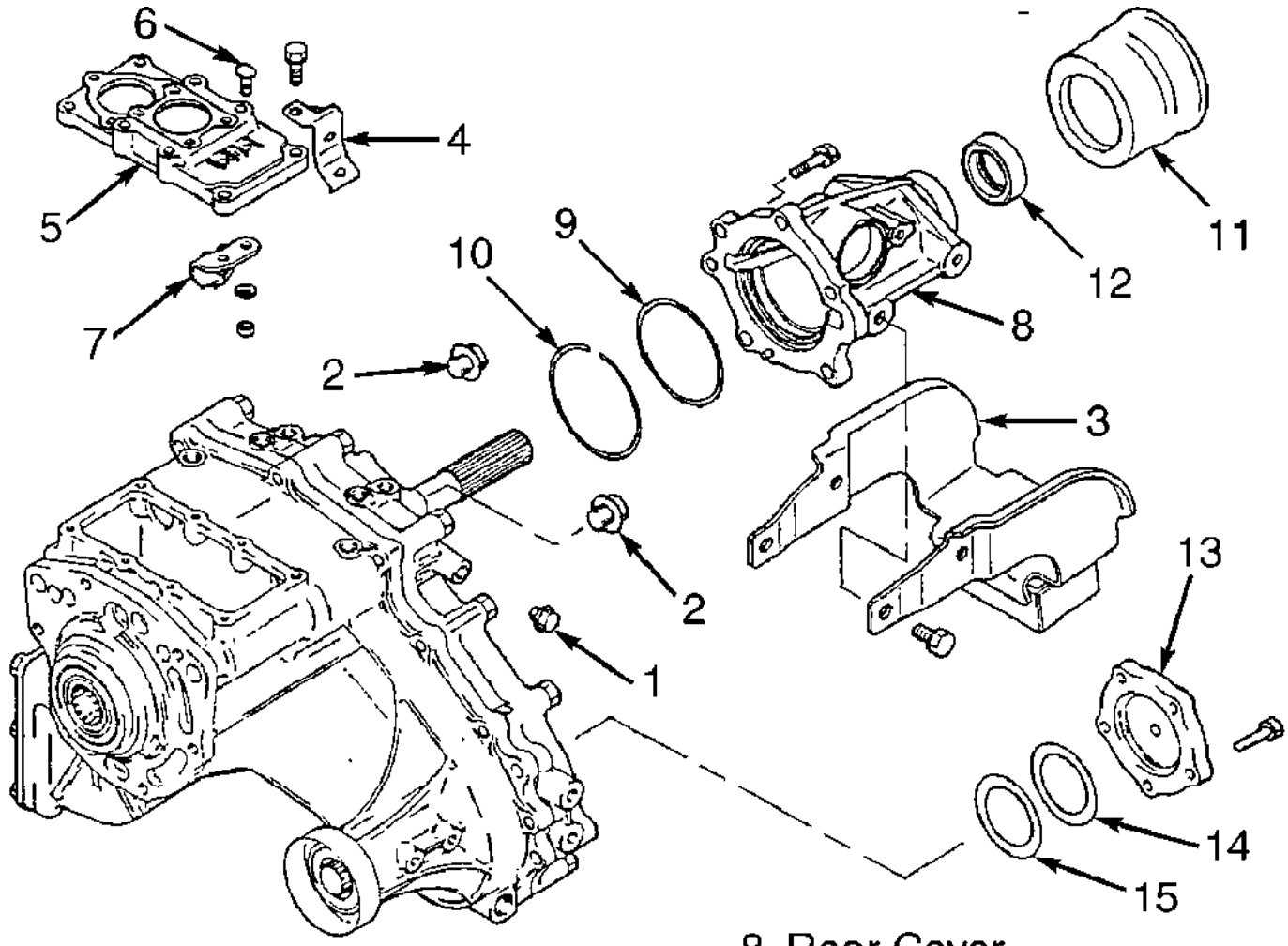
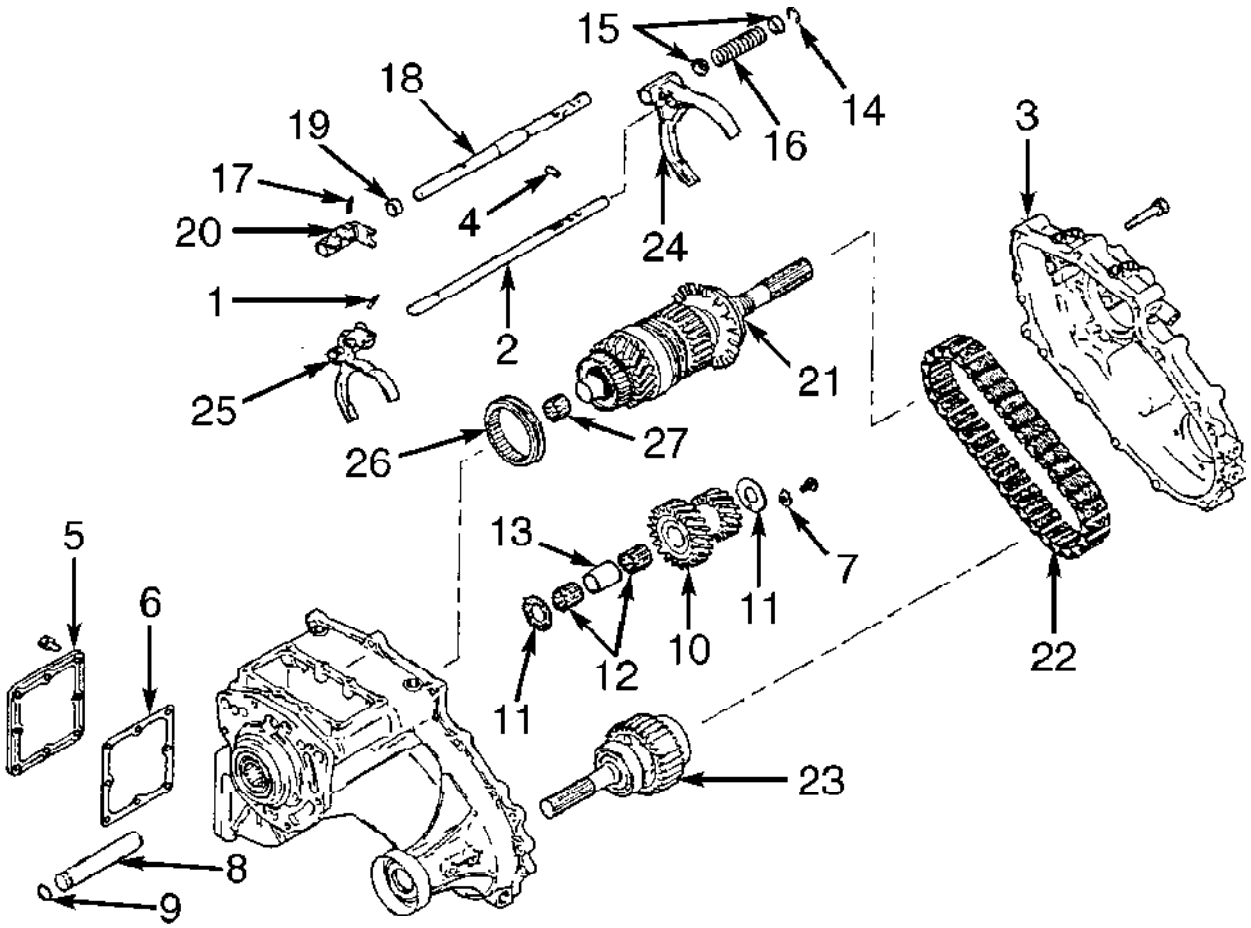
Fig. 4: External Transfer Case Components
Courtesy of Mitsubishi Motor Sales of America.



1. Plug
2. H-L Shift Rail Plug
3. Dynamic Damper
4. Cord Fastener
5. Control Housing Cover
6. Bolt
7. Stopper Bracket
8. Rear Cover
9. Spacer
10. Snap Ring
11. Dust Seal Guard
12. Oil Seal
13. Cover
14. Spacer
15. Wave Spring

99G04275

Fig. 5: Exploded View Of Rear Cover & Related Components
Courtesy of Mitsubishi Motor Sales of America.



1. Spring Pin
2. H-L Shift Rail
3. Chain Cover
4. Interlock Plunger
5. Side Cover
6. Side Cover Gasket
7. Lock Plate
8. Countergear Shaft
9. "O" Ring
10. Countergear
11. Thrust Washer
12. Needle Bearing
13. Bearing Spacer
14. Snap Ring
15. Spring Seat
16. Spring
17. Spring Pin
18. 2-4WD Shift Rail
19. Distance Piece
20. 2-4WD Shift Lug
21. Rear Output Shaft
22. Chain
23. Front Output Shaft
24. 2-4WD Shift Fork
25. H-L Shift Fork
26. H-L Clutch Sleeve
27. Needle Bearing

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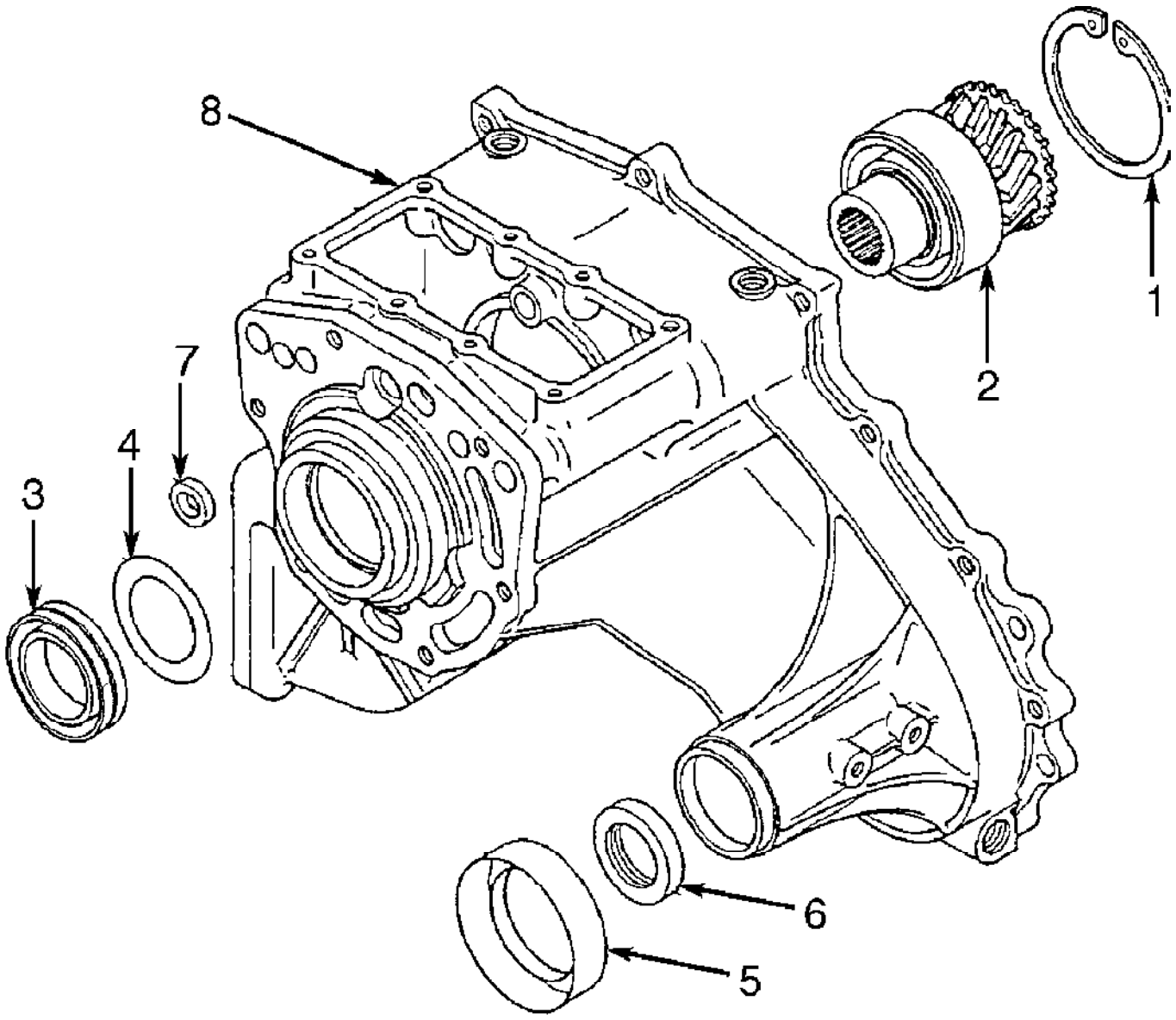
Fig. 6: Exploded View Of Transfer Case Gear Assembly
Courtesy of Mitsubishi Motor Sales of America.



1. Snap Ring
2. Input Gear
3. Oil Seal
4. Baffle Plate
5. Dust Seal Guard
6. Oil Seal
7. Oil Seal
8. Transfer Case

99A04277

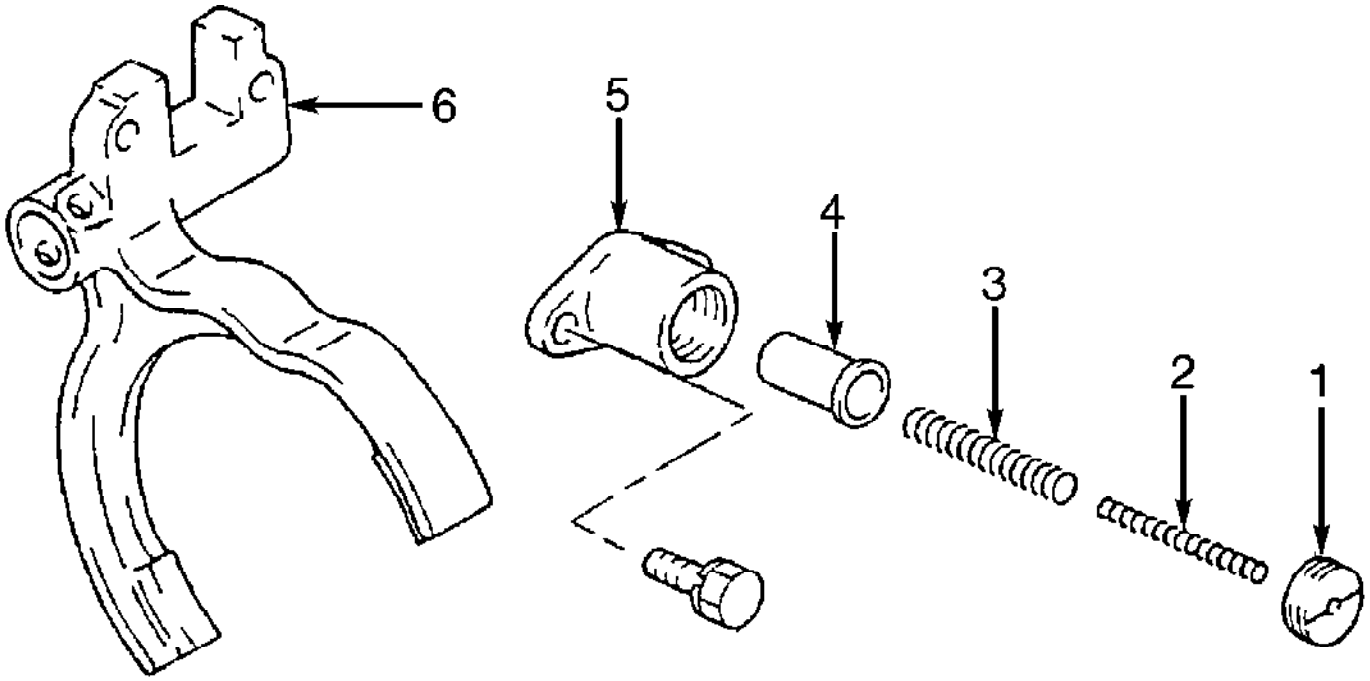
Fig. 7: Exploded View Of Transfer Case & Related Components
Courtesy of Mitsubishi Motor Sales of America.

COMPONENT DISASSEMBLY & REASSEMBLY

H-L SHIFT FORK

Disassembly & Reassembly

Remove plug, 2 return springs, select plunger and plunger boss from side of H-L shift fork. Apply gear oil to all moving surfaces during reassembly. When reassembling, apply Sealant (3M Super Weatherstrip 8001) to return spring plug. Screw plug in until flush with plunger boss housing. Tighten plunger boss housing bolts to 24 ft. lbs. (33 N.m). See Fig. 8.



1. Plug
2. Return Spring
3. Return Spring
4. Select Plunger
5. Plunger Boss
6. H-L Shift Fork

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Fig. 8: Exploded View Of H-L Shift Fork Assembly
Courtesy of Mitsubishi Motor Sales of America.

FRONT OUTPUT SHAFT

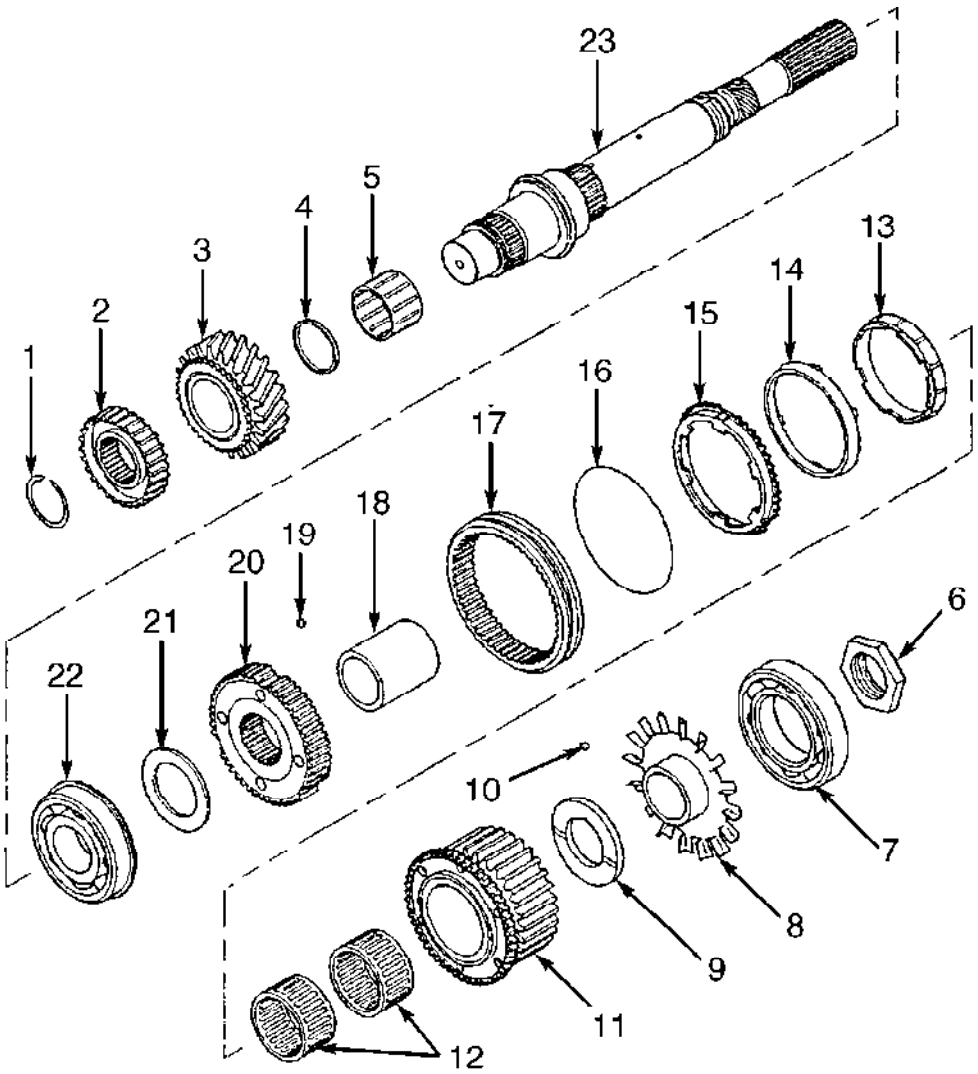
Disassembly & Reassembly

Remove front and rear bearings, using Bearing Remover (MD998801). To install bearings, use Bearing Remover plus Installer Cap, Installer-100, and Adapter (MD998801/12/13/18).

REAR OUTPUT SHAFT

Disassembly

1) Remove snap ring from front end of rear output shaft. Using Bearing Remover (MD998801) with load applied at low speed gear and press at front edge of rear output shaft to remove clutch hub. Remove low speed gear. Remove bearing spacer and needle bearing. See Fig. 9.



1. Snap Ring
2. Clutch Hub
3. Low Speed Gear
4. Bearing Spacer
5. Needle Bearing
6. Jam Nut
7. Radial Ball Bearing
8. Oil Guide
9. Sprocket Spacer
10. Steel Ball
11. Drive Sprocket
12. Needle Bearing
13. Inner Synchronizer Ring
14. Synchronizer Cone
15. Outer Synchronizer Ring
16. Synchronizer Spring
17. Clutch Sleeve
18. Sprocket Sleeve
19. Steel Ball
20. Clutch Hub
21. Stopper Plate
22. Ball Bearing
23. Rear Output Shaft

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Fig. 9: Exploded View Of Rear Output Shaft Assembly
Courtesy of Mitsubishi Motor Sales of America.

2) Chisel staking points from jam nut on rear of rear output shaft. Use Nut Remover (MD998809) to remove jam nut. Use bearing

remover and press off radial ball bearing, if needed. Remove oil guide, sprocket spacer, drive sprocket and needle bearings.

3) Remove inner synchronizer ring, synchronizer cone, outer synchronizer ring and spring. Remove clutch sleeve and steel ball. Use bearing remover and press off clutch hub, if needed. Remove stopper plate and ball bearing.

Reassembly

1) Use Bearing Remover, Installer Cap, and Adapters (MD998801/12/13/14/29) to press ball bearing and stopper plate into position. Use similar tool setup to press clutch hub onto output shaft. Install steel ball and sprocket sleeve. Position clutch sleeve in place with thin side of outer edge facing transfer case front.

2) Assemble synchronizer components, in same order and position as removed. Install needle bearings, drive sprocket and sprocket spacer, with chamfered edge away from drive sprocket. Install oil guide. Press on ball bearing. Use Lock Nut Wrench (MD998809) to install new jam nut to 83 ft. lbs. (112 N.m). Use punch to crimp jam nut at groove in rear output shaft.

3) Install needle bearing on front of rear output shaft, then install bearing spacer and low speed gear. Use Bearing Remover, Installer Cap and Adapter (MD998801/12/21) to install clutch hub. Ensure hub is installed with larger dimples facing transfer case front side. Install new snap ring and ensure clearance between ring and clutch hub is 0-.003" (0-.08 mm). Synchronizer ring-to-cone minimum clearance is .01" (.3 mm).

INPUT GEAR

Disassembly & Reassembly

Remove snap ring. With Bearing Remover (MD998801), press off ball bearing. Remove spacer, snap ring, cone spring (note direction) and sub-gear. Reassemble in reverse order, ensuring cone spring faces same direction as removed. Use Bearing Installers (MD998812/24) to press bearing onto input gear. Install new snap ring so end play will be 0-.002" (0-.06 mm). Snap rings are available in selective sizes to adjust end play to specifications. See Fig. 10.

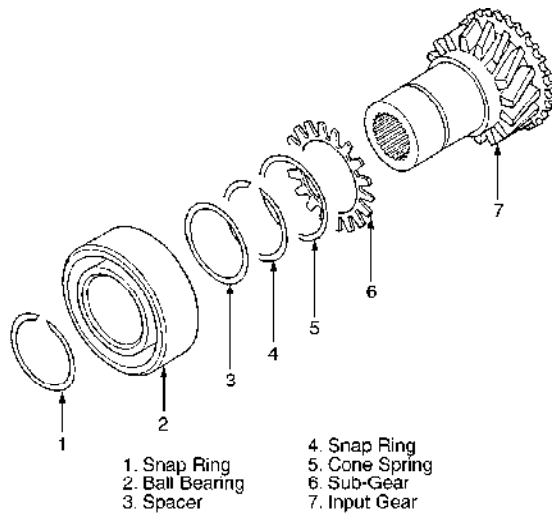

Fig. 10: Exploded View Of Input Gear
Courtesy of Mitsubishi Motor Sales of America.

TRANSFER CASE REASSEMBLY

NOTE: ALWAYS replace all gaskets, oil seals, snap rings and spring pins with new parts. Coat both sides of gaskets and bolt threads with appropriate sealant. Lubricate all sliding and rotating parts with transfer case gear oil before assembling.

1) Install oil seals, dust seal guard and baffle plate to front side of transfer case housing. Install input gear and snap ring to inside of transfer case housing.

2) Install needle bearing and H-L clutch sleeve to rear output shaft. Assemble H-L shift fork and 2-4WD shift fork to shift rails with new retaining pins. Engage output shaft chain precisely with sprocket of rear output shaft and front output shaft, in same position as removed. Install 2-4WD shift fork on clutch sleeve. Install front output shaft, chain and rear output shaft assembly.

3) Ensure thrust washer is installed with tab in groove of transfer case. Install counter gear shaft from transmission case side. Ensure lock plate groove is aligned. Insert interlock plunger into position so it does not interfere with 2-4WD shift rail. Apply sealant to chain cover, in even, thin layer. Insert H-L shift rail into hole, noting direction of shift rail as removed. Align spring pin holes on shift rail with shift fork, then tap spring pin so slit of spring pin is facing shaft center of shift rail.

4) Measure amount of projection of rear bearing from end of front output shaft. Measure depth of indentation in cover. If difference between these measurements (clearance) is more than .07" (2 mm), insert a spacer between cover and wave spring. If clearance is less than specified, use wave spring alone.

5) Measure amount of projection of rear output shaft bearing. Measure depth of bearing relief in rear cover. Difference of these measurements (clearance) should be 0-.003" (0-.1 mm). Select thickness of snap ring needed to achieve this clearance.

6) When installing speedometer gear, match mating marks to number of teeth on gear. When installing springs with steel balls, ensure ball is on small end of spring. Mount position detection switches in their original positions (switches are not interchangeable).

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Chain Cover Bolt	26 (35)
Control Housing Cover Bolt	13 (18)
Cover Bolt	13 (18)
Dynamic Damper Bolt	26 (35)
H-L Detection Switch	25 (34)
H-L Shift Fork Plunger Boss Bolts	24 (33)
H-L Shift Rail Plug	24 (33)
Lock Plate Bolt	13 (18)
Rear Cover Bolts	26 (35)
Rear Output Shaft Jam Nut	83 (112)
Seal Plug	26 (35)
Speedometer Sleeve Clamp Bolt	13 (18)
Stopper Bracket Nut	13 (18)
2-4WD Detection Switch	25 (34)
	INCH Lbs. (N.m)

WIRING DIAGRAMS

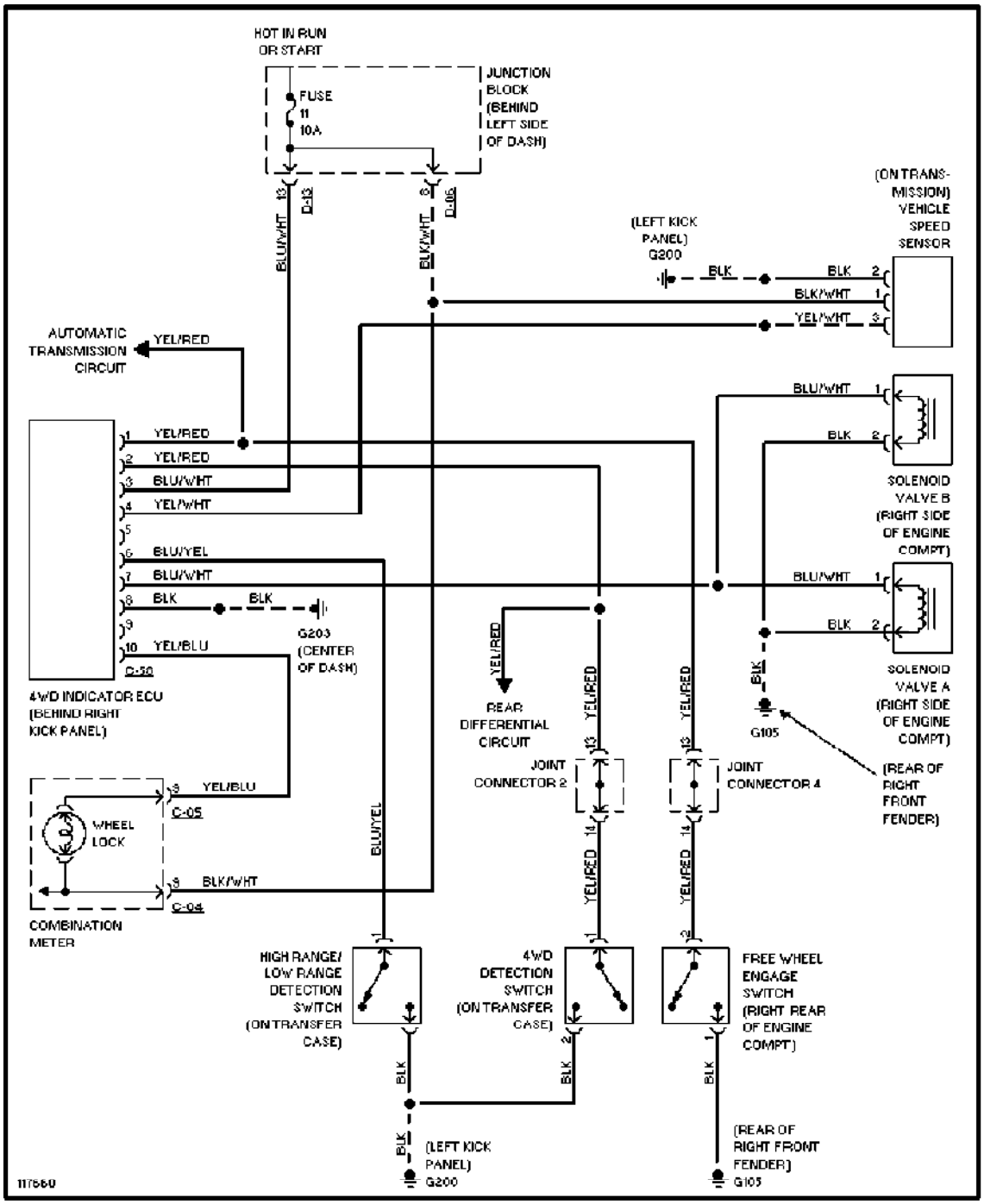

Fig. 11: Transfer Case Wiring Diagram (1997-98 Mitsubishi Montero Sport)

TRANSMISSION REMOVAL & INSTALLATION - A/T

1997-99 Mitsubishi Montero Sport

1997-99 TRANSMISSION SERVICING
Mitsubishi Transmission Removal & Installation

Diamante, Eclipse, Galant, Mirage, Montero, 3000GT

REMOVAL & INSTALLATION

AWD & FWD MODELS

Removal

1) On all models except Galant, remove battery and battery tray. On 3000GT, remove washer tank. On all models, remove air cleaner cover with air inlet hose assembly. Raise and support vehicle. Remove wheels. Remove undercover(s) (if equipped). Disconnect control cables at transaxle. Drain transaxle fluid.

2) On AWD models, remove front exhaust pipe. On all models, disconnect neutral safety switch connector, oil cooler hoses and electrical connectors from transaxle. Disconnect speedometer cable and throttle control cable (if equipped). Remove starter motor.

3) Separate tie rod end. Separate lower ball joint. Separate stabilizer bar connection (if necessary). Remove axle shafts. See appropriate AXLE SHAFTS article in DRIVE AXLES. Remove center crossmember assembly.

4) On AWD models, separate transfer assembly from transaxle. Reference mark transfer assembly-to-drive shaft and remove transfer assembly.

5) On all models, remove transmission inspection (dust) cover. Place index mark on torque converter and drive plate for reassembly reference. Remove torque converter-to-drive plate bolts. Push torque converter away from engine into transaxle.

6) On all 4-cylinder models, support engine. On all models, support transaxle with jack. Remove bolts from transaxle mounts. Remove mounting brackets and remaining transaxle-to-engine bolts. Slide transaxle assembly to right and lower to remove.

CAUTION: Ensure torque converter is fully seated in transaxle before installation. Always install new snap rings on inner constant velocity joints.

Installation

1) To install, reverse removal procedure. Tighten transaxle-to-engine bolts and torque converter-to-drive plate bolts to specification. See TORQUE SPECIFICATIONS.

2) Ensure reference marks on torque converter-to-drive plate and transfer assembly-to-drive shaft align. Tighten mounting bolts with weight of engine and transaxle on mounts. Refill transaxle fluid to specified level. See LUBRICATION in TRANSMISSION SERVICING - A/T article. Adjust all control cables. See ADJUSTMENTS in TRANSMISSION SERVICING - A/T article.

RWD & 4WD MODELS

Removal

1) Disconnect negative battery cable. On Montero 4WD, remove transfer case shift lever knob, dust boot and retainer plate or console. Remove transfer case gearshift assembly.

2) On all models, raise and support vehicle. Remove undercarriage cover and/or skid plate(s). Drain transmission and transfer case (if applicable). Place reference mark on drive shaft(s)

and remove. Disconnect all external solenoid and switch connections.

3) On Montero 4WD, remove catalytic converter and front exhaust pipe. On all models, disconnect speedometer cable and control cables at transmission. Remove starter and bellhousing cover. Place reference mark on torque converter and drive plate for reassembly reference. Remove torque converter bolts. Push torque converter back and away from drive plate.

4) Disconnect transmission cooler lines. Remove oil filler tube. Secure transmission on a jack. Raise transmission slightly to take weight off mount. Remove crossmember-to-mount bolts and crossmember.

5) Remove transfer case mounting bracket and mount (if equipped). Remove transmission-to-engine mounting bolts. Carefully lower transmission from vehicle.

CAUTION: Ensure torque converter is fully seated in transmission before installation.

Installation

1) To install, reverse removal procedure. Tighten transmission-to-engine bolts and torque converter-to-drive plate bolts to specification. See TORQUE SPECIFICATIONS. Tighten mount bolts with weight of engine and transmission on mounts. Ensure reference marks on drive shaft(s) and torque converter-to-drive plate are matched.

2) Apply sealant to transfer case gearshift assembly gasket before installation. Coat transmission oil filler tube "O" ring with transmission fluid before installation. Refill transmission fluid to specified level. See LUBRICATION in TRANSMISSION SERVICING - A/T article. Adjust all control cables. See ADJUSTMENTS in TRANSMISSION SERVICING - A/T article.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS - FWD MODELS

Applications	Ft. Lbs. (N.m)
Ball Joint Nut	74 (100)
Center Crossmember Assembly Front Bolt	69 (93)
Center Crossmember Assembly Rear Bolt	52 (70)
Starter Bolts	22 (30)
Tie Rod End Nut	21 (28)
Torque Converter-To-Drive Plate Bolt	33-38 (45-52)
Transaxle-To-Engine Block Bolt	
8-mm Bolt	(1)
10-mm Bolt	22-25 (30-34)
12-mm Bolt	31-40 (42-54)
Upper Coupling Bolts	
2.4L	35 (48)
3.0L	54 (73)
Lower Coupling Bolts	
2.4L	35 (48)
3.0L	65 (88)

(1) - Tighten to 84-108 INCH lbs. (10-12 N.m).

TORQUE SPECIFICATIONS - RWD MODELS

Applications	Ft. Lbs. (N.m)
Engine-To-Transmission Bolt	65 (88)

Torque Converter-To-Drive Plate Bolt	30 (41)
Transmission-To-Engine Block Bolt	55 (74)

TRANSMISSION SERVICING - A/T

1997-99 Mitsubishi Montero Sport

1997-99 TRANSMISSION SERVICING
Mitsubishi Automatic Transmission

Diamante, Eclipse, Galant, Mirage, Montero, 3000GT

IDENTIFICATION

AUTOMATIC TRANSMISSION APPLICATIONS

Model	Transmission/Transaxle
Diamante	Model F4A51 Transaxle
Eclipse	
AWD	Model W4A33 Transaxle
FWD	
2.0L Non-Turbo	Model F4AC1 Transaxle
2.0L Turbo	Model F4A33 Transaxle
2.4L	Model F4A23 Transaxle
Galant	Model F4A23 Transaxle
Mirage	
1.5L	Model F4A41 Transaxle
1.8L	Model F4A42 Transaxle
Montero	
2WD	Model R4AW3 Transmission
4WD	Model V4AW3 Transmission
3000GT	Model F4A33 Transaxle

LUBRICATION

SERVICE INTERVALS

Transaxle/Transmission
Check fluid level every 12 months or 15,000 miles. Change fluid and filter every 30,000 miles. If vehicle is operated under severe conditions, change fluid more often. If severe darkening of fluid and strong odor are noted, bands should also be adjusted.

Transfer Case
On 4WD and AWD models, change transfer case fluid every 30,000 miles.

CHECKING FLUID LEVEL

Transaxle/Transmission
1) Park vehicle on level area. Ensure oil is at normal operating temperature, parking brake is engaged, and engine is at idle. Move gear selector through each position, stopping briefly at each selection.
2) Place gear selector in Neutral, and clean area around dipstick tube. Ensure fluid level is between lower and upper marks, but never over upper mark, in HOT range. Add or drain fluid if necessary.

CAUTION: If severe darkening of fluid and strong odor are noted, change fluid and filter, and adjust bands.

Transfer Case (All Others)

Lubricant level should be to bottom of fill hole on side of transfer case.

RECOMMENDED FLUID

Transaxle/Transmission
Except Montero, use Diamond ATF SP-II. On Montero, use Dexron-II ATF.

Transfer Cases
Use SAE 75W-85 gear oil with API GL-4 rating or higher.

FLUID CAPACITIES

TRANSAXLE/TRANSMISSION REFILL CAPACITIES

Application	Qts. (L)
Diamante	9.0 (8.5)
Eclipse	
2.0L Non-Turbo	9.1 (8.6)
2.0L Turbo	7.1 (6.7)
2.4L	6.4 (6.1)
Galant	6.3 (6.0)
Mirage	8.2 (7.8)
Montero	10.4 (9.8)
3000GT	7.9 (7.5)

TRANSFER CASE REFILL CAPACITIES

Application	Pts. (L)
Eclipse AWD	1.0 (.5)
Montero	5.3 (2.5)
Montero Sport	4.9 (2.3)
3000GT	.6 (.3)

DRAINING & REFILLING

NOTE: Although manufacturer recommends changing only fluid, the oil filter/screen may also require replacement. If replacing oil filter/screen, note length and location of all bolts.

Transaxle (Except Montero)
1) Remove drain plug(s), and drain fluid. Some models may contain a drain plug located in housing below axle shaft, in oil pan. Remove oil pan. Remove oil filter/screen if necessary.
2) If oil filter/screen is replaced, tighten bolts to specification. See TORQUE SPECIFICATIONS. Clean oil pan, replace gasket, and install oil pan. Tighten oil pan bolts and drain plug to specification. See TORQUE SPECIFICATIONS. Ensure dipstick hole area is clean. Fill transmission with Diamond ATF SP-II, through filler tube, until COLD level is reached on dipstick.
3) Start engine and allow to idle for 2 minutes. Shift transaxle to each position, ending in Neutral. Add sufficient fluid to reach lower mark. After reaching normal operating temperature, fluid should be between upper and lower marks of HOT range on dipstick.

Transmission (Montero)
1) Remove drain plug (if equipped) from transmission pan, and allow fluid to drain. On models without drain plug, oil pan must be

removed to drain fluid. Remove oil filter/screen if necessary.

2) If oil filter/screen is replaced, tighten bolts to specification. See TORQUE SPECIFICATIONS. Clean oil pan, replace gasket, and install oil pan. Tighten oil pan bolts and drain plug to specification. See TORQUE SPECIFICATIONS. Ensure dipstick hole area is clean. Fill transmission with Dexron-II ATF, through filler tube, until COLD level is reached on dipstick. Start engine, and allow to idle for 2 minutes.

3) Shift transmission into each position, ending in Neutral. Check fluid level with engine running at idle. If necessary, add sufficient fluid to bring level to lower mark of dipstick. Recheck fluid level after transmission is at normal operating temperature.

Transfer Case

Drain plug is located on bottom of transfer case. Change drain plug gasket whenever fluid is changed. Lubricant level should be at bottom of fill hole on side of transfer case.

ADJUSTMENTS

KICKDOWN SERVO

Eclipse, Galant & 3000 GT

1) Remove all dirt and grease around kickdown servo switch. Remove snap ring and kickdown servo switch.

2) To prevent servo piston from turning, install Adapter (MD998915) and Kickdown Servo Wrench (MD998918) so tab of wrench engages with notch of piston. See Fig. 1.

CAUTION: DO NOT push servo piston inward while installing adapter and servo wrench. Install adapter in brake pressure port by hand ONLY. DO NOT use wrench to tighten adapter.

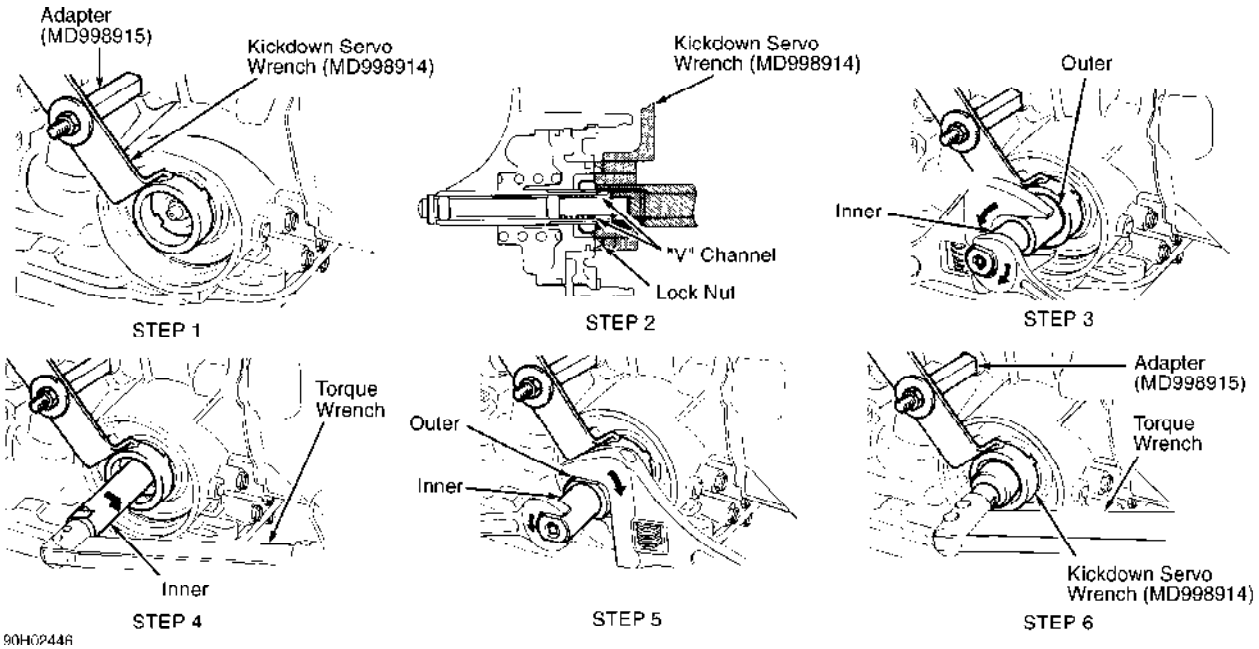

Fig. 1: Adjusting Kickdown Servo (Eclipse, Galant & 3000 GT)
Courtesy of Mitsubishi Motor Sales of America.

3) Loosen lock nut to "V" channel of adjuster rod. Tighten inner section of Kickdown Service Adjustment Assembly (MD998916) until

it contacts lock nut. See Fig. 1.

4) Install outer section of kickdown service adjustment assembly on lock nut. Rotate outer section to left and inner section to right to contact lock nut with inner section.

5) Using an INCH-lb. torque wrench on inner section, tighten inner section to 89 INCH lbs. (10 N.m), and then loosen inner section. Tighten inner section to 44 INCH lbs. (5 N.m).

CAUTION: Before tightening lock nut with torque wrench, tighten it by hand until it contacts piston. If torque wrench is used initially, lock nut and adjustment rod may rotate together.

6) Back off outer section 2-2 1/4 turns. Rotate outer section to right and inner section to left until inner section is free of lock nut. Tighten lock nut by hand until it contacts piston. Using torque wrench, tighten lock nut to 18-23 ft. lbs. (25-32 N.m).

7) Remove adapter and kickdown servo wrench. Install new "O" ring in groove around switch. Install switch and snap ring.

SHIFT LINKAGE

Except Montero

1) Ensure shift and transaxle/transmission levers are both in Neutral position. Loosen adjusting nut on control cable. See Fig. 2. Loosen park/neutral position switch body bolts. Rotate park/neutral position switch until hole in end of transmission manual control lever is aligned with hole (cross section A-A) in flange of park/neutral position switch body. Tighten park/neutral position switch body bolts. Ensure holes in park/neutral position switch flange and transmission manual control lever stay aligned.

2) Gently pull control cable from dust cover. Make sure shift lever is still in Neutral. Tighten adjusting nut. Check transaxle/transmission operation through all ranges. Readjust control cable if necessary.

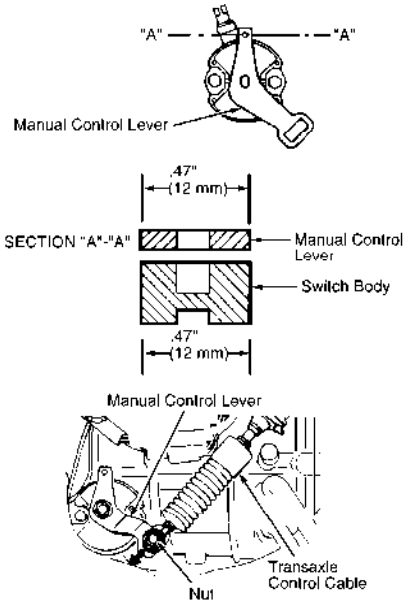

Fig. 2: Adjusting Shift Cable (Except Montero)
Courtesy of Mitsubishi Motor Sales of America.

Montero

Ensure shift and transmission levers are both in Neutral

position. Loosen adjusting nut on control cable. See Fig. 3. Gently pull control cable from dust cover. Make sure shift lever is still in Neutral. Tighten adjusting nut. Check transmission operation through all ranges. Readjust control cable if necessary.

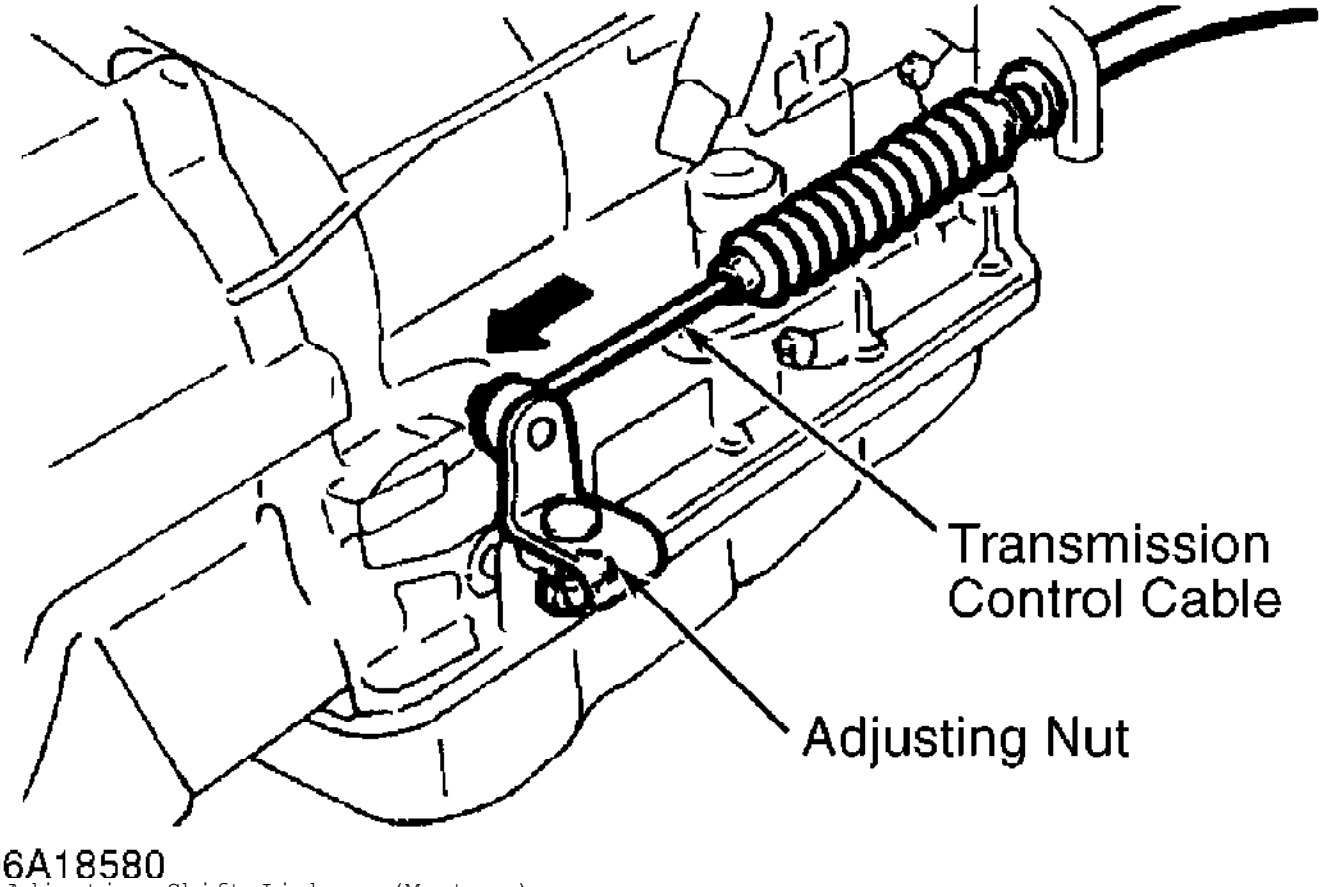

Fig. 3: Adjusting Shift Linkage (Montero)
Courtesy of Mitsubishi Motor Sales of America.

SHIFT LEVER SLEEVE

Eclipse & Galant

To adjust shift lever sleeve, remove shift handle on top of shift lever. With lever in Neutral, turn sleeve so distance between sleeve and lever end is within specification. See SHIFT LEVER SLEEVE CLEARANCE SPECIFICATION table. See Fig. 4. Ensure beveled side of sleeve faces toward push button (if equipped).

SHIFT LEVER SLEEVE CLEARANCE SPECIFICATION

Application	Clearance In. (mm)
Eclipse & Galant	.62-.64 (15.7-16.3)

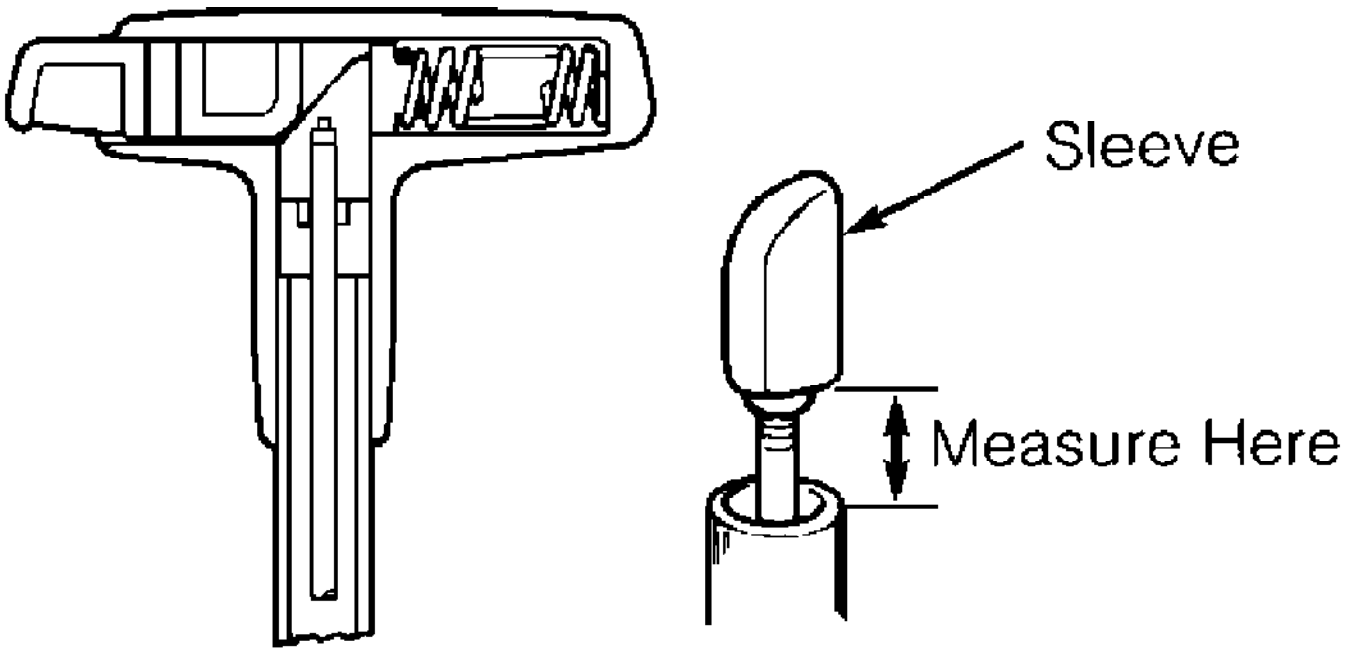

Fig. 4: Adjusting Shift Lever Sleeve (Eclipse & Galant)
Courtesy of Mitsubishi Motor Sales of America.

