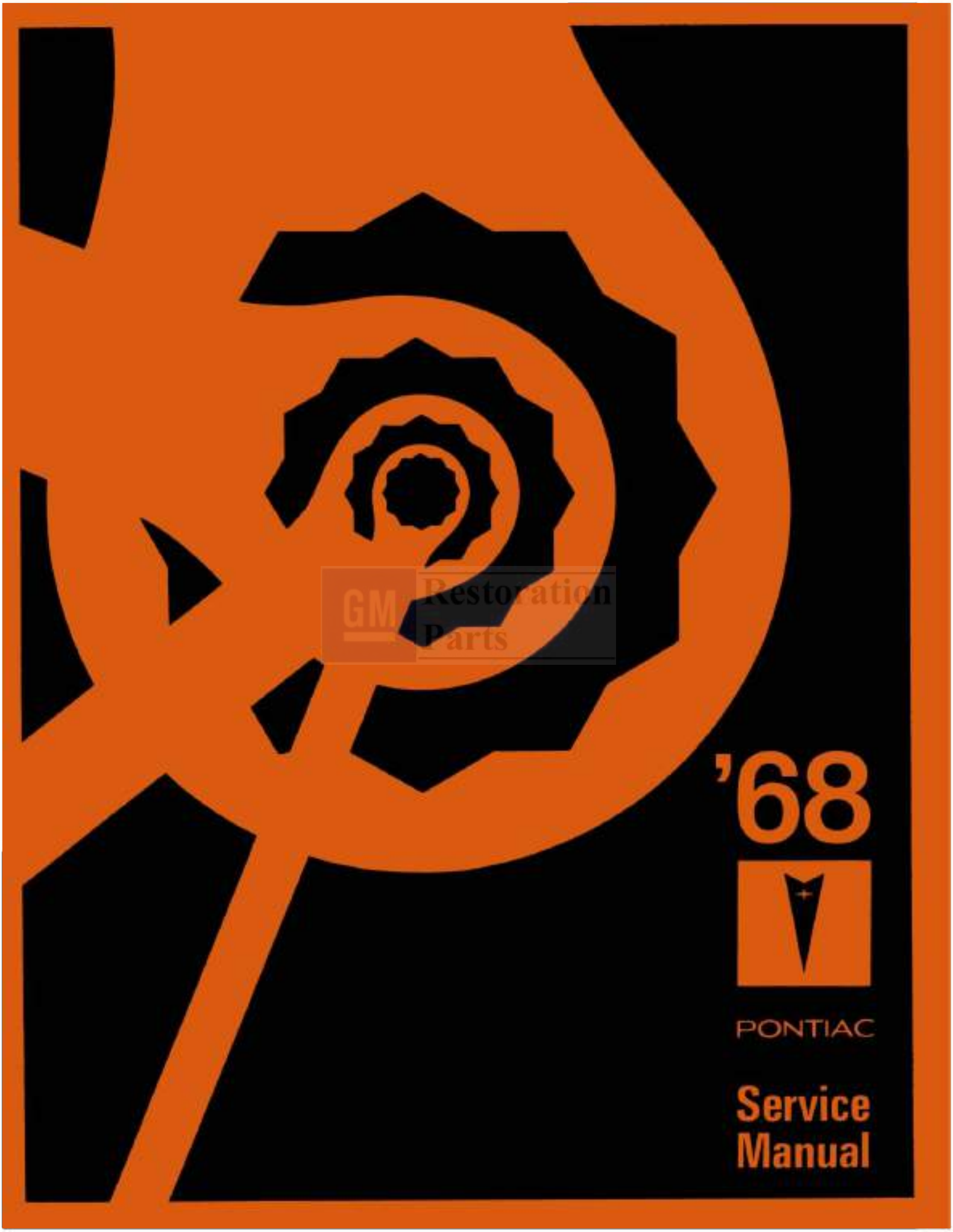


1968 PONTIAC

SERVICE MANUAL

Navigation Tools: Click on the "Table of Contents" below, or use the Bookmarks to the left.

GENERAL

This manual applies to 1968 Pontiac, Tempest and Firebird models and contains information on all components of the car with the exception of the body which is covered in a separate manual. The New Vehicle Warranty and other information pertaining to Pontiac models is contained in the Owner's Manual which accompanies each vehicle and the Owner Protection Plan booklet which is issued directly to the Owner shortly after taking delivery of his car.

CONTENTS

The arrangement of material in the manual is shown by the table of contents on the right side of this page. Black tabs on the first page of each section register with this table to assist in readily locating information desired. A detailed table of contents appears at the beginning of each section and an alphabetical index is included in the back of the manual.