NEUTRAL SAFETY SWITCH

All Models

Neutral safety switch is adjusted along with shift linkage. See SHIFT LINKAGE.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Drain Plug	
Transaxle/Transmission	
Except Montero	22-25 (30-35)
Montero	13-17 (18-24)
Transfer Case	24 (32)
Rear Cover	17 (23)
	INCH Lbs. (N.m)
Kickdown Servo Lock Nut	121 (29)
Oil Filter/Screen Bolt	
Except Montero	48-60 (5.4-6.8)
Montero	61 (6.9)
Oil Pan Bolt	
Except Montero	84-108 (9.5-12.2)
Montero	69 (7.8)
Park/Neutral Switch Mounting Bolt (Except Montero)	97 (11)
Park/Neutral Switch Mounting Bolt (Montero)	115 (13)
Transmission Control Cable Adjusting Nut	115 (13)
Valve Body Cover	97 (11)

TRANSMISSION SERVICING - M/T

1997-99 Mitsubishi Montero Sport

1997-99 TRANSMISSION SERVICING
Mitsubishi Manual Transmission

Eclipse, Galant, Mirage, Montero, 3000GT

IDENTIFICATION

MANUAL TRANSMISSION APPLICATIONS

Model	Transmission/Transaxle (Model)
Eclipse	
AWD	5-Speed Transaxle (W5M33)
FWD	
2.0L Non-Turbo	5-Speed Transaxle (F5MC1)
2.0L Turbo	5-Speed Transaxle (F5M33)
2.4L	5-Speed Transaxle (F5M31)
Galant	5-Speed Transaxle (F5M31)
Mirage	
1.5L	5-Speed Transaxle (F5M41)
1.8L	5-Speed Transaxle (F5M42)
Montero	
2WD	5-Speed Transmission (R5M21)
4WD	5-Speed Transmission (V5MT1)
3000GT	
SOHC & DOHC Non-Turbo	5-Speed Transaxle (F5M33)
DOHC Turbo	6-Speed Transaxle (W6MG1)

LUBRICATION

SERVICE INTERVALS

Check transaxle/transmission and transfer case fluid level every 30,000 miles. Change fluid at 30,000 miles if operated under severe conditions.

CHECKING FLUID LEVEL

Transaxle/Transmission
Check fluid level at fill hole on side of transaxle or transmission. Lubricant must be at bottom of fill hole.

Transfer Case
Transfer case contains separate drain and fill plugs. Lubricant must be at bottom of fill hole.

RECOMMENDED FLUID

Transaxle/Transmission
Use API classification GL-4 or higher SAE 75W-85W gear oil.

Transfer Case
Use API classification GL-4 or higher SAE 75W-85W gear oil.

FLUID CAPACITIES

TRANSAXLE/TRANSMISSION REFILL CAPACITIES

Application	Pts. (L)
Eclipse	
2.0L	4.2 (2.0)
2.0L Turbo	4.9 (2.3)
2.4L	4.9 (2.3)
Galant	4.6 (2.2)
Mirage	
1.5L	4.4 (2.1)
1.8L	4.6 (2.2)
Montero	
2.4L	4.9 (2.3)
3.0L	5.3 (2.5)
3000GT	
Non-Turbo	4.2 (2.0)
Turbo	5.0 (2.4)

TRANSFER CASE REFILL CAPACITIES

Application	Pts. (L)
Eclipse	1.1 (0.5)
Montero	
2.4L	5.3 (2.5)
3.0L	4.9 (2.3)
3000GT	1.3 (0.6)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Except Montero 4WD	
Transfer Case Drain Plug & Filler Plug	24 (33)
Transmission Drain Plug & Filler Plug	24 (33)
Montero 4WD	
Transfer Case Drain Plug & Filler Plug	24 (33)
Transmission Drain Plug & Filler Plug	51 (69)

TROUBLE SHOOTING - BASIC PROCEDURES

1997-99 Mitsubishi Montero Sport

GENERAL TROUBLE SHOOTING

*** PLEASE READ THIS FIRST ***

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ACCESSORIES & ELECTRICAL

CHARGING SYSTEM TROUBLE SHOOTING

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BASIC CHARGING SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Vehicle Will Not Start	Dead battery	Check battery cells, alternator belt tension and alternator output
	Loose or corroded battery connections	Check all charging system connections
	Ignition circuit or switch malfunction	Check and replace as necessary
Alternator Light Stays On With Engine Running	Loose or worn alternator drive belt	Check alternator drive tension and condition, See Belt Adjustment in TUNE-UP article in the TUNE-UP section
	Loose alternator wiring connections	Check all charging system connections
	Short in alternator light wiring	See Indicator Warning Lights in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
	Defective alternator stator or diodes	See Bench Tests in ALTERNATOR article
	Defective regulator	See Regulator Check in

		ALTERNATOR article
Alternator Light Stays Off With Ignition Switch ON	Blown fuse	See WIRING DIAGRAMS
	Defective alternator	See Testing in ALTERNATOR article
	Defective indicator light bulb or socket	See Indicator Warning Lights in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Alternator Light Stays OFF With Ignition Switch ON	Short in alternator wiring	See On-Vehicle Tests in ALTERNATOR article
	Defective rectifier bridge	See Bench Tests in ALTERNATOR article
Lights or Fuses Burn Out Frequently	Defective alternator wiring	See On-Vehicle Tests in ALTERNATOR article
	Defective regulator	See Regulator Check in ALTERNATOR article
	Defective battery	Check and replace as necessary
Ammeter Gauge Shows Discharge	Loose or worn drive belt	Check alternator drive belt tension and condition. See Belt Adjustment in TUNE-UP article in the TUNE-UP section
	Defective wiring	Check all wires and wire connections
	Defective alternator or regulator	See Bench Tests and On-Vehicle Tests in ALTERNATOR article
	Defective ammeter, or improper ammeter wiring connection	See Testing in STANDARD INSTRUMENTS in the ACCESSORIES & EQUIPMENT section
Noisy Alternator	Loose drive pulley	Tighten drive pulley attaching nut
	Loose mounting bolts	Tighten all alternator mounting bolts
	Worn or dirty bearings	See Bearing Replacement ALTERNATOR article

	Defective diodes or stator	See Bench Test in ALTERNATOR article
Battery Does Stay Charged	Loose or worn drive belt	Check alternator drive belt tension and condition. See Belt Adjustment in appropriate TUNE-UP article in the TUNE-UP section
	Loose or corroded battery connections	Check all charging system connections
	Loose alternator connections	Check all charging system connections
	Defective alternator or battery	See On-Vehicle Tests and Bench Tests in ALTERNATOR article
	Add-on electrical accessories exceeding alternator capacity	Install larger alternator
Battery Overcharged-Uses Too Much Water	Defective battery	Check alternator output and repair as necessary
	Defective alternator	See On-Vehicle Test and Bench Tests in ALTERNATOR article
	Excessive alternator voltage	Check alternator output and repair as necessary

IGNITION SYSTEM TROUBLE SHOOTING

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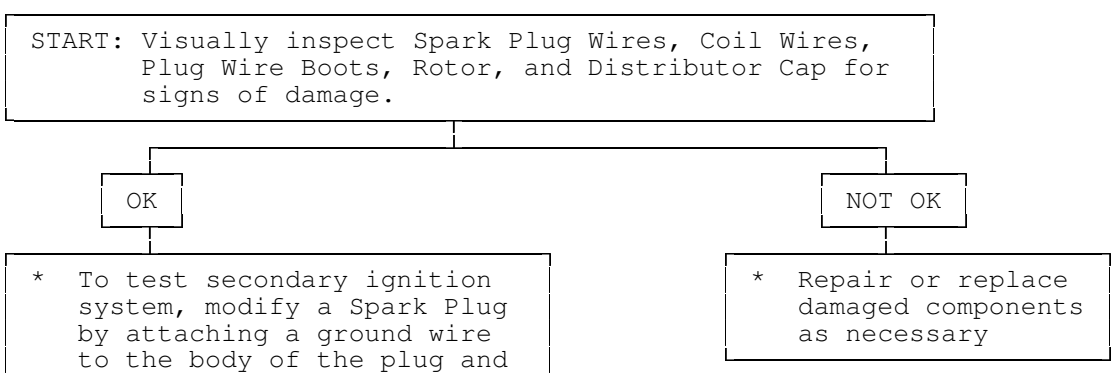
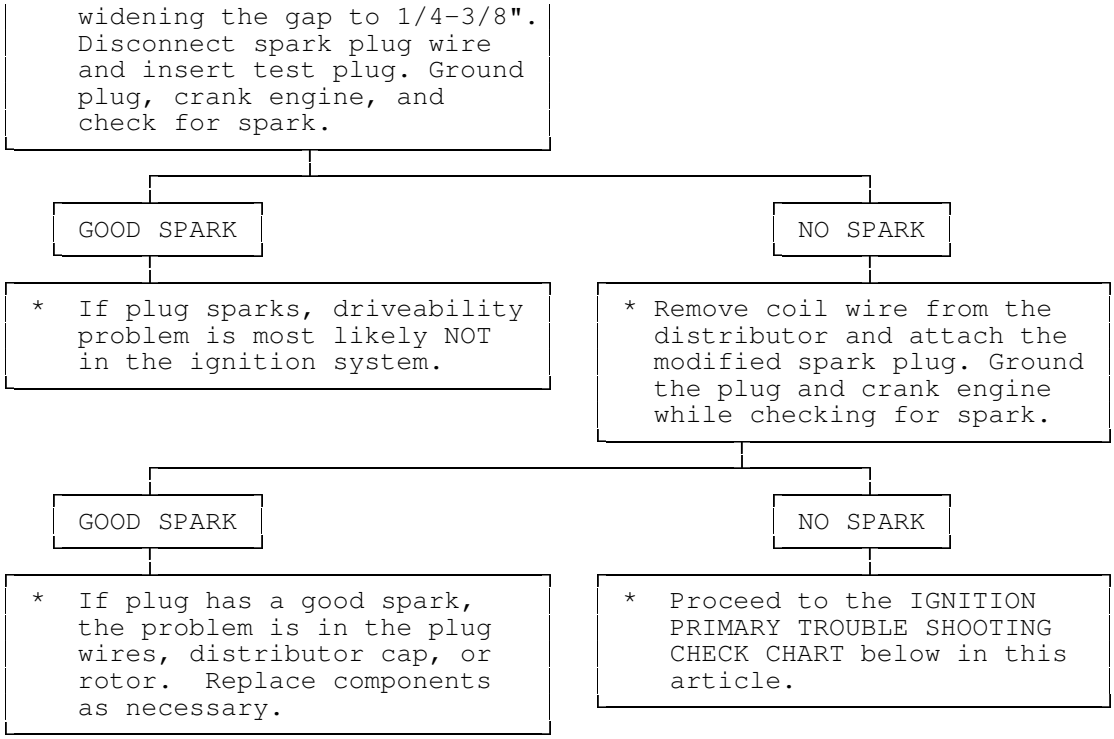
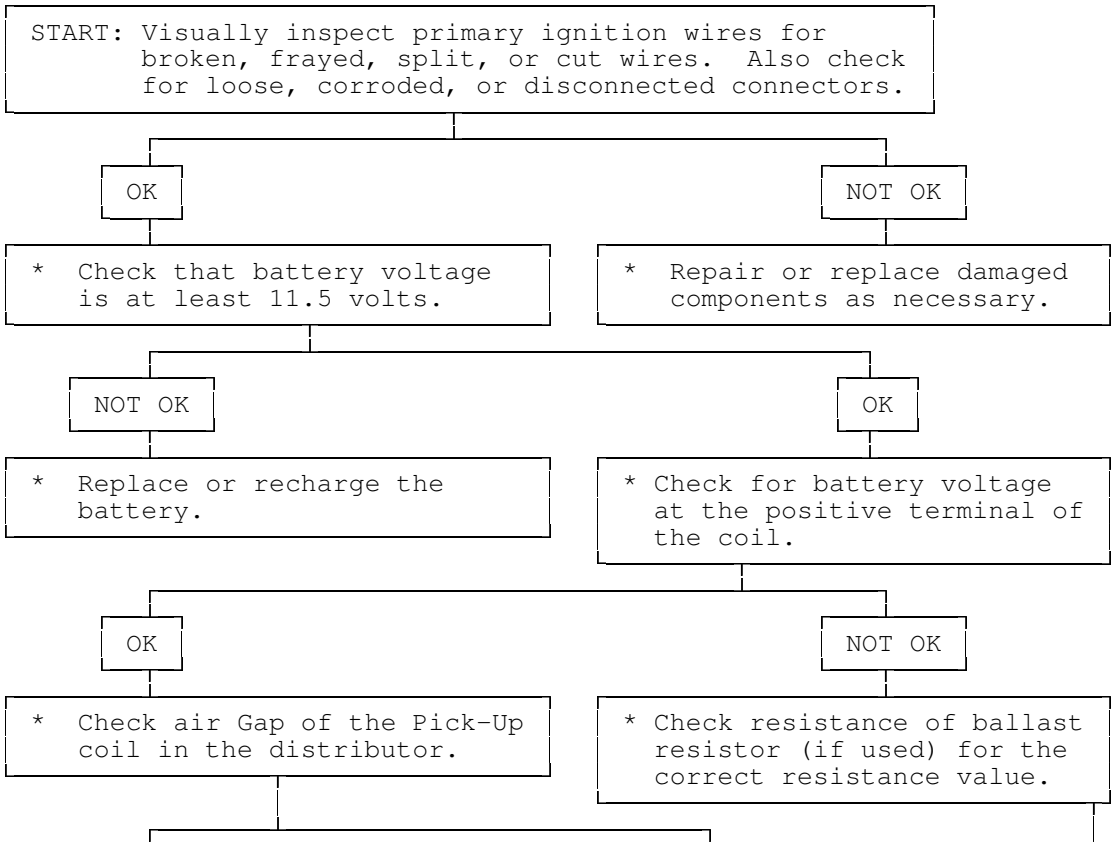
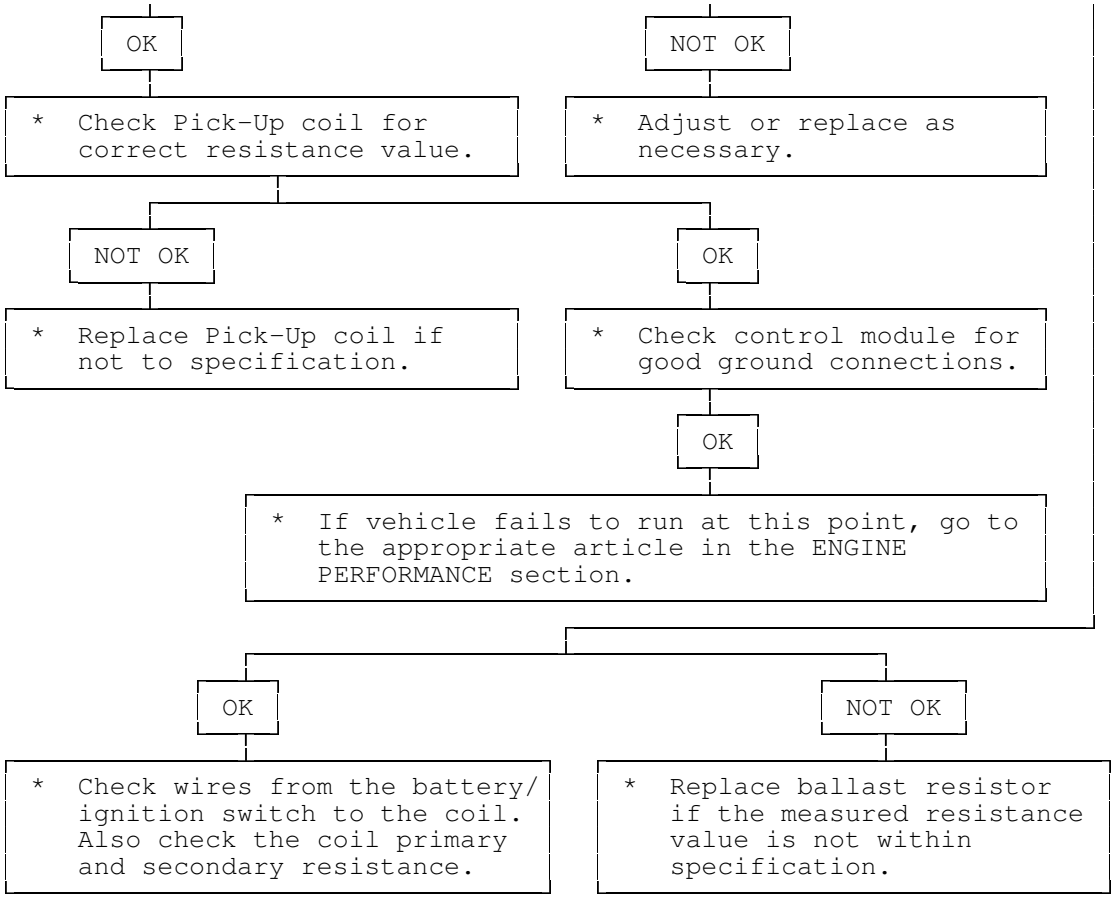
Ignition Secondary Trouble Shooting Chart





Ignition Primary Trouble Shooting Chart





STARTER TROUBLE SHOOTING

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BASIC STARTER TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Starter Fails to Operate	Dead battery or bad connections between starter and battery	Check battery charge and all wires and connections to starter
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch
	Open circuit between starter switch ignition terminal on starter relay	Check and repair wires and connections as necessary
	Starter relay or starter defective	See Testing in STARTER article

	Open solenoid pull-in wire	See Testing in STARTER article
Starter Does Not Operate and Headlights Dim	Weak battery or dead cell	Charge or replace battery as necessary
	Loose or corroded battery connections	Check that battery connections are clean and tight
	Internal ground in starter windings	See Testing in STARTER article
	Grounded starter fields	See Testing in STARTERS
	Armature rubbing on pole shoes	See STARTER article
Starter Turns but Engine Does Not Rotate	Starter clutch slipping	See STARTER article
	Broken clutch housing	See STARTER article
	Pinion shaft rusted or dry	See STARTER article
	Engine basic timing incorrect	See Ignition Timing in TUNE-UP article
	Broken teeth on engine flywheel	Replace flywheel and check for starter pinion gear damage
Starter Will Not Crank Engine	Faulty overrunning clutch	See STARTER article
	Broken clutch housing	See STARTER article
	Broken flywheel teeth	Replace flywheel and check for starter pinion gear damage
	Armature shaft sheared or reduction gear teeth stripped	See STARTER article
	Weak battery	Charge or replace battery as necessary
	Faulty solenoid	See On-Vehicle Tests in STARTER article
	Poor grounds	Check all ground connections for tight and clean connections
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch as necessary
Starter Cranks Engine Slowly	Battery weak or defective	Charge or replace battery as necessary

	Engine overheated	See ENGINE COOLING SYSTEM article
	Engine oil too heavy	Check that proper viscosity oil is used
	Poor battery-to-starter connections	Check that all between battery and starter are clean and tight
	Current draw too low or too high	See Bench Tests in STARTER article
	Bent armature, loose pole shoes screws or worn bearings	See STARTER article
	Burned solenoid contacts	Replace solenoid
	Faulty starter	Replace starter
Starter Engages Engine Only Momentarily	Engine timing too far advanced	See Ignition Timing in TUNE-UP article
	Overrunning clutch not engaging properly	Replace overrunning clutch. See STARTER article
	Broken starter clutch	See STARTER article
	Broken teeth on engine flywheel	Replace flywheel and check starter pinion gear for damage
	Weak drive assembly thrust spring	See STARTER article
	Weak hold-in coil	See Bench Tests in STARTER article
Starter Drive Will Not Engage	Defective point assembly	See Testing in STARTER article
	Poor point assembly ground	See Testing in STARTER article
	Defective pull-in coil	Replace starter solenoid
Starter Relay Does Not Close	Dead battery	Charge or replace battery as necessary
	Faulty wiring	Check all wiring and connections leading to relay
	Neutral safety switch faulty	Replace neutral safety switch
	Starter relay faulty	Replace starter relay

Starter Drive Will Not Disengage	Starter motor loose on mountings	Tighten starter attach bolts
	Worn drive end bushing	See STARTER article
	Damaged engine flywheel teeth	Replace flywheel and starter pinion gear for damage
	Drive yolk return spring broken or missing	Replace return spring
	Faulty ignition switch	Replace ignition switch
	Insufficient clearance between winding leads to solenoid terminal and main contact in solenoid	Replace starter solenoid
	Starter clutch not disengaging	Replace starter clutch
	Ignition starter switch contacts sticking	Replace ignition switch
Starter Relay Operates but Solenoid Does Not	Faulty solenoid switch, switch connections or	Check all wiring between relay and solenoid or replace relay or solenoid as necessary
	Broken lead or loose soldered connections	Repair wire or wire connections as necessary
Solenoid Plunger Vibrates When Switch is Engaged	Weak battery	Charge or replace battery as necessary
	Solenoid contacts corroded	Clean contacts or replace solenoid
	Faulty wiring	Check all wiring leading to solenoid
	Broken connections inside switch cover	Repair connections or replace solenoid
	Open hold-in wire	Replace solenoid
Low Current Draw	Worn brushes or weak	Replace brushes or brush springs as necessary
High Pitched Whine During Cranking Before Engine Fires but Engine Fires and Cranks Normally	Distance too great between starter pinion and flywheel	Align starter or check that correct starter and flywheel are being used
High Pitched Whine After Engine	Distance too small between starter pinion and flywheel	

Fires With Key released. Engine Fires and Cranks Normally	Flywheel runout contributes to the intermittent nature

AIR CONDITIONING & HEAT

AIR CONDITIONING TROUBLE SHOOTING

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BASIC AIR CONDITIONING TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Compressor Not Working	• Compressor clutch circuit open. • Compressor clutch coil inoperative. • Poor clutch ground connection. • Fan belts loose. • Thermostatic switch inoperative. • Thermostatic switch not adjusted. • Ambient temperature switch open. • Superheat fuse blown.
Excessive Noise or Vibration	• Missing or loose mounting bolts. • Bad idler pulley bearings. • Fan belts not tightened correctly. • Compressor clutch contacting body. • Excessive system pressure. • Compressor oil level low. • Damaged clutch bearings. • Damaged reed valves. • Damaged compressor.
Insufficient or No Cooling; Compressor Working	• Expansion valve inoperative. • Heater control valve stuck open. • Low system pressure. • Blocked condenser fins. • Blocked evaporator fins. • Vacuum system leak. • Vacuum motors inoperative. • Control cables improperly adjusted. • Restricted air inlet. • Mode doors binding. • Blower motor inoperative. • Temperature above system capacity.

HEATER SYSTEM TROUBLE SHOOTING

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problem symptoms. For model-specific Trouble Shooting, refer to DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC HEATER SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Insufficient, Erratic, or No Heat	• Low Coolant Level • Incorrect thermostat. • Restricted coolant flow through heater core. • Heater hoses plugged. • Misadjusted control cable. • Sticking heater control valve. • Vacuum hose leaking. • Vacuum hose blocked. • Vacuum motors inoperative. • Blocked air inlet. • Inoperative heater blower motor. • Oil residue on heater core fins. • Dirt on heater core fins.
Too Much Heat	• Improperly adjusted cables. • Sticking heater control valve. • No vacuum to heater control valve. • Temperature door stuck open.
Air Flow Changes During Acceleration	• Vacuum system leak. • Bad check valve or reservoir.
Air From Defroster At All Times	• Vacuum system leak. • Improperly adjusted control cables. • Inoperative vacuum motor.
Blower Does Not Operate Correctly	• Blown fuse. • Blower motor windings open. • Resistors burned out. • Motor ground connection loose. • Wiring harness connections loose. • Blower motor switch inoperative. • Blower relay inoperative. • Fan binding or foreign object in housing. • Fan blades broken or bent.

BRAKES

BRAKE SYSTEM TROUBLE SHOOTING

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BRAKE SYSTEM TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Brakes Pull Left or Right	Incorrect tire pressure	Inflate tires to proper pressure
	Front end out of alignment	See WHEEL ALIGNMENT
	Mismatched tires	Check tires sizes
	Restricted brake lines or hoses	Check hose routing
	Loose or malfunctioning caliper	See DISC BRAKES or BRAKE SYSTEM
	Bent shoe or oily linings	See DRUM BRAKES or BRAKE SYSTEM
	Malfunctioning rear brakes	See DRUM, DISC BRAKES or BRAKE SYSTEM
	Loose suspension parts	See SUSPENSION
Noises Without Brakes Applied	Front linings worn out	Replace linings
	Dust or oil on drums or rotors	See DRUM, DISC BRAKES or BRAKE SYSTEM
Noises With Brakes Applied	Insulator on outboard shoe damaged	See DISC BRAKES or BRAKE SYSTEM
	Incorrect pads or linings	Replace pads or linings
Brake Rough, Chatters or Pulsates	Excessive lateral runout	Check rotor runout
	Parallelism not to specifications	Reface or replace rotor
	Wheel bearings not adjusted	See SUSPENSION
	Rear drums out-of-round	Reface or replace drums
	Disc pad reversed, steel against rotor	Remove and reinstall pad
Excessive Pedal Effort	Malfunctioning power unit	See POWER BRAKES or BRAKE SYSTEM
	Partial system failure	Check fluid and pipes
	Worn disc pad or lining	Replace pad or lining
	Caliper piston stuck or	

	sluggish	See DISC BRAKES or BRAKE SYSTEM
	Master cylinder piston stuck	See MASTER CYLINDERS or BRAKE SYSTEM
	Brake fade due to incorrect pads for linings	Replace pads or linings
	Linings or pads glazed	Replace pads or linings
	Worn drums	Reface or replace drums
Excessive Pedal Travel	Partial brake system failure	Check fluid and pipes
	Insufficient fluid in master cylinder	See MASTER CYLINDERS or BRAKE SYSTEM
	Air trapped in system	See BRAKE BLEEDING or BRAKE SYSTEM
	Rear brakes not adjusted	See Adjustments in DRUM BRAKES or BRAKE SYSTEM
	Bent shoe or lining	See DRUM BRAKES or BRAKE SYSTEM
	Plugged master cylinder cap	See MASTER CYLINDERS or BRAKE SYSTEM
	Improper brake fluid	Replace brake fluid
Pedal Travel Decreasing	Compensating port plugged	See MASTER CYLINDERS or BRAKE SYSTEM
	Swollen cup in master cylinder	See MASTER CYLINDERS or BRAKE SYSTEM
	Master cylinder piston not returning	See MASTER CYLINDERS or BRAKE SYSTEM
	Weak shoe retracting springs	See DRUM BRAKES BRAKE SYSTEM
	Wheel cylinder piston sticking	See DRUM BRAKES or BRAKE SYSTEM
Dragging Brakes	Master cylinder pistons not returning	See MASTER CYLINDERS BRAKE SYSTEM
	Restricted brake lines or hoses	Check line routing
	Incorrect parking brake adjustment	See DRUM BRAKES BRAKE SYSTEM

	Parking Brake cables frozen	See DRUM BRAKES BRAKE SYSTEM
	Incorrect installation of inboard disc pad	Remove and replace correctly
	Power booster output rod too long	See POWER BRAKE UNITS BRAKE SYSTEM
	Brake pedal not returning freely	See DISC, DRUM BRAKES BRAKE SYSTEM
Brakes Grab or Uneven Braking Action	Malfunction of combination valve	See CONTROL VALVE or BRAKE SYSTEM
	Malfunction of power brake unit	See POWER BRAKE UNITS or BRAKE SYSTEM
	Binding brake pedal	See DISC, DRUM BRAKES or BRAKE SYSTEM
Pulsation or Roughness	Uneven pad wear caused by caliper	See DISC BRAKES or BRAKE SYSTEM
	Uneven rotor wear	See DISC BRAKES or BRAKE SYSTEM
	Drums out-of-round	Reface or replace drums

ENGINE MECHANICAL

COOLING SYSTEM TROUBLE SHOOTING

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COOLING SYSTEM TROUBLE SHOOTING

CONDITION	POSSIBLE CAUSE	CORRECTION
Overheating	Coolant Leak	Fill/Pressure Test System
	A/C Condenser Fins Clogged	Remove/Clean Condenser
	Radiator Fins Clogged	Remove/Clean Radiator
	Thermostat Stuck Closed	Replace Thermostat
	Clogged Cooling System Passages	Clean/Flush Cooling System

	Water Pump Malfunction	Replace Water Pump
	Fan Clutch Malfunction	Replace Fan Clutch
	Retarded Ignition Timing	Reset Ignition Timing
	Cooling Fan Malfunction	Test Cooling Fan/ Circuit
	Cooling Fan Motor Malfunction	Test Fan Motor
	Cooling Fan Relay Malfunction	Test Fan Relay
	Faulty Radiator Cap	Replace Radiator Cap
	Broken/Slipping Fan Belt	Replace Fan Belt
	Restricted Exhaust	Repair Exhaust System
Corrosion	Impurities In Coolant	Clean/Flush System
Coolant Leakage	Damaged hose	Replace Hose
	Leaky Water Pump	Replace Water Pump
	Damaged Radiator Seam	Replace/Repair Radiator
	Leaky Thermostat Cover	Replace Thermostat Cover
	Cylinder Head Problem	Check Head/Head Gasket
	Leaky Freeze Plugs	Replace Freeze Plugs
Recovery System Inoperative		
	Loose and/or Defective Radiator Cap	Replace Radiator Cap
	Overflow Tube Clogged and/or Leaking	Repair Tube
	Recovery Bottle Vent Restricted	Clean Vent
No Heater Core Flow		
	Collapsed Heater Hose	Replace Heater Hose
	Plugged Heater Core	Clean/Replace Heater Core
	Faulty Heater Valve	Replace Heater Valve

GASOLINE ENGINE - MECHANICAL TROUBLE SHOOTING

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BASIC GASOLINE ENGINE - MECHANICAL TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Lopes At Idle	Intake manifold-to-head leaks	Replace manifold gasket, See ENGINES
	Blown head gasket	Replace head gasket, See ENGINES
	Worn timing gears, chain or sprocket	Replace gears, chain or sprocket
	Worn camshaft lobes	Replace camshaft, See ENGINES
	Overheated engine	Check cooling system, See COOLING
	Blocked crankcase vent valve	Remove restriction
	Leaking EGR valve	Repair leak and/or replace valve
	Faulty fuel pump	Replace fuel pump
Engine Has Low Power	Leaking fuel pump	Repair leak and/or replace fuel pump
	Excessive piston-to-bore clearance	Install larger pistons, See ENGINES
	Sticking valves or weak valve springs	Check valve train components, See ENGINES
	Incorrect valve timing	Reset valve timing, See ENGINES
	Worn camshaft lobes	Replace camshaft, See ENGINES
	Blown head gasket	Replace head gasket. See ENGINES.
	Clutch slipping	Adjust pedal and/or replace components, See ENGINES
	Engine overheating	Check cooling system, See COOLING
	Auto. Trans. pressure regulator valve faulty	Replace pressure regulator valve
	Auto. Trans. fluid level too low	Add fluid as necessary
	Improper vacuum diverter valve operation	Replace vacuum diverter valve
	Vacuum leaks	Inspect vacuum system and repair as required
	Leaking piston rings	Replace piston rings, See ENGINES
Faulty High Speed Operation	Low fuel pump volume	Replace fuel pump
	Leaking valves or worn	Replace valves and/or springs, See ENGINES
	Incorrect valve timing	Reset valve timing,See ENGINES
	Intake manifold restricted	Remove restriction
	Worn distributor shaft	Replace distributor
Faulty Acceleration	Improper fuel pump stroke	Remove pump and reset pump stroke

	Incorrect ignition timing	Reset ignition timing, See TUNE-UP
	Leaking valves	Replace valves, See ENGINES
	Worn fuel pump diaphragm or piston	Replace diaphragm or piston
Intake Backfire	Improper ignition timing	Reset ignition timing, See TUNE-UP
	Faulty accelerator pump discharge	Replace accelerator pump
	Improper choke operation	Check choke and adjust as required
	Defective EGR valve	Replace EGR valve
	Fuel mixture too lean	Reset air/fuel mixture, See TUNE-UP
	Choke valve initial clearance too large	Reset choke valve initial clearance
Exhaust Backfire	Vacuum leak	Inspect and repair vacuum system
	Faulty vacuum diverter valve	Replace vacuum diverter valve
	Faulty choke operation	Check choke and adjust as required
	Exhaust system leak	repair exhaust system leak
Engine Detonation	Ignition timing too far advanced	Reset ignition timing, See TUNE-UP
	Faulty ignition system	Check ignition timing, See TUNE-UP
	Spark plugs loose or faulty	Retighten or replace plugs
	Fuel delivery system clogged	Inspect lines, pump and filter for clog
	EGR valve inoperative	Replace EGR valve
	PCV system inoperative	Inspect and/or replace hoses or valve
	Vacuum leaks	Check vacuum system and repair leaks
	Excessive combustion chamber deposits	Remove built-up deposits
	Leaking, sticking or broken valves	Inspect and/or replace valves
External Oil Leakage	Fuel pump improperly seated or worn gasket	Remove pump, replace gasket and seat properly
	Oil pan gasket broken or pan bent	Straighten pan and replace gasket
	Timing chain cover gasket broken	Replace timing chain cover gasket
	Rear main oil seal worn	Replace rear main oil seal
	Oil pan drain plug not seated properly	Remove and reinstall drain plug
	Camshaft bearing drain hole blocked	Remove restriction
	Oil pressure sending switch leaking	Remove and reinstall sending switch

Excessive Oil Consumption	Worn valve stems or guides	Replace stems or guides, See ENGINES
	Valve "O" ring seals damaged	Replace "O" ring seals, See ENGINES
	Plugged oil drain back holes	Remove restrictions
	Improper PCV valve operation	Replace PCV valve
	Engine oil level too high	Remove excess oil
	Engine oil too thin	Replace thicker oil
	Valve stem oil deflectors damaged	Replace oil deflectors
	Incorrect piston rings	Replace piston rings, See ENGINES
	Piston ring gaps not staggered	Reinstall piston rings, See ENGINES
	Insufficient piston ring tension	Replace rings, See ENGINES
	Piston ring grooves or oil return slots clogged	Replace piston rings, See ENGINES
	Piston rings sticking in grooves	Replace piston rings, See ENGINES
	Piston ring grooves excessively worn	Replace piston and rings, See ENGINES
	Compression rings installed upside down	Replace compression rings correctly, See ENGINES
	Worn or scored cylinder walls	Rebore cylinders or replace block
	Mismatched oil ring expander and rail	Replace oil ring expander and rail, See ENGINES
	Intake gasket dowels too long	Replace intake gasket dowels
	Excessive main or connecting rod bearing clearance	Replace main or connecting rod bearings, See ENGINES
No Oil Pressure	Low oil level	Add oil to proper level
	Oil pressure sender or gauge broken	Replace sender or gauge
	Oil pump malfunction	Remove and overhaul oil pump, See ENGINES
	Oil pressure relief valve sticking	Remove and reinstall valve
	Oil pump passages blocked	Overhaul oil pump, See ENGINES
	Oil pickup screen or tube blocked	remove restriction
	Loose oil inlet tube	Tighten oil inlet tube
	Loose camshaft bearings	Replace camshaft bearings, See ENGINES
	Internal leakage at oil passages	Replace block or cylinder head
Low Oil Pressure	Low engine oil level	Add oil to proper level
	Engine oil too thin	Remove and replace with thicker oil
	Excessive oil pump clearance	Reduce oil pump clearance, See ENGINES
	Oil pickup tube or screen blocked	Remove restrictions
	Main, rod or cam bearing clearance excessive	Replace bearing to reduce clearance, See

		ENGINES
High Oil Pressure	Improper grade of oil	Replace with proper oil
	Oil pressure relief valve stuck closed	Eliminate binding
	Oil pressure sender or gauge faulty	Replace sender or gauge
Noisy Main Bearings	Inadequate oil supply	Check oil delivery to main bearings
	Excessive main bearing clearance	Replace main bearings, See ENGINES
	Excessive crankshaft end play	Replace crankshaft, See ENGINES
	Loose flywheel or torque converter	Tighten attaching bolts
	Loose or damaged vibration damper	Tighten or replace vibration damper
	Crankshaft journals out-of-round	Re-grind crankshaft journals
	Excessive belt tension	Loosen belt tension
Noisy Connecting Rods	Excessive bearing clearance or missing bearing	Replace bearing, See ENGINES
	Crankshaft rod journal out-of-round	Re-grind crankshaft journal
	Misaligned connecting rod or cap	Remove rod or cap and realign
	Incorrectly tightened rod bolts	Remove and re-tighten rod bolts
Noisy Pistons and Rings	Excessive piston-to-bore clearance	Install larger pistons, See ENGINES
	Bore tapered or out-of-round	Rebore block
	Piston ring broken	Replace piston rings, See ENGINES
	Piston pin loose or seized	Replace piston pin, See ENGINES
	Connecting rods misaligned	Realign connecting rods
	Ring side clearance too loose or tight	Replace with larger or smaller rings
	Carbon build-up on piston	Remove carbon
Noisy Valve Train	Worn or bent push rods	Replace push rods, See ENGINES
	Worn rocker arms or bridged pivots	Replace push rods, See ENGINES
	Dirt or chips in valve lifters	Remove lifters and remove dirt/chips
	Excessive valve lifter leak-down	Replace valve lifters, See ENGINES
	Valve lifter face worn	Replace valve lifters, See ENGINES
	Broken or cocked valve springs	replace or reposition springs
	Too much valve stem-to-guide clearance	Replace valve guides, See ENGINES
	Valve bent	Replace valve, See ENGINES
	Loose rocker arms	Retighten rocker arms, See ENGINES
	Excessive valve seat run-out	Reface valve seats, See ENGINES

	Missing valve lock	Install new valve lock
	Excessively worn camshaft lobes	Replace camshaft, See ENGINES
	Plugged valve lifter oil holes	Eliminate restriction or replace lifter
	Faulty valve lifter check ball	Replace lifter check ball, See ENGINES
	Rocker arm nut installed upside down	Remove and reinstall correctly
	Valve lifter incorrect for engine	Remove and replace valve lifters
	Faulty push rod seat or lifter plunger	Replace plunger or push rod
Noisy Valves	Improper valve lash	Re-adjust valve lash, See ENGINES
	Worn or dirty valve lifters	Clean and/or replace lifters
	Worn valve guides	Replace valve guides, See ENGINES
	Excessive valve seat or face run-out	Reface seats or valve face
	Worn camshaft lobes	Replace camshaft, See ENGINES
	Loose rocker arm studs	Re-tighten rocker arm studs, See ENGINES
	Bent push rods	Replace push rods, See ENGINES
	Broken valve springs	Replace valve springs, See ENGINES
Burned,Sticking or Broken Valves	Weak valve springs or warped valves	Replace valves and/or springs, See ENGINES
	Improper lifter clearance	Re-adjust clearance or replace lifters
	Worn guides or improper guide clearance	Replace valve guides, See ENGINES
	Out-of-round valve seats or improper seat width	Re-grind valve seats
	Gum deposits on valve stems, seats or guides	Remove deposits
	Improper spark timing	Re-adjust spark timing
Broken Pistons/Rings	Undersize pistons	Replace with larger pistons, See ENGINES
	Wrong piston rings	Replace with correct rings, See ENGINES
	Out-of-round cylinder bore	Re-bore cylinder bore
	Improper connecting rod alignment	Remove and realign connecting rods
	Excessively worn ring grooves	Replace pistons, See ENGINES
	Improperly assembled piston pins	Re-assemble pin-to -piston, See ENGINES
	Insufficient ring gap clearance	Install new rings, See ENGINES
	Engine overheating	Check cooling system
	Incorrect ignition timing	Re-adjust ignition timing, See TUNE-UP
Excessive Exhaust Noise	Leaks at manifold to head, or to pipe	Replace manifold or pipe gasket
	Exhaust manifold	Replace exhaust

	cracked or broken	manifold, See ENGINES

ENGINE PERFORMANCE

CARBURETOR TROUBLE SHOOTING:

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BASIC COLD START SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Choke not closing	Check choke operation, see FUEL SYSTEMS
	Choke linkage bent	Check linkage, see FUEL SYSTEM
Engine Starts, Then Dies	Choke vacuum kick setting too wide	Check setting and adjust see, FUEL SYSTEMS
	Fast idle RPM too low	Reset RPM to specif-ication, see TUNE-UP
	Fast idle cam index incorrect	Reset fast idle cam index, see FUEL SYSTEMS
	Vacuum leak	Inspect vacuum system for leaks
	Low fuel pump outlet	Repair or replace pump, see FUEL SYSTEMS
	Low carburetor fuel level	Check float setting see FUEL SYSTEM
Engine Quits Under Load	Choke vacuum kick setting incorrect	Reset vacuum kick setting,see FUEL SYSTEMS
	Fast idle cam index incorrect	Reset fast idle cam index, see FUEL SYSTEM
	Incorrect hot fast idle speed RPM	Reset fast idle RPM, see TUNE-UP
Engine Starts, Runs Up,Then Idles, Slowly With Black Smoke	Choke vacuum kick set too narrow	Reset vacuum kick, see FUEL SYSTEMS
	Fast idle cam index	Reset fast idle cam

	incorrect	index, see FUEL SYSTEMS
	Hot fast idle RPM too low	Reset fast idle RPM, see TUNE-UP

BASIC HOT START SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Engine flooded	Allow fuel to evaporate

BASIC COLD ENGINE DRIVEABILITY SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Stalls in Gear	Choke vacuum kick setting incorrect	Reset choke vacuum kick, see FUEL SYSTEMS
	Fast idle RPM incorrect	Reset fast idle RPM, see TUNE-UP
	Fast idle cam index incorrect	Reset fast idle cam see FUEL SYSTEMS
Acceleration Sag or Stall	Defective choke control switch	Replace choke control switch
	Choke vacuum kick setting incorrect	Reset choke vacuum kick see, FUEL SYSTEMS
	Float level incorrect (too low)	Adjust float level, FUEL SYSTEMS
	Accelerator pump defective	Repair or replace pump see FUEL SYSTEMS
	Secondary throttles not closed	Inspect lockout adjustment,see FUEL SYSTEMS
Sag or Stall After Warmup	Defective choke control switch	Replace choke control switch, see FUEL SYSTEMS
	Defective accelerator pump	Replace pump, see FUEL SYSTEMS
	Float level incorrect (too low)	Adjust float level, see FUEL SYSTEMS
Backfiring & Black Smoke	Plugged heat crossover system	Remove restriction

BASIC WARM ENGINE DRIVEABILITY SYMPTOMS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Hesitation With Small Amount of Gas Pedal Movement	Vacuum leak	Inspect vacuum lines
	Accelerator pump weak or inoperable	Replace pump, see FUEL SYSTEMS
	Float level setting too low	Reset float level, see,FUEL SYSTEMS
	Metering rods sticking or binding	Inspect and/or replace rods, see FUEL SYSTEMS
	Carburetor idle or transfer system plugged	Inspect system and remove restriction
	Frozen or binding heated air inlet	Inspect heated air door for binding
Hesitation With Heavy Gas Pedal Movement	Defective accelerator pump	Replace pump, see FUEL SYSTEMS
	Metering rod carrier sticking or binding	Remove restriction
	Large vacuum leak	Inspect vacuum system and repair leak
	Float level setting too low	Reset float level, see FUEL SYSTEMS
	Defective fuel pump, lines or filter	Inspect pump, lines and filter
	Air door setting incorrect	Adjust air door setting, see FUEL

DIESEL ENGINE TROUBLE SHOOTING

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NOTE: Diesel engines mechanical diagnosis is the same as gasoline engines for items such as noisy valves, bearings, pistons, etc. The following trouble shooting covers only items pertaining to diesel engines.

BASIC DIESEL ENGINE TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Crank	Bad battery connections or dead batteries	Check connections and/or replace

		batteries
	Bad starter connections or bad starter	Check connections and/or replace batteries
Engine Cranks Slowly, Won't Start	Bad battery connections or dead batteries	Check connections and/or replace batteries
	Engine oil too heavy	Replace engine oil
Engine Cranks Normally, But Will Not Start	Glow plugs not functioning	Check glow plug system, see FUEL SYSTEMS
	Glow plug control not functioning	Check controller, see FUEL SYSTEMS
	Fuel not injected into cylinders	Check fuel injectors, see FUEL SYSTEMS
	No fuel to injection pump	Check fuel delivery system
	Fuel filter blocked	Replace fuel filter
	Fuel tank filter blocked	Replace fuel tank filter
	Fuel pump not operating	Check pump operation and/or replace pump
	Fuel return system blocked	Inspect system and remove restriction
	No voltage to fuel solenoid	Check solenoid and connections
	Incorrect or contaminated fuel	Replace fuel
	Incorrect injection pump timing	Re-adjust pump timing, see FUEL SYSTEMS
	Low compression	Check valves, pistons, rings, see ENGINES
	Injection pump malfunction	Inspect and/or replace injection pump
Engine Starts, Won't Idle	Incorrect slow idle adjustment	Reset idle adjustment, see TUNE-UP
	Fast idle solenoid malfunctioning	Check solenoid and connections
	Fuel return system blocked	Check system and remove restrictions
	Glow plugs go off too soon	See glow plug diagnosis in FUEL SYSTEMS
	Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
	No fuel to injection pump	Check fuel delivery system
	Incorrect or contaminated fuel	Replace fuel
	Low compression	Check valves, piston, rings, see ENGINES
	Injection pump malfunction	Replace injection pump, see FUEL SYSTEMS
	Fuel solenoid closes in RUN position	Check solenoid and connections
Engines Starts/ Idles Rough W/out Smoke or Noise	Incorrect slow idle adjustment	Reset slow idle, see TUNE-UP
	Injection line fuel leaks	Check lines and connections
	Fuel return system blocked	Check lines and connections

	Air in fuel system	Bleed air from system
	Incorrect or contaminated fuel	Replace fuel
	Injector nozzle malfunction	Check nozzles, see FUEL SYSTEMS
Engines Starts and Idles Rough W/out Smoke or Noise, But Clears After Warm-Up	Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
	Engine not fully broken in	Put more miles on engine
	Air in system	Bleed air from system
	Injector nozzle malfunction	Check nozzles, see FUEL SYSTEMS
Engine Idles Correctly, Misfires Above Idle	Blocked fuel filter	Replace fuel filter
	Injection pump timing incorrect	Reset pump timing, see FUEL SYSTEMS
	Incorrect or contaminated fuel	Replace fuel
Engine Won't Return To Idle	Fast idle adjustment incorrect	Reset fast idle, see TUNE-UP
	Internal injection pump malfunction	Replace injection pump, see FUEL SYSTEMS
	External linkage binding	Check linkage and remove binding
Fuel Leaks On Ground	Loose or broken fuel line	Check lines and connections
	Internal injection pump seal leak	Replace injection pump, see FUEL SYSTEMS
Cylinder Knocking Noise	Injector nozzles sticking open	Test injectors, see FUEL SYSTEMS
	Very low nozzle opening pressure	Test injectors and/or replace
Loss of Engine Power	Restricted air intake	Remove restriction
	EGR valve malfunction	Replace EGR valve
	Blocked or damaged exhaust system	Remove restriction and/or replace components
	Blocked fuel tank filter	Replace filter
	Restricted fuel filter	Remove restriction and/or replace filter
	Block vent in gas cap	Remove restriction and/or replace cap
	Tank-to-injection pump fuel supply blocked	Check fuel lines and connections
	Blocked fuel return system	Remove restriction
	Incorrect or contaminated fuel	Replace fuel
	Blocked injector nozzles	Check nozzle for blockage, see FUEL SYSTEMS
	Low compression	Check valves, rings, pistons, see ENGINES
Loud Engine Noise With Black Smoke	Basic timing incorrect	Reset timing, see FUEL SYSTEMS
	EGR valve malfunction	Replace EGR valve
	Internal injection pump malfunction	Replace injection pump, see FUEL SYSTEMS

	Incorrect injector pump housing pressure	Check pressure, see FUEL SYSTEMS
Engine Overheating	Cooling system leaks	Check cooling system and repair leaks
	Belt slipping or damaged	Check tension and/or replace belt
	Thermostat stuck closed	Remove and replace thermostat, see ENGINE COOLING
	Head gasket leaking	Replace head gasket
Oil Light on at Idle	Low oil pump pressure	Check oil pump operation, see ENGINES
	Oil cooler or line restricted	Remove restriction and/or replace cooler
Engine Won't Shut Off	Injector pump fuel solenoid does not return fuel valve to OFF position	Remove and check solenoid and replace if needed
	VACUUM PUMP DIAGNOSIS	
Excessive Noise	Loose pump-to-drive assembly screws	Tighten screws
	Loose tube on pump assembly	Tighten tube
	Valves not functioning properly	Replace valves
Oil Leakage	Loose end plug	Tighten end plug
	Bad seal crimp	Remove and re-crimp seal

FUEL INJECTION TROUBLE SHOOTING

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BASIC FUEL INJECTION TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start (Cranks Normally)	Cold start valve inoperative	Test valve and circuit
	Poor connection;vacuum or wiring	Check vacuum and electrical connections
	Contaminated fuel	Test fuel for water or alcohol
	Defective fuel pump relay or circuit	Test relay and wiring
	Battery too low	Charge and test battery

	Low fuel pressure	Test pressure regulator and fuel pump, check for restricted lines and filters
	No distributor reference pulses	Repair ignition system as necessary
	Open coolant temperature sensor circuit	Test sensor and wiring
	Shorted W.O.T. switch in T.P.S.	Disconnect W.O.T. switch, engine should start
	Defective ECM	Replace ECM
	Fuel tank residual pressure valve leaks	Test for fuel pressure drop after shut down
Hard Starting	Disconnected hot air tube to air cleaner	Reconnect tube and test control valve
	Defective Idle Air Control (IAC) valve	Test valve operation and circuit
	Shorted, open or misadjusted T.P.S.	Test and adjust or replace T.P.S.
	EGR valve open	Test EGR valve and control circuit
	Poor Oxygen sensor signal	Test for shorted or circuit
	Incorrect mixture from PCV system	Test PCV for flow, check sealing of oil filter cap
Poor High Speed Operation	Low fuel pump volume	Faulty pump or restricted fuel lines or filters
	Poor MAP sensor signal	Test MAP sensor, vacuum hose and wiring
	Poor Oxygen sensor signal	Test for shorted or open sensor or circuit
	Open coolant temperature sensor circuit	Test sensor and wiring
	Faulty ignition operation	Check wires for cracks or poor connections, test secondary voltage with oscilloscope
	Contaminated fuel	Test fuel for water

		or alcohol
	Intermittent ECM ground	Test ECM ground connection for resistance
	Restricted air cleaner	Replace air cleaner
	Restricted exhaust system	Test for exhaust manifold back pressure
	Poor MAF sensor signal	Check leakage between sensor and manifold
	Poor VSS signal	If tester for ALCL hook-up is available check that VSS reading matches speedometer
Ping or Knock on Acceleration	Poor Knock sensor signal	Test for shorted or open sensor or circuit
	Poor Baro sensor signal	Test for shorted or open sensor or circuit
	Improper ignition timing	See VEHICLE EMISSION CONTROL LABEL (where applicable)
	Check for engine overheating problems	Low coolant, loose belts or electric cooling fan inoperative

NOTE: For additional electronic fuel injection trouble shooting information, see the appropriate article in the ENGINE PERFORMANCE section (not all vehicles have Computer Engine Control articles). Information is provided there for diagnosing fuel system problems on vehicles with electronic fuel injection.

IGNITION SYSTEM TROUBLE SHOOTING

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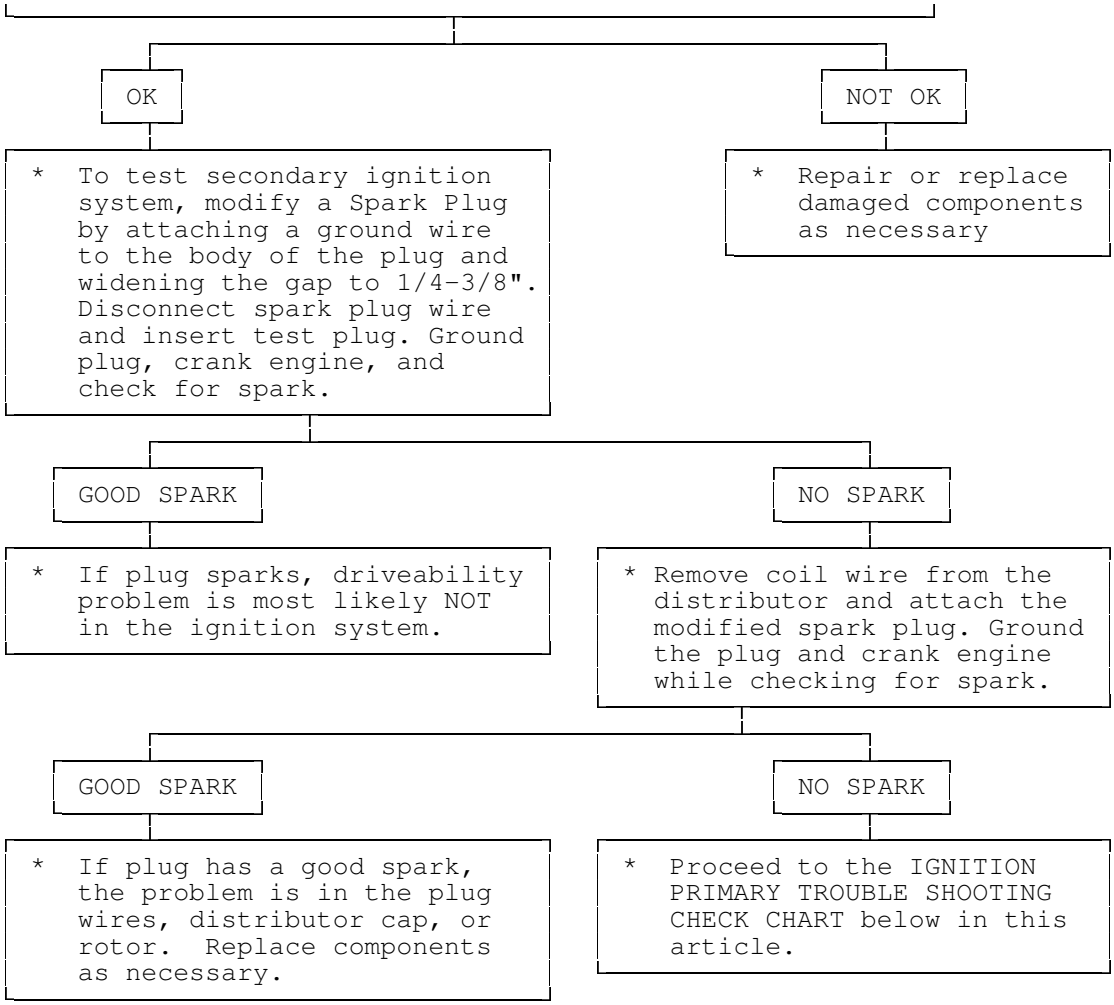
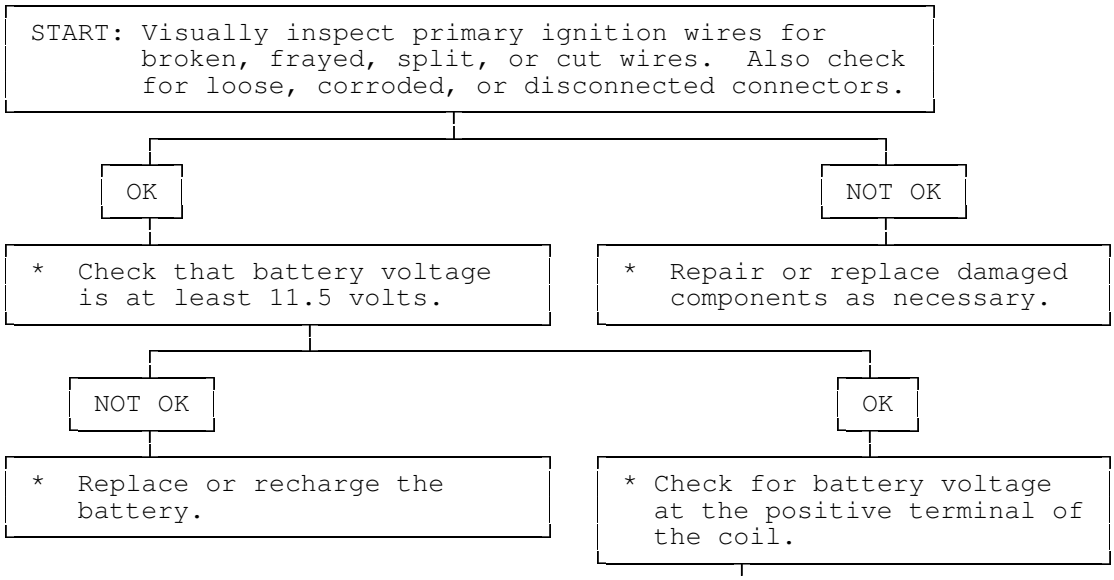
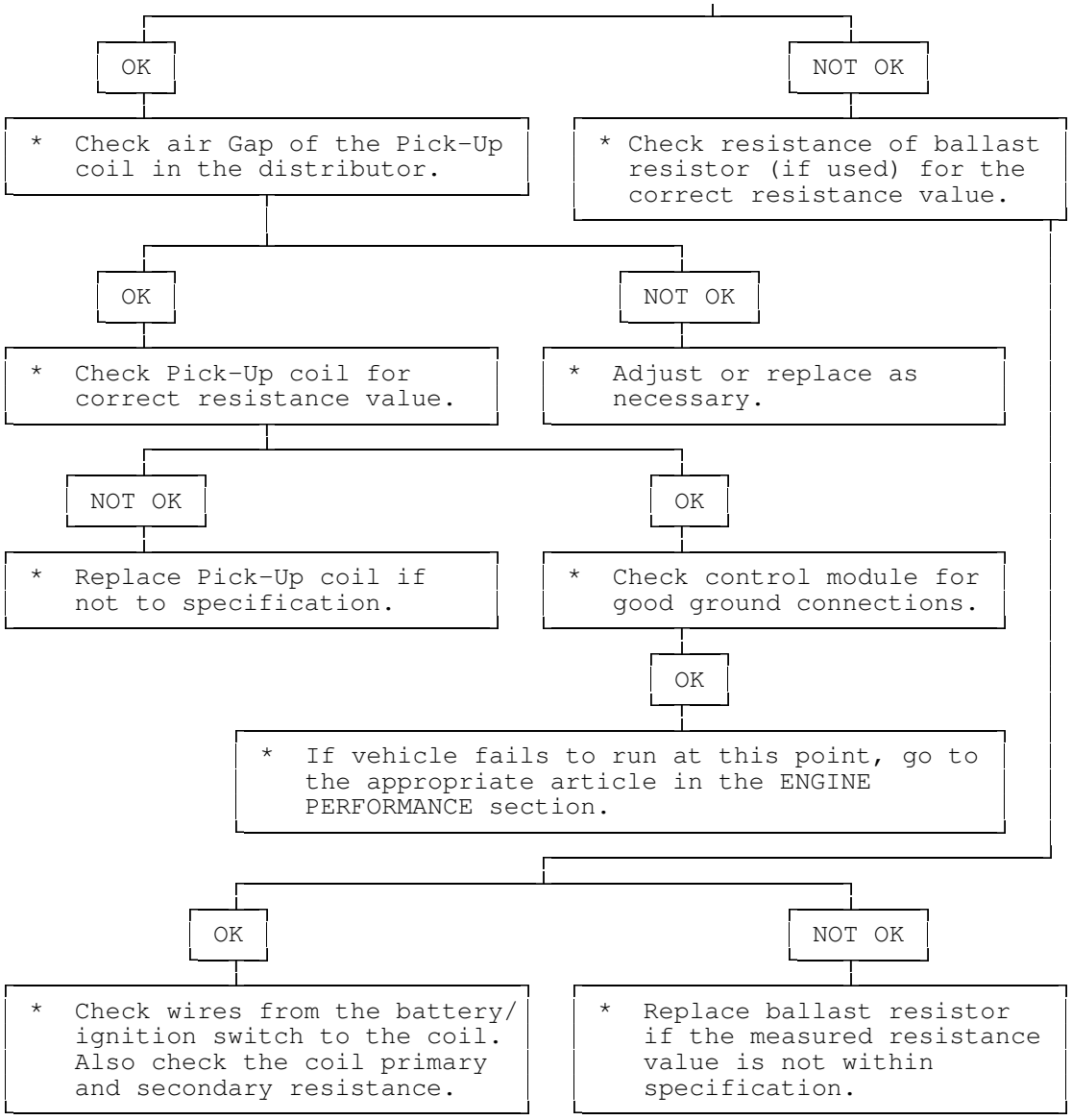
Ignition Secondary Trouble Shooting Chart

START: Visually inspect Spark Plug Wires, Coil Wires, Plug Wire Boots, Rotor, and Distributor Cap for signs of damage.



Ignition Primary Trouble Shooting Chart





STARTER TROUBLE SHOOTING

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BASIC STARTER TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Starter Fails to Operate	Dead battery or bad connections between starter and battery	Check battery charge and all wires and connections to starter

	Ignition switch faulty or misadjusted	Adjust or replace ignition switch
	Open circuit between starter switch ignition terminal on starter relay	Check and repair wires and connections as necessary
	Starter relay or starter defective	See Testing in STARTER article
	Open solenoid pull-in wire	See Testing in STARTER article
Starter Does Not Operate and Headlights Dim	Weak battery or dead cell	Charge or replace battery as necessary
	Loose or corroded battery connections	Check that battery connections are clean and tight
	Internal ground in starter windings	See Testing in STARTER article
	Grounded starter fields	See Testing in STARTERS
	Armature rubbing on pole shoes	See STARTER article
Starter Turns but Engine Does Not Rotate	Starter clutch slipping	See STARTER article
	Broken clutch housing	See STARTER article
	Pinion shaft rusted or dry	See STARTER article
	Engine basic timing incorrect	See Ignition Timing in TUNE-UP article
	Broken teeth on engine flywheel	Replace flywheel and check for starter pinion gear damage
Starter Will Not Crank Engine	Faulty overrunning clutch	See STARTER article
	Broken clutch housing	See STARTER article
	Broken flywheel teeth	Replace flywheel and check for starter pinion gear damage
	Armature shaft sheared or reduction gear teeth stripped	See STARTER article
	Weak battery	Charge or replace battery as necessary
	Faulty solenoid	See On-Vehicle Tests in STARTER article
	Poor grounds	Check all ground

		connections for tight and clean connections
	Ignition switch faulty or misadjusted	Adjust or replace ignition switch as necessary
Starter Cranks Engine Slowly	Battery weak or defective	Charge or replace battery as necessary
	Engine overheated	See ENGINE COOLING SYSTEM article
	Engine oil too heavy	Check that proper viscosity oil is used
	Poor battery-to-starter connections	Check that all between battery and starter are clean and tight
	Current draw too low or too high	See Bench Tests in STARTER article
	Bent armature, loose pole shoes screws or worn bearings	See STARTER article
	Burned solenoid contacts	Replace solenoid
	Faulty starter	Replace starter
Starter Engages Engine Only Momentarily	Engine timing too far advanced	See Ignition Timing in TUNE-UP article
	Overrunning clutch not engaging properly	Replace overrunning clutch. See STARTER article
	Broken starter clutch	See STARTER article
	Broken teeth on engine flywheel	Replace flywheel and check starter pinion gear for damage
	Weak drive assembly thrust spring	See STARTER article
	Weak hold-in coil	See Bench Tests in STARTER article
Starter Drive Will Not Engage	Defective point assembly	See Testing in STARTER article
	Poor point assembly ground	See Testing in STARTER article
	Defective pull-in coil	Replace starter solenoid
Starter Relay	Dead battery	Charge or replace

Does Not Close		battery as necessary
	Faulty wiring	Check all wiring and connections leading to relay
	Neutral safety switch faulty	Replace neutral safety switch
	Starter relay faulty	Replace starter relay
Starter Drive Will Not Disengage	Starter motor loose on mountings	Tighten starter attach bolts
	Worn drive end bushing	See STARTER article
	Damaged engine flywheel teeth	Replace flywheel and starter pinion gear for damage
	Drive yolk return spring broken or missing	Replace return spring
	Faulty ignition switch	Replace ignition switch
	Insufficient clearance between winding leads to solenoid terminal and main contact in solenoid	Replace starter solenoid
	Starter clutch not disengaging	Replace starter clutch
	Ignition starter switch contacts sticking	Replace ignition switch
Starter Relay Operates but Solenoid Does Not	Faulty solenoid switch, switch connections or	Check all wiring between relay and solenoid or replace relay or solenoid as necessary
	Broken lead or loose soldered connections	Repair wire or wire connections as necessary
Solenoid Plunger Vibrates When Switch is Engaged	Weak battery	Charge or replace battery as necessary
	Solenoid contacts corroded	Clean contacts or replace solenoid
	Faulty wiring	Check all wiring leading to solenoid
	Broken connections inside switch cover	Repair connections or replace solenoid
	Open hold-in wire	Replace solenoid
Low Current Draw	Worn brushes or weak	Replace brushes or brush springs as necessary

High Pitched Whine During Cranking Before Engine Fires but Engine Fires and Cranks Normally	Distance too great between starter pinion and flywheel	Align starter or check that correct starter and flywheel are being used
High Pitched Whine After Engine Fires With Key released. Engine Fires and Cranks Normally	Distance too small between starter pinion and flywheel Flywheel runout contributes to the intermittent nature	

TUNE-UP TROUBLE SHOOTING - GAS ENGINE VEHICLES

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BASIC SPARK PLUG TROUBLE SHOOTING CHARTS

CONDITION	POSSIBLE CAUSE	CORRECTION
Normal Spark Plug Condition	Light Tan or Gray deposits	No Action
	Electrode not burned or fouled	No Action
	Gap tolerance not changed	No Action
Cold Fouling or Carbon Deposits	Overrich air/fuel mixture	Adjust air/fuel mixture, see ENGINE PERFORMANCE section
	Faulty choke	Replace choke assembly, see ENGINE PERFORMANCE section
	Clogged air filter	Clean and/or replace air filter
	Incorrect idle speed or dirty carburetor	Reset idle speed and/ or clean carburetor
	Faulty ignition wires	Replace ignition wiring
	Prolonged operation at idle	Shut engine off during long idle
	Sticking valves or worn valve guide seals	Check valve train
Wet Fouling or Oil Deposits	Worn rings and pistons	Install new rings and pistons

	Excessive cylinder wear	Rebore or replace block
	Excessive valve guide clearance	Worn or loose bearing
Gap Bridged	Deposits in combustion chamber becoming fused to electrode	Clean combustion chamber of deposits
Blistered Electrode	Engine overheating	Check cooling system
	Wrong type of fuel	Replace with correct fuel
	Loose spark plugs	Retighten spark plugs
	Over-advanced ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Pre-Ignition or Melted Electrodes	Incorrect type of fuel	Replace with correct fuel
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Burned valves	Replace valves
	Engine Overheating	Check cooling system
	Wrong type of spark plug, too hot	Replace with correct spark plug, see ENGINE PERFORMANCE
Chipped Insulators	Severe detonation	Check for over-advanced timing or combustion
	Improper gapping procedure	Re-gap spark plugs
Rust Colored Deposits	Additives in unleaded fuel	Try different fuel brand
Water In Combus-tion Chamber	Blown head gasket or cracked head	Repair or replace head or head gasket

NOTE: Before diagnosing an electronic ignition system, ensure that all wiring is connected properly between distributor, wiring connector and spark plugs. Ignition problem will show up either as: Engine Will Not Start or Engine Runs Rough.

BASIC ELECTRONIC IGNITION TROUBLE SHOOTING CHARTS

CONDITION	POSSIBLE CAUSE	CORRECTION
Engine Won't Start	Open circuit between distributor and bulkhead connector	Repair circuit
	Open circuit between bulkhead connector and	Repair circuit

	ignition switch	
	Open circuit between ignition switch and starter solenoid	Repair circuit
Engine Runs Rough	Fuel lines leaking or clogged	Tighten fitting, remove restriction
	Initial timing incorrect	Reset ignition timing see ENGINE PERFORMANCE
	Centrifugal advance malfunction	Repair distributor advance
	Defective spark plugs or wiring	Replace plugs or plug wiring
Component Failure	Spark arc-over on cap, rotor or coil	Replace cap, rotor or or coil
	Defective pick-up coil	Replace pick-up coil
	Defective ignition coil	Replace ignition coil
	Defective vacuum unit	Replace vacuum unit
	Defective control module	Replace control module

BASIC ELECTRONIC IGNITION TROUBLE SHOOTING CHARTS - USING OSCILLOSCOPE PATTERNS

CONDITION	POSSIBLE CAUSE	CORRECTION
Firing Voltage Lines are the Same, but Abnormally High	Retarded ignition timing	Reset ignition timing, see ENGINE PERFORMANCE section
	Fuel mixture too lean	Readjust carburetor, see ENGINE PERFORMANCE
	High resistance in coil wire	Replace coil wire
	Corrosion in coil tower terminal	Clean and/or replace coil
	Corrosion in distributor coil terminal	Clean and/or replace distributor cap
Firing Voltage Lines are the Same but Abnormally Low	Fuel mixture too rich	Readjust carburetor, see ENGINE PERFORMANCE
	Breaks in coil wire causing arcing	Replace coil wire
	Cracked coil tower causing arcing	Replace coil
	Low coil output	Replace coil
	Low engine compression	Determine cause and

		repair
One or More, But Not All Firing Voltage Lines are Higher Than Others	Carburetor idle mixture not balanced	Readjust carburetor, see ENGINE PERFORMANCE
	EGR valve stuck open	Clean and/or replace valve
	High resistance in spark plug wires	Replace spark plug wires
	Cracked or broken spark plug insulator	Replace spark plugs
	Intake vacuum leak	Repair leak
	Defective spark plugs	Replace spark plugs
	Corroded spark plug terminals	Replace spark plugs
One or More, But Not All Firing Voltage Lines Are Lower Than Others	Curb idle mixture not balanced	Readjust carburetor, see ENGINE PERFORMANCE
	Breaks in plug wires causing arcing	Replace plug wires
	Cracked coil tower causing arcing	Replace coil
	Low compression	Determine cause and repair
	Defective spark plugs	Replace spark plugs
	Corroded spark plugs	Replace spark plugs
Cylinders Not Firing	Cracked distributor cap terminals	Replace distributor cap
	Shorted spark plug wire	Determine cause and repair
	Mechanical problem in engine	Determine cause and repair
	Defective spark plugs	Replace spark plugs
	Spark plugs fouled	Replace spark plugs

BASIC DRIVEABILITY PROBLEMS TROUBLE SHOOTING TABLE

CONDITION	POSSIBLE CAUSE	CORRECTION
Hard Starting	Binding carburetor linkage	Eliminate binding
	Binding choke linkage	Eliminate binding
	Binding choke piston	Eliminate binding
	Restricted choke vacuum	Check vacuum lines for blockage

	Worn or dirty needle valve and seat	Clean carburetor, see ENGINE PERFORMANCE
	Float sticking	Readjust or replace float see the ENGINE PERFORMANCE section
	Incorrect choke adjustment	Reset choke adjustment see ENGINE PERFORMANCE
	Defective coil	Replace coil
	Improper spark plug gap	Regap spark plugs
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
Detonation	Over-advanced ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Defective spark plugs	Replace spark plugs
	Fuel lines clogged	Clean fuel lines
	EGR system malfunction	Check and repair EGR system
	PCV system malfunction	Repair PCV system
	Vacuum leaks	Check and repair vacuum system
	Loose fan belts	Tighten or replace fan belts, see ENGINE PERFORMANCE
	Restricted airflow	Remove restriction
	Vacuum advance malfunction	Check distributor operation
Dieseling	Binding carburetor linkage	Eliminate binding
	Binding throttle linkage	Eliminate blinding
	Binding choke linkage or fast idle cam	Eliminate binding
	Defective idle solenoid	Replace idle solenoid see ENGINE PERFORMANCE
	Improper base idle speed	Reset idle speed, see see ENGINE PERFORMANCE
	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Incorrect idle mixture setting	Reset idle mixture, see ENGINE PERFORMANCE
Faulty Acceleration	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE

	Engine cold and choke too lean	Adjust choke and allow engine to warm-up
	Defective spark plugs	Replace spark plugs
	Defective coil	Replace coil
Faulty Low Speed Operation	Clogged idle transfer slots	Clean idle transfer slots, see FUEL
	Restricted idle air bleeds and passages	Disassemble and clean carburetor, see FUEL
	Clogged air cleaner	Replace air filter
	Defective spark plugs	Replace spark plugs
	Defective ignition wires	Replace ignition wire see ENGINE PERFORMANCE
	Defective distributor cap	Replace distributor cap
Faulty High Speed Operation	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Defective distributor centrifugal advance	Replace advance mechanism
	Defective distributor vacuum advance	Replace advance unit
	Incorrect spark plugs or plug gap	Check gap and/or replace spark plugs
	Faulty choke operation	Check choke and repair as required
	Clogged vacuum passages	Remove restrictions
	Improper size or clogged main jet	Check jet size and clean, see FUEL
	Restricted air cleaner	Check filter and replace as necessary
	Defective distributor cap, rotor or coil	Replace cap, rotor or coil
Misfire at All Speeds	Defective spark plugs	Replace spark plugs
	Defective spark plug wires	Replace spark plug wires
	Defective distributor cap, rotor, or coil	Replace cap, rotor, or coil
	Cracked or broken vacuum hoses	Replace vacuum hoses

	Vacuum leaks	Repair vacuum leaks
	Fuel lines clogged	Remove restriction
Hesitation	Cracked or broken vacuum hoses	Replace vacuum hoses
	Vacuum leaks	Repair Vacuum leaks
	Binding carburetor linkage	Eliminate binding
	Binding throttle linkage	Eliminate binding
	Binding choke linkage or fast idle cam	Eliminate binding
	Improper float setting	Readjust float setting, see FUEL
	Cracked or broken ignition wires	Replace ignition wires
Rough idle, Missing or Stalling	Incorrect curb idle or fast idle speed	Reset idle speed, see see ENGINE PERFORMANCE
	Incorrect basic timing	Reset ignition timing see ENGINE PERFORMANCE
	Improper idle mixture adjustment	Reset idle mixture, see ENGINE PERFORMANCE
	Improper feedback system operation	Check feedback system see ENGINE PERFORMANCE
	Incorrect spark plug gap	Reset spark plug gap, see ENGINE PERFORMANCE
	Moisture in ignition components	Dry components
	Loose or broken ignition wires	Replace ignition wires
	Damaged distributor cap or or rotor	Replace distributor cap or rotor
	Faulty ignition coil	Replace ignition coil
	Fuel filter clogged or worn	Replace fuel filter
	Damaged idle mixture screw	Replace idle mixture screw, see FUEL
	Improper fast idle cam adjustment	Reset fast idle cam adjustment, see TUNE- see ENGINE PERFORMANCE
	Improper EGR valve operation	Replace EGR valve
	Faulty PCV valve air flow	Replace PCV valve
	Choke binding or improper choke setting	Reset choke or eliminate binding

	Vacuum leak	Repair vacuum leak
	Improper float bowl fuel level	Reset float adjustment, see FUEL
	Clogged air bleed or idle passages	Clean carburetor passages, see FUEL
	Clogged or worn air cleaner filter	Replace air filter
	Faulty choke vacuum diaphragm	Replace diaphragm, see ENGINE PERFORMANCE
	Exhaust manifold heat valve inoperative	Replace heat valve
	Improper distributor spark advance	Check distributor operation
	Leaking valves or valve components	Check and repair valvetrain
	Improper carburetor mounting	Remove and remount carburetor
	Excessive play in distributor shaft	Replace distributor
	Loose or corroded wiring connections	Repair or replace as required
Engine Surges	Improper PCV valve airflow	Replace PCV valve
	Vacuum leaks	Repair vacuum leaks
	Clogged air bleeds	Remove restriction
	EGR valve malfunction	Replace EGR valve
	Restricted air cleaner filter	Replace air filter
	Cracked or broken vacuum hoses	Replace vacuum hoses
	Cracked or broken ignition wires	Replace ignition wires
	Vacuum advance malfunction	Check unit and replace as necessary
	Defective or fouled spark plugs	Replace spark plugs
Ping or Spark Knock	Incorrect ignition timing	Reset ignition timing see ENGINE PERFORMANCE
	Distributor centrifugal or vacuum advance malfunction	Check operation and replace as necessary
	Carburetor setting too lean	Readjust mixture

		setting, see ENGINE PERFORMANCE
	Vacuum leak	Eliminate vacuum leak
	EGR valve malfunction	Replace EGR valve
Poor Gasoline Mileage	Cracked or broken vacuum hoses	Replace vacuum hoses
	Vacuum leaks	Repair vacuum leaks
	Defective ignition wires	Replace wires
	Incorrect choke setting	Readjust setting, see ENGINE PERFORMANCE
	Defective vacuum advance	Replace vacuum advance
	Defective spark plugs	Replace spark plugs
	Binding carburetor power piston	Eliminate binding
	Dirt in carburetor jets	Clean and/or replace jets
	Incorrect float adjustment	Readjust float setting, see FUEL
	Defective power valve	Replace power valve, see ENGINE PERFORMANCE
	Incorrect idle speed	Readjust idle speed
Engine Stalls	Improper float level	Readjust float level
	Leaking needle valve and seat	Replace needle valve and seat
	Vacuum leaks	Eliminate vacuum leaks

VACUUM PUMP - DIESEL TROUBLE SHOOTING

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NOTE: Diesel engines mechanical diagnosis is the same as gasoline engines for items such as noisy valves, bearings, pistons, etc. The following trouble shooting covers only items pertaining to diesel engines.

VACUUM PUMP (DIESEL) TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION

Excessive Noise	Loose pump-to-drive assembly screws	Tighten screws
	Loose tube on pump assembly	Tighten tube
	Valves not functioning properly	Replace valves
Oil Leakage	Loose end plug	Tighten end plug
	Bad seal crimp	Remove and re-crimp seal

MANUAL TRANSMISSION

MANUAL TRANSMISSION TROUBLE SHOOTING

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MANUAL TRANSMISSION/TRANSAXLE TROUBLE SHOOTING

Condition	Possible Cause
Noisy In Forward Gears	.Low gear oil level, .Loose bell housing bolts, .Worn bearings or gears
Clunk On Deceleration (FWD Only)	.Loose engine mounts, .Worn inboard CV joints, .Worn differential pinion shaft, .Side gear hub counterbore in case worn oversize
Gear Clash When Shifting Forward Gears	.Clutch Out Of Adjustment, .Shift linkage damaged or out of adjustment, .Gears or synchronizers damaged, .Low gear oil level
Transmission Noisy When Moving (RWD Only) Quiet In Neutral With Clutch Engaged	.Worn rear outputshaft bearing
Gear Rattle	.Worn bearings, .Wrong gear oil, .Low gear oil, .Worn gears
Steady Ticking At Idle (Increases With RPM)	.Broken tooth on gear
Gear Clash When Shifting Forward Gears	.Worn or broken synchronizers
Loud Whine In Reverse	.Normal condition (1)

Noise When Stepping On Clutch	.Bad release bearing, .Worn pilot bearing
Ticking Or Screeching As Clutch Is Engaged	.Faulty release bearing, .Uneven pressure plate fingers
Click Or Snap When Clutch Is Engaged	.Worn clutch fork, .Worn or broken front bearing retainer
Transmission Shifts Hard	.Clutch not releasing, .Shift mechanism binding, .Clutch installed backwards
Will Not Shift Into One Gear, Shifts Into All Others	.Bent shift fork, .Worn detent balls
Locked Into Gear, Cannot Shift	.Clutch adjustment, .Worn detent balls
Transmission Jumps Out Of Gear	.Pilot bearing worn, .Bent shift fork, .Worn gear teeth or face .Excessive gear train end play .Worn synchronizers .Missing detent ball spring .Shift mechanism worn or out of adjustment .Engine or transmission mount bolts loose or out of adjustment .Transmission not aligned
Shift Lever Rattle	.Worn shift lever or detents .Worn shift forks .Worn synchronizers sleeve
Shift Lever Hops Under Acceleration	.Worn engine or transmission mounts
(1) - Most units use spur cut gears in reverse and are noisy	

POWERTRAIN

CLUTCH TROUBLE SHOOTING

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BASIC CLUTCH TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Chattering or Grabbing	Incorrect clutch adjustment	Adjust clutch
	Oil, grease or glaze on facings	Disassemble and clean or replace
	Loose "U" joint flange	See DRIVE AXLES article
	Worn input shaft spline	Replace input shaft
	Binding pressure plate	Replace pressure plate
	Binding release lever	See CLUTCH article
	Binding clutch disc hub	Replace clutch disc
	Unequal pressure plate contact	Replace worn/misaligned components
	Loose/bent clutch disc	Replace clutch disc
	Incorrect transmission alignment	Realign transmission
	Worn pressure plate, disc or flywheel	Replace damaged components
	Broken or weak pressure springs	Replace pressure plate
	Sticking clutch pedal	Lubricate clutch pedal & linkage
	Incorrect clutch disc facing	Replace clutch disc
	Engine loose in chassis	Tighten all mounting bolts
Failure to Release	Oil or grease on clutch facings	Clean or replace clutch clutch disc
	Incorrect release lever or pedal adjustment	See CLUTCH article
	Worn or broken clutch facings	Replace clutch disc
	Bent clutch disc or pressure plate	Replace damaged components
	Clutch disc hub binding on input shaft	Clean or replace clutch disc and/or input shaft
	Binding pilot bearing	Replace pilot bearing
	Sticking release bearing sleeve	Replace release bearing and/or sleeve
	Binding clutch cable	See CLUTCH article

	Defective clutch master	Replace master cylinder
	Defective clutch slave	Replace slave cylinder
	Air in hydraulic system	Bleed hydraulic system
Rattling	Weak or broken release lever spring	Replace spring and check alignment
	Damaged pressure plate	Replace pressure plate
	Broken clutch return spring	Replace return spring
	Worn splines on clutch disc or input shaft	Replace clutch disc and/or input shaft
	Worn clutch release bearing	Replace release bearing
	Dry or worn pilot bearing	Lubricate or replace pilot bearing
	Unequal release lever contact	Align or replace release lever
	Incorrect pedal free play	Adjust free play
	Warped or damaged clutch disc	Replace damaged components
Slipping	Pressure springs worn or	Release pressure plate
	Oily, greasy or worn facings	Clean or replace clutch disc
	Incorrect clutch alignment	Realign clutch assembly
	Warped clutch disc or pressure plate	Replace damaged components
	Binding release levers or clutch pedal	Lubricate and/or replace release components
Squeaking	Worn or damaged release	Replace release bearing
	Dry or worn pilot or release bearing	Lubricate or replace assembly
	Pilot bearing turning in crankshaft	Replace pilot bearing and/or crankshaft
	Worn input shaft bearing	Replace bearing and seal
	Incorrect transmission alignment	Realign transmission
	Dry release fork between pivot	Lubricate release fork and pivot
Heavy and/or Stiff Pedal	Sticking release bearing sleeve	Replace release bearing and/or sleeve

	Dry or binding clutch pedal hub	Lubricate and align components
	Floor mat interference with pedal	Lay mat flat in proper area
	Dry or binding ball/fork pivots	Lubricate and align components
	Faulty clutch cable	Replace clutch cable
Noisy Clutch Pedal	Faulty interlock switch	Replace interlock switch
	Self-adjuster ratchet noise	Lubricate or replace self-adjuster
	Speed control interlock switch	Lubricate or replace interlock switch
Clutch Pedal Sticks Down	Binding clutch cable	See CLUTCH article
	Springs weak in pressure plate	Replace pressure plate
	Binding in clutch linkage	Lubricate and free linkage
Noisy	Dry release bearing	Lubricate or replace release bearing
	Dry or worn pilot bearing	Lubricate or replace bearing
	Worn input shaft bearing	Replace bearing
Transmission Click	Weak springs in pressure plate	Replace pressure plate
	Release fork loose on ball stud	Replace release fork and/or ball stud
	Oil on clutch disc damper	Replace clutch disc
	Broken spring in slave cylinder	Replace slave cylinder

DRIVE AXLE - NOISE DIAGNOSIS

Unrelated Noises

Some driveline trouble symptoms are also common to the engine, transmission, wheel bearings, tires, and other parts of the vehicle. Ensure cause of trouble actually is in the drive axle before adjusting, repairing, or replacing any of its parts.

Non-Drive Axle Noises

A few conditions can sound just like drive axle noise and have to be considered in pre-diagnosis. The 4 most common noises are exhaust, tires, CV/universal joints and wheel trim rings.

In certain conditions, the pitch of the exhaust gases may sound like gear whine. At other times, it may be mistaken for a wheel bearing rumble.

Tires, especially radial and snow, can have a high-pitched tread whine or roar, similar to gear noise. Also, some non-standard tires with an unusual tread construction may emit a roar or whine.

Defective CV/universal joints may cause clicking noises or excessive driveline play that can be improperly diagnosed as drive axle problems.

Trim and moldings also can cause a whistling or whining noise. Ensure none of these components are causing the noise before disassembling the drive axle.

Gear Noise

A "howling" or "whining" noise from the ring and pinion gear can be caused by an improper gear pattern, gear damage, or improper bearing preload. It can occur at various speeds and driving conditions, or it can be continuous.

Before disassembling axle to diagnose and correct gear noise, make sure that tires, exhaust, and vehicle trim have been checked as possible causes.

Chuckle

This is a particular rattling noise that sounds like a stick against the spokes of a spinning bicycle wheel. It occurs while decelerating from 40 MPH and usually can be heard until vehicle comes to a complete stop. The frequency varies with the speed of the vehicle.

A chuckle that occurs on the driving phase is usually caused by excessive clearance due to differential gear wear, or by a damaged tooth on the coast side of the pinion or ring gear. Even a very small tooth nick or a ridge on the edge of a gear tooth is enough the cause the noise.

This condition can be corrected simply by cleaning the gear tooth nick or ridge with a small grinding wheel. If either gear is damaged or scored badly, the gear set must be replaced. If metal has broken loose, the carrier and housing must be cleaned to remove particles that could cause damage.

Knock

This is very similar to a chuckle, though it may be louder, and occur on acceleration or deceleration. Knock can be caused by a gear tooth that is damaged on the drive side of the ring and pinion gears. Ring gear bolts that are hitting the carrier casting can cause knock. Knock can also be due to excessive end play in the axle shafts.

Clunk

Clunk is a metallic noise heard when an automatic transmission is engaged in Reverse or Drive, or when throttle is applied or released. It is caused by backlash somewhere in the driveline, but not necessarily in the axle. To determine whether driveline clunk is caused by the axle, check the total axle backlash as follows:

1) Raise vehicle on a frame or twinpost hoist so that drive wheels are free. Clamp a bar between axle companion flange and a part of the frame or body so that flange cannot move.

2) On conventional drive axles, lock the left wheel to keep it from turning. On all models, turn the right wheel slowly until it is felt to be in Drive condition. Hold a chalk marker on side of tire about 12" from center of wheel. Turn wheel in the opposite direction until it is again felt to be in Drive condition.

3) Measure the length of the chalk mark, which is the total

axle backlash. If backlash is one inch or less, drive axle is not the source of clunk noise.

Bearing Whine

Bearing whine is a high-pitched sound similar to a whistle. It is usually caused by malfunctioning pinion bearings. Pinion bearings operate at drive shaft speed. Roller wheel bearings may whine in a similar manner if they run completely dry of lubricant. Bearing noise will occur at all driving speeds. This distinguishes it from gear whine, which usually comes and goes as speed changes.

Bearing Rumble

Bearing rumble sounds like marbles being tumbled. It is usually caused by a malfunctioning wheel bearing. The lower pitch is because the wheel bearing turns at only about 1/3 of drive shaft speed.

Chatter On Turns

This is a condition where the entire front or rear of vehicle vibrates when vehicle is moving. The vibration is plainly felt as well as heard. Extra differential thrust washers installed during axle repair can cause a condition of partial lock-up that creates this chatter.

Axle Shaft Noise

Axle shaft noise is similar to gear noise and pinion bearing whine. Axle shaft bearing noise will normally distinguish itself from gear noise by occurring in all driving modes (Drive, cruise, coast and float), and will persist with transmission in Neutral while vehicle is moving at problem speed.

If vehicle displays this noise condition, remove suspect axle shafts, replace wheel seals and install a new set of bearings. Re-evaluate vehicle for noise before removing any internal components.

Vibration

Vibration is a high-frequency trembling, shaking or grinding condition (felt or heard) that may be constant or variable in level and can occur during the total operating speed range of the vehicle.

The types of vibrations that can be felt in the vehicle can be divided into 3 main groups:

* Vibrations of various unbalanced rotating parts of the vehicle.
* Resonance vibrations of the body and frame structures caused by rotating of unbalanced parts.
* Tip-in moans of resonance vibrations from stressed engine or exhaust system mounts or driveline flexing modes.

DRIVE AXLE - RWD TROUBLE SHOOTING

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DRIVE AXLE (RWD) TROUBLE SHOOTING

CONDITION	POSSIBLE CAUSE	CORRECTION

Knocking or Clunking		
	Differential Side Gear Clearance	Check Clearance
	Worn Pinion Shaft	Replace Pinion Shaft
	Axle Shaft End Play	Check End Play
	Missing Gear Teeth	Check Differential/ Replace Gear
	Wrong Axle Backlash	Check Backlash
	Misaligned Driveline	Realign Driveline
Clinking During Engagement		
	Side Gear Clearance	Check Clearance
	Ring and Pinion Backlash	Check Backlash
	Worn/Loose Pinion Shaft	Replace Shaft/Bearing
	Bad "U" Joint	Replace "U" Joint
	Sticking Slip Yoke	Lube Slip Yoke
	Broken Rear Axle Mount	Replace Mount
	Loose Drive Shaft Flange	Check Flange
Click/Chatter On Turns		
	Differential Side Gear Clearance	Check Clearance
	Wrong Turn On Plates (1)	Replace Clutch Plates
	Wrong Differential Lubricant (1)	Change Lubricant
Knock Or Click	Flat Spot on Rear Wheel Bearing	Replace Wheel Bearing
Low Vibration At All Speeds		
	Faulty Wheel Bearing	Replace Wheel Bearing
	Faulty "U" Joint	Replace "U" Joint
	Faulty Drive Shaft	Balance Drive Shaft
	Faulty Companion Flange	Replace Flange
	Faulty Slip Yoke Flange	Replace Flange

(1) - Limited slip differential only.

FWD AXLE SHAFTS & CV JOINTS TROUBLE SHOOTING

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problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC FWD AXLE SHAFTS & CV JOINTS TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE
Grease Leaks	CV boot torn or cracked
Clicking Noise on Cornering	Damaged outer CV
Clunk Noise on Acceleration	Damaged inner CV
Vibration or Shudder on Acceleration	Sticking, damaged or worn CV Misalignment or spring height

STEERING & SUSPENSION

MANUAL STEERING GEAR TROUBLE SHOOTING

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BASIC MANUAL STEERING GEAR TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Rattle or Chucking Noise in Rack and Pinion	Rack and pinion mounting bracket loose	Tighten all mounting bolts
	Lack of/or incorrect lubricant	Correct as necessary
	Steering gear mounting bolts loose	Tighten all mounting bolts
Excessive Play	Front wheel bearing improperly adjusted	See FRONT SUSPENSION article
	Loose or worn steering linkage	See STEERING LINKAGE article
	Loose or worn steering gear shift	See MANUAL STEERING GEAR article
	Steering arm loose on gear shaft	See MANUAL STEERING GEAR article
	Steering gear housing bolts loose	Tighten all mounting bolts
	Steering gear adjustment too loose	See MANUAL STEERING GEAR article
	Steering arms loose on	Tighten and check

	knuckles	steering linkage
	Rack and pinion mounting loose	Tighten all mounting bolts
	Rack and pinion out of adjustment	See adjustment in STEERING article
	Tie rod end loose	Tighten and check steering linkage
	Excessive Pitman shaft-to-ball nut lash	Repair as necessary
Poor Returnability	Lack of lubricant in ball joint or linkage	Lubricate and service systems
	Binding in linkage or ball joints	See STEERING LINKAGE and SUSPENSION article
	Improper front end alignment	See WHEEL ALIGNMENT article
	Improper tire pressure	Inflate to proper pressure
	Tie rod binding	Inflate to proper pressure
	Shaft seal rubbing shaft	See STEERING COLUMN article
Excessive Vertical Motion	Improper tire pressure	Inflate to proper pressure
	Tires, wheels or rotors out of balance	Balance tires then check wheels and rotors
	Worn or faulty shock absorbers	Check and replace if necessary
	Loose tie rod ends or steering	Tighten or replace if necessary
	Loose or worn wheel bearings	See SUSPENSION article
Steering Pulls to One Side	Improper tire pressure	Inflate to proper pressure
	Front tires are different sizes	Rotate or replace if necessary
	Wheel bearings not adjusted properly	See FRONT SUSPENSION article
	Bent or broken suspension components	See FRONT SUSPENSION article
	Improper wheel alignment	See WHEEL ALIGNMENT article

	Brakes dragging	See BRAKES article
Instability	Low or uneven tire pressure	Inflate to proper pressure
	Loose or worn wheel bearings	See FRONT SUSPENSION article
	Loose or worn idler arm bushing	See FRONT SUSPENSION article
	Loose or worn strut bushings	See FRONT SUSPENSION article
	Incorrect front wheel alignment	See WHEEL ALIGNMENT article
	Steering gear not centered	See MANUAL STEERING GEARS article
	Springs or shock	Check and replace if necessary
	Improper cross shaft	See MANUAL STEERING GEARS article

POWER STEERING TROUBLE SHOOTING

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BASIC POWER STEERING TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Rattle or Chucking Noise	Pressure hoses touching engine parts	Adjust to proper clearance
	Loose Pitman shaft	Adjust or replace if necessary
	Tie rods ends or Pitman arm loose	Tighten and check system
	Rack and pinion mounts loose	Tighten all mounting bolts
	Free play in worm and	See POWER STEERING GEAR article
	Loose sector shaft or thrust bearing adjustment	See POWER STEERING GEAR
	Free play in pot coupling	See STEERING COLUMN article

	Worn shaft serrations	See STEERING COLUMN article
Growl in Steering Pump	Excessive pressure in hoses	Restricted hoses, see POWER STEERING GEAR article
	Scored pressure plates	See POWER STEERING GEAR article
	Scored thrust plates or rotor	See POWER STEERING GEAR article
	Extreme wear of cam ring	See POWER STEERING GEAR article
Rattle in Steering Pump	Vanes not installed	See POWER STEERING PUMP article
	Vanes sticking in rotor	See POWER STEERING PUMP article
Swish noise in Pump	Defective flow control valve	See POWER STEERING PUMP article
Groan in Steering Pump	Air in fluid	See POWER STEERING PUMP article
	Poor pressure hose connection	Tighten and check, replace if necessary
Squawk When Turning	Damper "O" ring on valve spool cut	See POWER STEERING PUMP article
Moan or Whine in Pump	Pump shaft bearing scored	Replace bearing and fluid
	Air in fluid or fluid level low	See POWER STEERING PUMP article
	Hose or column grounded	Check and replace if necessary
	Cover "O" ring missing or damaged	See POWER STEERING PUMP article
	Valve cover baffle missing or damaged	See POWER STEERING PUMP article
	Interference of components in pump	See POWER STEERING PUMP article
	Loose or poor bracket alignment	Correct or replace if necessary
Hissing When Parking	Internal leakage in steering gear	Check valved assembly first
Chirp in Steering Pump	Loose or worn power steering belt	Adjust or replace if necessary
Buzzing When Not Steering	Noisy pump	See POWER STEERING PUMP article

	Free play in steering shaft bearing	See STEERING COLUMN article
	Bearing loose on shaft serrations	See STEERING COLUMN article
Clicking Noise in Pump	Pump slippers too long	See POWER STEERING PUMP article
	Broken slipper springs	See POWER STEERING PUMP article
	Excessive wear or nicked rotors	See POWER STEERING PUMP article
	Damaged cam contour	See POWER STEERING PUMP article
Poor Return of Wheel	Wheel rubbing against turn signal	See STEERING COLUMN SWITCHES article
	Flange rubbing steering gear adjuster	See STEERING COLUMN article
	Tight or frozen steering shaft bearing	See STEERING COLUMN article
	Steering gear out of adjustment	See POWER STEERING GEAR article
	Sticking or plugged spool valve	See POWER STEERING PUMP article
	Improper front end alignment	See WHEEL ALIGNMENT article
	Wheel bearings worn or loose	See FRONT SUSPENSION article
	Ties rods or ball joints binding	Check and replace if necessary
	Intermediate shaft joints binding	See STEERING COLUMN article
	Kinked pressure hoses	Correct or replace if necessary
	Loose housing head spanner nut	See POWER STEERING GEAR article
	Damaged valve lever	See POWER STEERING GEAR article
	Sector shaft adjusted too tight	See ADJUSTMENTS in POWER STEERING GEAR article
	Worm thrust bearing adjusted too tight	See ADJUSTMENTS in POWER STEERING GEAR article
	Reaction ring sticking in cylinder	See POWER STEERING GEAR article

	Reaction ring sticking in housing head	See POWER STEERING GEAR article
	Steering pump internal leakage	See POWER STEERING PUMP article
	Steering gear-to-column misalignment	See STEERING COLUMN article
	Lack of lubrication in linkage	Service front suspension
	Lack of lubrication in ball joints	Service front suspension
Increased Effort When Turning	High internal pump leakage	See POWER STEERING PUMP article
Wheel Fast Foaming, Milky Power Steering Fluid, Low Fluid Level or Low Pressure	Power steering pump belt slipping	Adjust or replace if necessary
	Low fluid level	Check and fill to proper level
	Engine idle speed to low	Adjust to correct setting
	Air in pump fluid system	See POWER STEERING PUMP article
	Pump output low	See POWER STEERING PUMP article
	Steering gear malfunctioning	See POWER STEERING GEAR article
Wheel Surges or Jerks	Low fluid level	Check and fill to proper level
	Loose fan belt	Adjust or replace if necessary
	Insufficient pump pressure	See POWER STEERING PUMP article
	Sticky flow control valve	See POWER STEERING PUMP article
	Linkage hitting oil pan at full turn	Replace bent components
Kick Back or Free Play	Air in pump fluid system	See POWER STEERING PUMP article
	Worn poppet valve in steering gear	See POWER STEERING PUMP article
	Excessive over center lash	See POWER STEERING GEAR article
	Thrust bearing out of adjustment	See POWER STEERING GEAR article

	Free play in pot coupling	See POWER STEERING PUMP article
	Steering gear coupling loose on shaft	See POWER STEERING PUMP article
	Steering disc mounting bolts loose	Tighten or replace if necessary
	Coupling loose on worm shaft	Tighten or replace if necessary
	Improper sector shaft adjustment	See POWER STEERING GEAR article
	Excessive worm piston side play	See POWER STEERING GEAR article
	Damaged valve lever	See POWER STEERING GEAR article
	Universal joint loose	Tighten or replace if necessary
	Defective rotary valve	See POWER STEERING GEAR article
No Power When Parking	Sticking flow control valve	See POWER STEERING PUMP article
	Insufficient pump pressure output	See POWER STEERING PUMP article
	Excessive internal pump leakage	See POWER STEERING PUMP article
	Excessive internal gear leakage	See POWER STEERING PUMP article
	Flange rubs against gear adjust plug	See STEERING COLUMN article
	Loose pump belt	Adjust or replace if necessary
	Low fluid level	Check and add proper amount of fluid
	Engine idle too low	Adjust to correct setting
	Steering gear-to-column misaligned	See STEERING COLUMN article
No Power, Left Turn	Left turn reaction seal "O" ring worn	See POWER STEERING GEAR article
	Left turn reaction seal damaged/missing	See POWER STEERING GEAR article
	Cylinder head "O" ring damaged	See POWER STEERING PUMP article

No Power, Right Turns	Column pot coupling bottomed	See STEERING COLUMN article
	Right turn reaction seal "O" ring worn	See POWER STEERING GEAR article
	Right turn reaction seal damaged	See POWER STEERING GEAR article
	Internal leakage through piston end plug	See POWER STEERING GEAR article
	Internal leakage through side plugs	See POWER STEERING GEAR article
Lack of Effort in Turning	Left and/or right reaction seal sticking in cylinder head	Replace, see POWER STEERING GEAR article
Wanders to One Side	Front end alignment incorrect	See WHEEL ALIGNMENT article
	Unbalanced steering gear valve	See POWER STEERING GEAR article
Low Pressure Due to Steering Pump	Flow control valve stuck or inoperative	See POWER STEERING PUMP article
	Pressure plate not flat against cam ring	See POWER STEERING PUMP article
	Extreme wear of cam ring	Replace and check adjustments
	Scored plate, thrust plate or rotor	See POWER STEERING PUMP article
	Vanes not installed properly	See POWER STEERING PUMP article
	Vanes sticking in rotor slots	See POWER STEERING PUMP article
	Cracked/broken thrust or pressure plate	See POWER STEERING PUMP article

STEERING COLUMN TROUBLE SHOOTING

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BASIC STEERING COLUMN TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Noise in Steering	Coupling pulled apart	See STEERING COLUMNS article

	Column not correctly aligned	See STEERING COLUMNS article
	Broken lower joint	Replace joint
	Horn contact ring not	See STEERING COLUMN article
	Bearing not lubricated	See STEERING COLUMN article
	Shaft snap ring not properly seated	Reseat or replace snap ring
	Plastic spherical joint not lubricated	See STEERING COLUMN article
	Shroud or housing loose	Tighten holding screws
	Lock plate retaining ring not seated	See STEERING COLUMN article
	Loose sight shield	Tighten holding screws
High Steering Shaft Effort	Column assembly misaligned	See STEERING COLUMN article
	Improperly installed dust shield	Adjust or replace
	Tight steering universal joint	See STEERING COLUMN article
High Shift Effort	Column is out of alignment	See STEERING COLUMN article
	Improperly installed dust shield	Adjust or replace
	Seals or bearings not lubricated	See STEERING COLUMNS article
	Mounting bracket screws too long	Replace with new shorter screws
	Burrs on shift tube	Remove burrs or replace tube
	Lower bowl bearing assembled wrong	See STEERING COLUMN article
	Shift tube bent or broken	Replace as necessary
	Improper adjustment of shift levers	See STEERING COLUMN article
Improper Trans. Shifting	Sheared shift tube joint	Replace as necessary
	Sheared lower shaft lever	Replace as necessary
	Improper shift lever adjustment	See STEERING COLUMN article

	Improper gate plate adjustment	See STEERING COLUMN article
Excess Play in Column	Instrument panel bracket bolts loose	Tighten bolts and check bracket
	Broken weld nut on jacket	See STEERING COLUMN article
	Instrument bracket capsule sheared	See STEERING COLUMN article
	Column bracket/jacket bolts loose	Tighten bolts and check bracket
Steering Locks in Gear	Release lever mechanism	See STEERING COLUMN article

SUSPENSION TROUBLE SHOOTING

NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC SUSPENSION TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Front End Noise	Loose or worn wheel	See Wheel Bearing Adjustment in SUSPENSION
	Worn shocks or shock mountings	Replace struts or strut mountings
	Worn struts or strut mountings	Replace struts or strut mountings
	Loose or worn lower control arm	See SUSPENSION
	Loose steering gear-to-frame bolts	See STEERING
	Worn control arm bushings	See SUSPENSION
	Ball joints not lubricated	Lubricate ball joints & see Ball Joint Checking in SUSPENSION
Front Wheel Shake, Shimmy, or Vibration	Tires or wheels out of balance	Check tire balance
	Incorrect wheel alignment	See WHEEL ALIGNMENT
	Drive shaft unbalanced	Check drive shaft balance

	Loose or worn wheel bearings	See WHEEL ALIGNMENT
	Loose or worn tie rod ends	See SUSPENSION
	Worn upper ball joints	See Ball Joint Checking in SUSPENSION
	Worn shock absorbers	Replace shock absorbers
	Worn strut bushings	Replace strut bushings
Car Pulls to One Side	Mismatched or uneven tires	Check tire condition
	Broken or sagging springs	See SUSPENSION
	Loose or worn strut bushings	See SUSPENSION
	Improper wheel alignment	See WHEEL ALIGNMENT
	Improper rear axle alignment	Check rear axle alignment
	Power steering gear unbalanced	See STEERING
	Front brakes dragging	See BRAKES
Abnormal Tire Wear	Unbalanced tires	Check tire balance & rotation
	Sagging or broken springs	See SUSPENSION
	Incorrect front end alignment	See WHEEL ALIGNMENT
	Faulty shock absorbers	Replace chock absorbers
Scuffed Tires	Toe-In incorrect	See WHEEL ALIGNMENT
	Suspension arm bent or twisted	See appropriate SUSPENSION article
Springs Bottom or Sag	Bent or broken springs	See SUSPENSION
	Leaking or worn shock absorbers	Replace shock absorbers
	Frame misalignment	Check frame for damage
Spring Noises	Loose "U" Bolts	See SUSPENSION
	Loose or worn bushings	See SUSPENSION
	Worn or missing interliners	See SUSPENSION
Shock Absorber Noise	Loose shock mountings	Check & tighten mountings
	Worn bushings	Replace bushings

	Air in system	Bleed air from system
	Undercoating on shocks	Remove undercoating
Car Leans or Sways on Corners	Loose stabilizer bar	See SUSPENSION
	Faulty shocks or mountings	Replace shocks or mountings
	Broken or sagging springs	See SUSPENSION
Shock Absorbers Leaking	Worn seals or reservoir tube crimped	See SUSPENSION
Broken Springs	Loose "U" bolts	See SUSPENSION
	Inoperative shock absorbers	Replace shock absorbers

WHEEL ALIGNMENT TROUBLE SHOOTING

NOTE: This is GENERAL information. This article is not intended to be specific to any unique situation or individual vehicle configuration. The purpose of this Trouble Shooting information is to provide a list of common causes to problem symptoms. For model-specific Trouble Shooting, refer to SUBJECT, DIAGNOSTIC, or TESTING articles available in the section(s) you are accessing.