PONTIAC MOTOR DIVISION
GENERAL MOTORS CORPORATION
PONTIAC, MICHIGAN 48053

6 6004 September 1967 Printed in U.S.A.

TABLE OF CONTENTS

GENERAL INFORMATION

CONTENTS OF THIS SECTION

GENERAL INFORMATION

Only general information and specifications appear in this section. Detailed specifications on major units are given at the end of each respective portion of this manual.

VEHICLE IDENTIFICATION PLATE

Serial number, assembly plant code and model year identification can be determined from the Manufacturer's Motor Vehicle Identification Number Plate. This plate is fastened to the upper left instrument panel area, visible through the windshield. The plate has embossed numerals as shown in Fig. 0-1.

BODY IDENTIFICATION PLATE

Information as to body style, trim number, body number and paint code may be found stamped on the Body Identification Plate (Fig. 0-2). This plate is attached to the left side of the cowl assembly just below the rear edge of the hood.

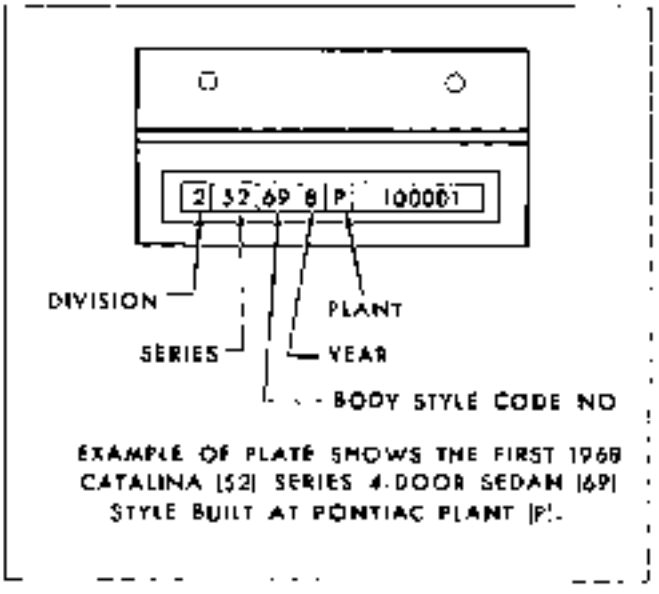


Fig. 0-1 Vehicle Identification Plate

CAR MODEL IDENTIFICATION

Certain publications carry "series" numbers to identify models and others carry sales department names. Figure 0-4 shows both methods of identification.

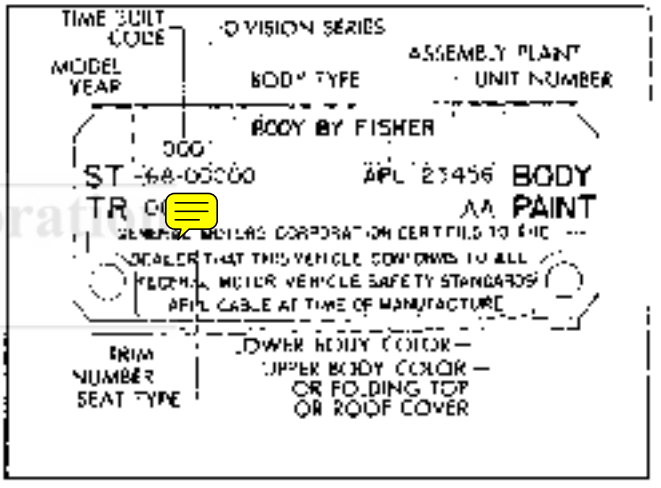


Fig. 0-2 Body Identification Plate

Plant	Code	Pontiac	Tempest	F
Pontiac	(P)	X	X	
Arlington	(R)	X		
Baltimore	(B)		X	
Fremont	(Z)		X	
Kansas City, Ks.	(X)	X		
Kansas City, Mo.	(K)		X	
Linden	(E)	X		
Southgate	(C)	X		
Lordstown	(U)			X
Framingham	(G)		X	

Fig. 0-3 Assembly Plants

ENGINE IDENTIFICATION

8-CYL.