BASIC WHEEL ALIGNMENT TROUBLE SHOOTING CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Premature Tire Wear	Improper tire inflation	Check tire pressure
	Front alignment out of tolerance	See ALIGNMENT SPECS in WHEEL ALIGNMENT section
	Suspension components worn	See SUSPENSION section
	Steering system components worn	See STEERING section
	Improper standing height	See WHEEL ALIGNMENT
	Uneven or sagging springs	See SUSPENSION section
	Bent wheel	See WHEEL ALIGNMENT
	Improper torsion bar adjustment	See SUSPENSION section
	Loose or worn wheel bearings	See WHEEL BEARING ADJ. in SUSPENSION section
	Worn or defective shock	Replace shock absorbers
	Tires out of balance	Check tire balance
Pulls to One Side	Improper tire inflation	Check tire pressure
	Brake dragging	See BRAKE section

	Mismatched tires	See WHEEL ALIGNMENT
	Broken or sagging spring	See SUSPENSION section
	Broken torsion bar	See SUSPENSION section
	Power steering valve not centered	See STEERING section
	Front alignment out of tolerance	See WHEEL ALIGNMENT section
	Defective wheel bearing	See WHEEL BEARINGS in SUSPENSION section
	Uneven sway bar links	See SUSPENSION section
	Frame bent	Check for frame damage
	Steering system bushing worn	See STEERING section
Hard Steering	Idler arm bushing too tight	See STEERING LINKAGE in STEERING section
	Ball joint tight or seized	See SUSPENSION section
	Steering linkage too tight	See STEERING LINKAGE in STEERING section
	Power steering fluid low	Add proper amount of fluid
	Power steering drive belt loose	See STEERING section
	Power steering pump defective	See STEERING section
	Steering gear out of adjustment	See STEERING section
	Incorrect wheel alignment	See WHEEL ALIGNMENT
	Damaged steering gear	See STEERING section
	Damaged suspension	See SUSPENSION section
	Bent steering knuckle or supports	See SUSPENSION section
Vehicle "Wanders"	Strut rod or control arm bushing worn	See SUSPENSION section
	Loose or worn wheel bearings	See WHEEL BEARINGS in SUSPENSION section
	Improper tire inflation	Check tire pressure
	Stabilizer bar missing or defective	See SUSPENSION section

	Wheel alignment out of tolerance	See Adjustment in WHEEL ALIGNMENT section
	Broken spring	See SUSPENSION section
	Defective shock absorbers	Replace shock absorbers
	Worn steering & suspension components	See SUSPENSION section
Front End Shimmy	Tire out of balance/round	Check tire balance
	Excessive wheel runout	See WHEEL ALIGNMENT
	Insufficient or improper caster	See WHEEL ALIGNMENT section
	Worn suspension or steering components	See SUSPENSION section
	Defective shock absorbers	Replace shock absorber
	Wheel bearings worn or loose	See WHEEL BEARING ADJ. in SUSPENSION section
	Power steering reaction Bracket loose	See STEERING section
	Steering gear box (rack) mounting loose	See STEERING section
	Steering gear adjustment loose	See STEERING section
	Worn spherical joints	See SUSPENSION section
Toe-In Not Adjustable	Lower control arm bent	See SUSPENSION section
	Frame bent	Check frame for damage
Camber Not Adjustable	Control arm bent	See SUSPENSION section
	Frame bent	Check frame for damage
	Hub & bearing not seated properly	See SUSPENSION section

M - VACUUM DIAGRAMS - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Vacuum Diagrams

Montero Sport - 2.4L

INTRODUCTION

This article contains underhood views or schematics of vacuum hose routing. Use these vacuum diagrams during the visual inspection in F - BASIC TESTING - 2.4L article. This will assist in identifying improperly routed vacuum hoses, which cause driveability and/or computer-indicated malfunctions.

NOTE: California and Federal applies to installed emission equipment, which may be verified by underhood Emission Control label. California emissions may be available in other states.

NOTE: Always refer to Emission Control label in engine compartment before attempting service. If manual and label differ, always use emission label specifications.

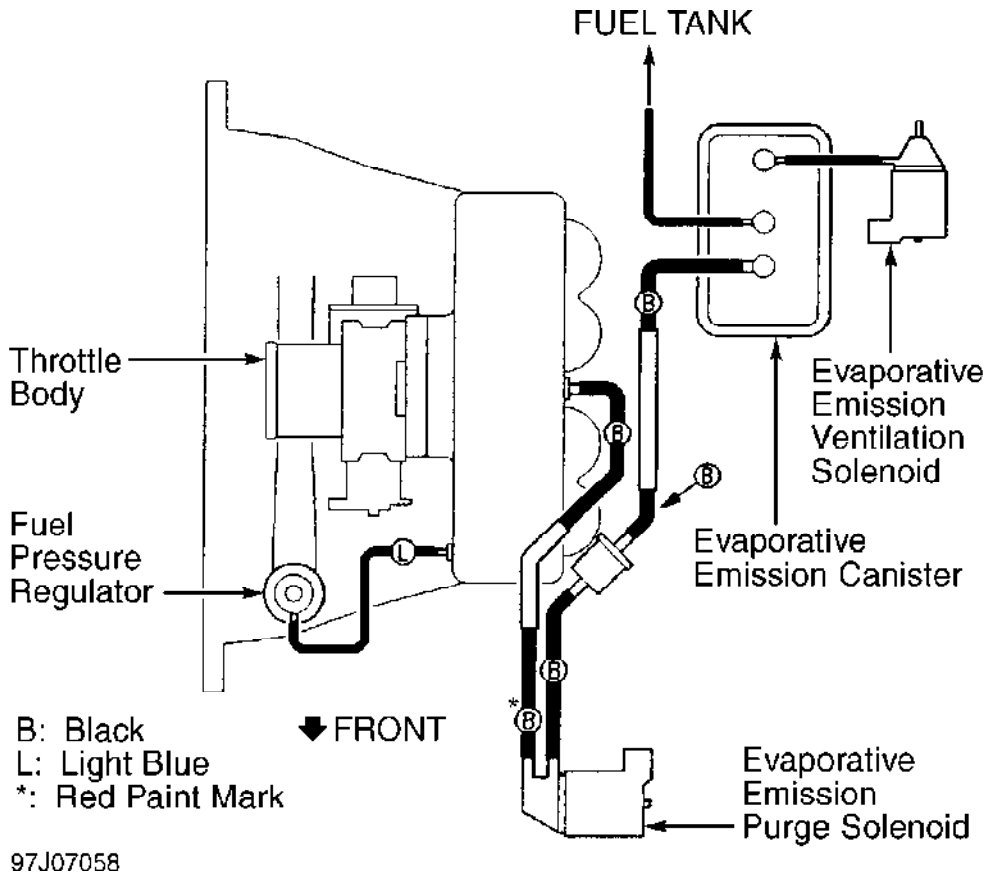

Fig. 1: Vacuum Diagram (California)
Courtesy of Mitsubishi Motor Sales of America.

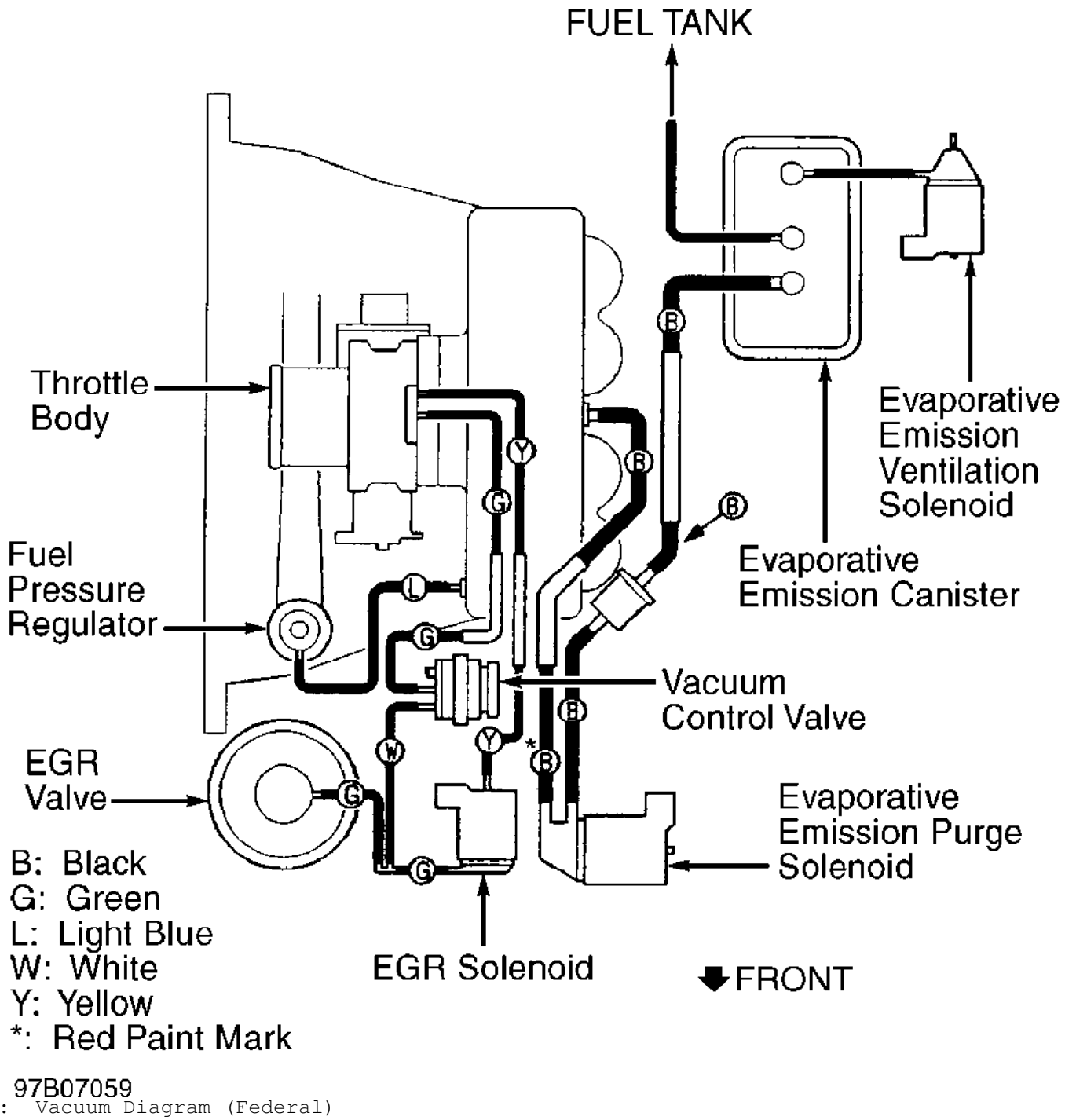

Fig. 2: Vacuum Diagram (Federal)
Courtesy of Mitsubishi Motor Sales of America.

M - VACUUM DIAGRAMS - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Vacuum Diagrams

Montero Sport - 3.0L

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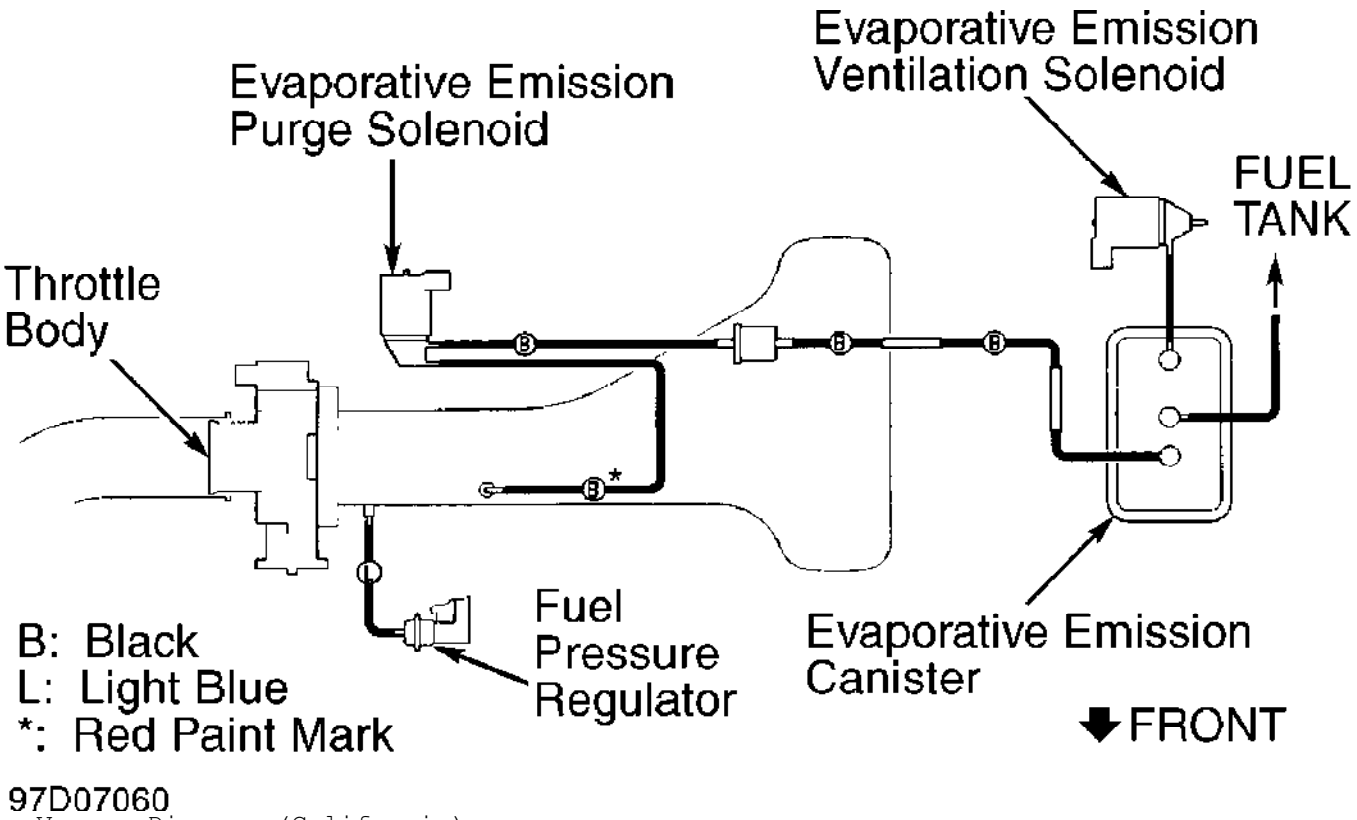

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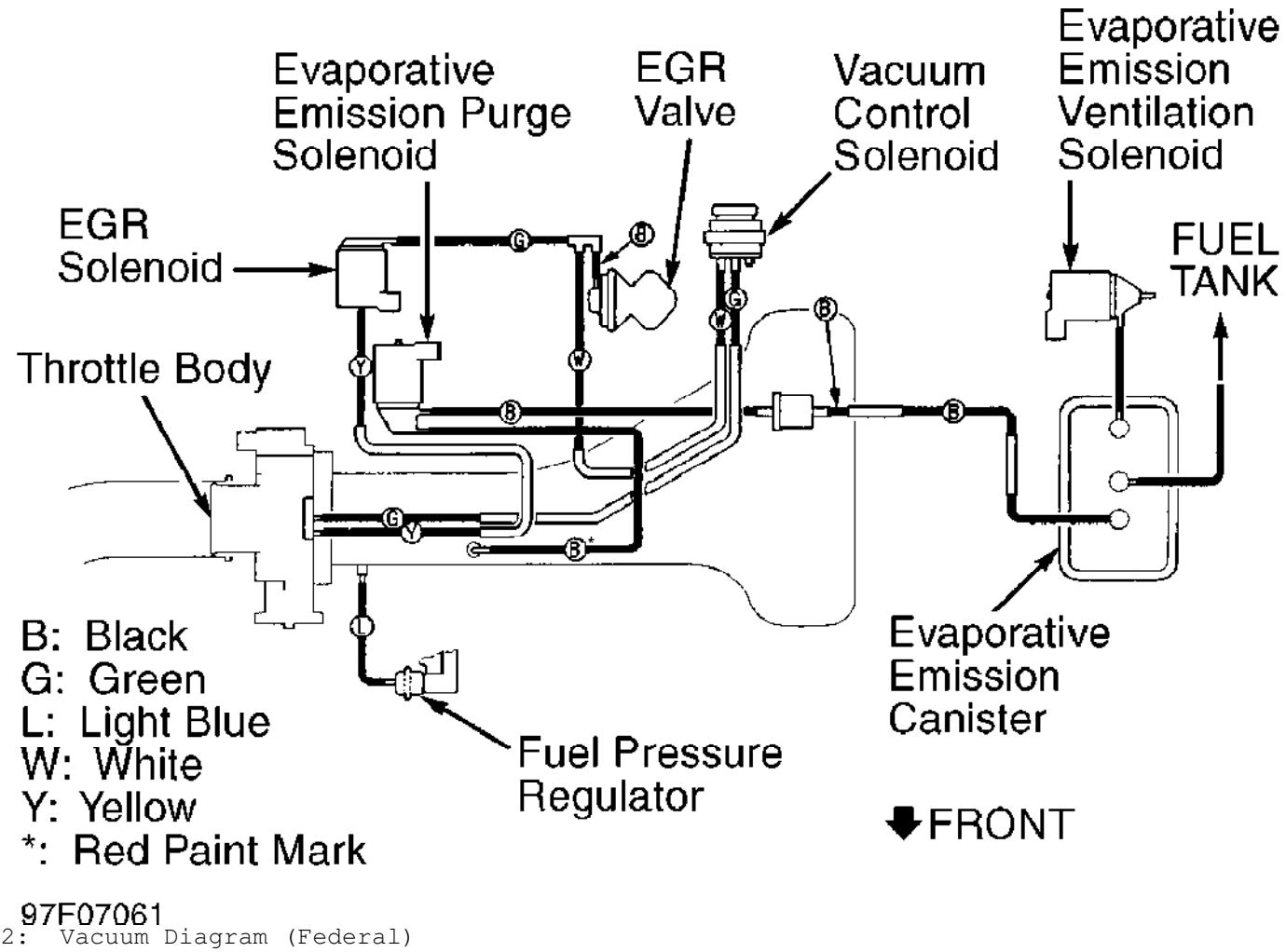

Fig. 2: Vacuum Diagram (Federal)
Courtesy of Mitsubishi Motor Sales of America.

WAVEFORMS - INJECTOR PATTERN TUTORIAL

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Waveforms - Injector Pattern Tutorial

*** PLEASE READ THIS FIRST ***

NOTE: This article is intended for general information purposes only. This information may not apply to all makes and models.

PURPOSE OF THIS ARTICLE

Learning how to interpret injector drive patterns from a Lab Scope can be like learning ignition patterns all over again. This article exists to ease you into becoming a skilled injector pattern interpreter.

You will learn:

* How a DVOM and noid light fall short of a lab scope.
* The two types of injector driver circuits, voltage controlled & current controlled.
* The two ways injector circuits can be wired, constant ground/switched power & constant power/switched ground.
* The two different pattern types you can use to diagnose with, voltage & current.
* All the valuable details injector patterns can reveal.

SCOPE OF THIS ARTICLE

This is NOT a manufacturer specific article. All different types of systems are covered here, regardless of the specific year/make/model/engine.

The reason for such broad coverage is because there are only a few basic ways to operate a solenoid-type injector. By understanding the fundamental principles, you will understand all the major points of injector patterns you encounter. Of course there are minor differences in each specific system, but that is where a waveform library helps out.

If this is confusing, consider a secondary ignition pattern. Even though there are many different implementations, each still has a primary voltage turn-on, firing line, spark line, etc.

If specific waveforms are available in On Demand for the engine and vehicle you are working on, you will find them in the Engine Performance section under the Engine Performance category.

IS A LAB SCOPE NECESSARY?

INTRODUCTION

You probably have several tools at your disposal to diagnose injector circuits. But you might have questioned "Is a lab scope necessary to do a thorough job, or will a set of noid lights and a multifunction DVOM do just as well?"

In the following text, we are going to look at what noid lights and DVOMs do best, do not do very well, and when they can mislead you. As you might suspect, the lab scope, with its ability to look inside an active circuit, comes to the rescue by answering for the deficiencies of these other tools.

OVERVIEW OF NOID LIGHT

The noid light is an excellent "quick and dirty" tool. It can usually be hooked to a fuel injector harness fast and the flashing light is easy to understand. It is a dependable way to identify a no-pulse situation.

However, a noid light can be very deceptive in two cases:

* If the wrong one is used for the circuit being tested. Beware: Just because a connector on a noid light fits the harness does not mean it is the right one.
* If an injector driver is weak or a minor voltage drop is present.

Use the Right Noid Light

In the following text we will look at what can happen if the wrong noid light is used, why there are different types of noid lights (besides differences with connectors), how to identify the types of noid lights, and how to know the right type to use.

First, let's discuss what can happen if the incorrect type of noid light is used. You might see:

* A dimly flashing light when it should be normal.
* A normal flashing light when it should be dim.

A noid light will flash dim if used on a lower voltage circuit than it was designed for. A normally operating circuit would appear underpowered, which could be misinterpreted as the cause of a fuel starvation problem.

Here are the two circuit types that could cause this problem:

* Circuits with external injector resistors. Used predominately on some Asian & European systems, they are used to reduce the available voltage to an injector in order to limit the current flow. This lower voltage can cause a dim flash on a noid light designed for full voltage.
* Circuits with current controlled injector drivers (e.g. "Peak and Hold"). Basically, this type of driver allows a quick burst of voltage/current to flow and then throttles it back significantly for the remainder of the pulse width duration. If a noid light was designed for the other type of driver (voltage controlled, e.g. "Saturated"), it will appear dim because it is expecting full voltage/current to flow for the entire duration of the pulse width.

Let's move to the other situation where a noid light flashes normally when it should be dim. This could occur if a more sensitive noid light is used on a higher voltage/amperage circuit that was weakened enough to cause problems (but not outright broken). A circuit with an actual problem would thus appear normal.

Let's look at why. A noid light does not come close to consuming as much amperage as an injector solenoid. If there is a partial driver failure or a minor voltage drop in the injector circuit, there can be adequate amperage to fully operate the noid light BUT NOT ENOUGH TO OPERATE THE INJECTOR.

If this is not clear, picture a battery with a lot of corrosion on the terminals. Say there is enough corrosion that the starter motor will not operate; it only clicks. Now imagine turning on the headlights (with the ignition in the RUN position). You find they light normally and are fully bright. This is the same idea as noid light: There is a problem, but enough amp flow exists to operate the headlights ("noid light"), but not the starter motor ("injector").

How do you identify and avoid all these situations? By using the correct type of noid light. This requires that you understanding

the types of injector circuits that your noid lights are designed for. There are three. They are:

* Systems with a voltage controlled injector driver. Another way to say it: The noid light is designed for a circuit with a "high" resistance injector (generally 12 ohms or above).
* Systems with a current controlled injector driver. Another way to say it: The noid light is designed for a circuit with a low resistance injector (generally less than 12 ohms) without an external injector resistor.
* Systems with a voltage controlled injector driver and an external injector resistor. Another way of saying it: The noid light is designed for a circuit with a low resistance injector (generally less than 12 ohms) and an external injector resistor.

NOTE: Some noid lights can meet both the second and third categories simultaneously.

If you are not sure which type of circuit your noid light is designed for, plug it into a known good car and check out the results. If it flashes normally during cranking, determine the circuit type by finding out injector resistance and if an external injector resistor is used. You now know enough to identify the type of injector circuit. Label the noid light appropriately.

Next time you need to use a noid light for diagnosis, determine what type of injector circuit you are dealing with and select the appropriate noid light.

Of course, if you suspect a no-pulse condition you could plug in any one whose connector fit without fear of misdiagnosis. This is because it is unimportant if the flashing light is dim or bright. It is only important that it flashes.

In any cases of doubt regarding the use of a noid light, a lab scope will overcome all inherent weaknesses.

OVERVIEW OF DVOM

A DVOM is typically used to check injector resistance and available voltage at the injector. Some techs also use it check injector on-time either with a built-in feature or by using the dwell/duty function.

There are situations where the DVOM performs these checks dependably, and other situations where it can deceive you. It is important to be aware of these strengths and weaknesses. We will cover the topics above in the following text.

Checking Injector Resistance

If a short in an injector coil winding is constant, an ohmmeter will accurately identify the lower resistance. The same is true with an open winding. Unfortunately, an intermittent short is an exception. A faulty injector with an intermittent short will show "good" if the ohmmeter cannot force the short to occur during testing.

Alcohol in fuel typically causes an intermittent short, happening only when the injector coil is hot and loaded by a current high enough to jump the air gap between two bare windings or to break down any oxides that may have formed between them.

When you measure resistance with an ohmmeter, you are only applying a small current of a few milliamps. This is nowhere near enough to load the coil sufficiently to detect most problems. As a result, most resistance checks identify intermittently shorted injectors as being normal.

There are two methods to get around this limitation. The first is to purchase an tool that checks injector coil windings under

full load. The Kent-Moore J-39021 is such a tool, though there are others. The Kent-Moore costs around $240 at the time of this writing and works on many different manufacturer's systems.

The second method is to use a lab scope. Remember, a lab scope allows you to see the regular operation of a circuit in real time. If an injector is having an short or intermittent short, the lab scope will show it.

Checking Available Voltage At the Injector

Verifying a fuel injector has the proper voltage to operate correctly is good diagnostic technique. Finding an open circuit on the feed circuit like a broken wire or connector is an accurate check with a DVOM. Unfortunately, finding an intermittent or excessive resistance problem with a DVOM is unreliable.

Let's explore this drawback. Remember that a voltage drop due to excessive resistance will only occur when a circuit is operating? Since the injector circuit is only operating for a few milliseconds at a time, a DVOM will only see a potential fault for a few milliseconds. The remaining 90+% of the time the unloaded injector circuit will show normal battery voltage.

Since DVOMs update their display roughly two to five times a second, all measurements in between are averaged. Because a potential voltage drop is visible for such a small amount of time, it gets "averaged out", causing you to miss it.

Only a DVOM that has a "min-max" function that checks EVERY MILLISECOND will catch this fault consistently (if used in that mode). The Fluke 87 among others has this capability.

A "min-max" DVOM with a lower frequency of checking (100 millisecond) can miss the fault because it will probably check when the injector is not on. This is especially true with current controlled driver circuits. The Fluke 88, among others fall into this category.

Outside of using a Fluke 87 (or equivalent) in the 1 mS "min-max" mode, the only way to catch a voltage drop fault is with a lab scope. You will be able to see a voltage drop as it happens.

One final note. It is important to be aware that an injector circuit with a solenoid resistor will always show a voltage drop when the circuit is energized. This is somewhat obvious and normal; it is a designed-in voltage drop. What can be unexpected is what we already covered--a voltage drop disappears when the circuit is unloaded. The unloaded injector circuit will show normal battery voltage at the injector. Remember this and do not get confused.

Checking Injector On-Time With Built-In Function

Several DVOMs have a feature that allows them to measure injector on-time (mS pulse width). While they are accurate and fast to hookup, they have three limitations you should be aware of:

* They only work on voltage controlled injector drivers (e.g "Saturated Switch"), NOT on current controlled injector drivers (e.g. "Peak & Hold").
* A few unusual conditions can cause inaccurate readings.
* Varying engine speeds can result in inaccurate readings.

Regarding the first limitation, DVOMs need a well-defined injector pulse in order to determine when the injector turns ON and OFF. Voltage controlled drivers provide this because of their simple switch-like operation. They completely close the circuit for the entire duration of the pulse. This is easy for the DVOM to interpret.

The other type of driver, the current controlled type, start off well by completely closing the circuit (until the injector pintle opens), but then they throttle back the voltage/current for the duration of the pulse. The DVOM understands the beginning of the pulse

but it cannot figure out the throttling action. In other words, it cannot distinguish the throttling from an open circuit (de-energized) condition.

Yet current controlled injectors will still yield a millisecond on-time reading on these DVOMs. You will find it is also always the same, regardless of the operating conditions. This is because it is only measuring the initial completely-closed circuit on-time, which always takes the same amount of time (to lift the injector pintle off its seat). So even though you get a reading, it is useless.

The second limitation is that a few erratic conditions can cause inaccurate readings. This is because of a DVOM's slow display rate; roughly two to five times a second. As we covered earlier, measurements in between display updates get averaged. So conditions like skipped injector pulses or intermittent long/short injector pulses tend to get "averaged out", which will cause you to miss important details.

The last limitation is that varying engine speeds can result in inaccurate readings. This is caused by the quickly shifting injector on-time as the engine load varies, or the RPM moves from a state of acceleration to stabilization, or similar situations. It too is caused by the averaging of all measurements in between DVOM display periods. You can avoid this by checking on-time when there are no RPM or load changes.

A lab scope allows you to overcome each one of these limitations.

Checking Injector On-Time With Dwell Or Duty

If no tool is available to directly measure injector millisecond on-time measurement, some techs use a simple DVOM dwell or duty cycle functions as a replacement.

While this is an approach of last resort, it does provide benefits. We will discuss the strengths and weaknesses in a moment, but first we will look at how a duty cycle meter and dwell meter work.

How A Duty Cycle Meter and Dwell Meter Work

All readings are obtained by comparing how long something has been OFF to how long it has been ON in a fixed time period. A dwell meter and duty cycle meter actually come up with the same answers using different scales. You can convert freely between them. See RELATIONSHIP BETWEEN DWELL & DUTY CYCLE READINGS TABLE.

The DVOM display updates roughly one time a second, although some DVOMs can be a little faster or slower. All measurements during this update period are tallied inside the DVOM as ON time or OFF time, and then the total ratio is displayed as either a percentage (duty cycle) or degrees (dwell meter).

For example, let's say a DVOM had an update rate of exactly 1 second (1000 milliseconds). Let's also say that it has been measuring/tallying an injector circuit that had been ON a total of 250 mS out of the 1000 mS. That is a ratio of one-quarter, which would be displayed as 25% duty cycle or 15° dwell (six-cylinder scale). Note that most duty cycle meters can reverse the readings by selecting the positive or negative slope to trigger on. If this reading were reversed, a duty cycle meter would display 75%.

Strengths of Dwell/Duty Meter

The obvious strength of a dwell/duty meter is that you can compare injector on-time against a known-good reading. This is the only practical way to use a dwell/duty meter, but requires you to have known-good values to compare against.

Another strength is that you can roughly convert injector mS on-time into dwell reading with some computations.

A final strength is that because the meter averages everything together it does not miss anything (though this is also a

severe weakness that we will look at later). If an injector has a fault where it occasionally skips a pulse, the meter registers it and the reading changes accordingly.

Let's go back to figuring out dwell/duty readings by using injector on-time specification. This is not generally practical, but we will cover it for completeness. You NEED to know three things:

* Injector mS on-time specification.
* Engine RPM when specification is valid.
* How many times the injectors fire per crankshaft revolution.

The first two are self-explanatory. The last one may require some research into whether it is a bank-fire type that injects every 360° of crankshaft rotation, a bank-fire that injects every 720°, or an SFI that injects every 720°. Many manufacturers do not release this data so you may have to figure it out yourself with a frequency meter.

Here are the four complete steps to convert millisecond on-time:

1) Determine the injector pulse width and RPM it was obtained at. Let's say the specification is for one millisecond of on-time at a hot idle of 600 RPM.

2) Determine injector firing method for the complete 4 stroke cycle. Let's say this is a 360° bank-fired, meaning an injector fires each and every crankshaft revolution.

3) Determine how many times the injector will fire at the specified engine speed (600 RPM) in a fixed time period. We will use 100 milliseconds because it is easy to use.

Six hundred crankshaft Revolutions Per Minute (RPM) divided by 60 seconds equals 10 revolutions per second.

Multiplying 10 times .100 yields one; the crankshaft turns one time in 100 milliseconds. With exactly one crankshaft rotation in 100 milliseconds, we know that the injector fires exactly one time.

4) Determine the ratio of injector on-time vs. off-time in the fixed time period, then figure duty cycle and/or dwell. The injector fires one time for a total of one millisecond in any given 100 millisecond period.

One hundred minus one equals 99. We have a 99% duty cycle. If we wanted to know the dwell (on 6 cylinder scale), multiple 99% times .6; this equals 59.4° dwell.

Weaknesses of Dwell/Duty Meter

The weaknesses are significant. First, there is no one-to-one correspondence to actual mS on-time. No manufacturer releases dwell/duty data, and it is time-consuming to convert the mS on-time readings. Besides, there can be a large degree of error because the conversion forces you to assume that the injector(s) are always firing at the same rate for the same period of time. This can be a dangerous assumption.

Second, all level of detail is lost in the averaging process. This is the primary weakness. You cannot see the details you need to make a confident diagnosis.

Here is one example. Imagine a vehicle that has a faulty injector driver that occasionally skips an injector pulse. Every skipped pulse means that that cylinder does not fire, thus unburned O2 gets pushed into the exhaust and passes the O2 sensor. The O2 sensor indicates lean, so the computer fattens up the mixture to compensate for the supposed "lean" condition.

A connected dwell/duty meter would see the fattened pulse width but would also see the skipped pulses. It would tally both and likely come back with a reading that indicated the "pulse width" was within specification because the rich mixture and missing pulses offset each other.

This situation is not a far-fetched scenario. Some early GM

3800 engines were suffering from exactly this. The point is that a lack of detail could cause misdiagnosis.

As you might have guessed, a lab scope would not miss this.

RELATIONSHIP BETWEEN DWELL & DUTY CYCLE READINGS TABLE (1)

Dwell Meter (2)	Duty Cycle Meter
1°	1%
15°	25%
30°	50%
45°	75%
60°	100%

(1) - These are just some examples for your understanding. It is okay to fill in the gaps.
(2) - Dwell meter on the six-cylinder scale.

THE TWO TYPES OF INJECTOR DRIVERS

OVERVIEW

There are two types of transistor driver circuits used to operate electric fuel injectors: voltage controlled and current controlled. The voltage controlled type is sometimes called a "saturated switch" driver, while the current controlled type is sometimes known as a "peak and hold" driver.

The basic difference between the two is the total resistance of the injector circuit. Roughly speaking, if a particular leg in an injector circuit has total resistance of 12 or more ohms, a voltage control driver is used. If less than 12 ohms, a current control driver is used.

It is a question of what is going to do the job of limiting the current flow in the injector circuit; the inherent "high" resistance in the injector circuit, or the transistor driver. Without some form of control, the current flow through the injector would cause the solenoid coil to overheat and result in a damaged injector.

VOLTAGE CONTROLLED CIRCUIT ("SATURATED SWITCH")

The voltage controlled driver inside the computer operates much like a simple switch because it does not need to worry about limiting current flow. Recall, this driver typically requires injector circuits with a total leg resistance of 12 or more ohms.

The driver is either ON, closing/completing the circuit (eliminating the voltage-drop), or OFF, opening the circuit (causing a total voltage drop).

Some manufacturers call it a "saturated switch" driver. This is because when switched ON, the driver allows the magnetic field in the injector to build to saturation. This is the same "saturation" property that you are familiar with for an ignition coil.

There are two ways "high" resistance can be built into an injector circuit to limit current flow. One method uses an external solenoid resistor and a low resistance injector, while the other uses a high resistance injector without the solenoid resistor. See the left side of Fig. 1.

In terms of injection opening time, the external resistor voltage controlled circuit is somewhat faster than the voltage controlled high resistance injector circuit. The trend, however, seems to be moving toward use of this latter type of circuit due to its lower cost and reliability. The ECU can compensate for slower opening

times by increasing injector pulse width accordingly.

NOTE: Never apply battery voltage directly across a low resistance injector. This will cause injector damage from solenoid coil overheating.

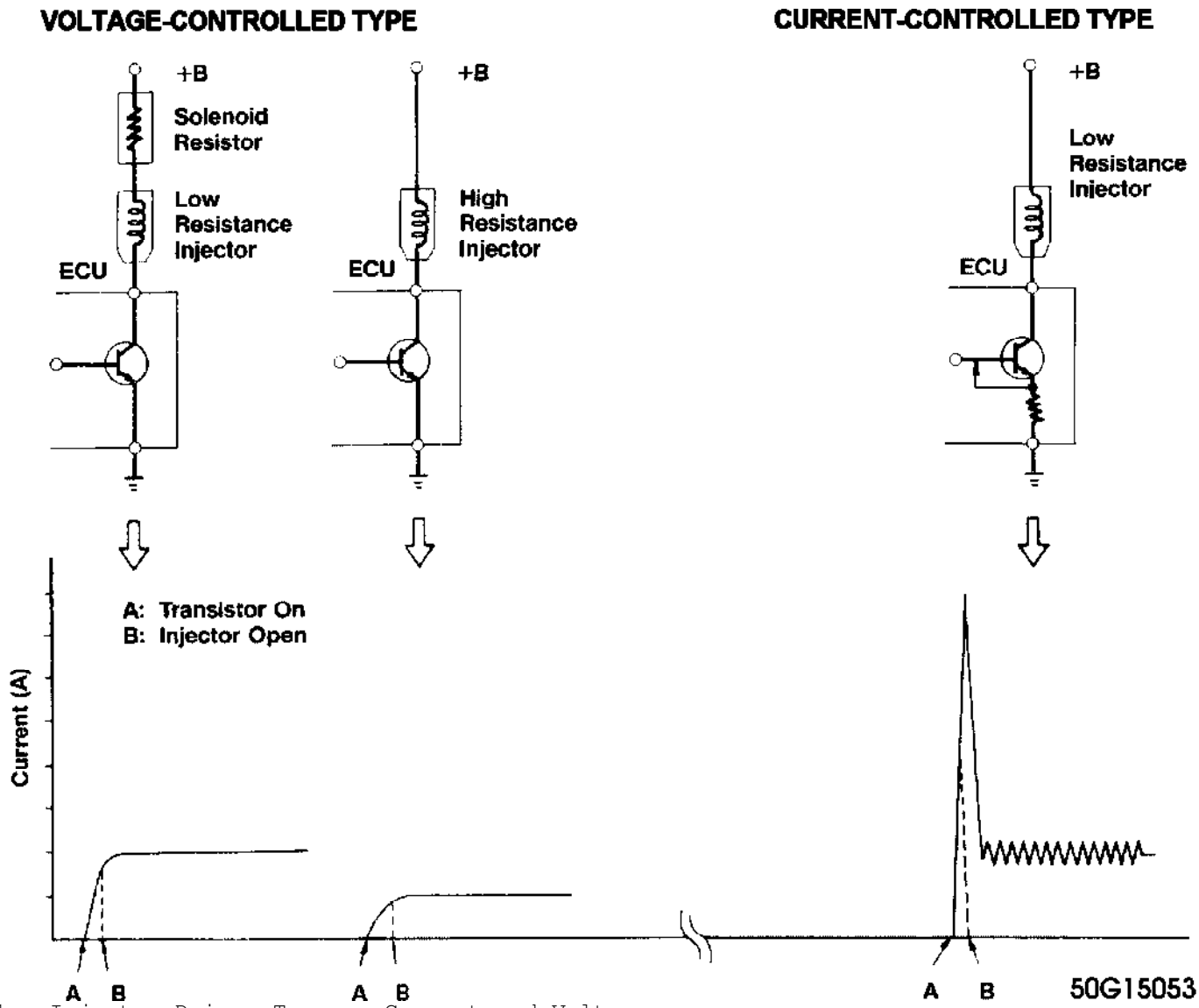

Fig. 1: Injector Driver Types - Current and Voltage

CURRENT CONTROLLED CIRCUIT ("PEAK & HOLD")

The current controlled driver inside the computer is more complex than a voltage controlled driver because as the name implies, it has to limit current flow in addition to its ON-OFF switching function. Recall, this driver typically requires injector circuits with a total leg resistance of less than 12 ohms.

Once the driver is turned ON, it will not limit current flow until enough time has passed for the injector pintle to open. This period is preset by the particular manufacturer/system based on the amount of current flow needed to open their injector. This is typically between two and six amps. Some manufacturers refer to this

as the "peak" time, referring to the fact that current flow is allowed to "peak" (to open the injector).

Once the injector pintle is open, the amp flow is considerably reduced for the rest of the pulse duration to protect the injector from overheating. This is okay because very little amperage is needed to hold the injector open, typically in the area of one amp or less. Some manufacturers refer to this as the "hold" time, meaning that just enough current is allowed through the circuit to "hold" the already-open injector open.

There are a couple methods of reducing the current. The most common trims back the available voltage for the circuit, similar to turning down a light at home with a dimmer.

The other method involves repeatedly cycling the circuit ON-OFF. It does this so fast that the magnetic field never collapses and the pintle stays open, but the current is still significantly reduced. See the right side of Fig. 1 for an illustration.

The advantage to the current controlled driver circuit is the short time period from when the driver transistor goes ON to when the injector actually opens. This is a function of the speed with which current flow reaches its peak due to the low circuit resistance. Also, the injector closes faster when the driver turns OFF because of the lower holding current.

NOTE: Never apply battery voltage directly across a low resistance injector. This will cause injector damage from solenoid coil overheating.

THE TWO WAYS INJECTOR CIRCUITS ARE WIRED

Like other circuits, injector circuits can be wired in one of two fundamental directions. The first method is to steadily power the injectors and have the computer driver switch the ground side of the circuit. Conversely, the injectors can be steadily grounded while the driver switches the power side of the circuit.

There is no performance benefit to either method. Voltage controlled and current controlled drivers have been successfully implemented both ways.

However, 95% percent of the systems are wired so the driver controls the ground side of the circuit. Only a handful of systems use the drivers on the power side of the circuit. Some examples of the latter are the 1970’s Cadillac EFI system, early Jeep 4.0 EFI (Renix system), and Chrysler 1984-87 TBI.

INTERPRETING INJECTOR WAVEFORMS

INTERPRETING A VOLTAGE CONTROLLED PATTERN

NOTE: Voltage controlled drivers are also known as "Saturated Switch" drivers. They typically require injector circuits with a total leg resistance of 12 ohms or more.

NOTE: This example is based on a constant power/switched ground circuit.

* See Fig. 2 for pattern that the following text describes.

Point "A" is where system voltage is supplied to the injector. A good hot run voltage is usually 13.5 or more volts. This point, commonly known as open circuit voltage, is critical because the injector will not get sufficient current saturation if there is a voltage shortfall. To obtain a good look at this precise point, you

will need to shift your Lab Scope to five volts per division.

You will find that some systems have slight voltage fluctuations here. This can occur if the injector feed wire is also used to power up other cycling components, like the ignition coil(s). Slight voltage fluctuations are normal and are no reason for concern. Major voltage fluctuations are a different story, however. Major voltage shifts on the injector feed line will create injector performance problems. Look for excessive resistance problems in the feed circuit if you see big shifts and repair as necessary.

Note that circuits with external injector resistors will not be any different because the resistor does not affect open circuit voltage.

Point "B" is where the driver completes the circuit to ground. This point of the waveform should be a clean square point straight down with no rounded edges. It is during this period that current saturation of the injector windings is taking place and the driver is heavily stressed. Weak drivers will distort this vertical line.

Point "C" represents the voltage drop across the injector windings. Point "C" should come very close to the ground reference point, but not quite touch. This is because the driver has a small amount of inherent resistance. Any significant offset from ground is an indication of a resistance problem on the ground circuit that needs repaired. You might miss this fault if you do not use the negative battery post for your Lab Scope hook-up, so it is HIGHLY recommended that you use the battery as your hook-up.

The points between "B" and "D" represent the time in milliseconds that the injector is being energized or held open. This line at Point "C" should remain flat. Any distortion or upward bend indicates a ground problem, short problem, or a weak driver. Alert readers will catch that this is exactly opposite of the current controlled type drivers (explained in the next section), because they bend upwards at this point.

How come the difference? Because of the total circuit resistance. Voltage controlled driver circuits have a high resistance of 12+ ohms that slows the building of the magnetic field in the injector. Hence, no counter voltage is built up and the line remains flat.

On the other hand, the current controlled driver circuit has low resistance which allows for a rapid magnetic field build-up. This causes a slight inductive rise (created by the effects of counter voltage) and hence, the upward bend. You should not see that here with voltage controlled circuits.

Point "D" represents the electrical condition of the injector windings. The height of this voltage spike (inductive kick) is proportional to the number of windings and the current flow through them. The more current flow and greater number of windings, the more potential for a greater inductive kick. The opposite is also true. The less current flow or fewer windings means less inductive kick. Typically you should see a minimum 35 volts at the top of Point "D".

If you do see approximately 35 volts, it is because a zener diode is used with the driver to clamp the voltage. Make sure the beginning top of the spike is squared off, indicating the zener dumped the remainder of the spike. If it is not squared, that indicates the spike is not strong enough to make the zener fully dump, meaning the injector has a weak winding.

If a zener diode is not used in the computer, the spike from a good injector will be 60 or more volts.

Point "E" brings us to a very interesting section. As you can see, the voltage dissipates back to supply value after the peak of the inductive kick. Notice the slight hump? This is actually the mechanical injector pintle closing. Recall that moving an iron core through a magnetic field will create a voltage surge. The pintle is

the iron core here.

This pintle hump at Point "E" should occur near the end of the downward slope, and not afterwards. If it does occur after the slope has ended and the voltage has stabilized, it is because the pintle is slightly sticking because of a faulty injector

If you see more than one hump it is because of a distorted pintle or seat. This faulty condition is known as "pintle float".

It is important to realize that it takes a good digital storage oscilloscope or analog lab scope to see this pintle hump clearly. Unfortunately, it cannot always be seen.

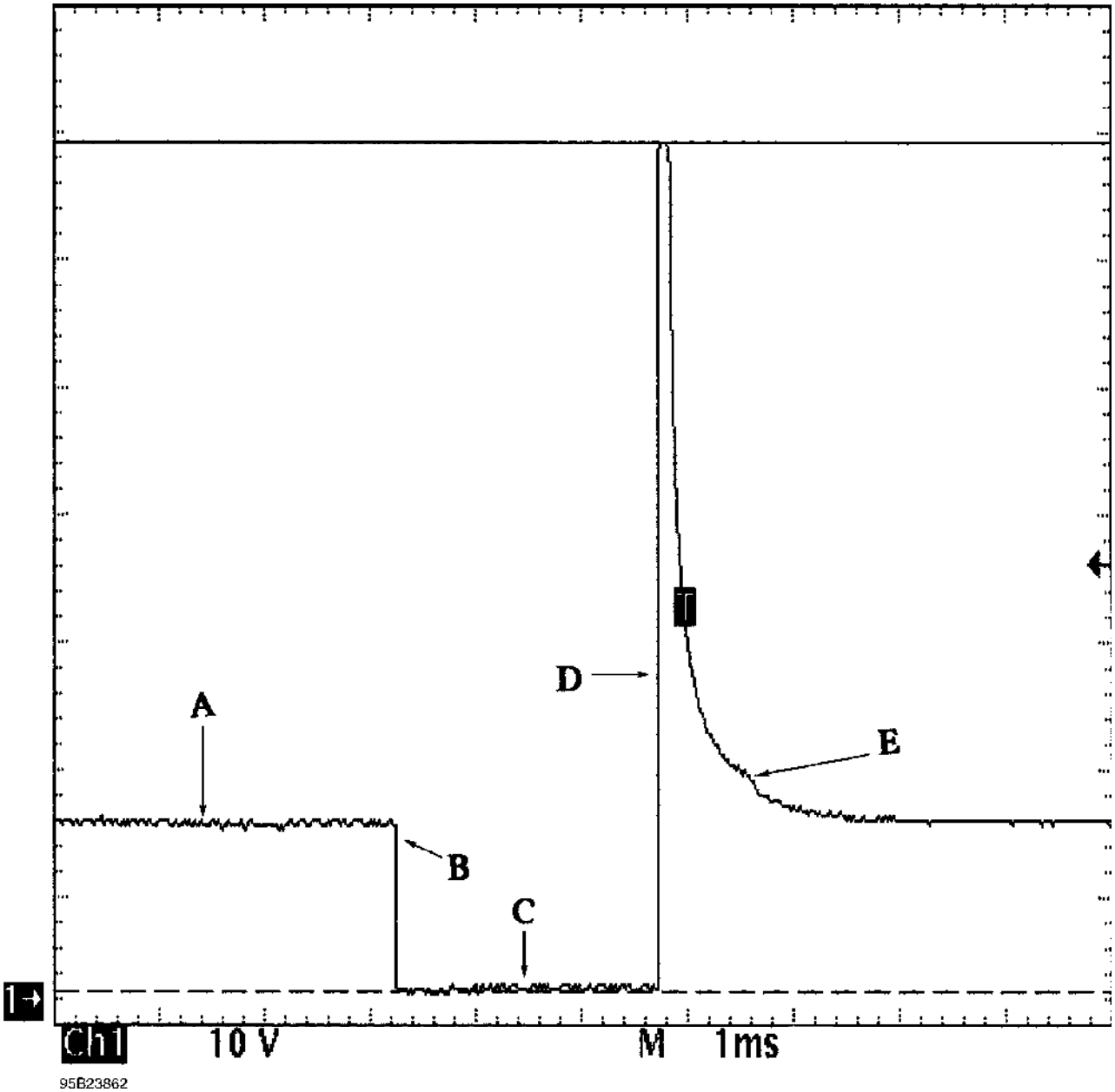

Fig. 2: Identifying Voltage Controlled Type Injector Pattern

INTERPRETING A CURRENT CONTROLLED PATTERN

NOTE: Current controlled drivers are also known as "Peak and Hold"

drivers. They typically require injector circuits with a total leg resistance with less than 12 ohm.

NOTE: This example is based on a constant power/switched ground circuit.

* See Fig. 3 for pattern that the following text describes.

Point "A" is where system voltage is supplied to the injector. A good hot run voltage is usually 13.5 or more volts. This point, commonly known as open circuit voltage, is critical because the injector will not get sufficient current saturation if there is a voltage shortfall. To obtain a good look at this precise point, you will need to shift your Lab Scope to five volts per division.

You will find that some systems have slight voltage fluctuations here. This could occur if the injector feed wire is also used to power up other cycling components, like the ignition coil(s). Slight voltage fluctuations are normal and are no reason for concern. Major voltage fluctuations are a different story, however. Major voltage shifts on the injector feed line will create injector performance problems. Look for excessive resistance problems in the feed circuit if you see big shifts and repair as necessary.

Point "B" is where the driver completes the circuit to ground. This point of the waveform should be a clean square point straight down with no rounded edges. It is during this period that current saturation of the injector windings is taking place and the driver is heavily stressed. Weak drivers will distort this vertical line.

Point "C" represents the voltage drop across the injector windings. Point "C" should come very close to the ground reference point, but not quite touch. This is because the driver has a small amount of inherent resistance. Any significant offset from ground is an indication of a resistance problem on the ground circuit that needs repaired. You might miss this fault if you do not use the negative battery post for your Lab Scope hook-up, so it is HIGHLY recommended that you use the battery as your hook-up.

Right after Point "C", something interesting happens. Notice the trace starts a normal upward bend. This slight inductive rise is created by the effects of counter voltage and is normal. This is because the low circuit resistance allowed a fast build-up of the magnetic field, which in turn created the counter voltage.

Point "D" is the start of the current limiting, also known as the "Hold" time. Before this point, the driver had allowed the current to free-flow ("Peak") just to get the injector pintle open. By the time point "D" occurs, the injector pintle has already opened and the computer has just significantly throttled the current back. It does this by only allowing a few volts through to maintain the minimum current required to keep the pintle open.

The height of the voltage spike seen at the top of Point "D" represents the electrical condition of the injector windings. The height of this voltage spike (inductive kick) is proportional to the number of windings and the current flow through them. The more current flow and greater number of windings, the more potential for a greater inductive kick. The opposite is also true. The less current flow or fewer windings means less inductive kick. Typically you should see a minimum 35 volts.

If you see approximately 35 volts, it is because a zener diode is used with the driver to clamp the voltage. Make sure the beginning top of the spike is squared off, indicating the zener dumped the remainder of the spike. If it is not squared, that indicates the spike is not strong enough to make the zener fully dump, meaning there is a problem with a weak injector winding.

If a zener diode is not used in the computer, the spike from

a good injector will be 60 or more volts.

At Point "E", notice that the trace is now just a few volts below system voltage and the injector is in the current limiting, or the "Hold" part of the pattern. This line will either remain flat and stable as shown here, or will cycle up and down rapidly. Both are normal methods to limit current flow. Any distortion may indicate shorted windings.

Point "F" is the actual turn-off point of the driver (and injector). To measure the millisecond on-time of the injector, measure between points "C" and "F". Note that we used cursors to do it for us; they are measuring a 2.56 mS on-time.

The top of Point "F" (second inductive kick) is created by the collapsing magnetic field caused by the final turn-off of the driver. This spike should be like the spike on top of point "D".

Point "G" shows a slight hump. This is actually the mechanical injector pintle closing. Recall that moving an iron core through a magnetic field will create a voltage surge. The pintle is the iron core here.

This pintle hump at Point "E" should occur near the end of the downward slope, and not afterwards. If it does occur after the slope has ended and the voltage has stabilized, it is because the pintle is slightly sticking. Some older Nissan TBI systems suffered from this.

If you see more than one hump it is because of a distorted pintle or seat. This faulty condition is known as "pintle float".

It is important to realize that it takes a good digital storage oscilloscope or analog lab scope to see this pintle hump clearly. Unfortunately, it cannot always be seen.

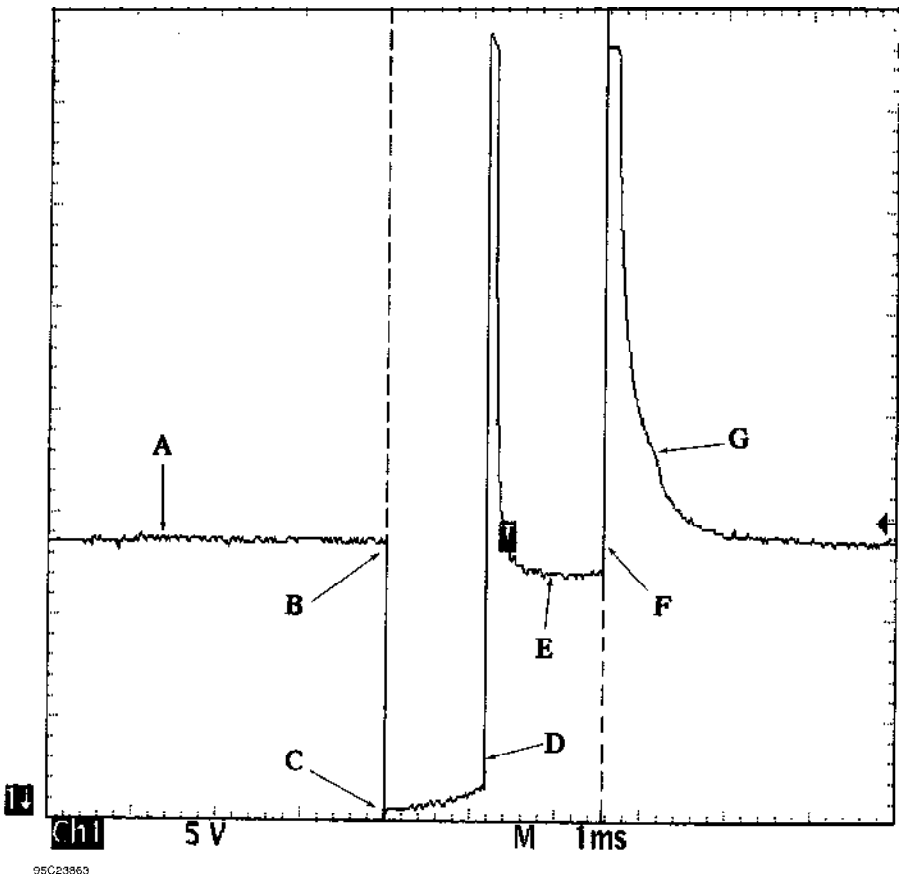

Fig. 3: Identifying Current Controlled Type Injector Pattern

CURRENT WAVEFORM SAMPLES

EXAMPLE #1 - VOLTAGE CONTROLLED DRIVER

The waveform pattern shown in Fig. 4 indicate a normal current waveform from a Ford 3.0L V6 VIN [U] engine. This voltage controlled type circuit pulses the injectors in groups of three injectors. Injectors No. 1, 3, and 5 are pulsed together and cylinders 2, 4, and 6 are pulsed together. The specification for an acceptable bank resistance is 4.4 ohms. Using Ohm's Law and assuming a hot run voltage of 14 volts, we determine that the bank would draw a current of 3.2 amps.

However this is not the case because as the injector windings become saturated, counter voltage is created which impedes the current flow. This, coupled with the inherent resistance of the driver's transistor, impedes the current flow even more. So, what is a known good value for a dynamic current draw on a voltage controlled bank of injectors? The waveform pattern shown below indicates a good parallel injector current flow of 2 amps. See Fig. 4.

Note that if just one injector has a resistance problem and partially shorts, the entire parallel bank that it belongs to will draw more current. This can damage the injector driver.

The waveform pattern in Fig. 5 indicates this type of problem with too much current flow. This is on other bank of injectors of the same vehicle; the even side. Notice the Lab Scope is set on a one amp per division scale. As you can see, the current is at an unacceptable 2.5 amps.

It is easy to find out which individual injector is at fault. All you need to do is inductively clamp onto each individual injector and compare them. To obtain a known-good value to compare against, we used the good bank to capture the waveform in Fig. 6. Notice that it limits current flow to 750 milliamps.

The waveform shown in Fig. 7 illustrates the problem injector we found. This waveform indicates an unacceptable current draw of just over one amp as compared to the 750 milliamp draw of the known-good injector. A subsequent check with a DVOM found 8.2 ohms, which is under the 12 ohm specification.

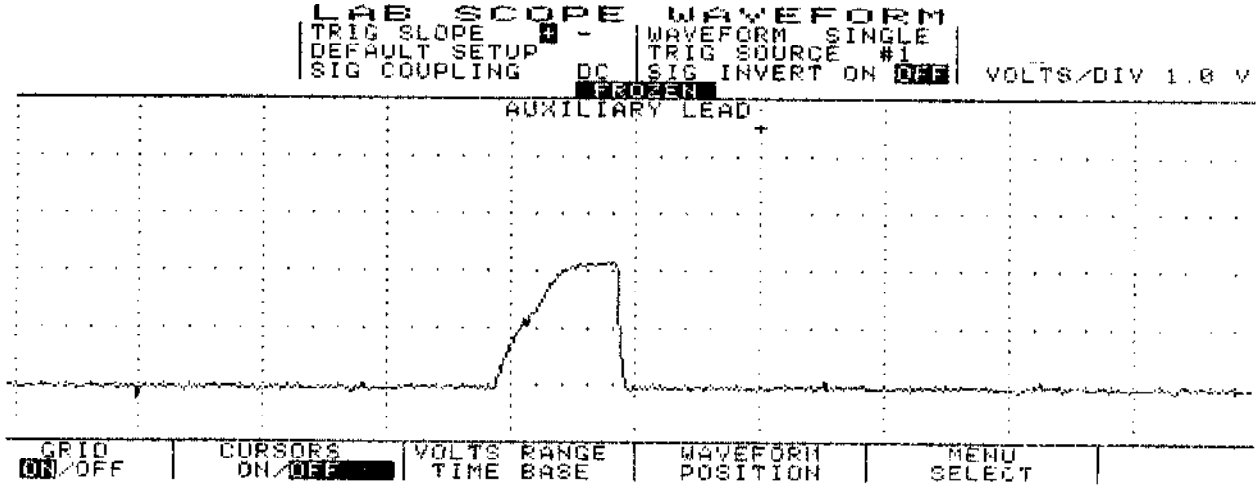

Fig. 4: Injector Bank w/Normal Current Flow - Current Pattern

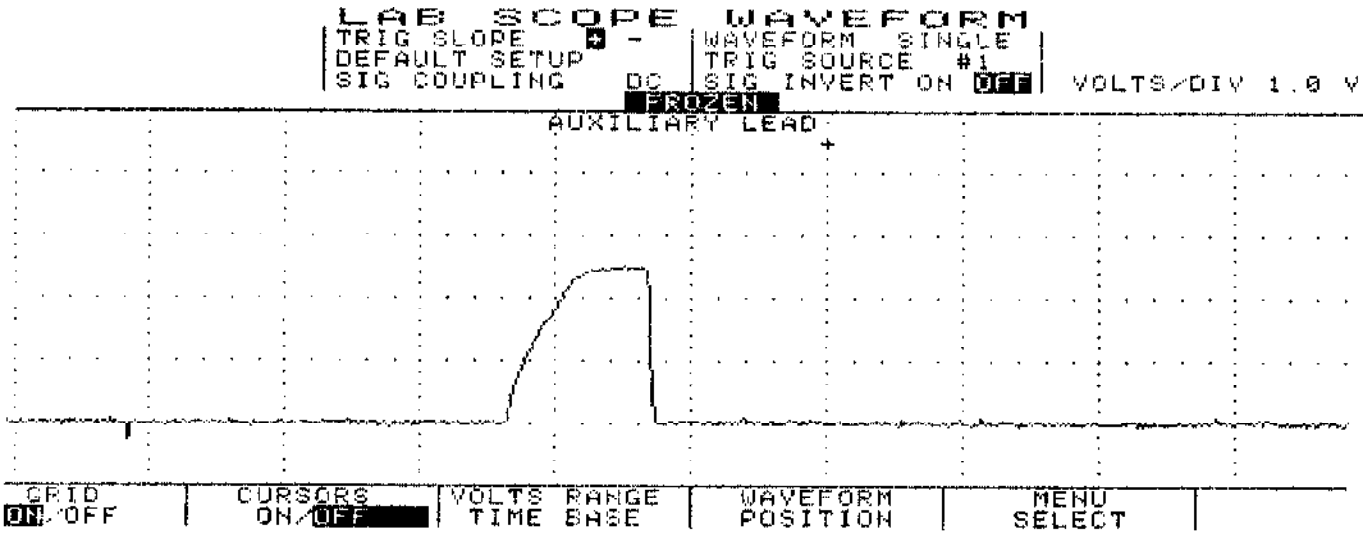

Fig. 5: Injector Bank w/Excessive Current Flow - Current Pattern

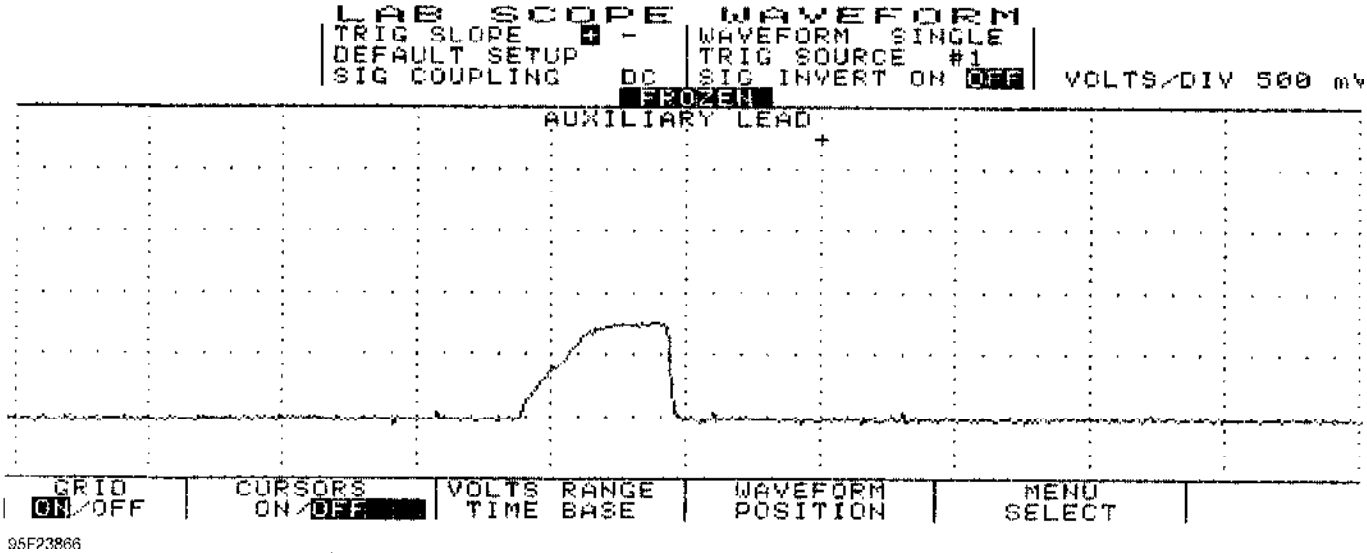

Fig. 6: Single Injector w/Normal Current Flow - Current Pattern

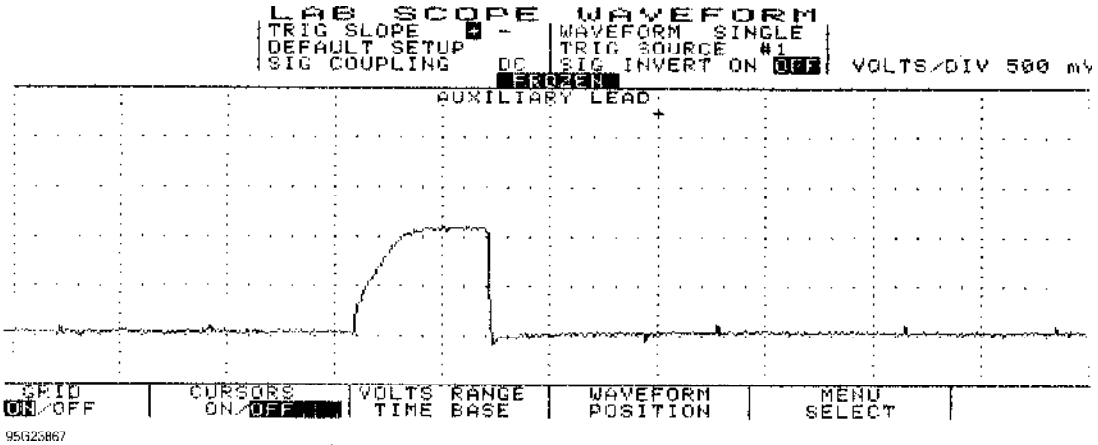

Fig. 7: Single Injector w/Excessive Current Flow - Current Pattern

EXAMPLE #2 - VOLTAGE CONTROLLED DRIVER

This time we will look at a GM 3.1L V6 VIN [T]. Fig. 8 shows the 1, 3, 5 (odd) injector bank with the current waveform indicating about a 2.6 amp draw at idle. This pattern, taken from a known good vehicle, correctly stays at or below the maximum 2.6 amps current range. Ideally, the current for each bank should be very close in comparison.

Notice the small dimple on the current flow's rising edge. This is the actual injector opening or what engineers refer to as the "set point." For good idle quality, the set point should be uniform between the banks.

When discussing Ohm's Law as it pertains to this parallel circuit, consider that each injector has specified resistance of 12.2 ohms. Since all three injectors are in parallel the total resistance of this parallel circuit drops to 4.1 ohms. Fourteen volts divided by four ohms would pull a maximum of 3.4 amps on this bank of injectors. However, as we discussed in EXAMPLE #1 above, other factors knock this value down to roughly the 2.6 amp neighborhood.

Now we are going to take a look at the even bank of injectors; injectors 2, 4, and 6. See Fig. 9. Notice this bank peaked at 1.7 amps at idle as compared to the 2.6 amps peak of the odd bank (Fig. 8). Current flow between even and odd injectors banks is not uniform, yet it is not causing a driveability problem. That is because it is still under the maximum amperage we figured out earlier. But be aware this vehicle could develop a problem if the amperage flow increases any more.

Checking the resistance of this even injector group with a DVOM yielded 6.2 ohms, while the odd injector group in the previous example read 4.1 ohms.

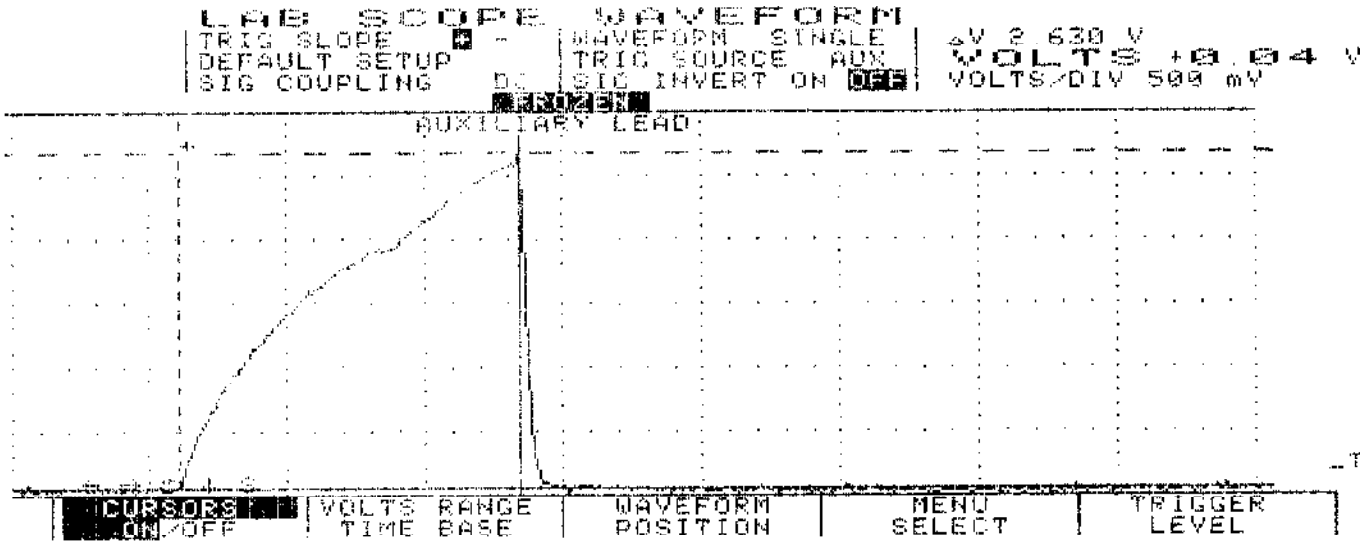

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Fig. 8: Injector Odd Bank w/Normal Current Flow - Current Pattern

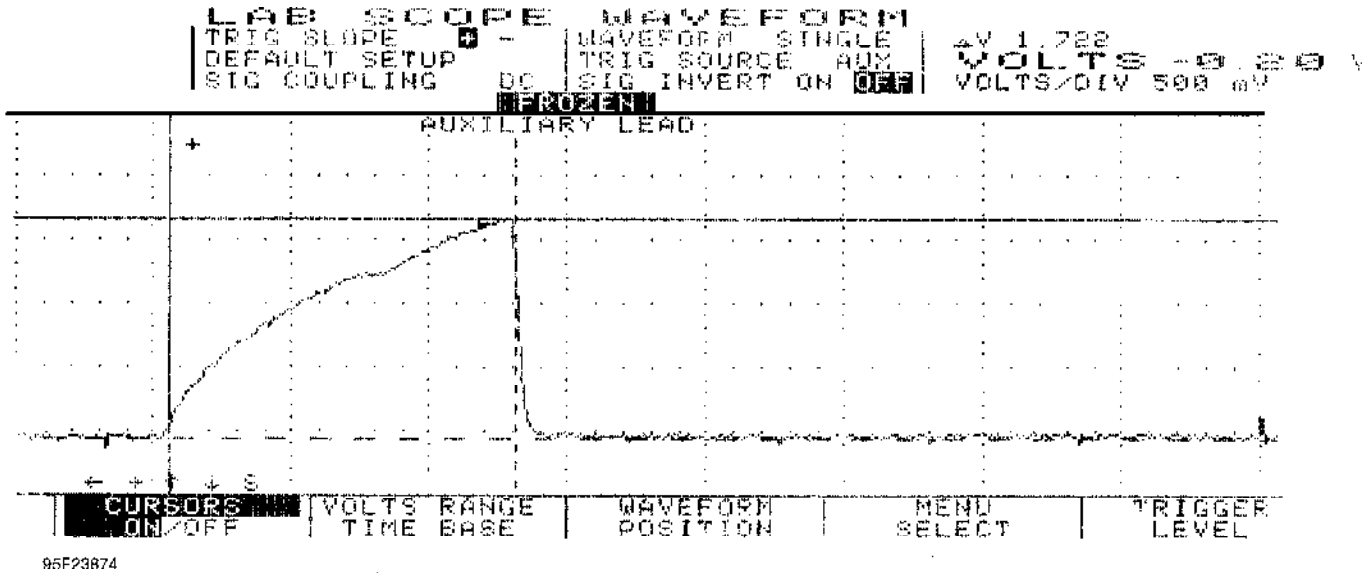


Fig. 9: Injector Even Bank w/Normal Current Flow - Current Pattern

EXAMPLE #3 - VOLTAGE CONTROLLED DRIVER

Example #3 is of a Ford 5.0L V8 SEFI. Fig. 10 shows a waveform of an individual injector at idle with the Lab Scope set on 200 milliamps per division. Notice the dimple in the rising edge. This dimple indicates the actual opening of the injector (set point) occurred at 400 milliamps and current peaked at 750 milliamps. This is a good specification for this engine.

The next waveform pattern in Fig. 11 shows an abnormality with another injector. With the Lab Scope set on 500 milliamps per division, you can see that the current waveform indicates a 1200 milliamp draw. This is a faulty injector.

Abnormally low resistance injectors create excessive current draw, causing rough idle, and possible computer driver damage.

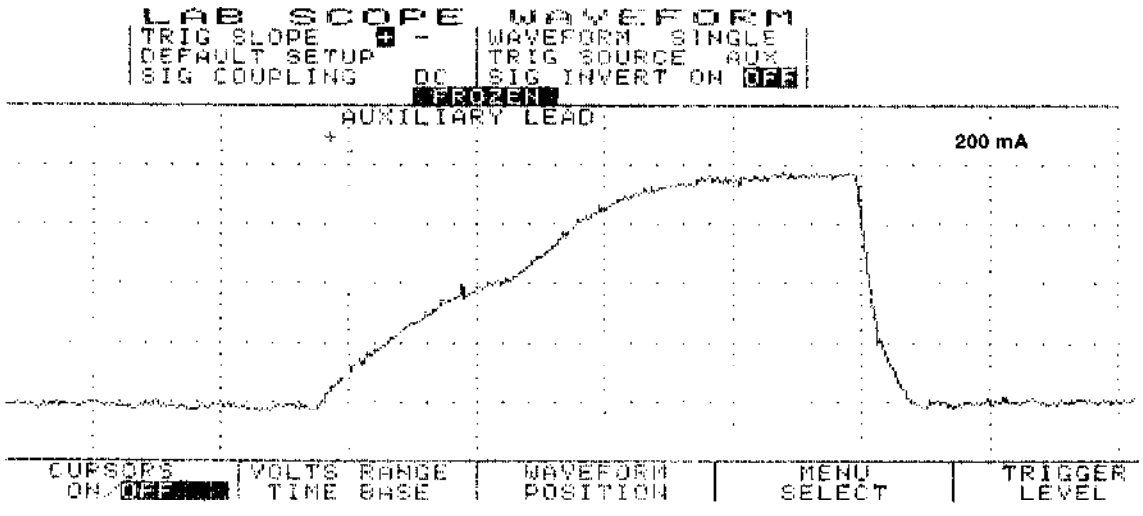
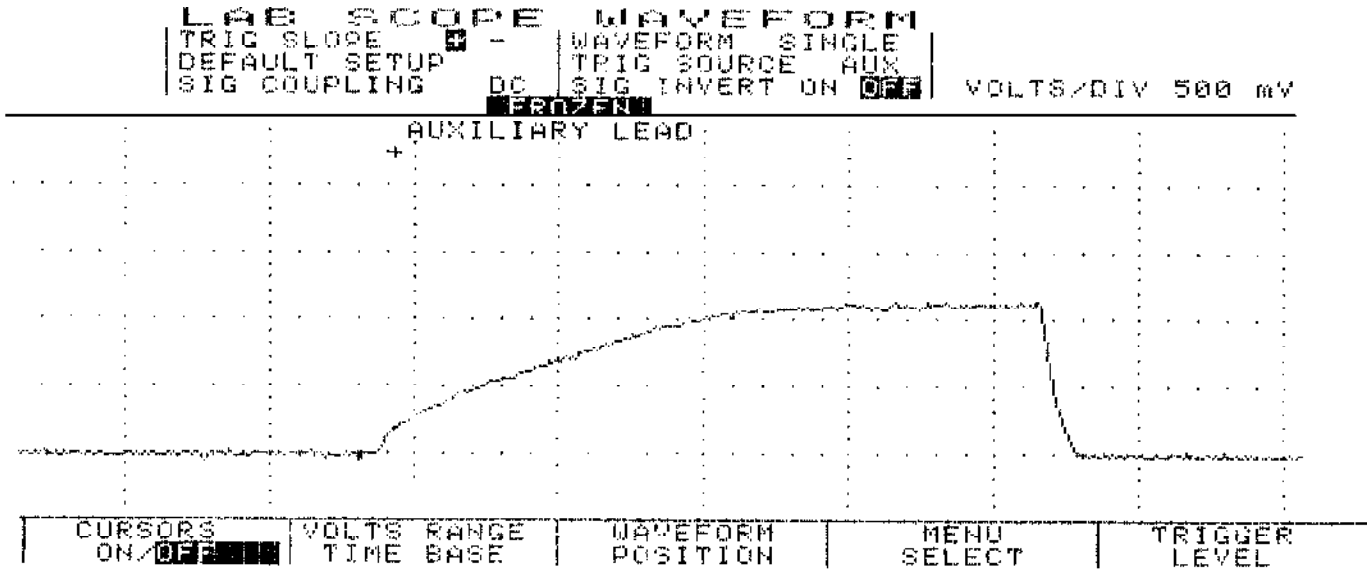


Fig. 10: Single Injector w/Normal Current Flow - Current Pattern



95H23876

Fig. 11: Single Injector w/Excessive Current Flow - Current Pattern

EXAMPLE #4 - CURRENT CONTROLLED DRIVER

Example #4 is of a Ford 4.6L SEFI VIN [W]. See Fig. 12 for the known-good waveform pattern. This Ford system is different from the one above in EXAMPLE #3 as it peaks at 900 milliamps and the actual opening of the injector (set point) is just below 600 milliamps.

This is offered as a comparison against the Ford pattern listed above, as they are both Ford SEFI injectors but with different operating ranges. The point is that you should not make any broad assumptions for any manufacturer.

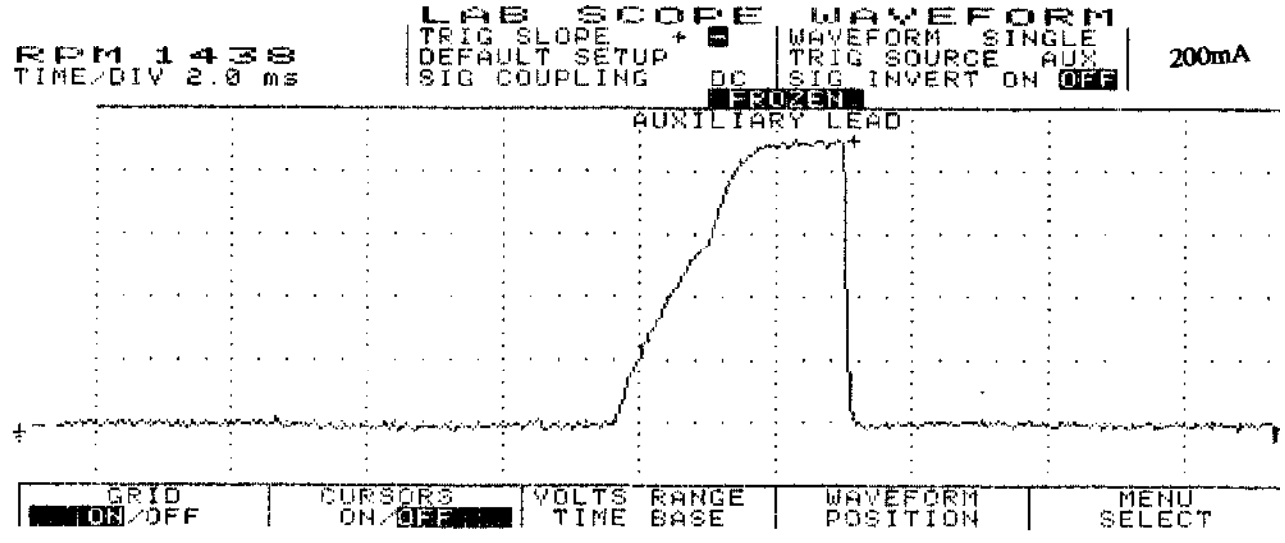


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Fig. 12: Single Injector w/Normal Current Flow - Current Pattern

EXAMPLE #5 - CURRENT CONTROLLED DRIVER

The known-good waveform in Fig. 13 is from a Chrysler 3.0L V6

PFI VIN [3]. It is a perfect example of the peak and hold theory. The waveform shows a 1-amp per division current flow, ramping to 4 amps and then decreasing to 1-amp to hold the injector open.

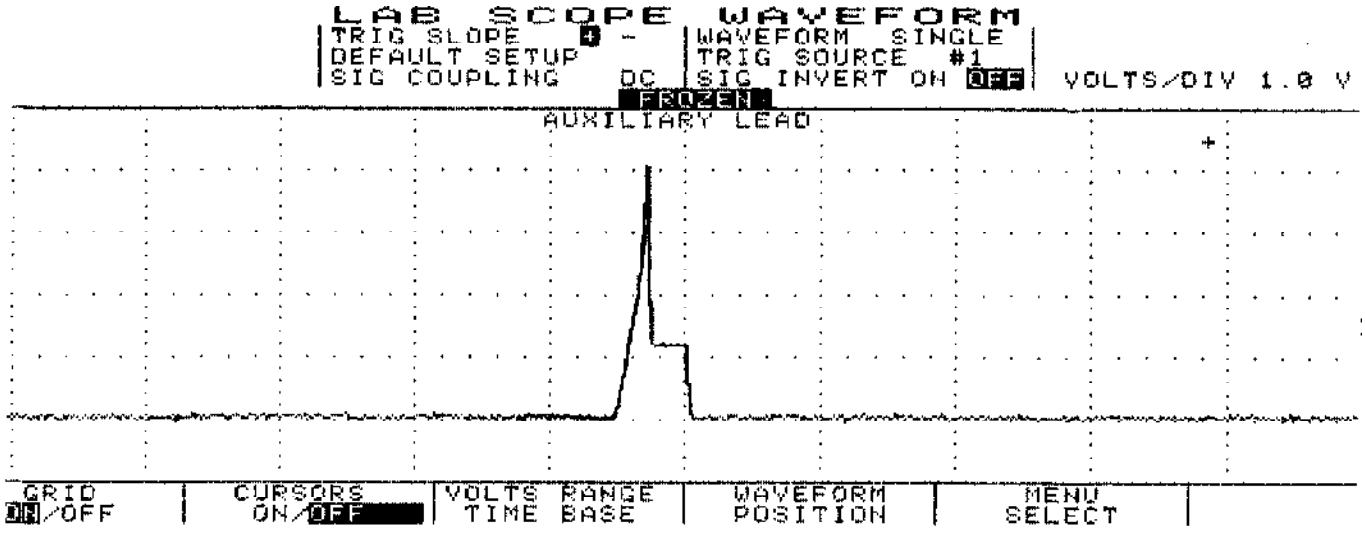

Fig. 13: Injector Bank w/Normal Current Flow - Current Pattern

EXAMPLE #6 - CURRENT CONTROLLED DRIVER

This next known-good waveform is from a Ford 5.0L V8 CFI VIN [F]. See Fig. 14. The pattern, which is set on a 250 milliamps scale, indicates a 1.25 amp peak draw and a hold at 350 milliamps.

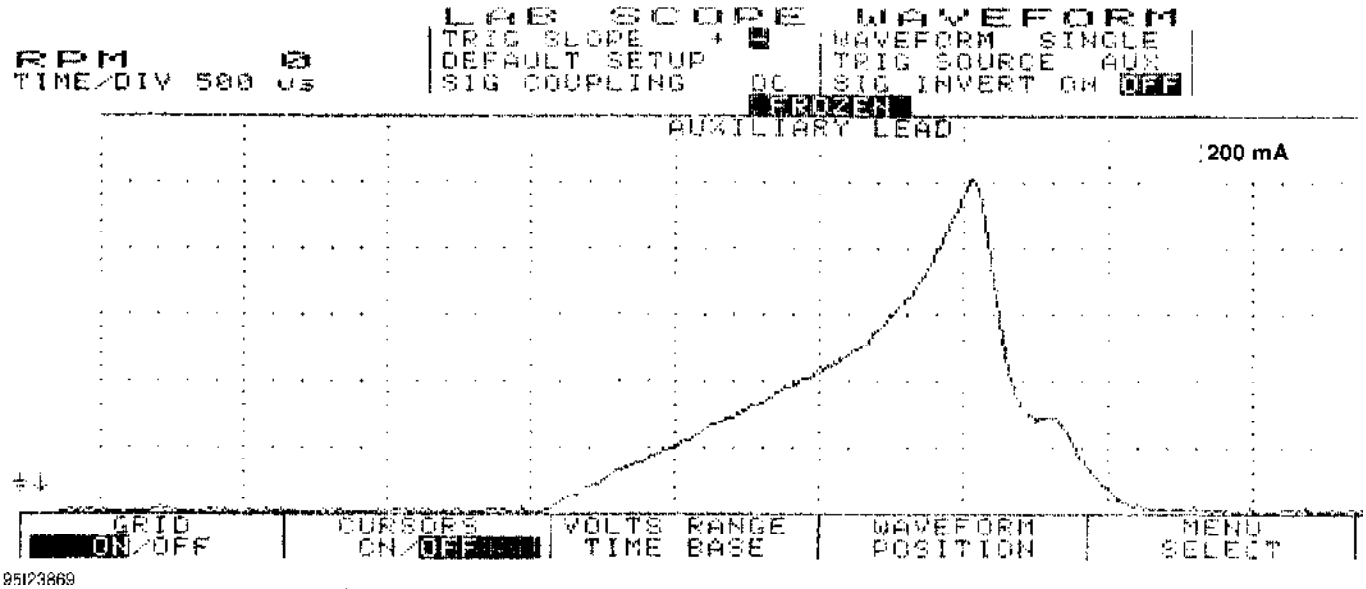

Fig. 14: Single Injector w/Normal Current Flow - Current Pattern

EXAMPLE #7 - CURRENT CONTROLLED DRIVER

The known-good current controlled type waveform in Fig. 15 is from a GM 2.0L TBI VIN [1]. With the lab scope set at 2 amps per division, notice that this system peaks at 4 amps and holds at 1 amp.

The next waveform is from the same type of engine, except

that it shows a faulty injector. See Fig. 16. Notice that the current went to almost 5 amps and stayed at 1 amp during the hold pattern. Excessive amounts of current flow from bad injectors are a common source of intermittent computer shutdown. Using a current waveform pattern is the most accurate method of pinpointing this problem.

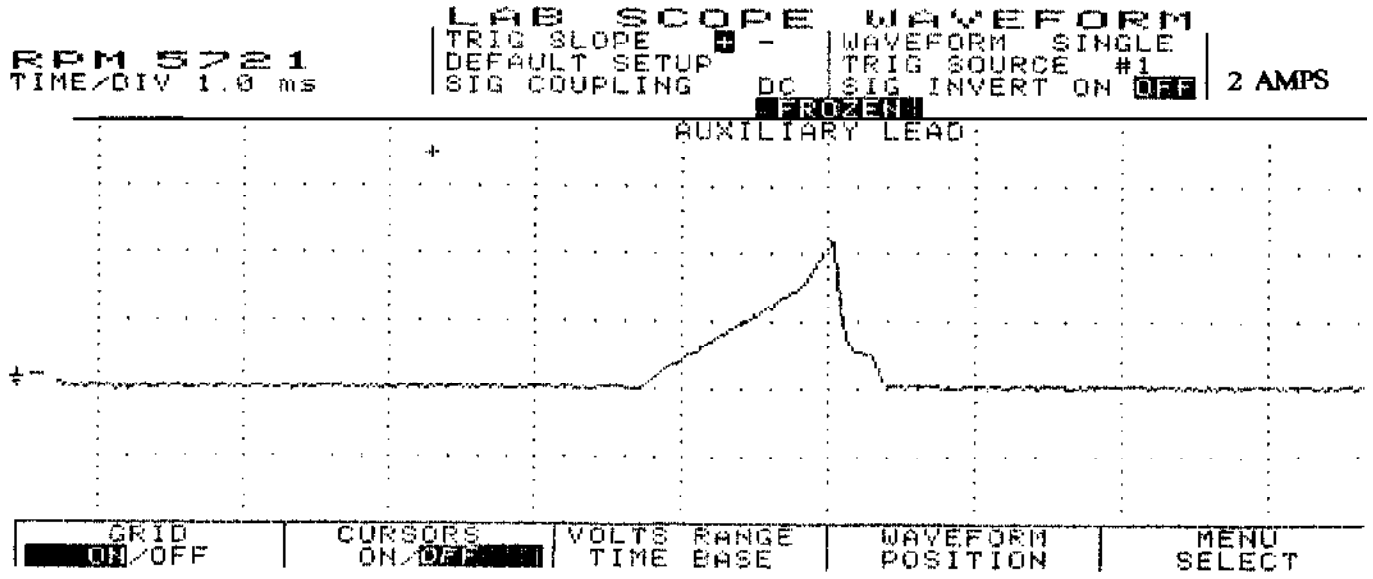

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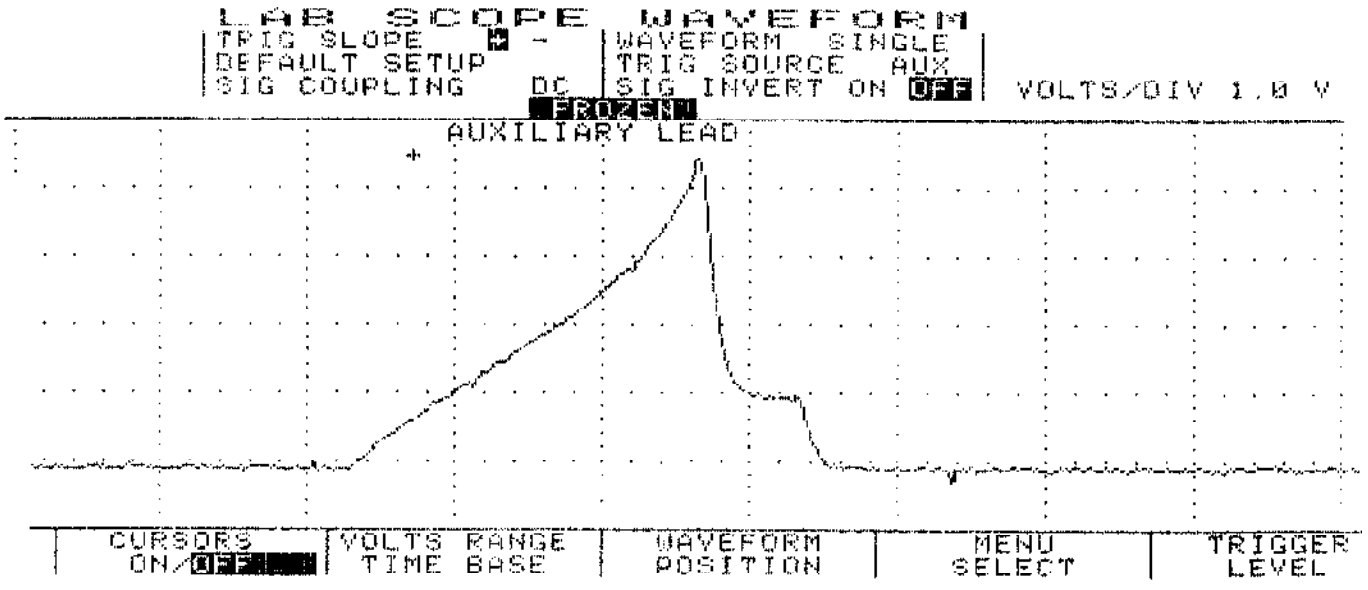
Fig. 15: Single Injector w/Normal Current Flow - Current Pattern



95I23877

Fig. 16: Single Injector w/Excessive Current Flow - Current Pattern

EXAMPLE #8 - CURRENT CONTROLLED DRIVER

This known-good CPI system waveform from a GM 4.3L V6 CPI VIN [W] peaks at 4 amps and holds at 1-amp. See Fig. 17 for waveform.

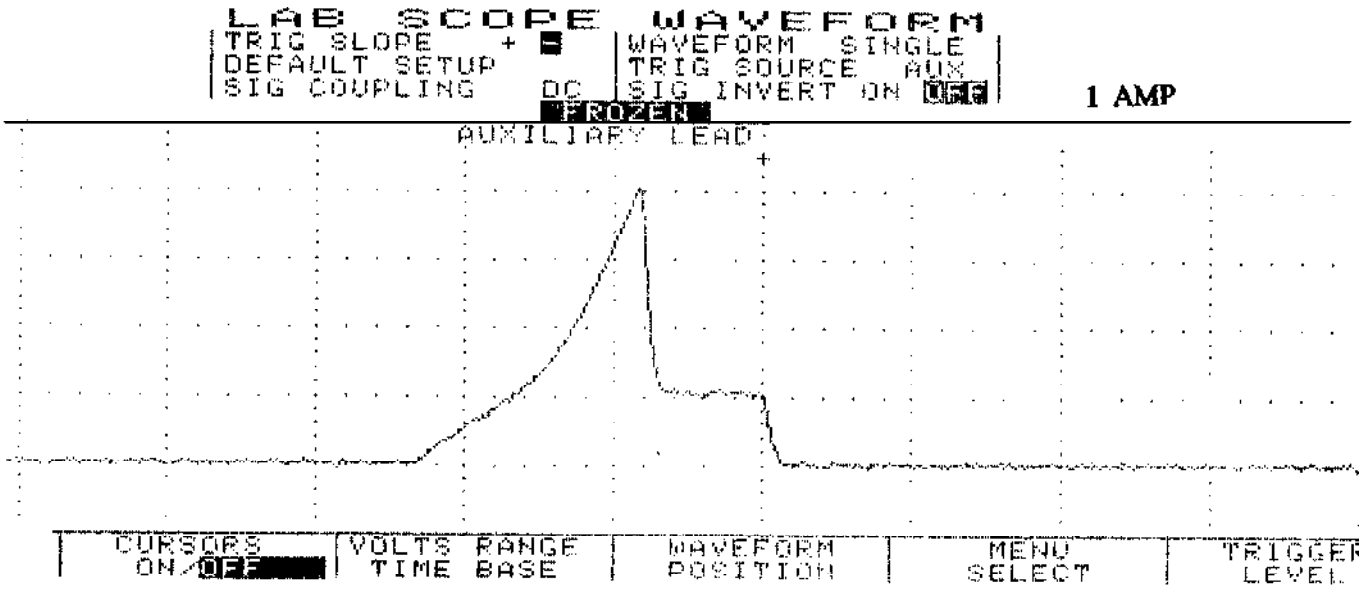


Fig. 17: Single Injector w/Normal Current Flow - Current Pattern

VOLTAGE WAVEFORM SAMPLES

EXAMPLE #1 - VOLTAGE CONTROLLED DRIVER

These two known-good waveform patterns are from a Ford 4.6L V8 VIN [W]. Fig. 18 illustrates the 64 volt inductive kick on this engine, indicating no clamping is occurring. The second pattern, Fig. 19, was taken during hot idle, closed loop, and no load.

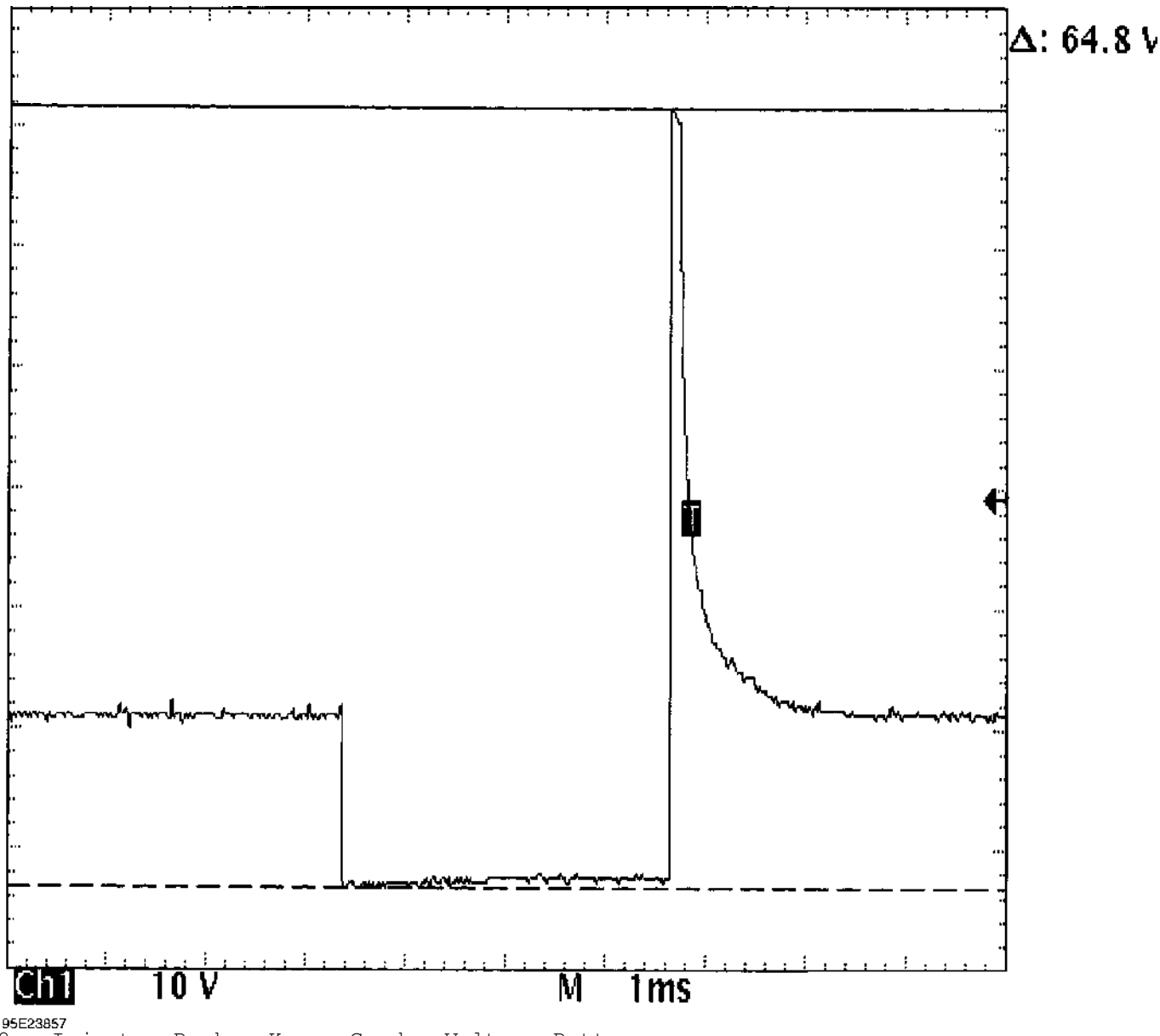


Fig. 18: Injector Bank - Known Good - Voltage Pattern

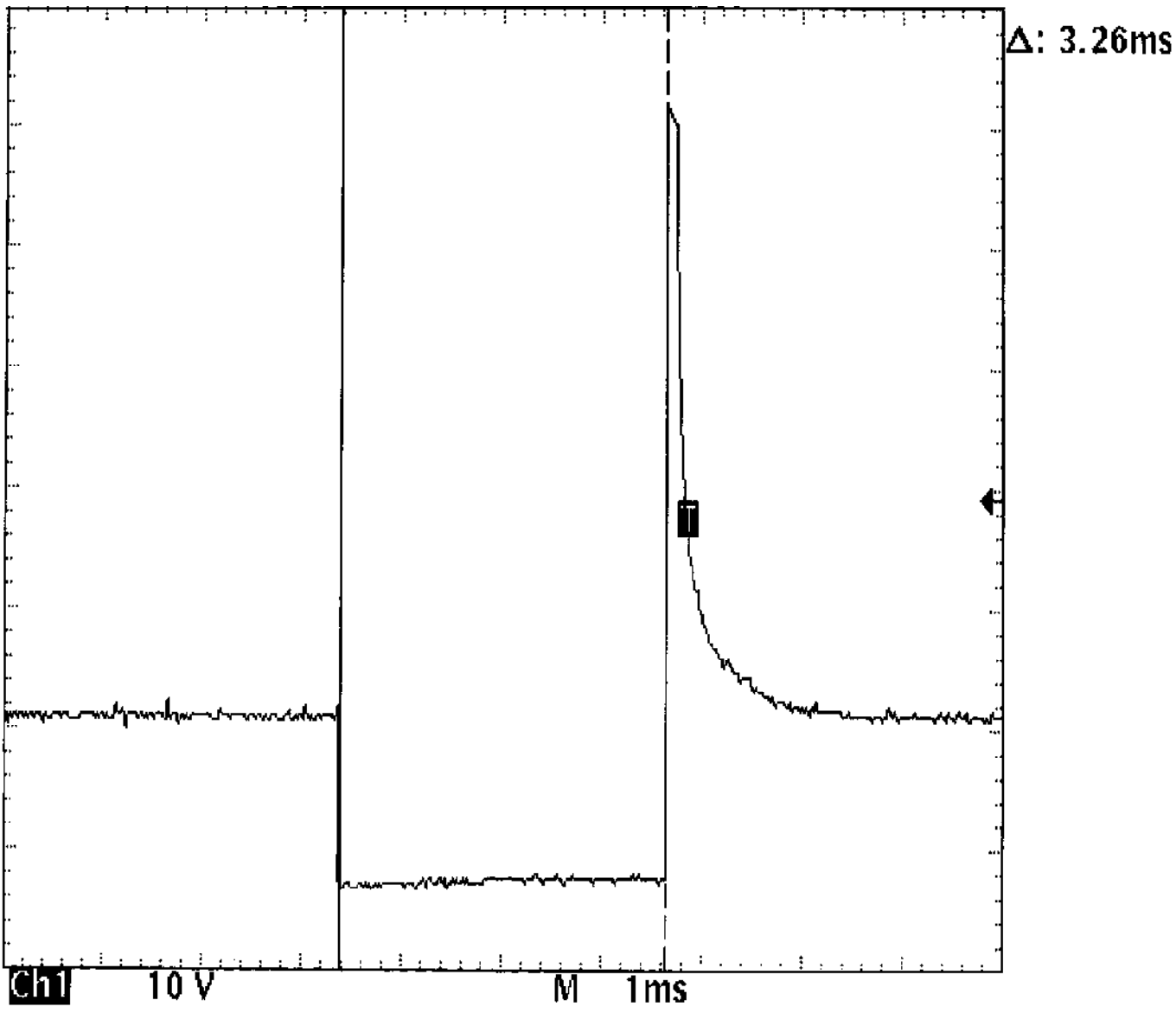


Fig. 19: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #2 - VOLTAGE CONTROLLED DRIVER

The known-good waveform pattern in Fig. 20 is from a GM 3.8L V6 PFI VIN [3]. It was taken during hot idle, closed loop and no load.

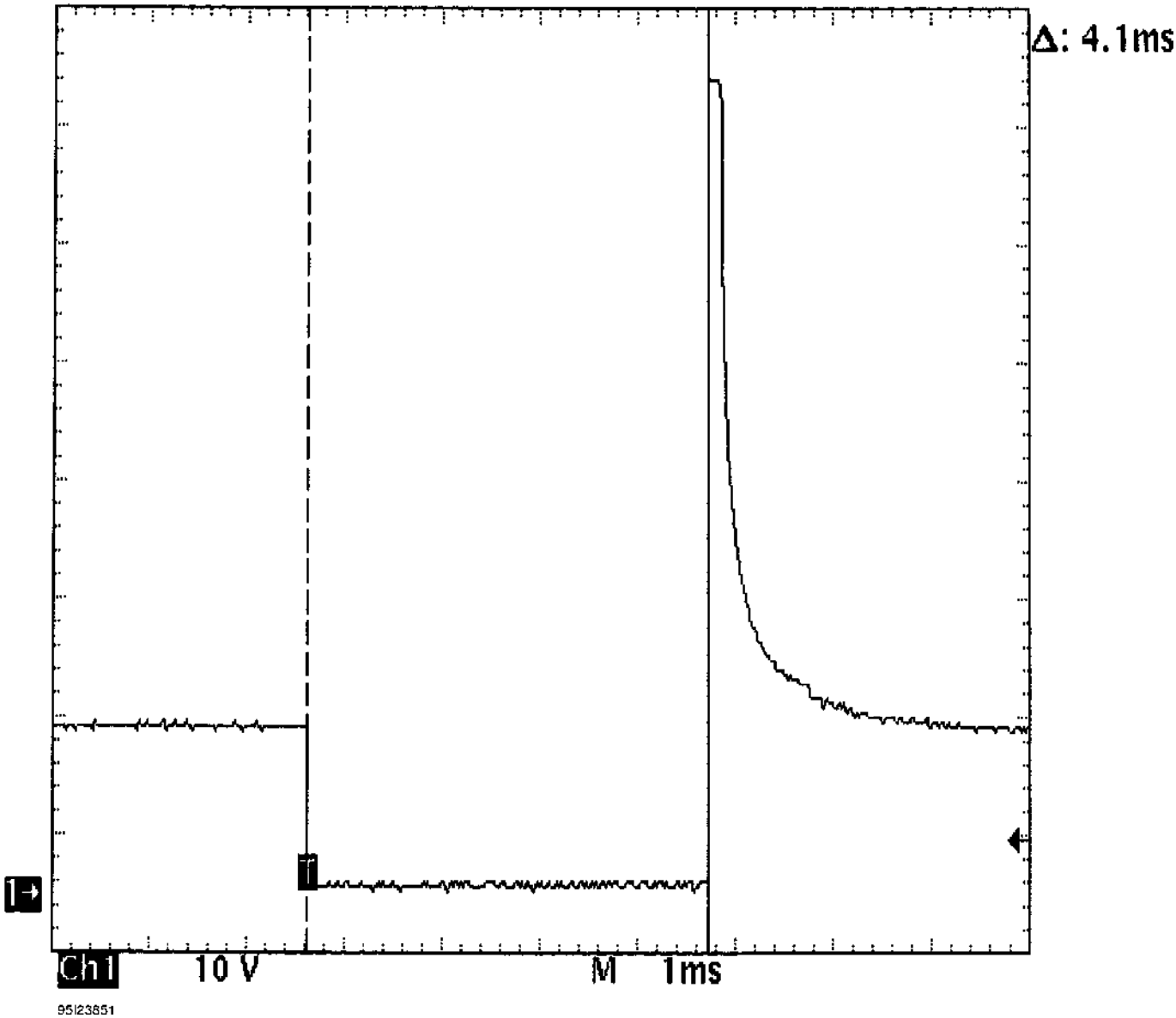


Fig. 20: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #3 - VOLTAGE CONTROLLED DRIVER

This known-good waveform pattern, Fig. 21, is from a GM 5.0L V8 TPI VIN [F]. It was taken during hot idle, closed loop and no load.