The 8-cyl. engine code is located beneath the production engine number on a machined pad on the right

Series	Model	Style Number
Catalina 25200	4-Door Sedan	25269
	Hardtop Coupe	25287
	4-Door Hardtop	25239
	Convertible	25267
	2-Seat Station Wagon	25235
	3-Seat Station Wagon	25245
Executive 25600	Hardtop Coupe	25687
	4-Door Sedan	25669
	4-Door Hardtop	25639
	2-Seat Station Wagon	25635
	3-Seat Station Wagon	25645
Bonneville	Hardtop Coupe	26287
	4-Door Hardtop	26239
	Convertible	26267
	Station Wagon	26245
Grand Prix 26500	Hardtop Coupe	26657
Tempest 23300	Sports Coupe	23327
	4-Door Sedan	23369
Tempest Custom 23500	Sports Coupe	23527
	Hardtop Coupe	23537
	4-Door Hardtop	23539
	4-Door Sedan	23569
	Convertible	23567
	Station Wagon	23535
LeMans 23700	Sports Coupe	23727
	Hardtop Coupe	23737
	4-Door Sedan	23739
	Convertible	23767
Tempest Safari 23935	2-Seat Station Wagon	23935
G.T.O. 24200	Hardtop Coupe	24237
	Convertible	24267
Firebird	Coupe	22337
	Convertible	22367

Fig. 2-4 Car Model Identification

head bank of the engine block (Fig. 0-5) and should be used whenever referring to a specific engine. For a complete listing of the various codes and engine options refer to section 6 of this manual. See Sec. 6 for the V.I. number derivative, which identifies the engine with the car.

6-CYL.

The 6 cylinder engine code is stamped on the cylinder head to block contact surface behind oil filler pipe (Fig. 0-6). See Sec. 6 for the V.I. number derivative, which identifies the engine with the car.

TRANSMISSION SERIAL NUMBER

TURBO HYDRA-MATIC

The Turbo Hydra-Matic transmission identification plate is located on the right side of the transmission case (Fig. 0-7). The serial number begins with the letter P meaning Pontiac, followed by the letter code A, B, C, G, J, Q, T or X designating engine usage. The numerical code 68, following the two-letter codes represents the model year. For more details and location of V.I. number derivative see section 7E of this manual.

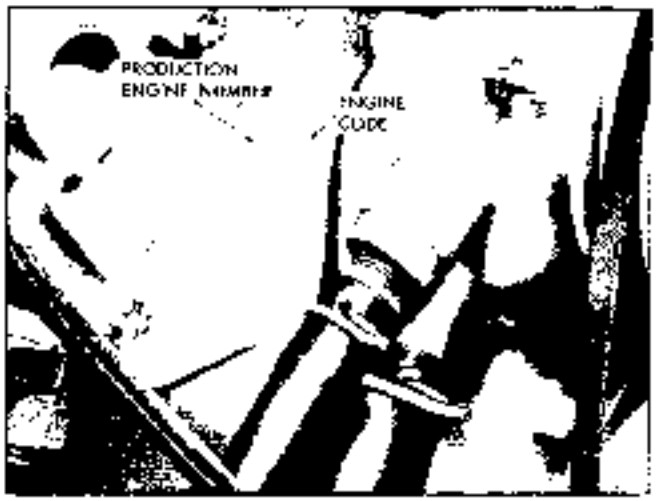


Fig. 0-5 8-Cylinder Engine Serial Number Location

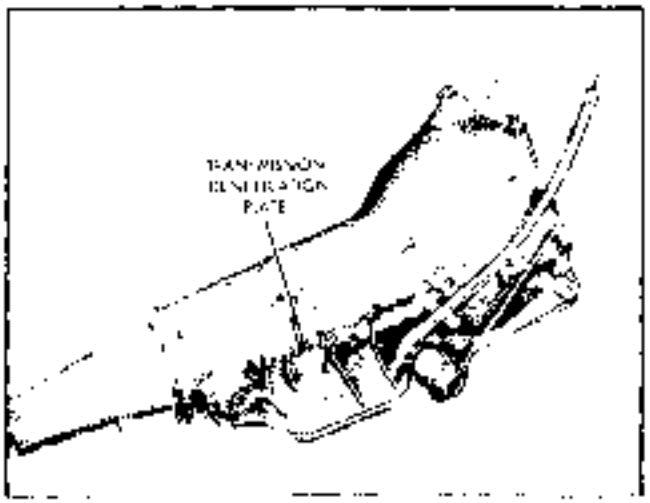


Fig. 0-7 Turbo Hydra-Matic Serial Number Location

TEMPEST AUTOMATIC

The transmission identification number located on the lower servo cover (Fig. 0-8), right side of the transmission, contains model and assembly date code. For more complete information and location of V.I. number derivative see section 7E.

LIFTING AND TOWING

Pontiac, Tempest and Firebird may be lifted on the frame rails as shown in Sec. 2. They can also be lifted at front cross member or at either front or rear lower control arms. When lifting on lower control arms, avoid contacting lower shock absorber brackets.