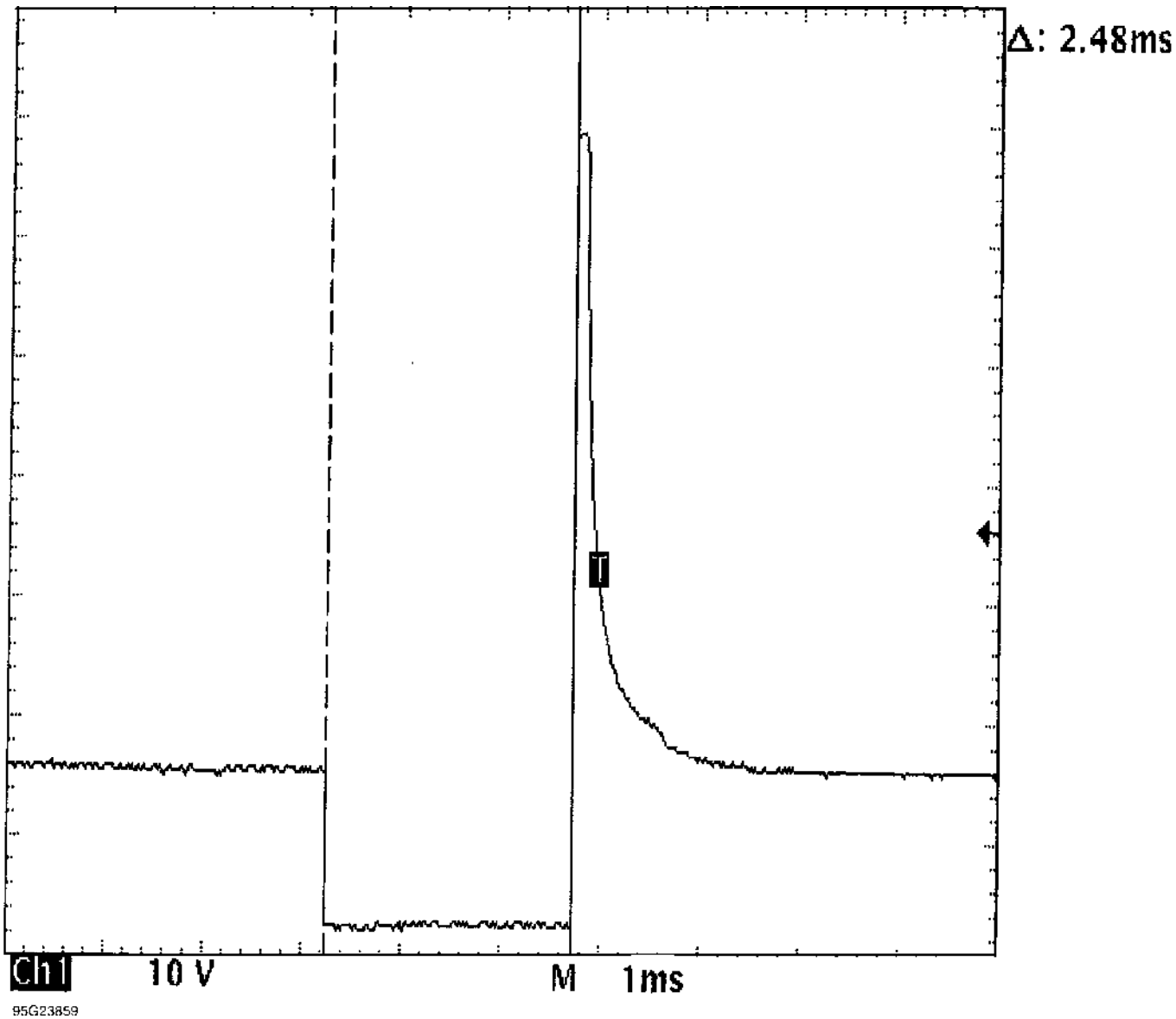
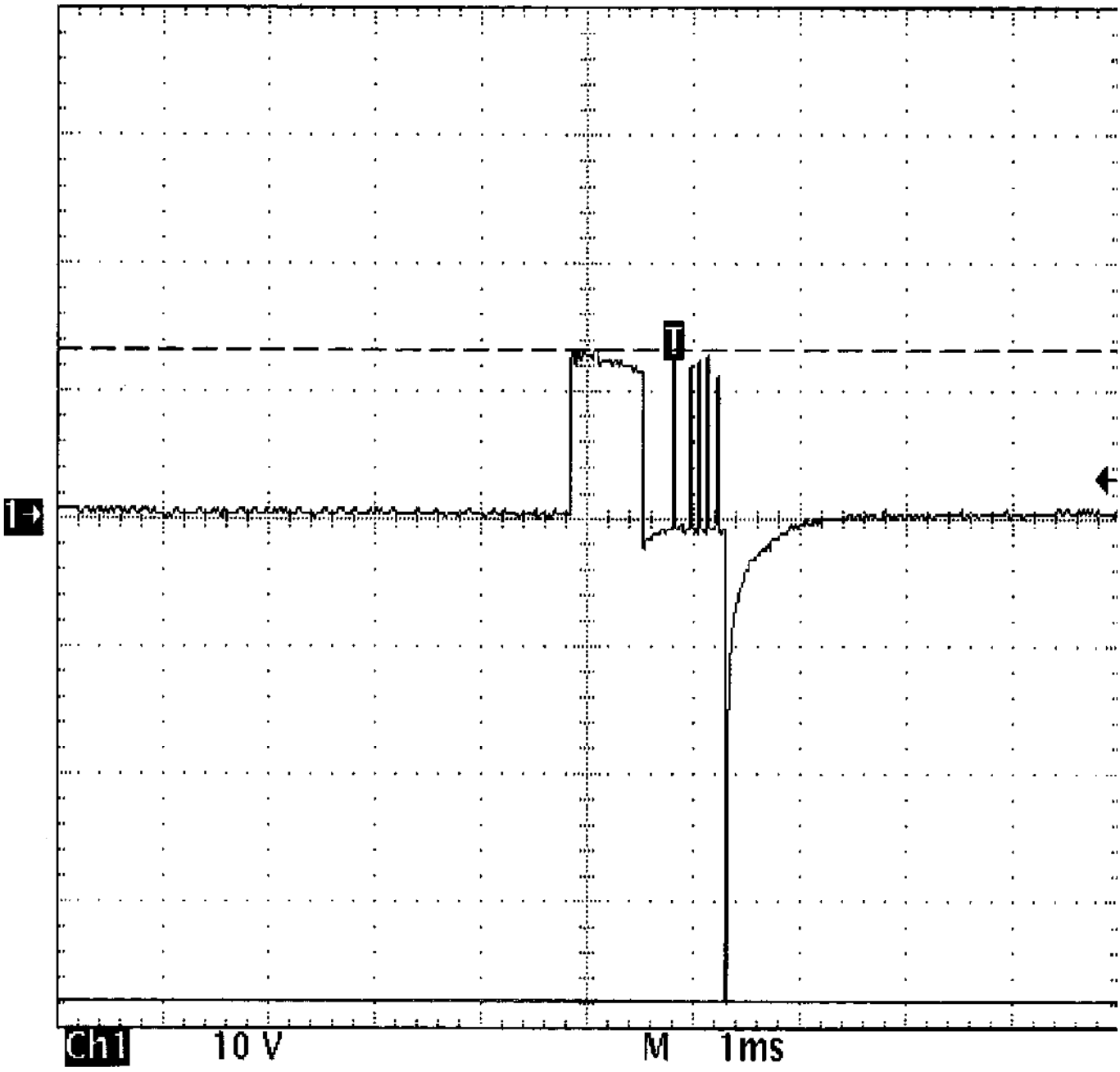


Fig. 21: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #4 - CURRENT CONTROLLED DRIVER

From 1984 to 1987, Chrysler used this type injector drive on their TBI-equipped engines. See Fig. 22 for a known-good pattern. Instead of the ground side controlling the injector, Chrysler permanently grounds out the injector and switches the power feed side. Most systems do not work this way.

These injectors peak at 6 amps of current flow and hold at 1 amp.



95J23860

Fig. 22: Single Injector - Known Good - Voltage Pattern

EXAMPLE #5 - CURRENT CONTROLLED DRIVER

These two known-good waveform patterns are from a Chrysler 3.0L V6 VIN [3]. The first waveform, Fig. 23, is a dual trace pattern that illustrates how Chrysler uses the rising edge of the engine speed signal to trigger the injectors. The second waveform, Fig. 24, was taken during hot idle, closed loop, and no load.

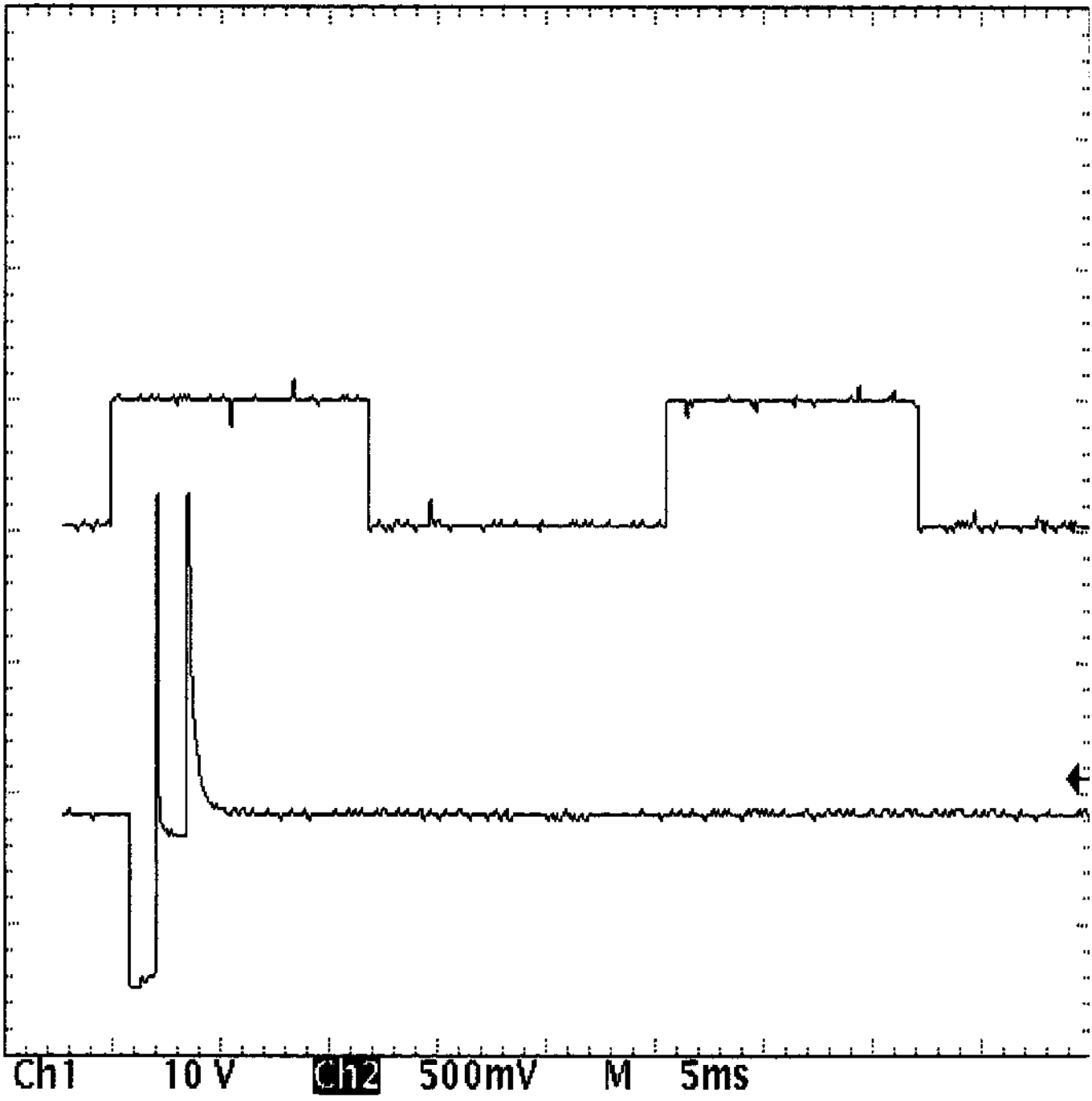
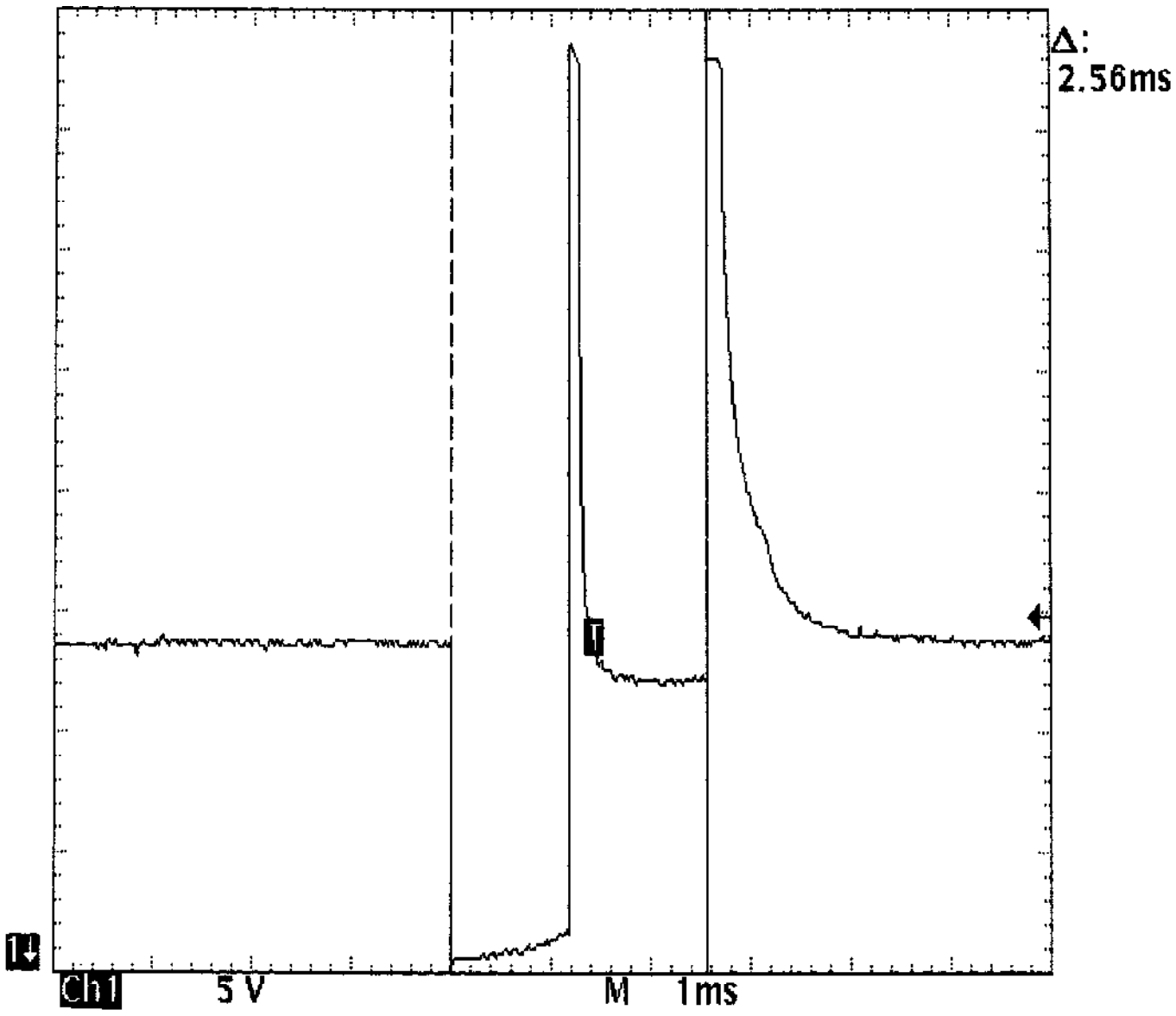


Fig. 23: Injector Bank - Known Good - Voltage Pattern



95B23854
Fig. 24: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #6 - CURRENT CONTROLLED DRIVER

This known-good pattern from a Ford 3.0L V6 PFI VIN [U] illustrates that a zener diode inside the computer is used to clamp the injector's inductive kick to 35-volts on this system. See Fig. 25.

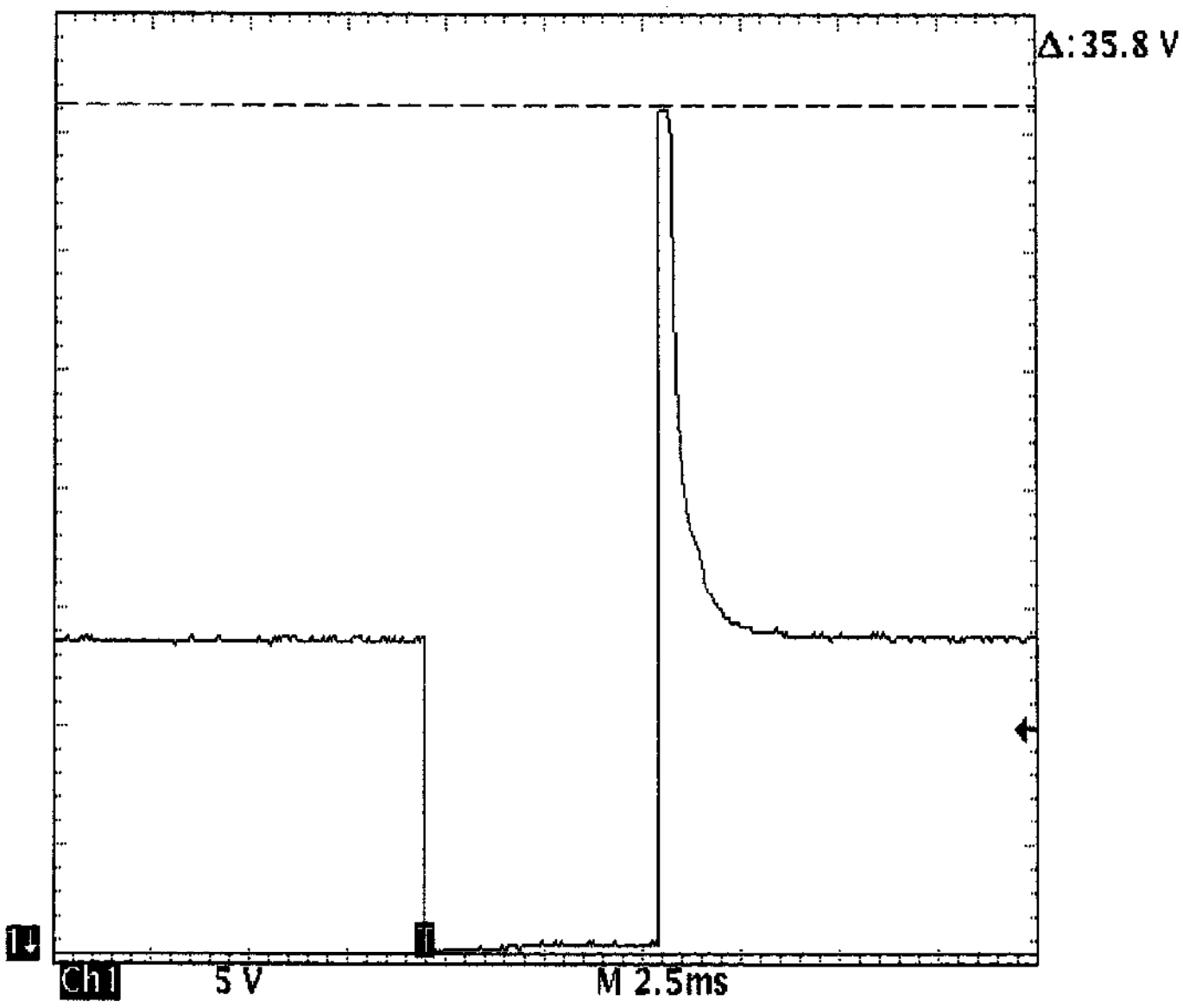


Fig. 25: Injector Bank - Known Good - Voltage Pattern

EXAMPLE #7 - CURRENT CONTROLLED DRIVER

This known-good waveform from a Ford 5.0L V8 CFI VIN [F] was taken during hot idle, closed loop, and no load. See Fig. 26.

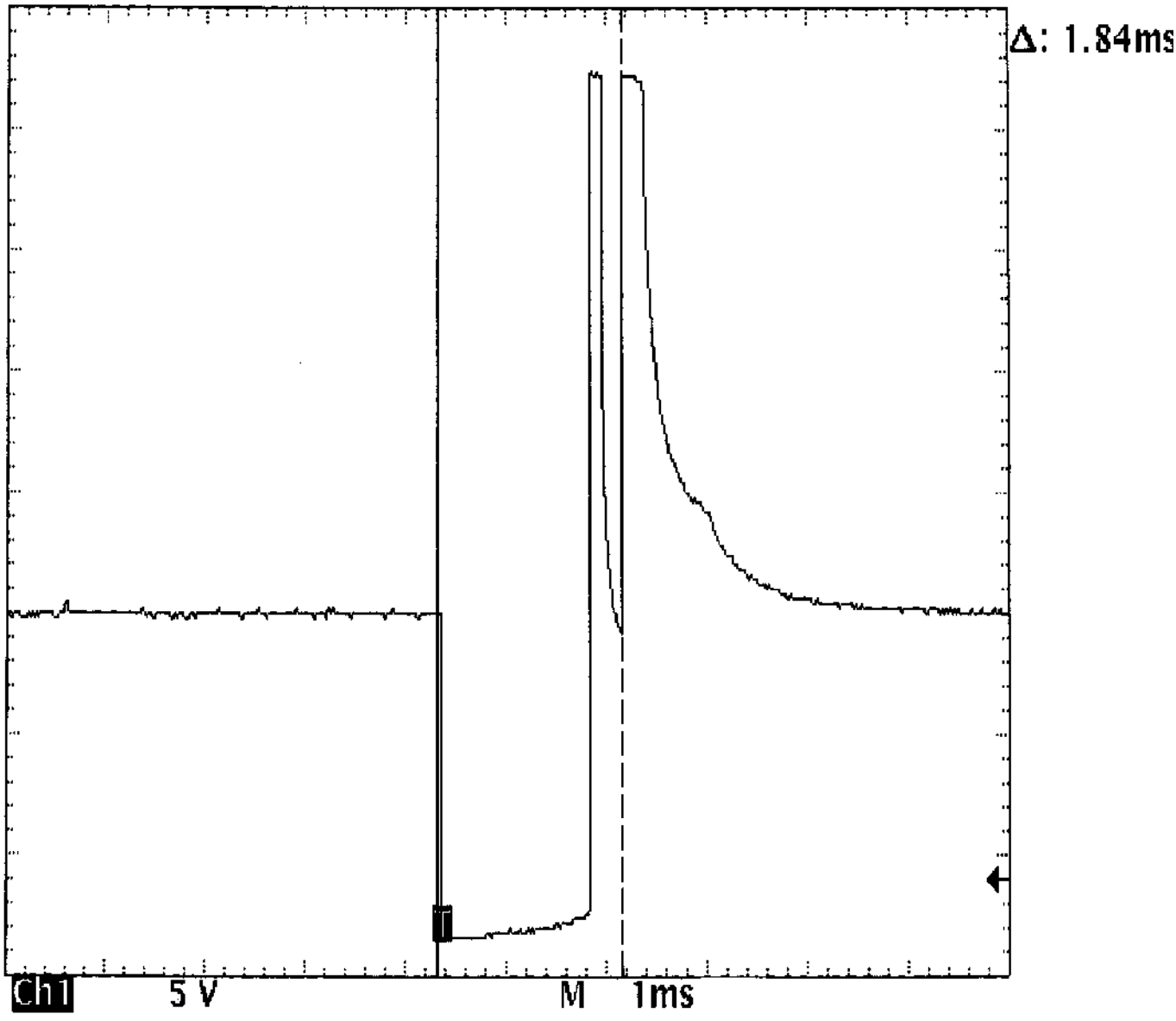


Fig. 26: Single Injector - Known Good - Voltage Pattern

EXAMPLE #8 - CURRENT CONTROLLED DRIVER

These two known-good waveform patterns are from a GM 2.0L In-Line 4 VIN [1]. Fig. 27 illustrates the 78 volt inductive spike that indicates a zener diode is not used. The second waveform, Fig. 28, was taken during hot idle, closed loop, and no load.

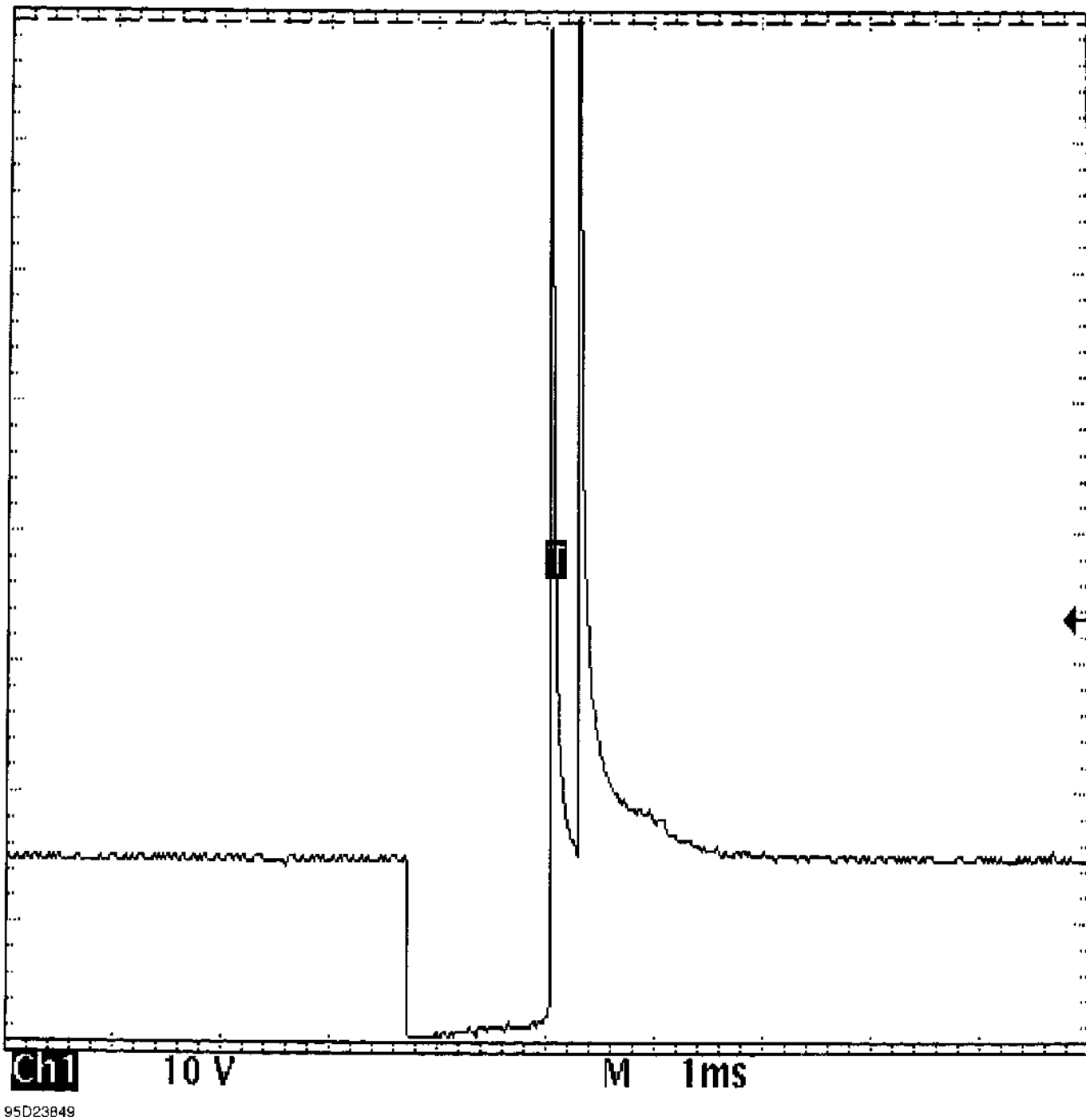


Fig. 27: Single Injector - Known Good - Voltage Pattern

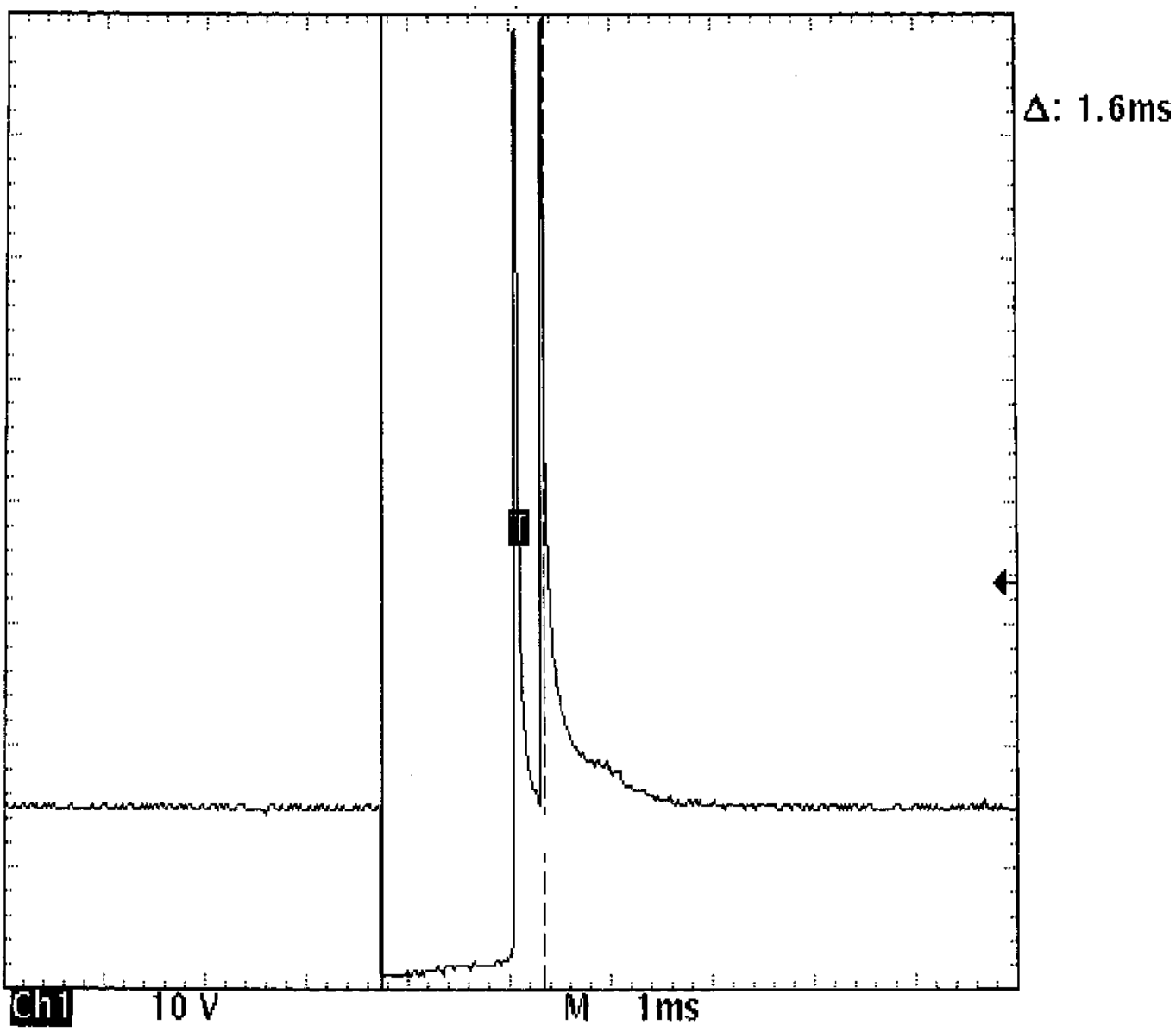


Fig. 28: Single Injector - Known Good - Voltage Pattern

WHEEL ALIGNMENT SPECIFICATIONS & PROCEDURES

1997-99 Mitsubishi Montero Sport

1997-99 WHEEL ALIGNMENT
Mitsubishi - Specifications & Procedures

Diamante, Eclipse, Galant, Mirage,
Montero, Montero Sport, 3000GT

RIDING HEIGHT ADJUSTMENT

NOTE: Prior to performing wheel alignment, perform preliminary visual and mechanical inspection of wheels, tires and suspension components. See PRE-ALIGNMENT INSTRUCTIONS in WHEEL ALIGNMENT THEORY & OPERATION article in GENERAL INFORMATION.

NOTE: On vehicles with electronic chassis controls, ensure all systems are functional before attempting to adjust riding height or wheel alignment. See appropriate ELECTRONIC article under SUSPENSION.

1) Before adjusting wheel alignment, visually inspect vehicle. Remove any heavy items from passenger and luggage compartments. Ensure tires are properly inflated and vehicle is level. Bounce vehicle several times, and allow suspension to settle.

2) Check riding height from front to rear and from side to side. If riding height is not as specified on Montero and Montero Sport, adjust torsion bar anchor arm nut until correct height is obtained. See RIDING HEIGHT SPECIFICATIONS (FRONT) table. On all other models, riding height for left and right sides of vehicle should not vary more than 1.0" (25.4 mm). If riding height is not within specification, check and repair suspension before adjusting alignment.

RIDING HEIGHT SPECIFICATIONS (FRONT)

Application	(1) In. (mm)
Montero	.83-.91 (21.0-23.0)
Montero Sport	2.7 (68)

(1) - Distance between lower control bumper stop and bracket. See Fig. 1.

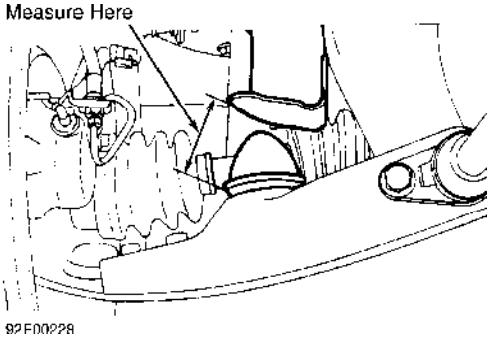


Fig. 1: Measuring Riding Height (Montero & Montero Sport)
Courtesy of Mitsubishi Motor Sales of America.

JACKING & HOISTING

* PLEASE READ FIRST *

NOTE: Following illustrations are given to provide reference points only. Illustrations do not represent exact structure of vehicle frame, underbody or body outline.

EMERGENCY JACKING

Points on outline of body were designated to be used specifically with vehicle jack. See Fig. 2. If using floor jack or hoist at these points, use extreme care to avoid damaging outer body shell.

FLOOR JACK & HOIST

Following illustrations indicate points for jacking and hoisting vehicle. These points are indicated by shaded areas on frame and underbody. See Figs. 3-5.

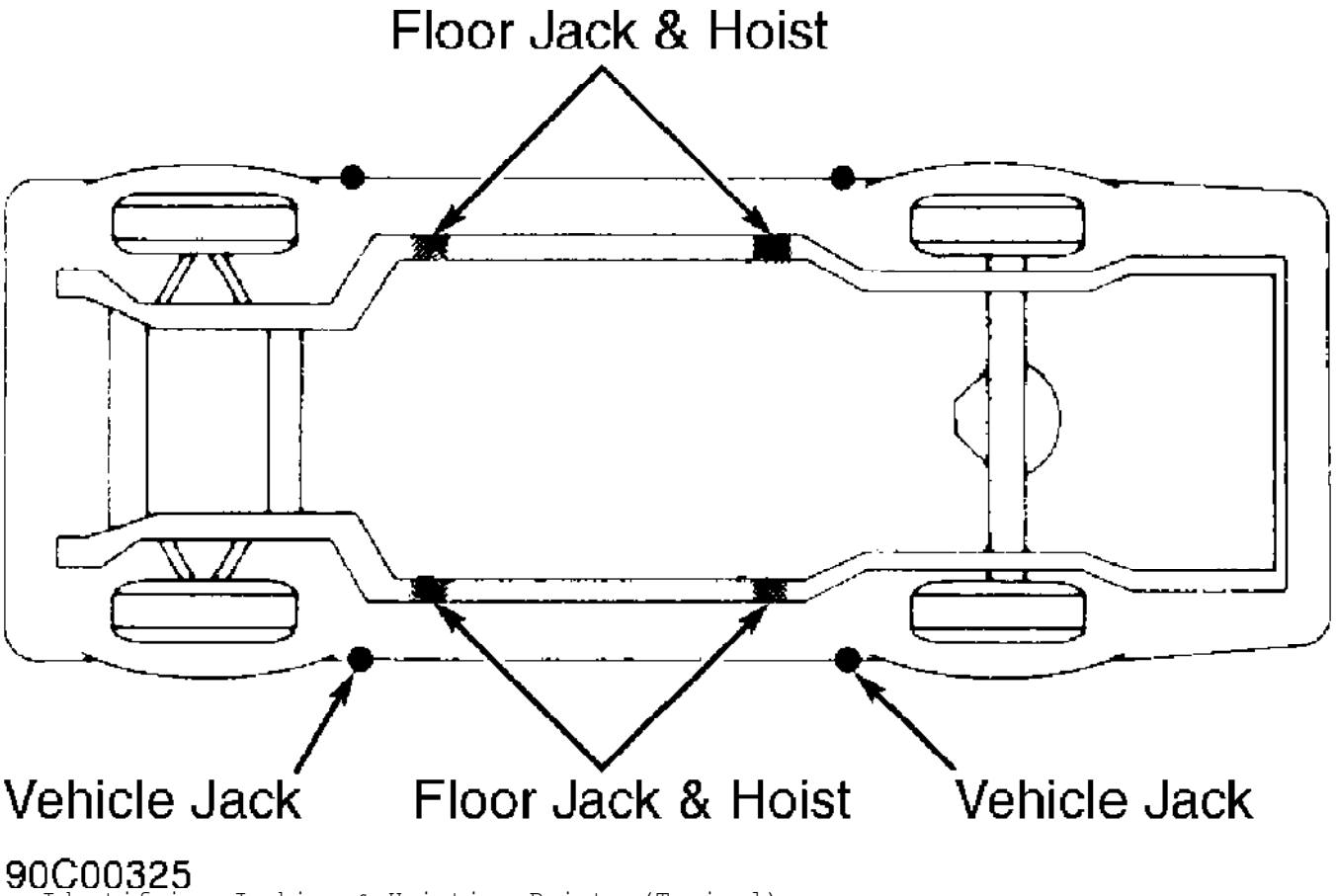


Fig. 2: Identifying Jacking & Hoisting Points (Typical)

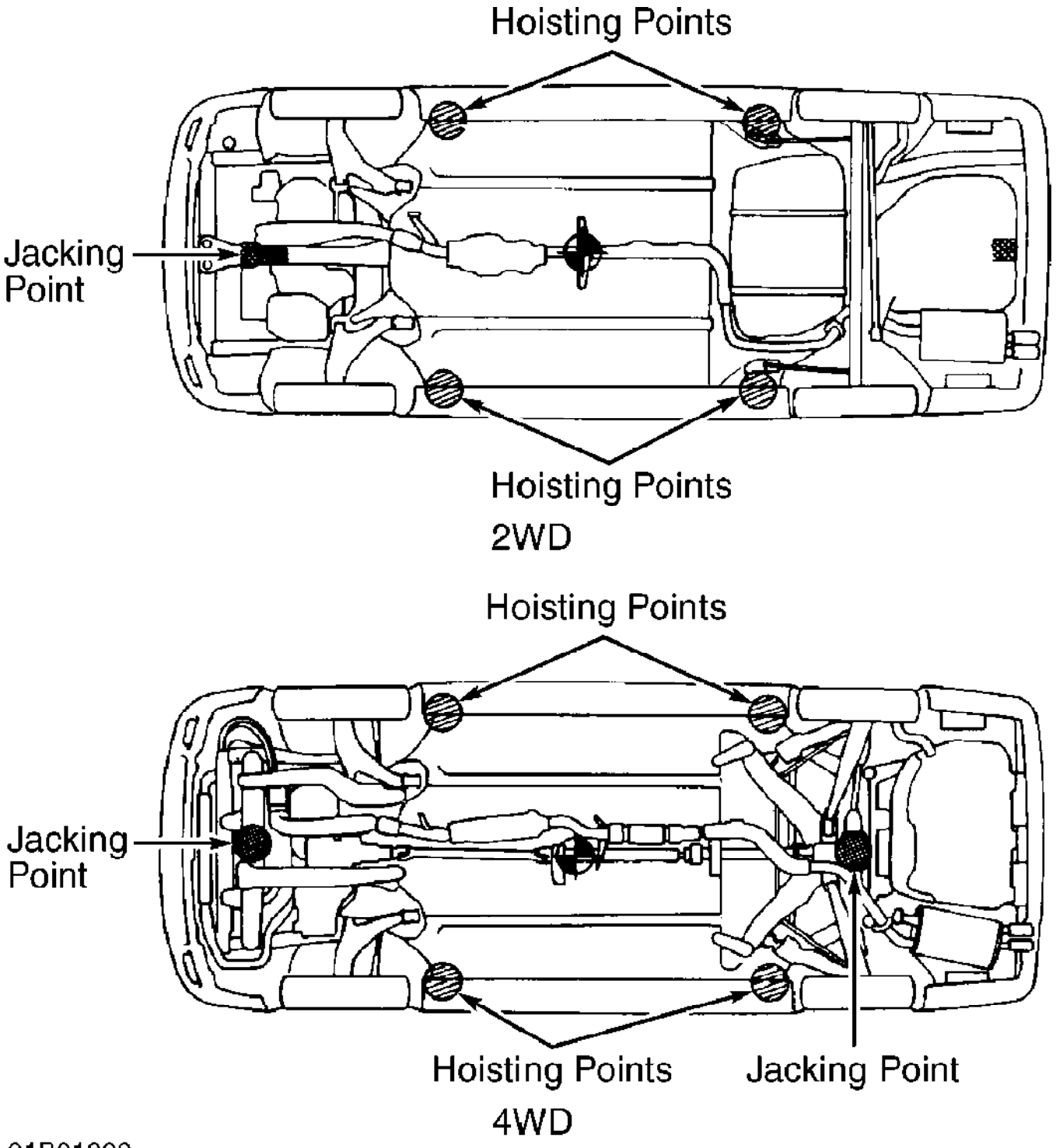


Fig. 3: Identifying Jacking & Hoisting Points (Except Montero, Montero Sport & 3000GT)
Courtesy of Mitsubishi Motor Sales of America.

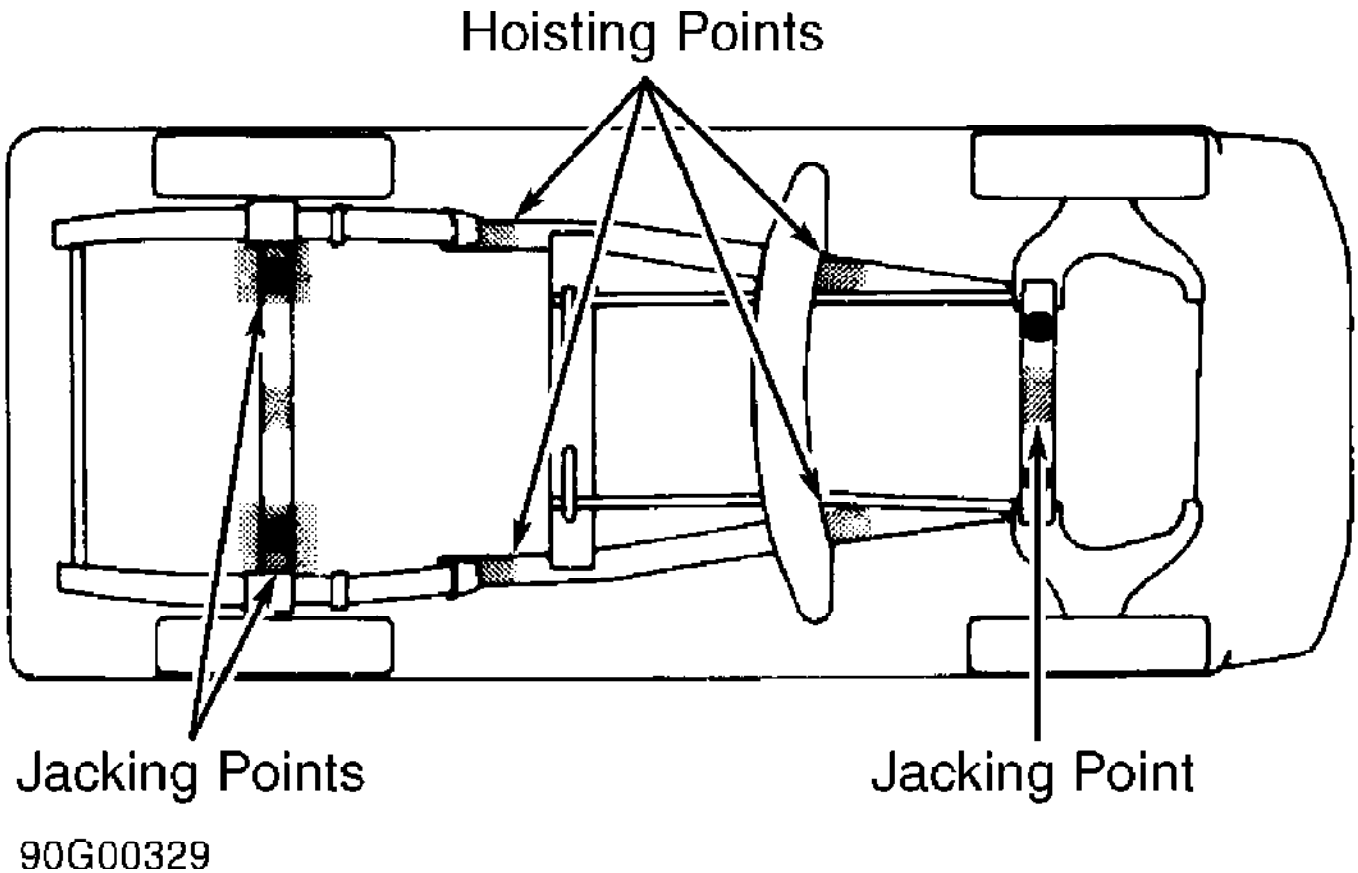


Fig. 4: Identifying Jacking & Hoisting Points (Montero & Montero Sport)
Courtesy of Mitsubishi Motor Sales of America.

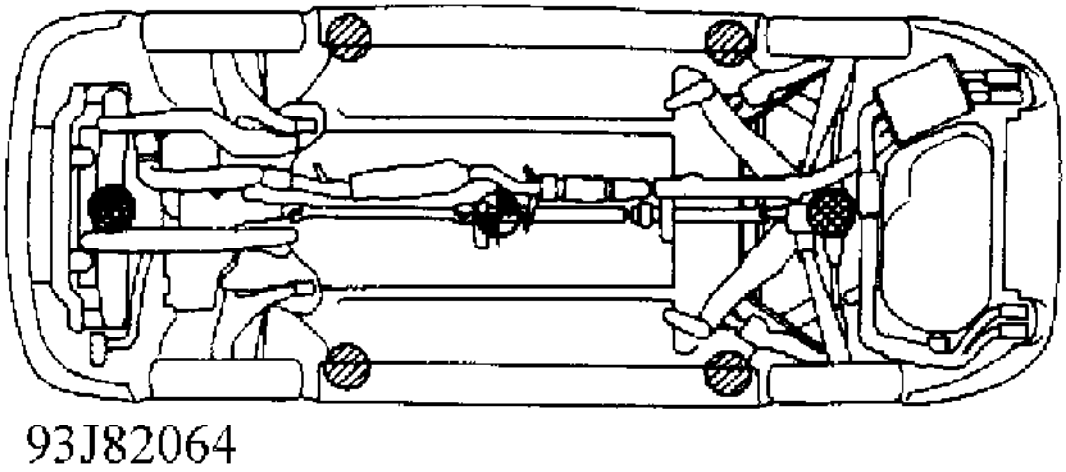


Fig. 5: Identifying Jacking & Hoisting Points (3000GT AWD Shown; FWD Is Similar)
Courtesy of Mitsubishi Motor Sales of America.

WHEEL ALIGNMENT PROCEDURES

CAMBER ADJUSTMENT

Except Montero, Montero Sport & 3000GT

Camber is preset and cannot be adjusted. Check camber. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If camber is not within specification, replace damaged or bent parts.

Montero & Montero Sport

1) Check camber. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If camber is not within specification, remove shock absorber mounting nut and lock nut.

CAUTION: Difference in shim thickness between front and rear must not exceed 0.16" (4.0 mm). DO NOT use more than 3 shims at onelocation.

2) Compress shock absorber, and loosen upper arm mounting bolts and nuts. Adjust camber by increasing or decreasing shims between upper arm shaft and crossmember. See Fig. 6.

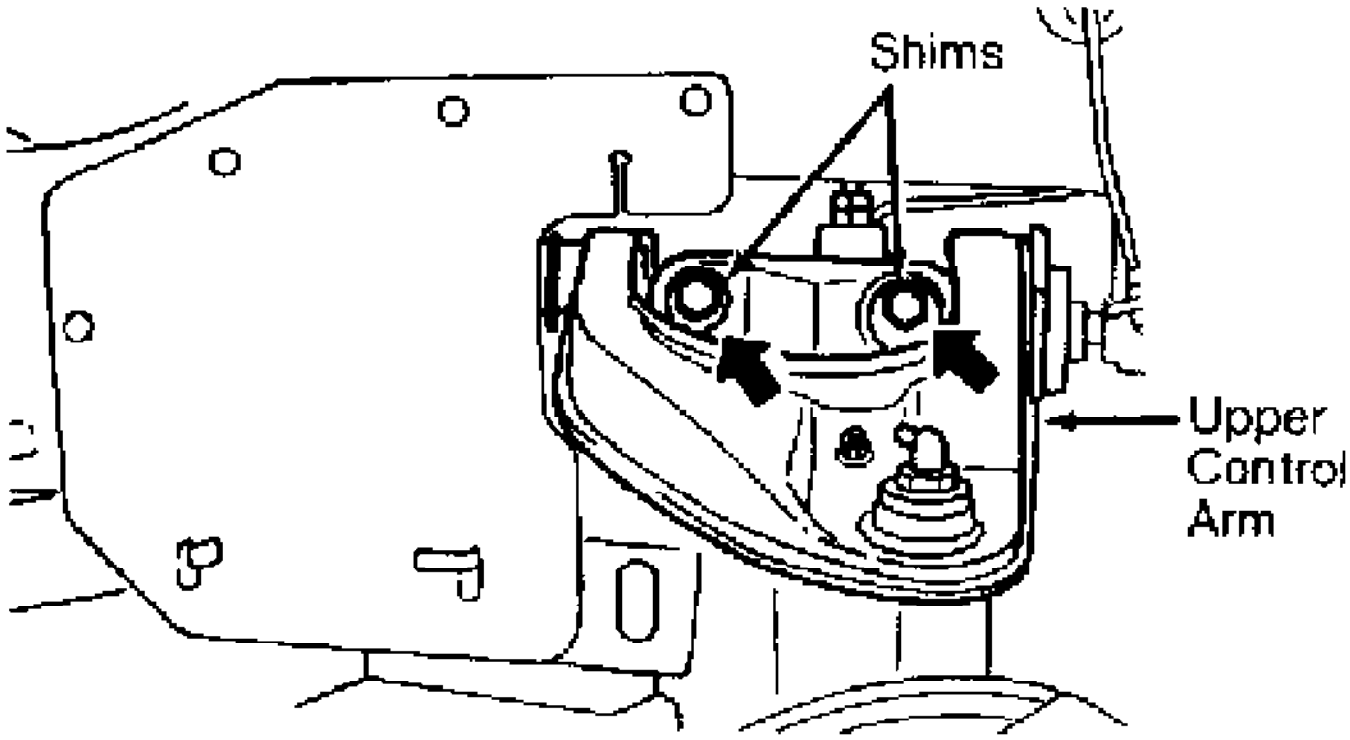


Fig. 6: Adjusting Camber & Caster (Montero Sport Shown; Montero Is Similar)
Courtesy of Mitsubishi Motor Sales of America.

3000GT

Check camber. See WHEEL ALIGNMENT SPECIFICATIONS (3000GT) table. If camber is not within specification, loosen eccentric cam nut. Rotate eccentric cam bolt to obtain correct camber. See Fig. 7. Each marking represents a change of .12-.25 degree of camber.

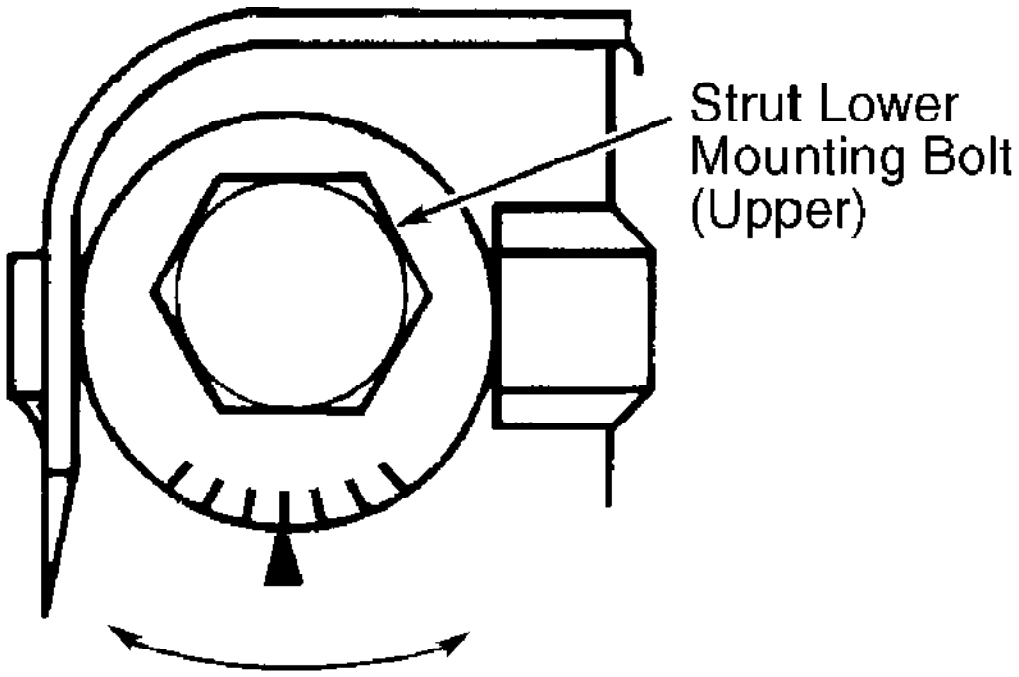


Fig. 7: Adjusting Camber (3000GT)
Courtesy of Mitsubishi Motor Sales of America.

CASTER ADJUSTMENT

Except Montero & Montero Sport
Check caster. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If caster is not within specification, replace damaged or bent parts.

Montero & Montero Sport
1) Check caster. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If caster is not within specification, remove shock absorber mounting nut and lock nut.

CAUTION: Difference in shim thickness between front and rear must not exceed .16" (4.0 mm). DO NOT use more than 3 shims at one location.

2) Compress shock absorber, and loosen upper arm mounting bolts and nuts. Adjust caster by increasing or decreasing shims between upper arm shaft and crossmember. See Fig. 6.

TOE-IN ADJUSTMENT

Front
Check front toe-in. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If front toe-in is not within specification, remove clips. Turn tie rods or turnbuckles same amount, but in opposite directions. Recheck front toe-in.

Rear (Montero & Montero Sport)
Check rear toe-in. See appropriate table under

WHEEL ALIGNMENT SPECIFICATIONS. If rear toe-in is not within specification, replace damaged or bent parts.

Rear (3000GT AWD)
Check rear toe-in. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If rear toe-in is not within specification, loosen both trailing arm eccentric cam nuts. Turn trailing arm eccentric cam bolts equal amount to obtain correct rear toe-in. See Fig. 8.

Rear (Except Montero, Montero Sport & 3000GT AWD)
Check rear toe-in. See appropriate table under WHEEL ALIGNMENT SPECIFICATIONS. If rear toe-in is not within specification, loosen both assist link eccentric cam nuts. Turn assist link eccentric cam bolts equal amount to obtain correct rear toe-in. See Fig. 9.

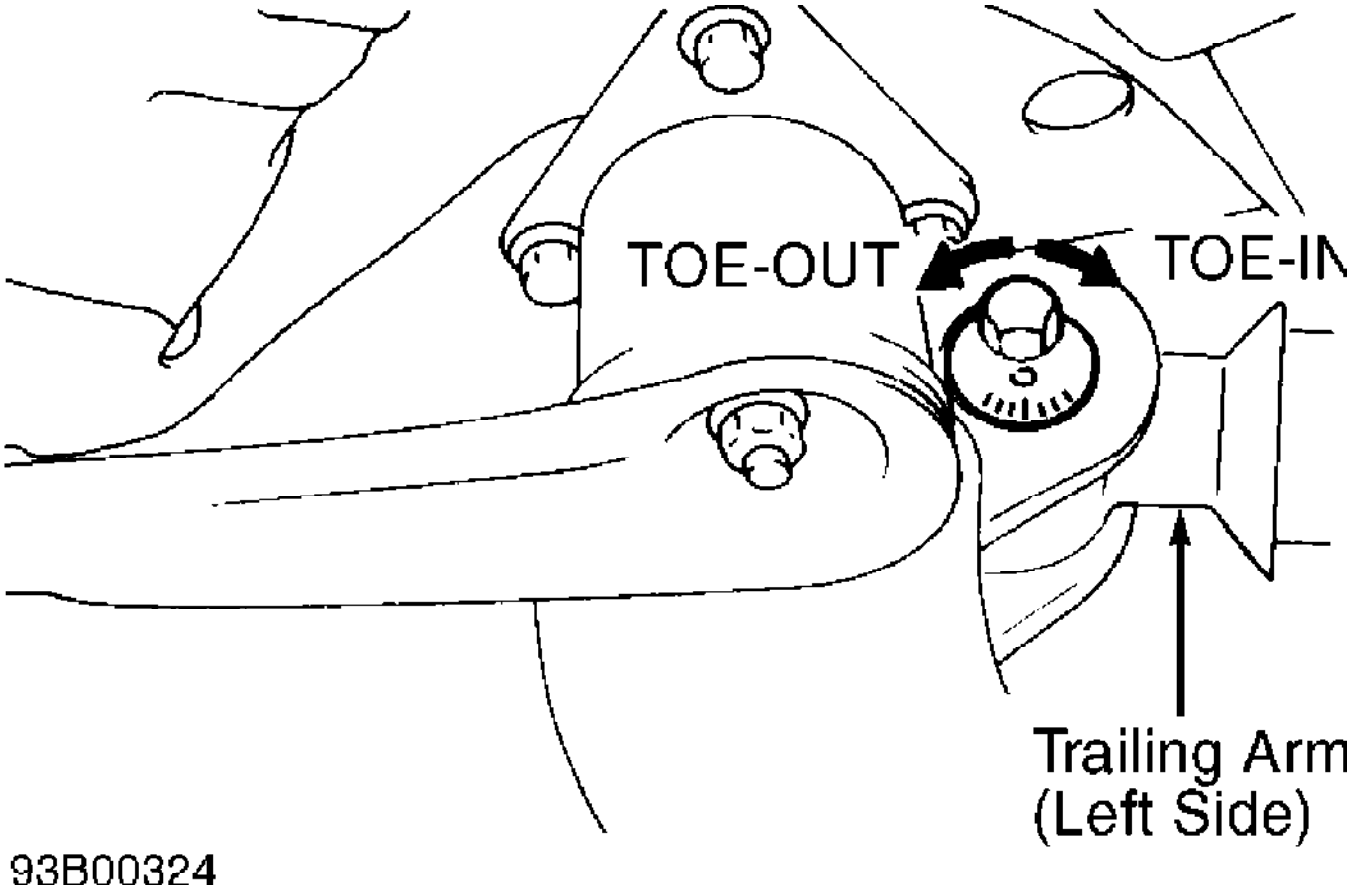


Fig. 8: Adjusting Rear Toe-In (3000GT AWD)
Courtesy of Mitsubishi Motor Sales of America.

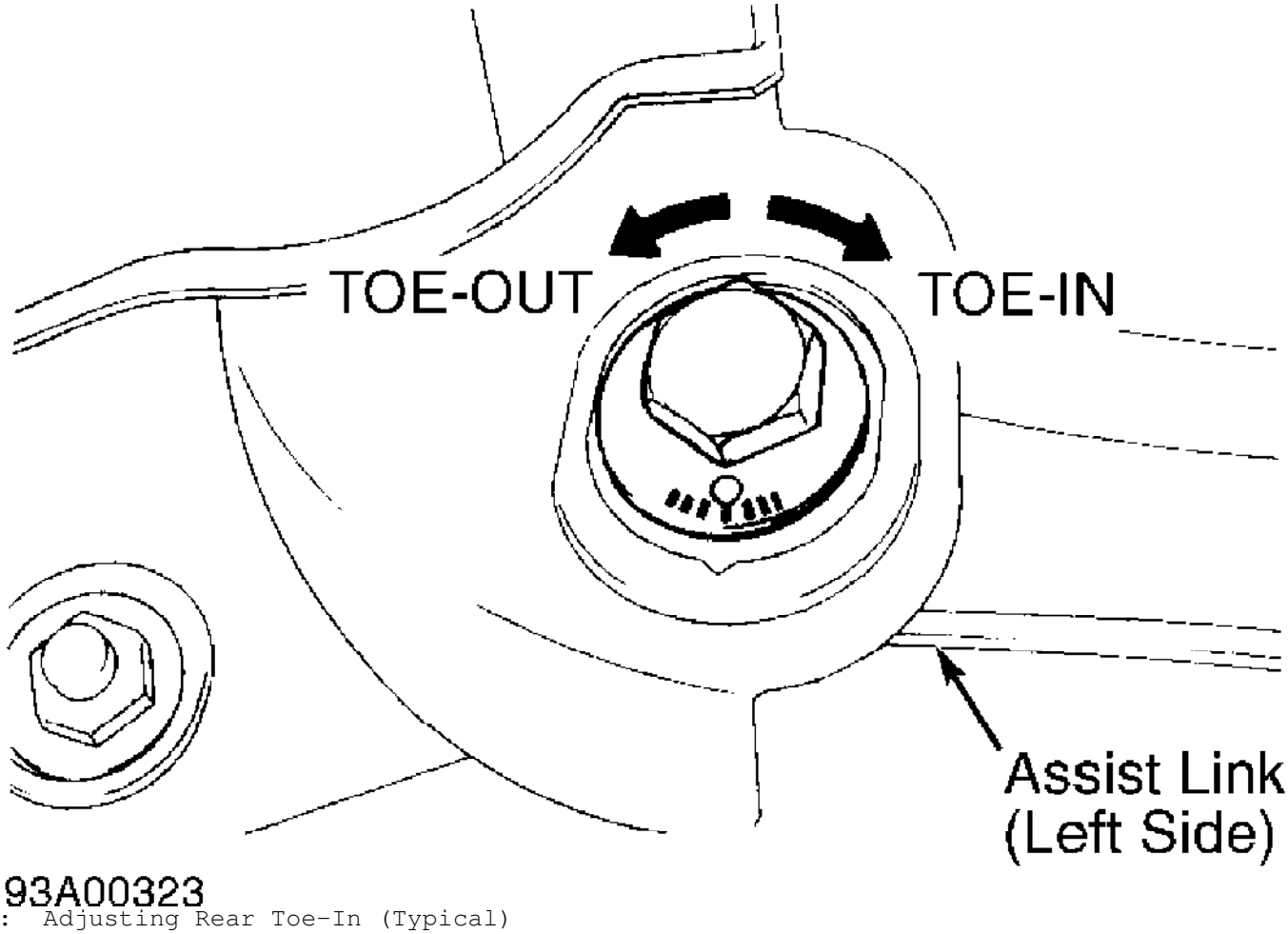


Fig. 9: Adjusting Rear Toe-In (Typical)
Courtesy of Mitsubishi Motor Sales of America.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Shock Absorber-To-Lower Control Arm Bolt	
Montero	65-76 (88-103)
Montero Sport	(1)
Upper Arm Shaft To Crossmember Nut	
Montero	80 (108)
Montero Sport	72-87 (98-118)
Wheel Lug Nut	
Diamante, Galant & Mirage	65-80 (88-108)
Eclipse & 3000GT	87-101 (118-137)
Montero	72-87 (98-118)
Montero Sport	
With 6" Wide Wheel (6JJ)	87-101 (118-137)
With 7" Wide Wheel (7JJ)	73-86 (99-117)
	INCH Lbs. (N.m)
Shock Absorber-To-Crossmember Nut	
Montero	133 (15)

Montero Sport	106-159 (12-18)

(1) - 80-124 INCH Lbs. (9-14 N.m).

WHEEL ALIGNMENT SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS (DIAMANTE)

Application	Preferred	Range
Camber (1)		
Front	0	-0.5 To 0.5
Rear		
15" Wheel	-.67	-1.17 To -.17
16" Wheel	-.83	-1.33 To -.33
Caster (Front) (1)	3	2.5 To 3.5
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	0	-0.24 To 0.24
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0 (0)	-0.12 To 0.12 (-3 To 3)

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (ECLIPSE)

Application	Preferred	Range
2WD		
14" & 17" Wheels		
Camber (1)		
Front	-0.33	-0.83 To 0.17
Rear	-1.33	-1.83 To -0.83
Caster (1)	4.67	3.67 To 5.67
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	0.24	0 To 0.48
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0.12 (3)	0 To 0.24 (0 To 6)
Toe-Out On Turns (1)		
Inner	32.5	N/A
Outer	27	N/A
16" Wheel		
Camber (1)		
Front	-0.33	-0.83 To 0.17
Rear	-1.67	-2.17 To -1.17
Caster (1)	4.67	3.67 To 5.67
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	0.24	0 To 0.48
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0.12 (3)	0 To 0.24 (0 To 6)
Toe-Out On Turns (1)		
Inner	32.5	N/A
Outer	27	N/A
AWD		

Camber (1)		
Front	-0.33	-0.83 To 0.17
Rear	-1.33	-1.83 To -0.83
Caster (1)	4.67	3.67 To 5.67
Toe-In (1)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0.12 (3)	0 To 0.24 (0 To 6)
Toe-In (2)		
Front	0	-0.24 To 0.24
Rear	0.24	0 To 0.48
Toe-Out On Turns (1)		
Inner	32.5	N/A
Outer	27	N/A

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (GALANT)

Application	Preferred	Range
Camber (1)		
Front	0	-0.50 To 0.50
Rear	-1.33	-1.83 To -0.83
Caster (1)	4.33	3.83 To 4.83
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	0.24	0 To 0.48
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	.12 (3)	0 To .24 (0 To 6)
Toe-Out On Turns (1)		
Inner	39	N/A
Outer	30.5	N/A

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (MIRAGE)

Application	Preferred	Range
Camber (1)		
Front	0	-0.5 To 0.5
Rear	-0.67	-1.17 To -0.17
Caster (1)	2.85	2.35 To 3.35
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	0.24	0.08 To 0.40
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0.12 (3)	0.04 To 0.20 (1 To 5)
Toe-Out On Turns (1)		
Inner	37.3	N/A
Outer	31	N/A

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (MONTERO)

Application	Preferred	Range
Camber (1)		
Front	0.67	0.17 To 1.17
Caster (1)	3	2 To 4
Toe-In (1)		
Front	0.28	0 To 0.56
Toe-In (2)		
Front	0.14 (3.5)	0 To 0.28 (0 To 7)
Toe-Out On Turns (1)		
Inner	21.93	N/A
Outer	20	N/A

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (MONTERO SPORT)

Application	Preferred	Range
Camber		
Front (1)	0.67	0.17 To 1.17
Caster (1)	2.67	1.67 To 3.67
Toe-In (1)		
Front	0.28	0 To 0.56
Toe-In (2)		
Front	0.14 (3.5)	0 To 0.28 (0 To 7)

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT SPECIFICATIONS (3000GT)

Application	Preferred	Range
Camber (1)		
Front	0	-0.5 To 0.5
Rear		
FWD	0	-0.5 To 0.5
AWD	-0.17	-0.67 To 0.33
Caster (1)	3.92	3.42 To 4.42
Toe-In (1)		
Front	0	-0.24 To 0.24
Rear	-0.02	-0.16 To 0.20
Toe-In (2)		
Front	0 (0)	-0.12 To 0.12 (-3 To 3)
Rear	0.01 (0.5)	-0.08 To 0.10 (-2 To 3)
Toe-Out On Turns (1)		
Inner	33.75	N/A
Outer	28.35	N/A

(1) - Measurement in degrees.
(2) - Measurement in inches (mm).

WHEEL ALIGNMENT THEORY/OPERATION

1997-99 Mitsubishi Montero Sport

GENERAL INFORMATION
Wheel Alignment Theory & Operation

ALL MODELS

*** PLEASE READ THIS FIRST ***

NOTE: This article is intended for general information purposes only. This information may not apply to all makes and models.

PRE-ALIGNMENT INSTRUCTIONS

GENERAL ALIGNMENT CHECKS

Before adjusting wheel alignment, check the following:

* Each axle uses tires of same construction and tread style, equal in tread wear and overall diameter. Verify that radial and axial runout is not excessive. Inflation should be at manufacturer's specifications.
* Steering linkage and suspension must not have excessive play. Check for wear in tie rod ends and ball joints. Springs must not be sagging. Control arm and strut rod bushings must not have excessive play. See Fig. 1.

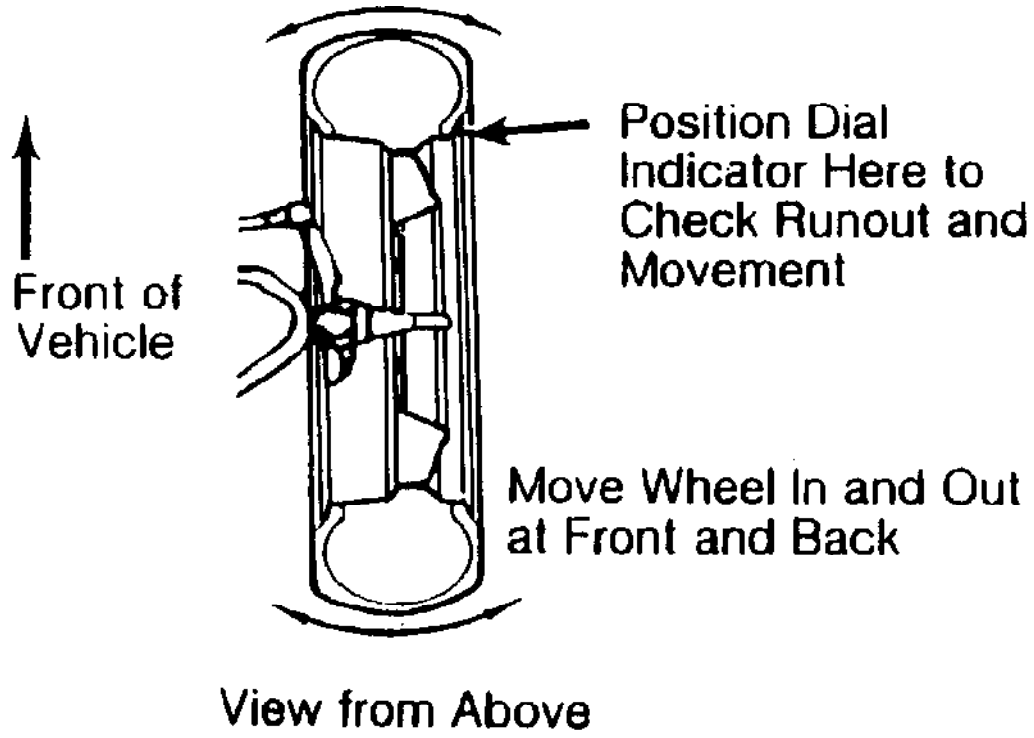


Fig. 1: Checking Steering Linkage

* Vehicle must be on level floor with full fuel tank, no passenger load, spare tire in place and no load in trunk. Bounce front and rear end of vehicle several times. Confirm

vehicle is at normal riding height.

* Steering wheel must be centered with wheels in straight ahead position. If required, shorten one tie rod adjusting sleeve and lengthen opposite sleeve (equal amount of turns). See Fig. 2.
* Wheel bearings should have the correct preload and lug nuts must be tightened to manufacturer's specifications. Adjust camber, caster and toe-in using this sequence. Follow instructions of the alignment equipment manufacturer.

CAUTION: Do not attempt to correct alignment by straightening parts. Damaged parts must be replaced.

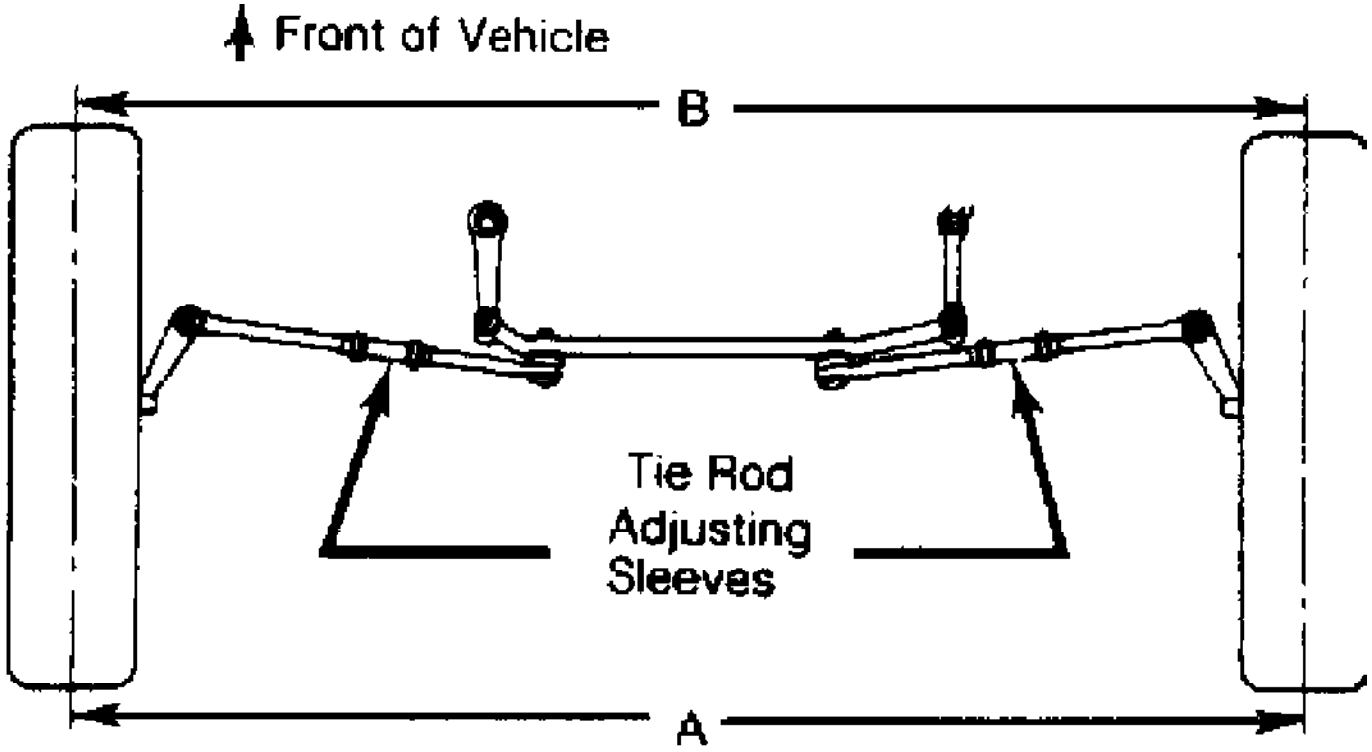


Fig. 2: Adjusting Tie Rod Sleeves (Top View)

CAMBER

1) Camber is the tilting of the wheel, outward at either top or bottom, as viewed from front of vehicle. See Fig. 3.

2) When wheels tilts outward at the top (from centerline of vehicle), camber is positive. When wheels tilt inward at top, camber is negative. Amount of tilt is measured in degrees from vertical.

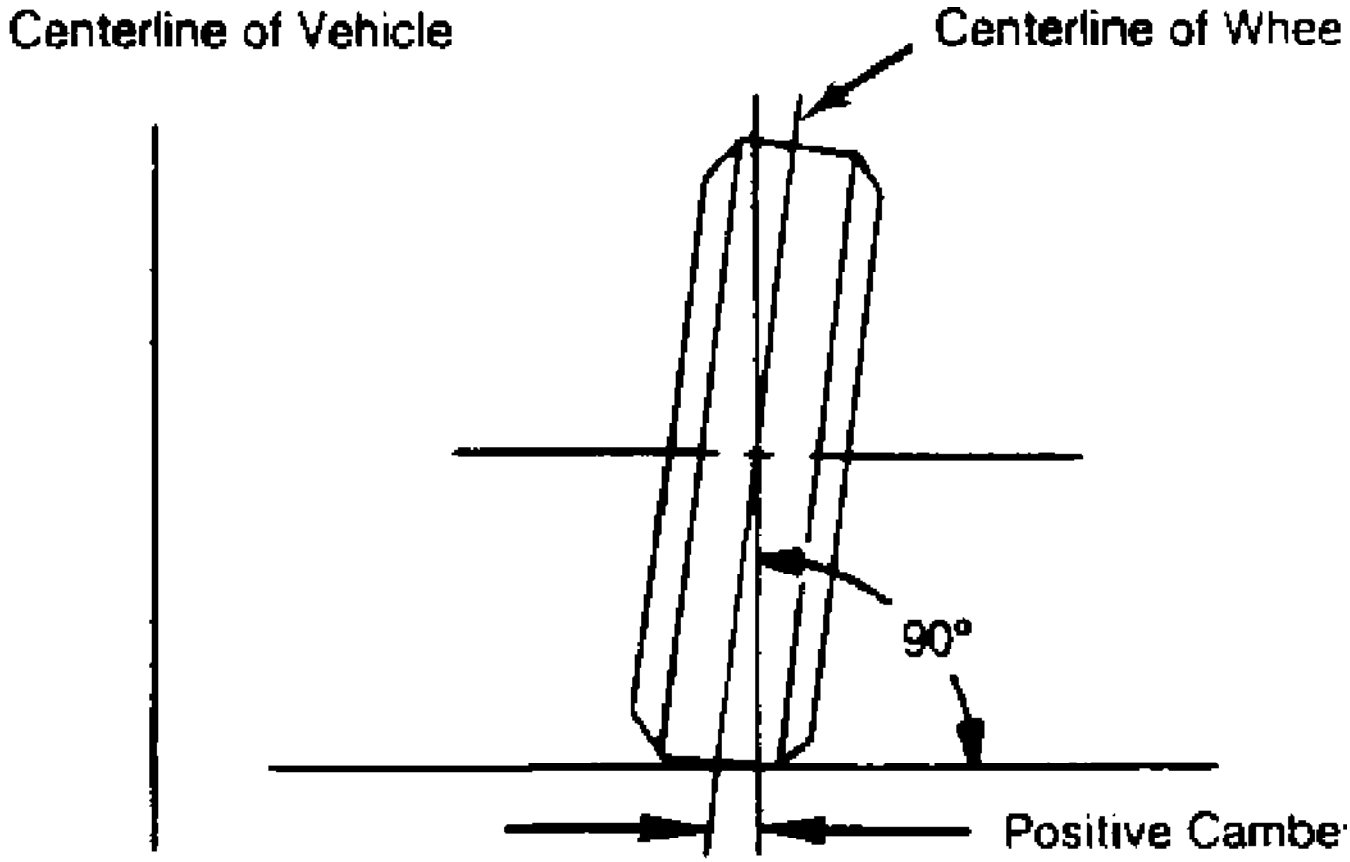


Fig. 3: Determining Camber Angle

CASTER

1) Caster is tilting of front steering axis either forward or backward from vertical, as viewed from side of vehicle. See Fig. 4.

2) When axis is tilted backward from vertical, caster is positive. This creates a trailing action on front wheels. When axis is tilted forward, caster is negative, causing a leading action on front wheels.

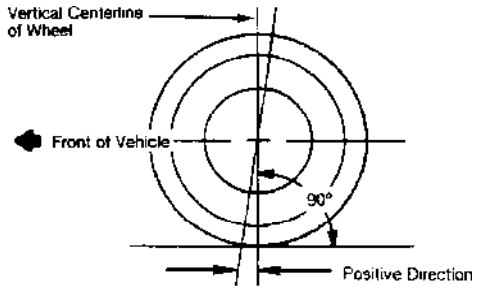


Fig. 4: Determining Caster Angle

TOE-IN ADJUSTMENT

Toe-in is the width measured at the rear of the tires

subtracted by the width measured at the front of the tires at about spindle height. A positive figure would indicate toe-in and a negative figure would indicate toe-out. If the distance between the front and rear of the tires is the same, toe measurement would be zero. To adjust:

1) Measure toe-in with front wheels in straight ahead position and steering wheel centered. To adjust toe-in, loosen clamps and turn adjusting sleeve or adjustable end on right and left tie rods. See Figs. 2 and 5.

2) Turn equally and in opposite directions to maintain steering wheel in centered position. Face of tie rod end must be parallel with machined surface of steering rod end to prevent binding.

3) When tightening clamps, make certain that clamp bolts are positioned so there will be no interference with other parts throughout the entire travel of linkage.

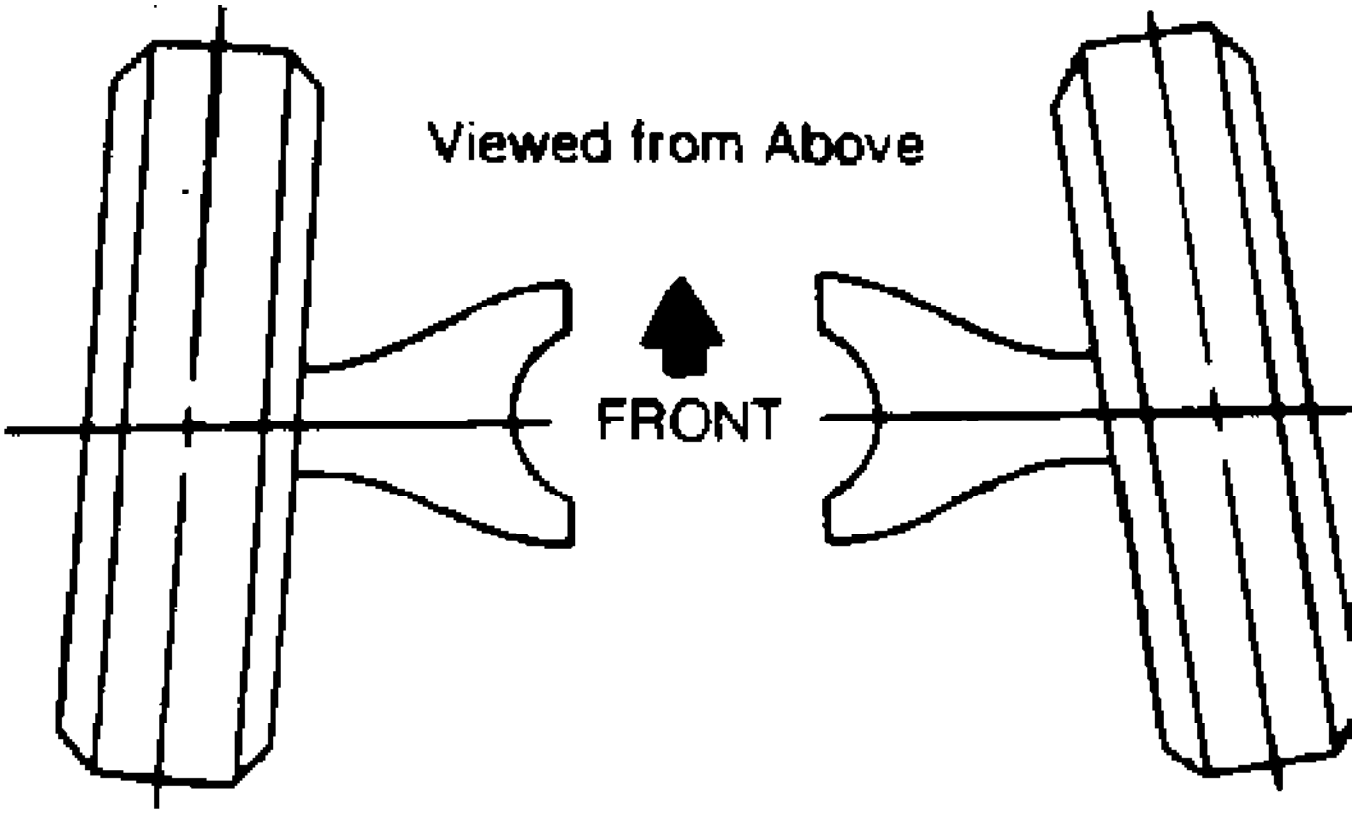


Fig. 5: Wheel Toe-In (Dimension A Less Dimension B)

TOE-OUT ON TURNS

1) Toe-out on turns (turning radius) is a check for bent or damaged parts, and not a service adjustment. With caster, camber, and toe-in properly adjusted, check toe-out with weight of vehicle on wheels.

2) Use a full floating turntable under each wheel, repeating test with each wheel positioned for right and left turns. Incorrect toe-out generally indicates a bent steering arm. Replace arm, if necessary, and recheck wheel alignment.

STEERING AXIS INCLINATION

1) Steering axis inclination is a check for bent or damaged parts, and not a service adjustment. Vehicle must be level and camber should be properly adjusted. See Fig. 6.

2) If camber cannot be brought within limits and steering axis inclination is correct, steering knuckle is bent. If camber and steering axis inclination are both incorrect by approximately the same amount, the upper and lower control arms are bent.

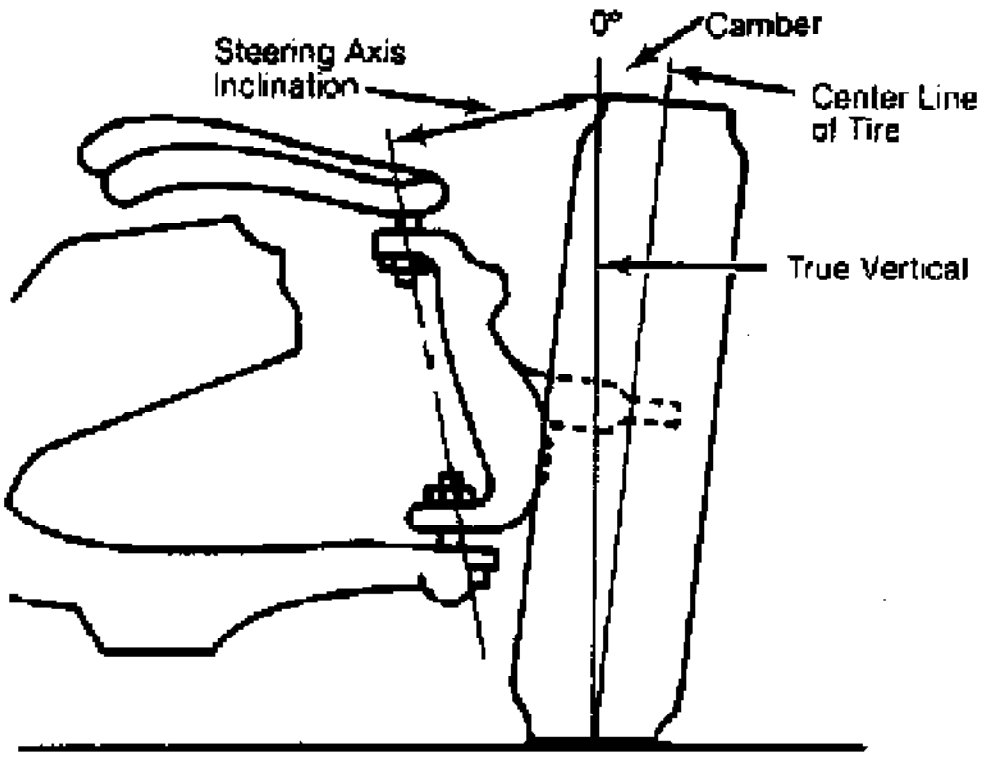


Fig. 6: Checking Steering Axis Inclination

WIPER/WASHER SYSTEM

1997-99 Mitsubishi Montero Sport

1997-99 ACCESSORIES & EQUIPMENT
Mitsubishi - Wiper/Washer System

Montero Sport

DESCRIPTION & OPERATION

Models are equipped with a 2-speed wiper motor with an optional intermittent wiper feature. Models are also equipped with a rear wiper/washer.

COMPONENT LOCATIONS

COMPONENT LOCATIONS TABLE

Component	Location
Wiper Relay	
Front	Integral With Steering Column Switch
Rear	On Relay Block, Behind Left Side Of Dash

ADJUSTMENTS

FRONT WIPER ARM ADJUSTMENT

Ensure wiper motor is in park position. Position wiper arm and blade assembly so tip of blade is specified distance above front window trim. See FRONT WIPER ADJUSTMENT SPECIFICATIONS table.

FRONT WIPER ADJUSTMENT SPECIFICATIONS TABLE

Model	Driver's Side In. (mm)	Passenger's Side In. (mm)
Montero Sport	.98-1.20 (25-31)	1.20-1.50 (31-38)

REAR WIPER ARM ADJUSTMENT

Ensure wiper motor is in park position. Position wiper arm and blade assembly so tip of blade is specified distance from edge of window. See REAR WIPER ADJUSTMENT SPECIFICATIONS table.

REAR WIPER ADJUSTMENT SPECIFICATIONS TABLE

Model	In. (mm)
Montero Sport	(1)

(1) - Information not available at time of publication.

TESTING

FRONT WIPER MOTOR TEST

Checking Wiper Motor Operation

Disconnect wiring connector from wiper motor. Connect battery voltage to wiper motor connector as shown, and ensure wiper motor operates at low and high speeds. See Fig. 1.

Checking Automatic Stop

1) Operate wiper motor at low speed. See Fig. 1. Disconnect battery voltage during operation to stop motor.

2) Using jumper wire, connect terminals as shown. See Fig. 1. Connect 12 volts to indicated terminal, and ground wiper motor bracket. Ensure wiper arm is correctly parked.

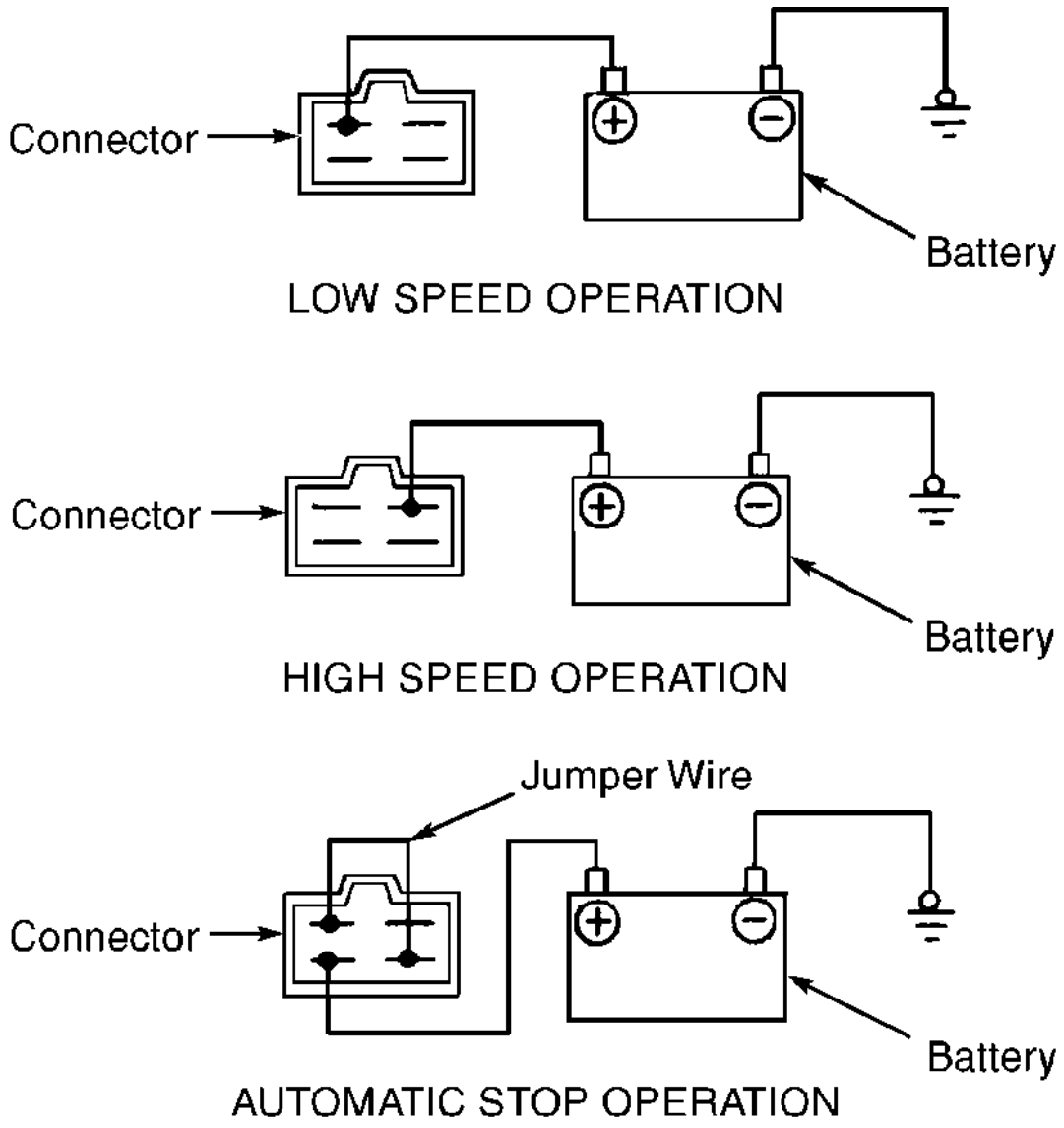


Fig. 1: Checking Front Wiper Motor Operation
Courtesy of Mitsubishi Motor Sales of America.

INTERMITTENT WIPER RELAY (FRONT) TEST

NOTE: Intermittent wiper relay is incorporated into wiper switch. Testing information not available at time of publication.

FRONT WIPER SWITCH TEST

NOTE: Front wiper switch is part of combination switch on steering column. See STEERING COLUMN SWITCHES article.

REAR WIPER MOTOR TEST

Operational Check

Disconnect wiring connector from wiper motor. Connect battery voltage to wiper motor connector as shown, and ensure motor housing is grounded. Motor should run at low speed. See Fig. 2.

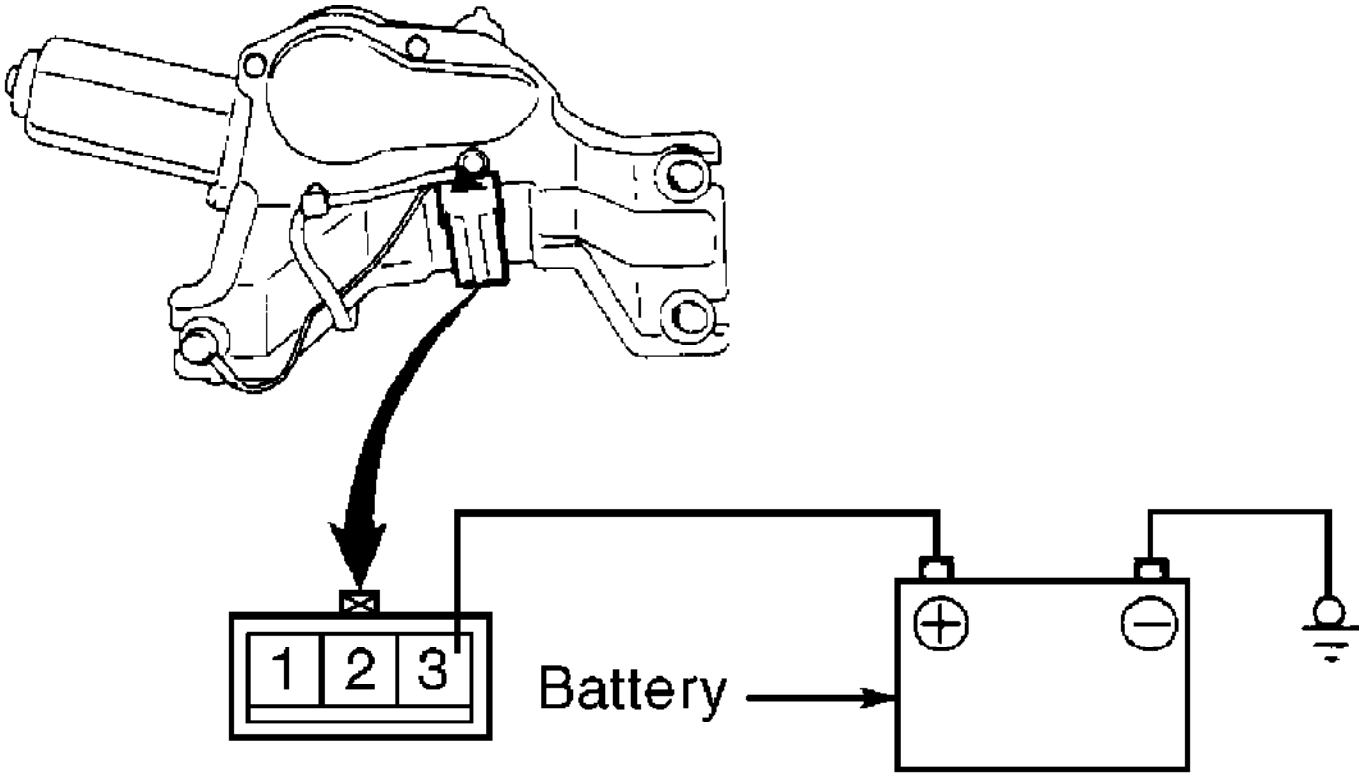


Fig. 2: Checking Rear Wiper Motor Operation
Courtesy of Mitsubishi Motor Sales of America

Automatic Stop Check

Operate wiper motor, and then disconnect wiring connector from wiper motor to stop motor operation at a point other than park position. Connect battery voltage and jumper wire to wiper motor connector as shown, and ensure motor housing is grounded. See Fig. 3. Motor should return to park position.

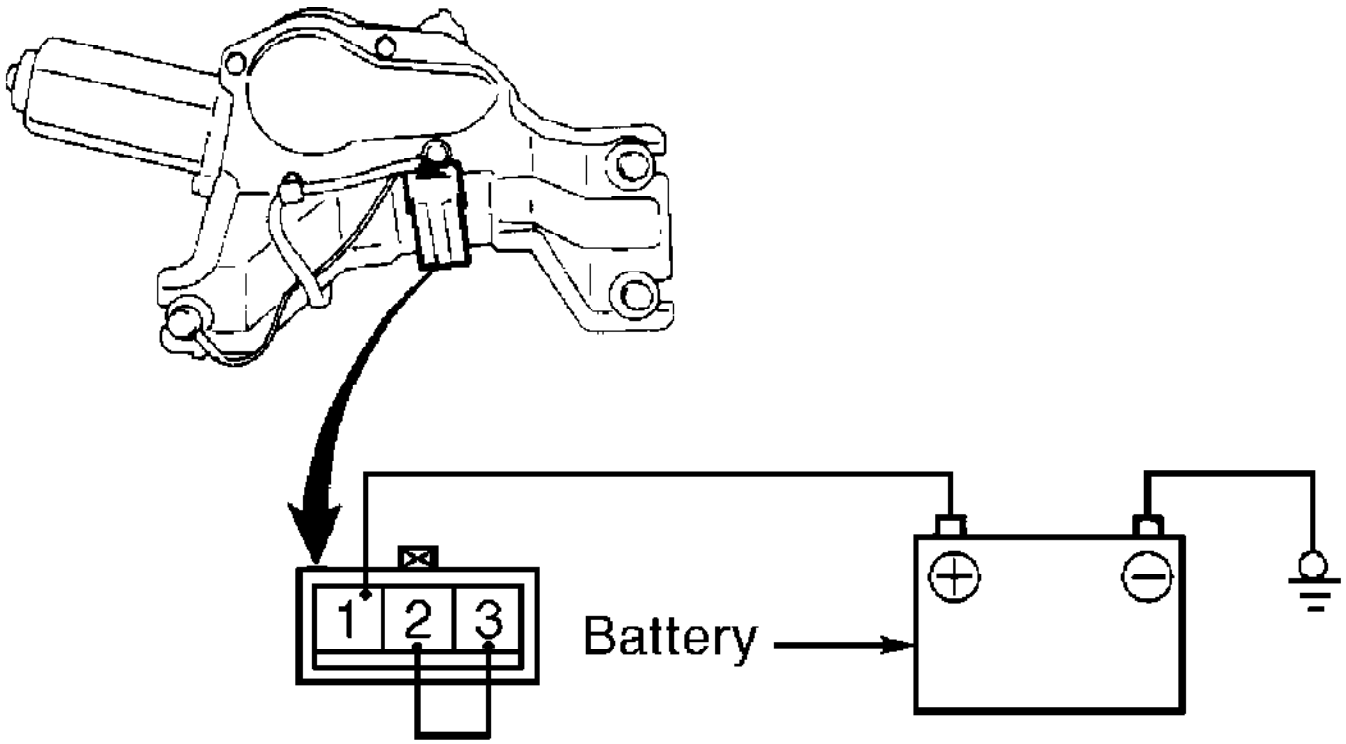


Fig. 3: Checking Rear Wiper Motor Automatic Stop
Courtesy of Mitsubishi Motor Sales of America

REAR WIPER RELAY TEST

Operational Check

1) Relay is on left side of steering column, behind dash. Disconnect relay from wiring harness. Connect positive voltmeter lead to terminal No. 2. Connect negative voltmeter lead to terminal No. 5. Connect battery voltage to terminal No. 4 and ground terminal No. 5. See Fig. 4.

2) Jumper terminals No. 1 and 4 for 2 seconds. Remove jumper. Jumper terminals No. 1 and 5 for about 8 seconds. Voltmeter should show zero volts. After relay terminals No. 1 and 5 have been connected for at least 8 seconds, battery voltage should be present on relay terminal No. 2. Replace relay if voltage is not as specified.

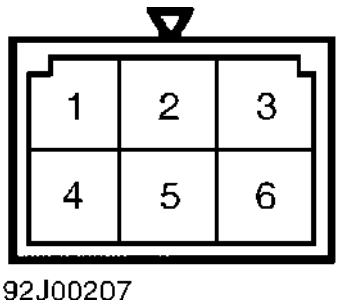
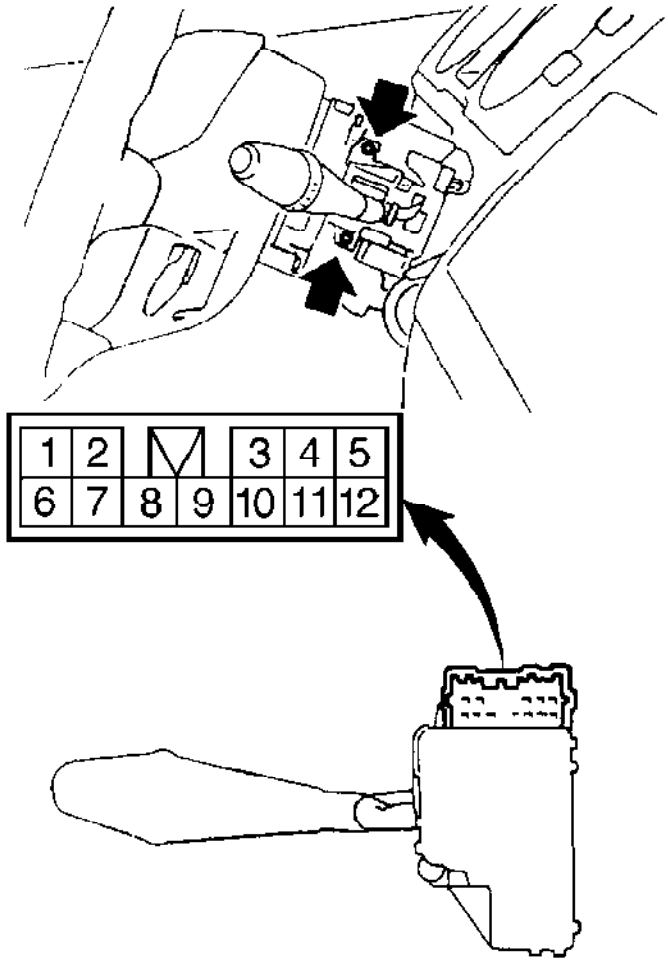


Fig. 4: Identifying Rear Wiper Relay Terminals
Courtesy of Mitsubishi Motor Sales of America.

REAR WIPER SWITCH TEST

Remove lower column cover. Remove upper column cover. Loosen screws indicated by arrow in illustration. See Fig. 5. Remove rear wiper/washer switch. Operate switch and check continuity according to illustration. See Fig. 5.



Switch position		Terminal			
		2	3	4	10
Wiper switch	OFF				
	INT		○		○
	ON			○	○
Washer switch	ON	○			○

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Fig. 5: Inspecting Rear Wiper/Washer Switch (Montero Shown; Montero Sport Is Similar)
Courtesy of Mitsubishi Motor Sales of America.

REMOVAL & INSTALLATION

FRONT WIPER MOTOR

Removal & Installation

Remove wiper motor bolts. Pull motor out slightly. Disconnect wiper linkage from motor assembly and remove motor. To install, reverse removal procedure.

FRONT WIPER SWITCH

NOTE: Front wiper switch is part of combination switch on steering column. See STEERING COLUMN SWITCHES article.

REAR WIPER MOTOR

Removal & Installation

Remove wiper blade and arm assembly. Remove tailgate trim, 2 bolts and wiper motor. To install, reverse removal procedure. Ensure grommet is in good condition.

REAR WIPER SWITCH

Removal & Installation

Pry rear wiper switch from instrument panel and disconnect wiper switch wiring connector. To install switch, reverse removal procedure.

WIRING DIAGRAMS

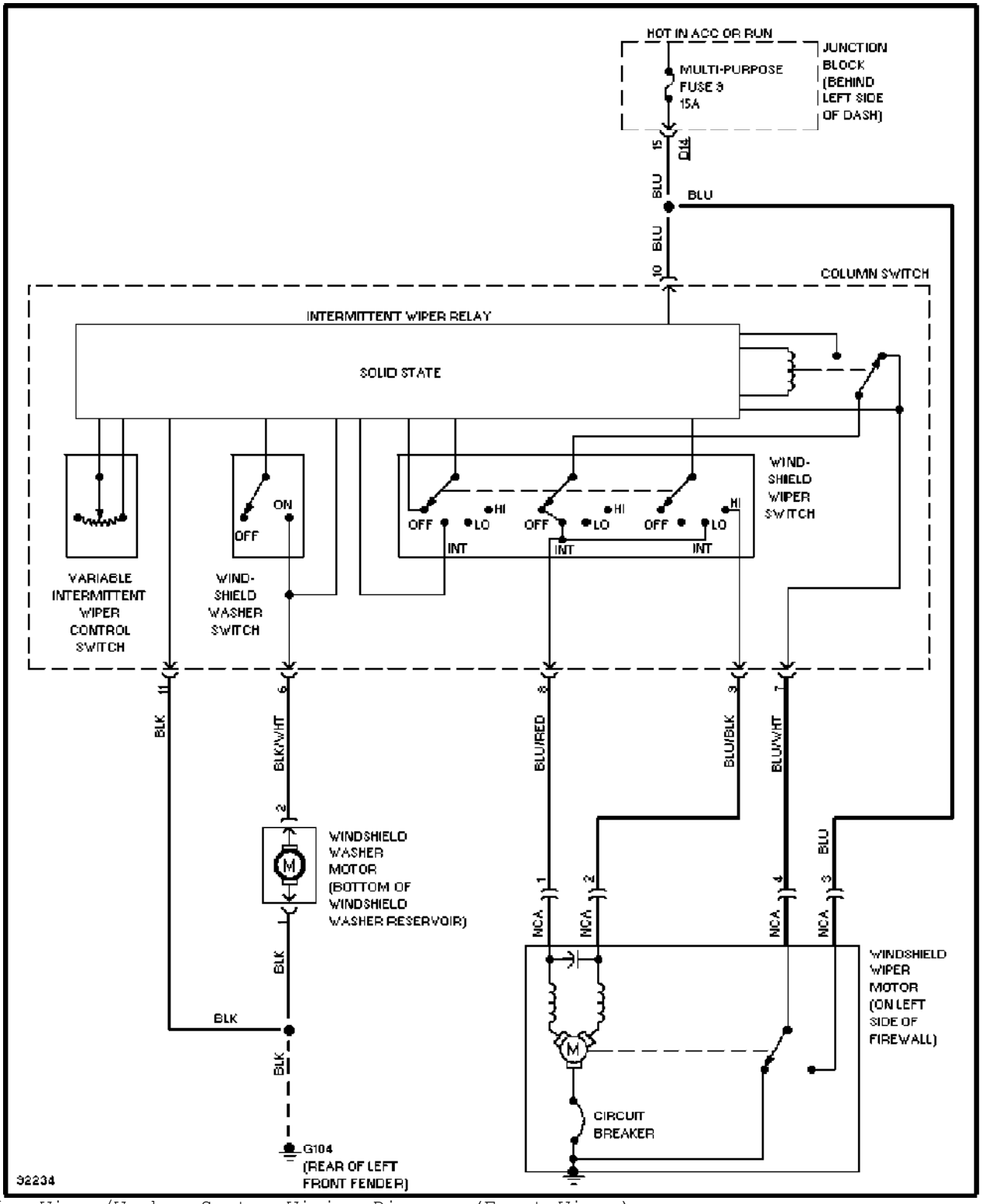

Fig. 6: Wiper/Washer System Wiring Diagram (Front Wiper)

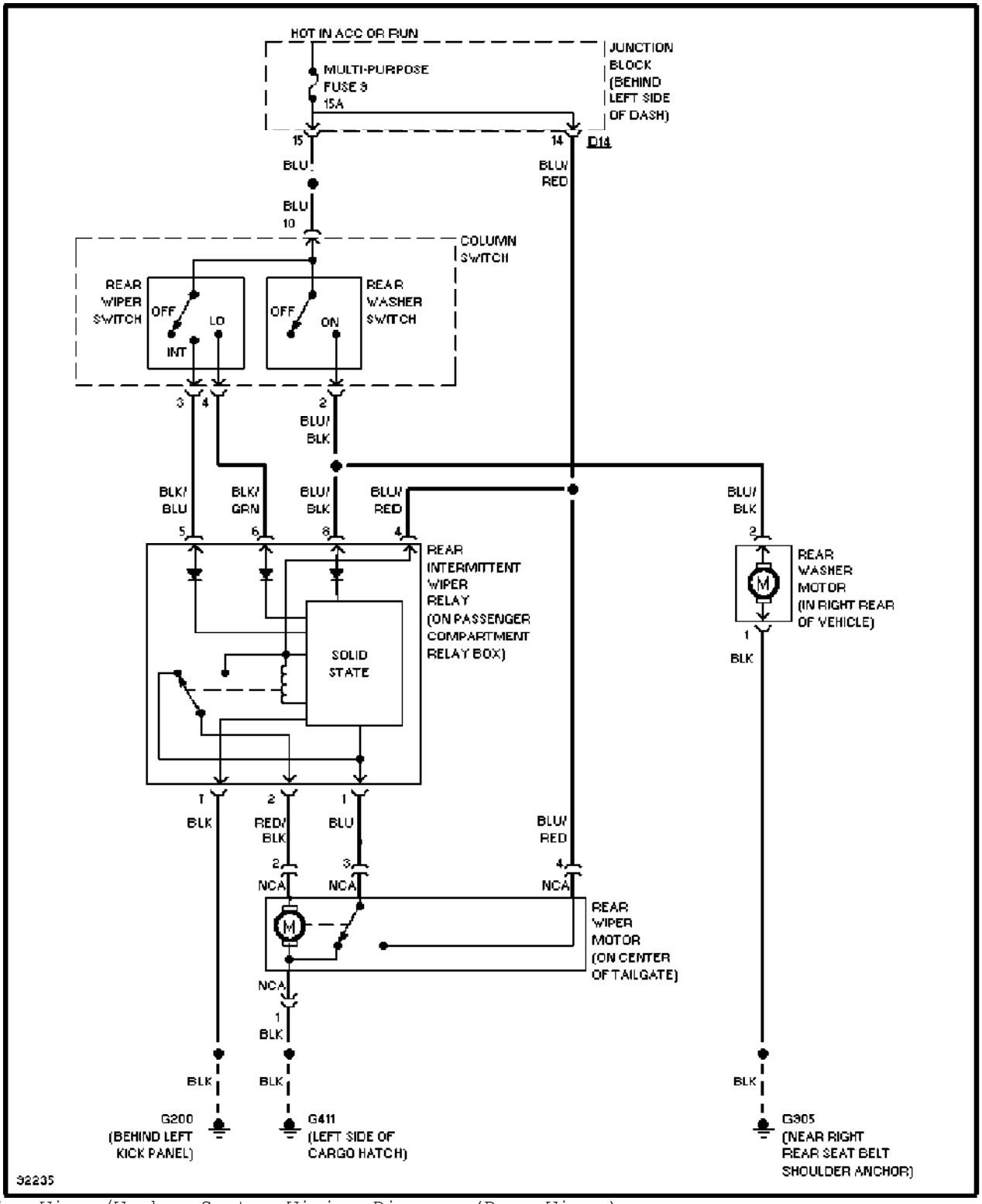

Fig. 7: Wiper/Washer System Wiring Diagram (Rear Wiper)

L - WIRING DIAGRAMS - 2.4L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Wiring Diagrams

Montero Sport - 2.4L

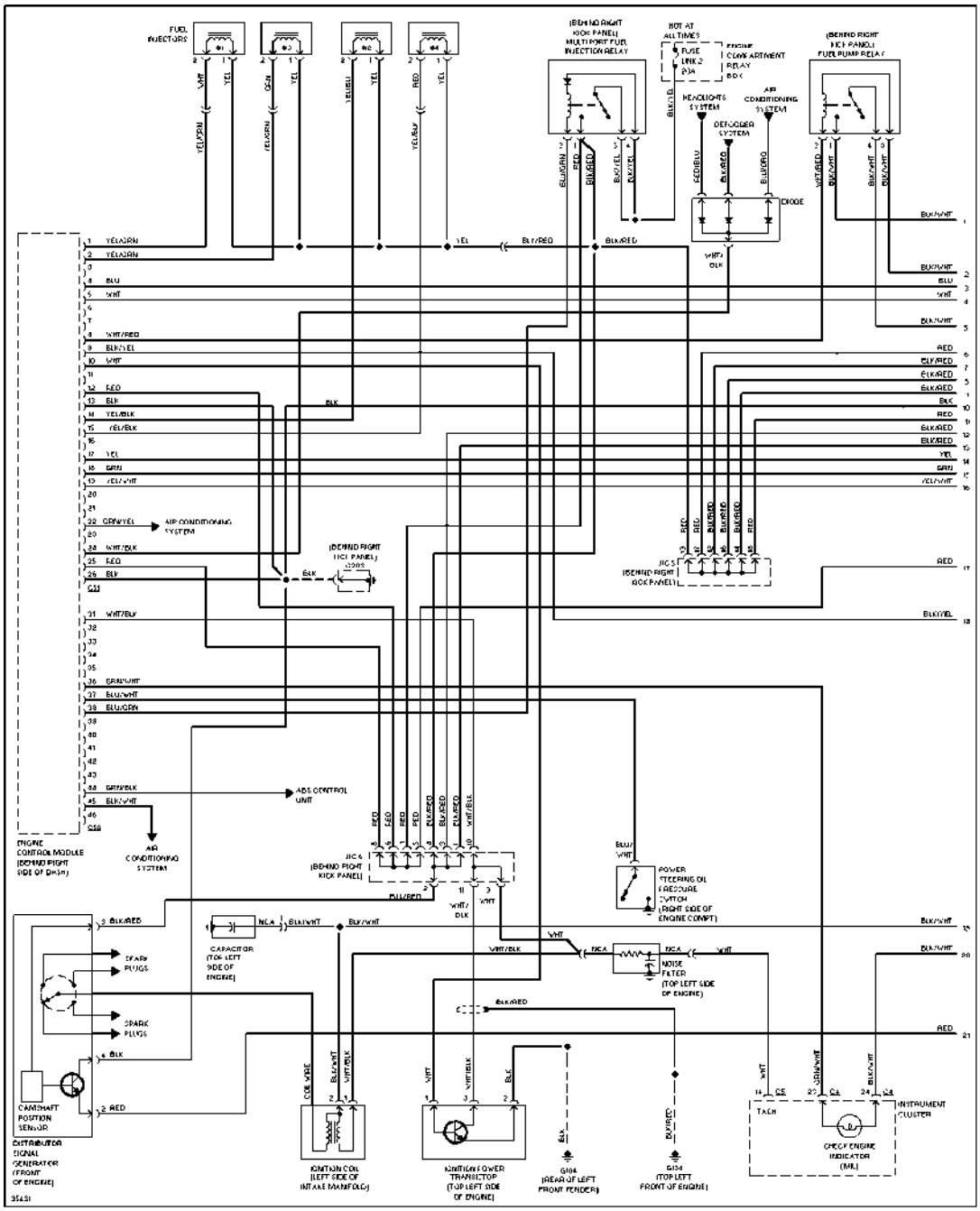

Fig. 1: Wiring Diagram (California Emissions - 1 Of 3)

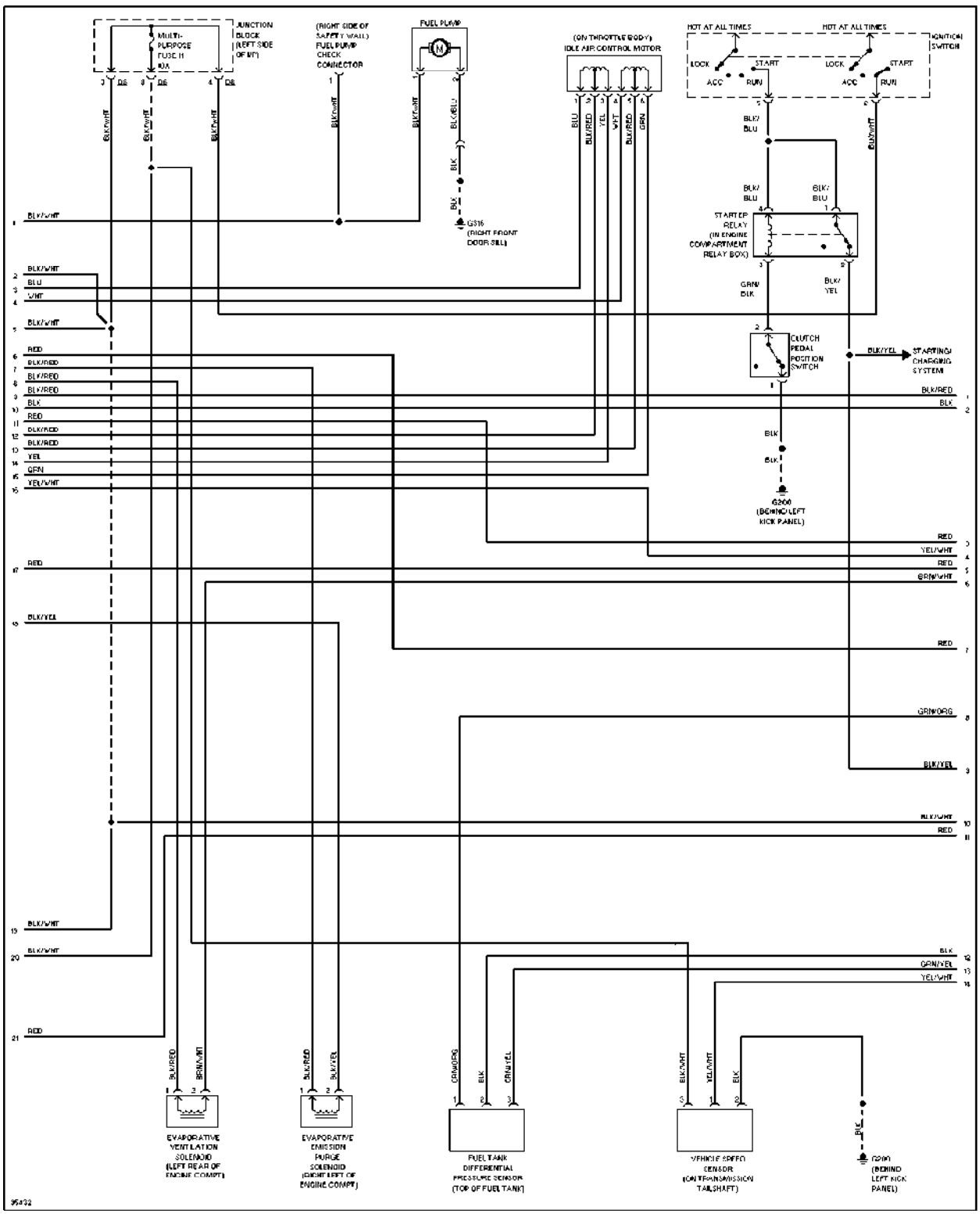

Fig. 2: Wiring Diagram (California Emissions - 2 Of 3)

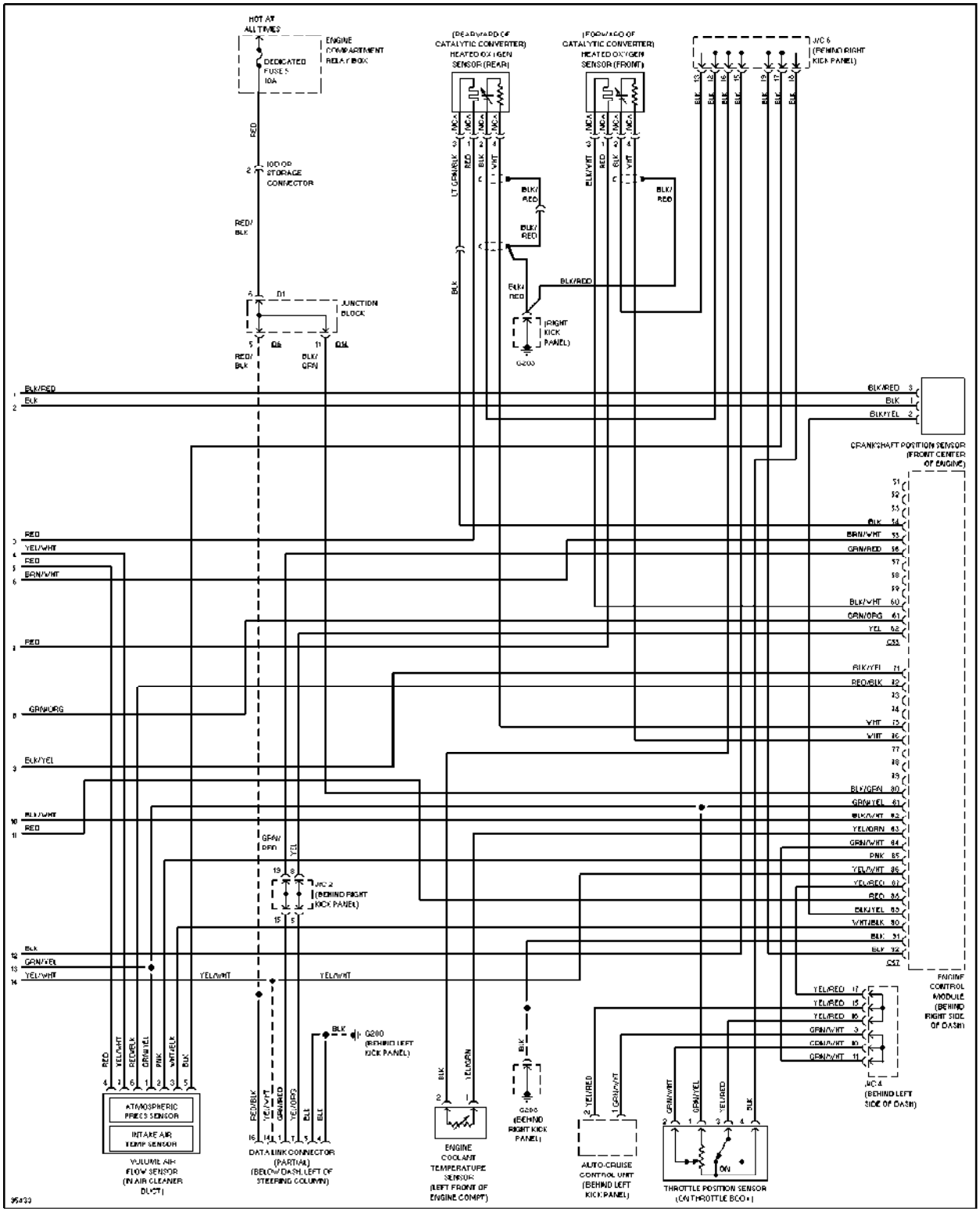

Fig. 3: Wiring Diagram (California Emissions - 3 Of 3)

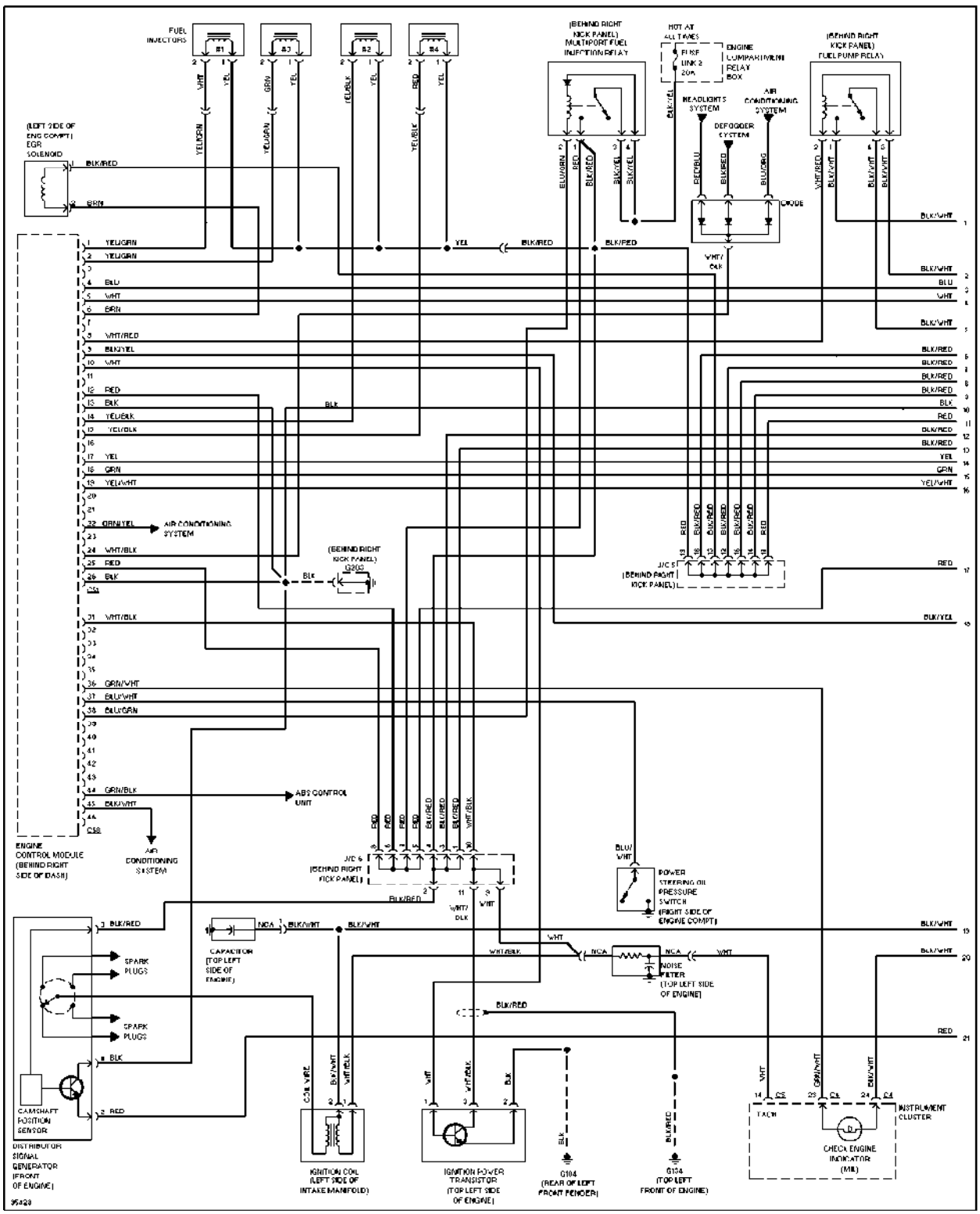

Fig. 4: Wiring Diagram (Federal Emissions - 1 Of 3)

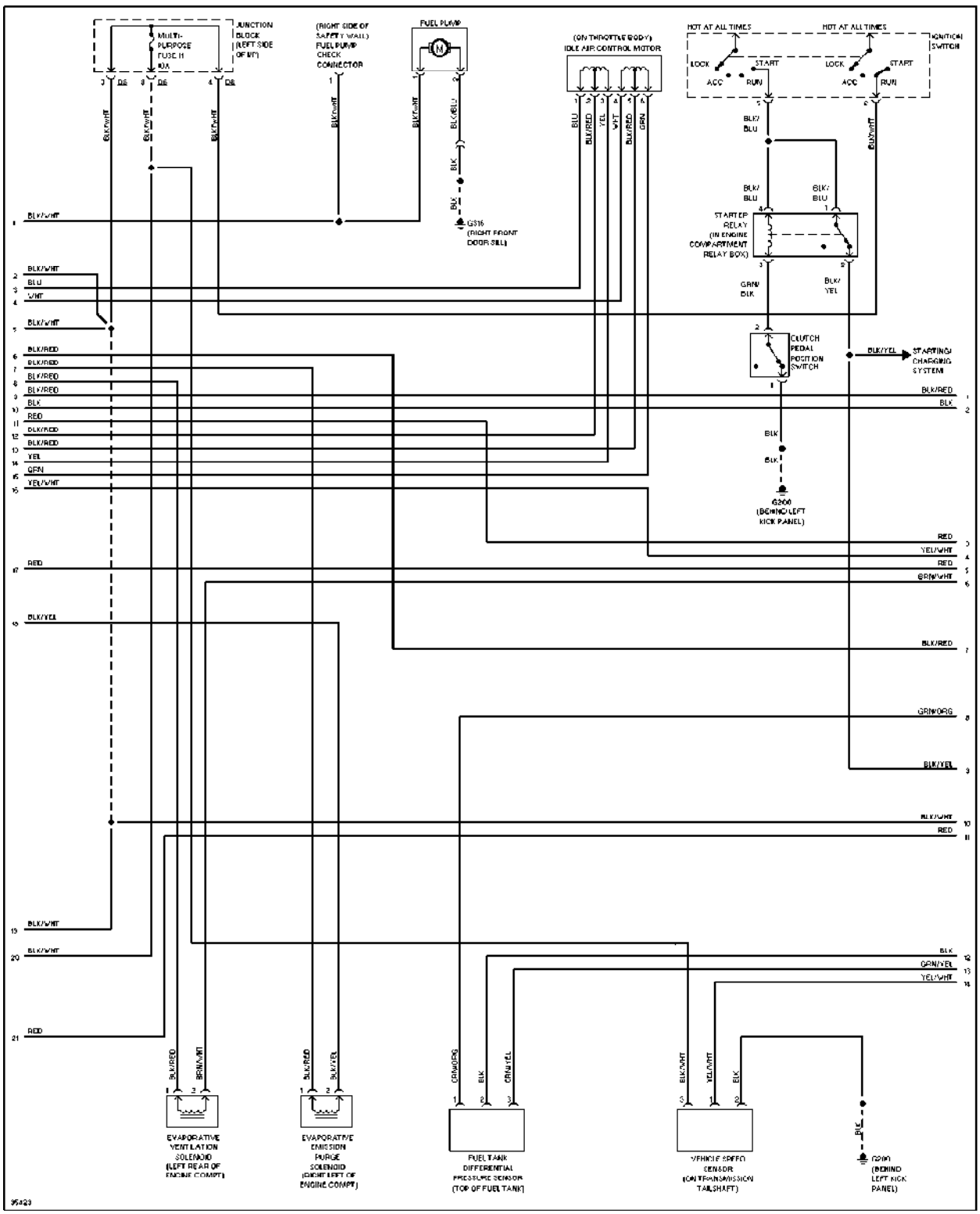

Fig. 5: Wiring Diagram (Federal Emissions - 2 Of 3)

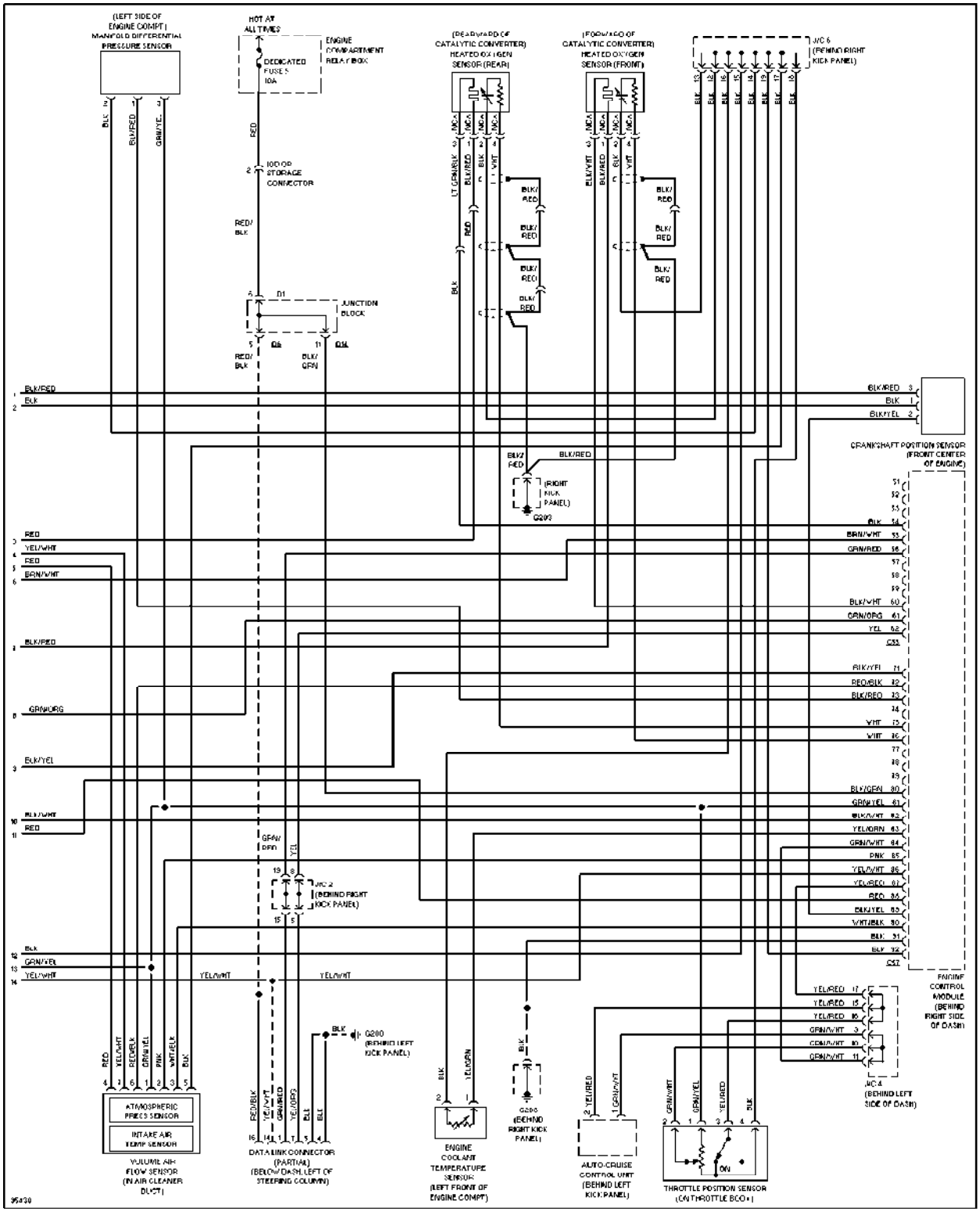

Fig. 6: Wiring Diagram (Federal Emissions - 3 Of 3)

L - WIRING DIAGRAMS - 3.0L

1997-99 Mitsubishi Montero Sport

1997-99 ENGINE PERFORMANCE
Mitsubishi - Wiring Diagrams

Montero Sport - 3.0L

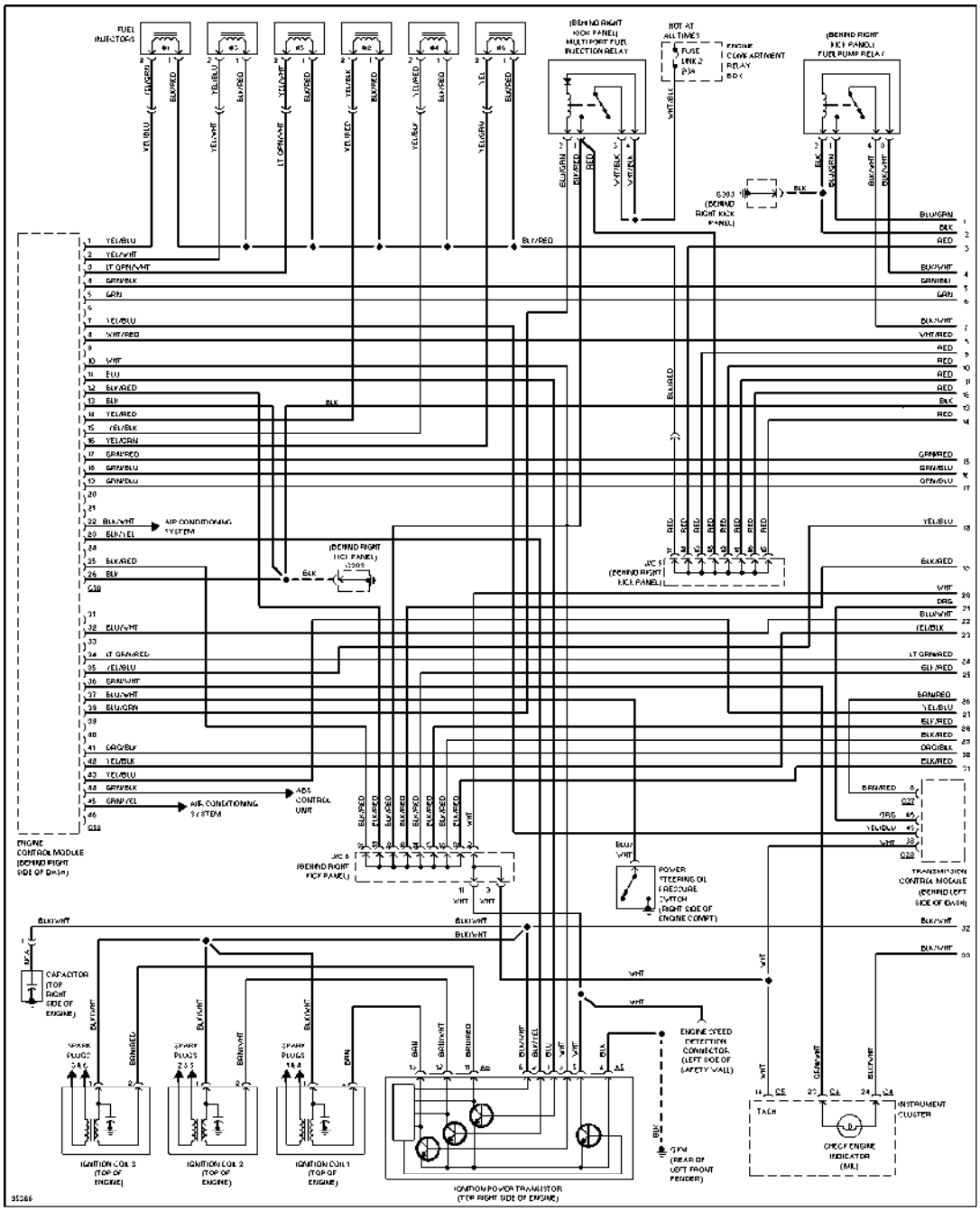

Fig. 1: Wiring Diagram (California Emissions - 1 Of 3)

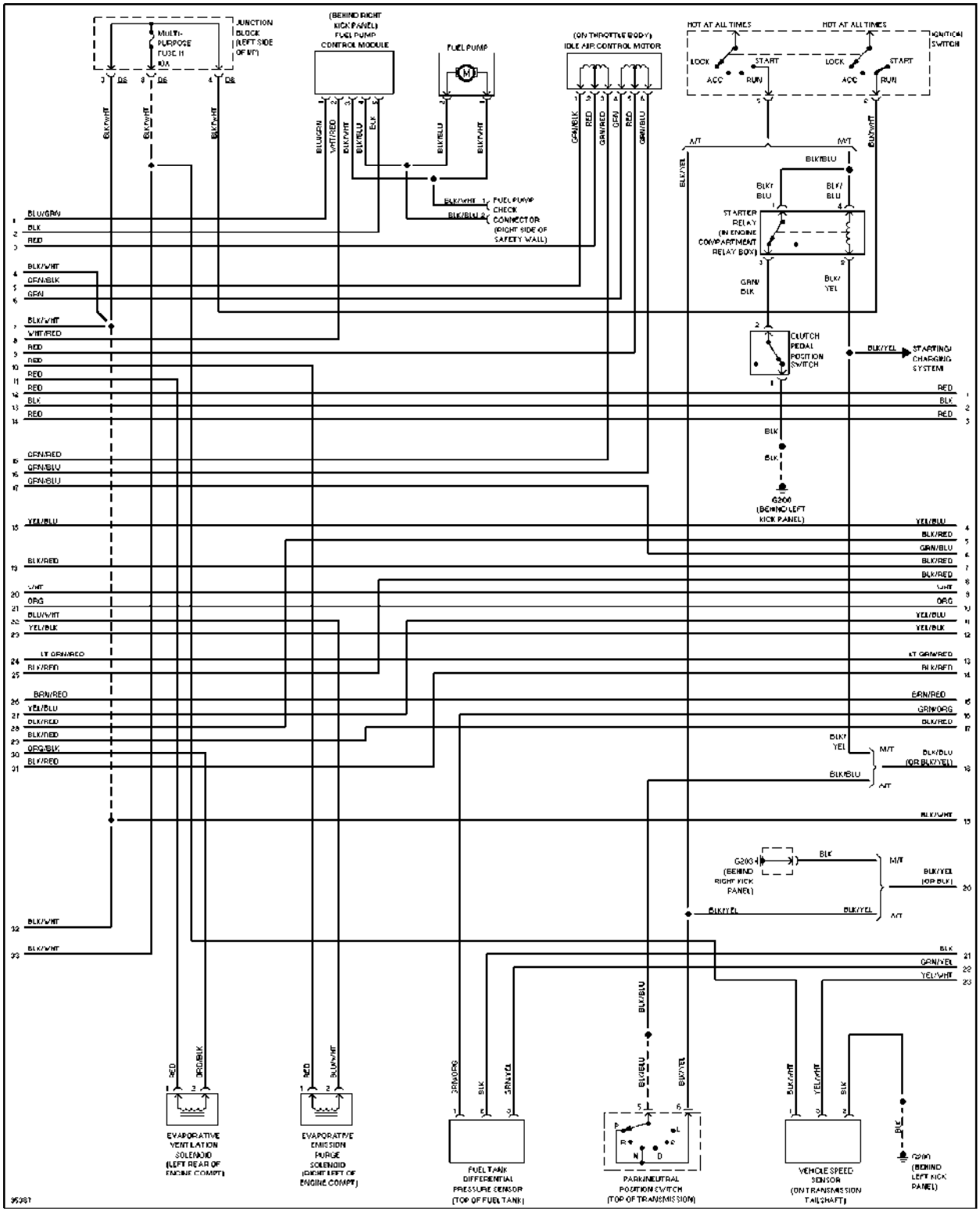

Fig. 2: Wiring Diagram (California Emissions - 2 Of 3)

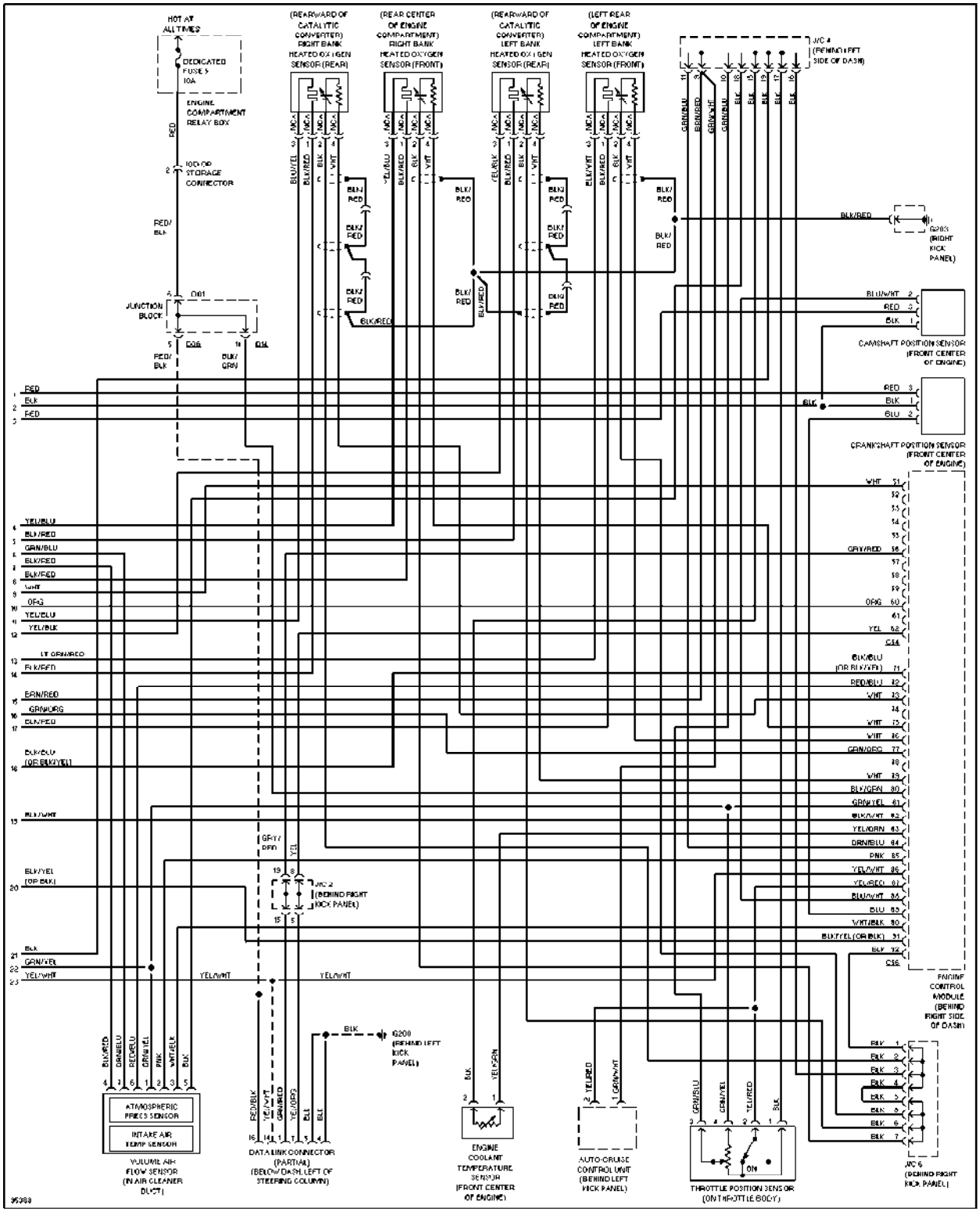

Fig. 3: Wiring Diagram (California Emissions - 3 Of 3)

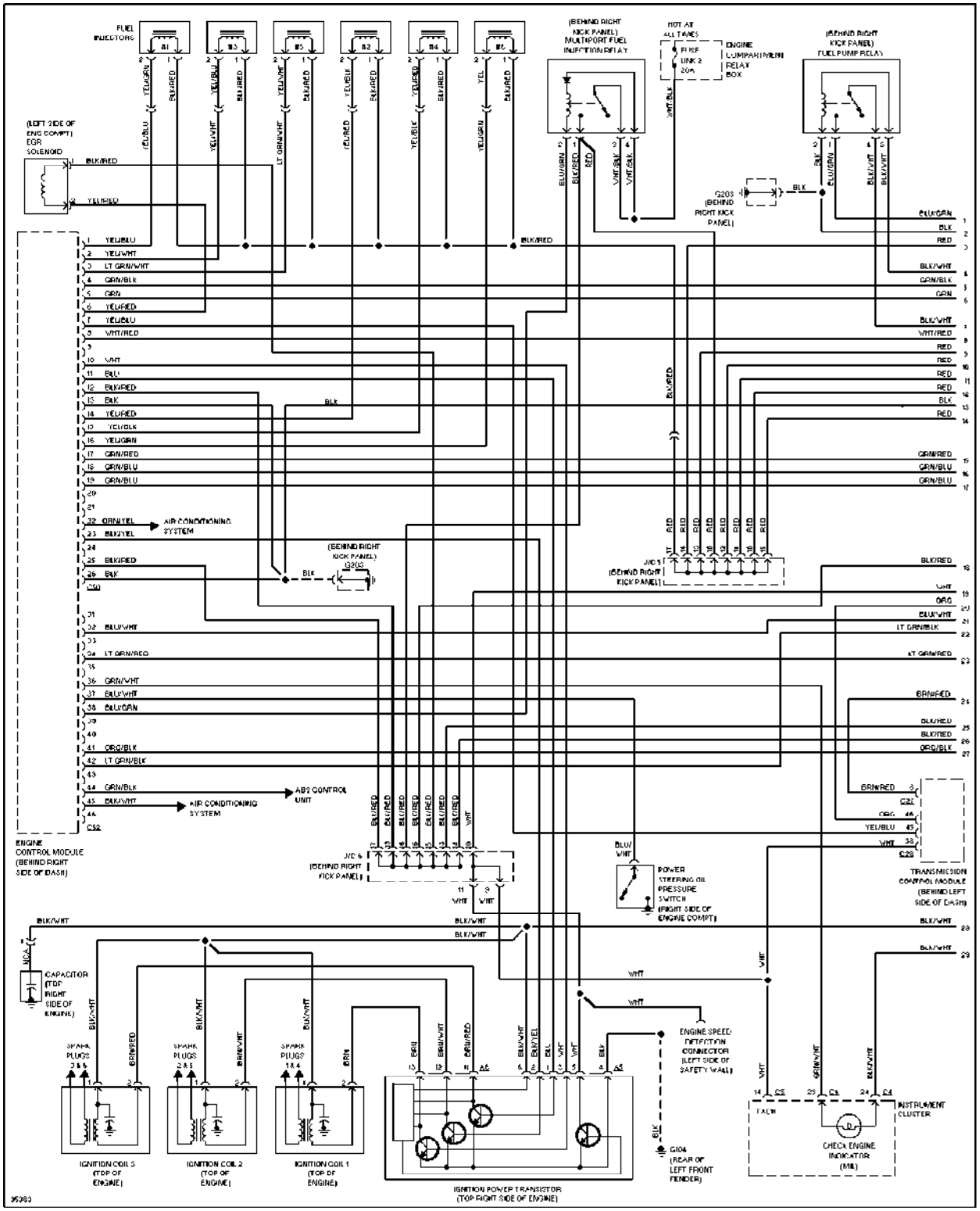

Fig. 4: Wiring Diagram (Federal Emissions - 1 Of 3)

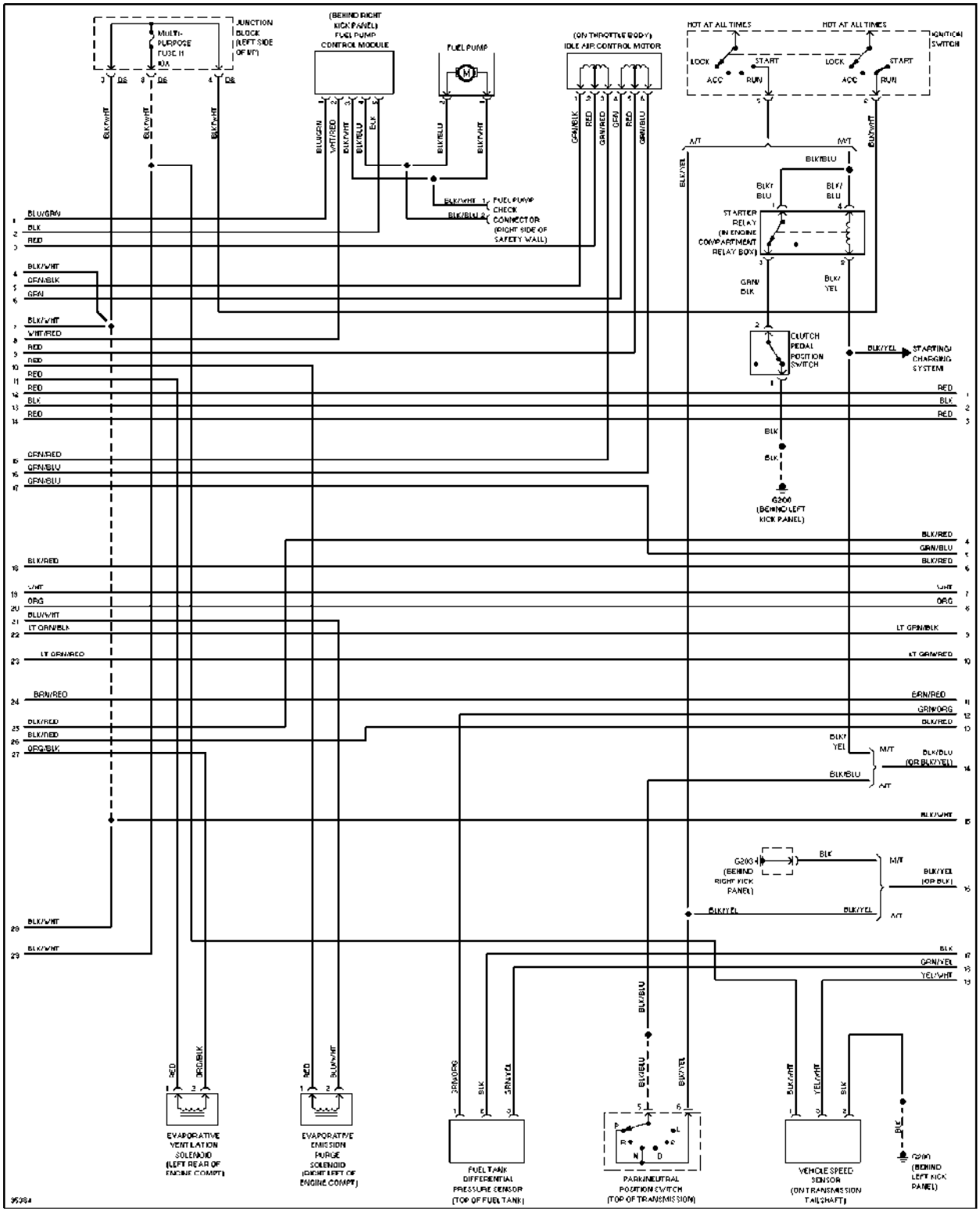

Fig. 5: Wiring Diagram (Federal Emissions - 2 Of 3)

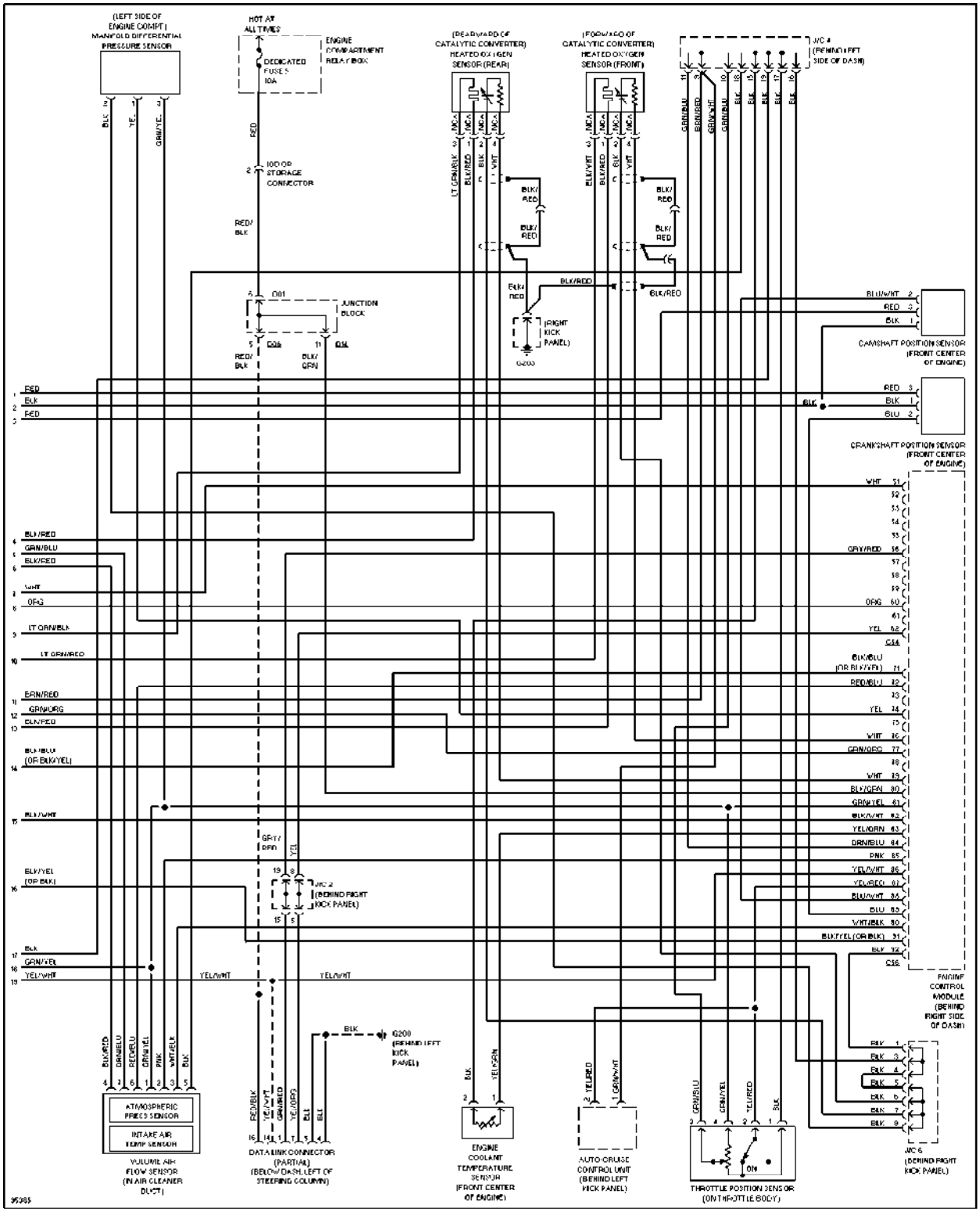

Fig. 6: Wiring Diagram (Federal Emissions - 3 Of 3)