Under no circumstances should lift adapters be used on the bumpers, propeller shaft, transmission, rear axle or engine.

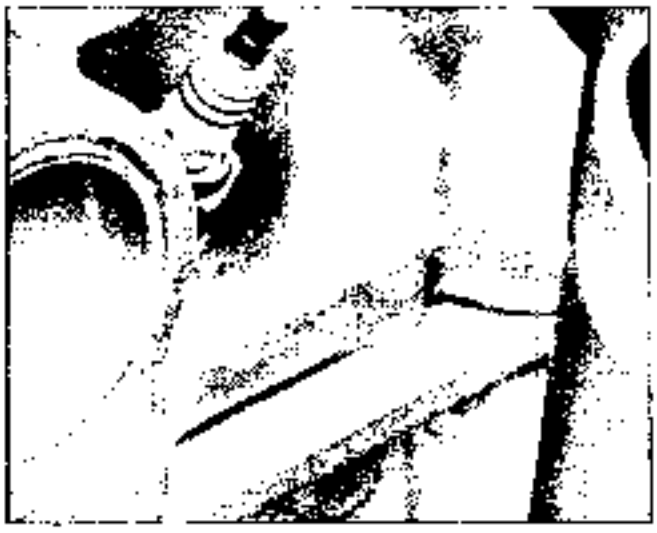


Fig. 0-6 6-Cylinder Engine Serial Number Location

The propeller shaft and exhaust system are lower than the side rails. Lift adapters must provide adequate clearance height for these parts.

TOWING PRECAUTIONS

Always place a rubber mat or other suitable material between the bumper and the tow chains or cables. For front end lifting, place chains or cables around the ends of the frame side rails at both sides. All models can be towed without disconnecting the propeller shaft except in cases where the transmission or propeller shaft has possibly been subject to failure or damage. In such cases, the propeller shaft must be disconnected from the differential and wired to tail pipe or car must be towed with rear wheels off the ground. If the propeller shaft is disconnected and the "U" joint bearing retaining strap is broken, wrap tape around the bearing caps to prevent loss. When towing with the rear wheels off the ground, the steering wheel must be centered and held in position by a steering wheel holding clamp or by tying it to

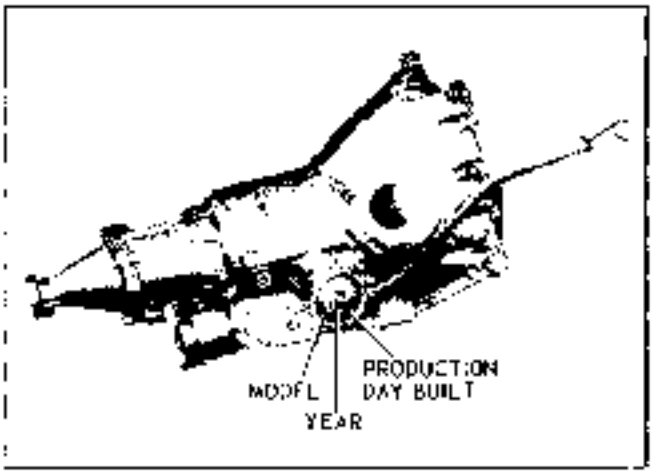


Fig. 0-8 Tempest Automatic Transmission Serial Number

the window division channel. Tire to ground clearance should not exceed 6 inches while towing the car and speeds should not exceed 35 mph for distances up to 50 miles.

CAUTION: Power steering-equipped cars should be towed with caution, since there is no power assist with the engine off.

CODING SIDE BAR LOCK

All 1968 Pontiacs, Tempests and Firebirds will have new type lock cylinders and keys (Fig. 0-9). Two separate keys are used; type "C" (hexagonal) for ignition switch, door locks and tailgate and type "D" (round) for the trunk and glove compartment. The keys will not be interchangeable with each other or with those used prior to 1968 because of new keyway design and an increased number of biting depths.

Locks are available without tumblers, springs or retainers. Uncoded side bar locks may be coded to match the keys used in the car by ordering the above parts separately. Five types of tumblers are used to compose the various combinations and each is coded according to a number, one (1) through five (5), stamped on its side. Before the lock cylinder may be coded, the correct code must be determined. If the numbered blank on the key head has not been removed, determine the code by consulting the lock manufacturer's code book. Should the blank be missing, proceed as follows:

1. Place the key on the silhouette in Fig. 0-10, aligning the key with the outline as accurately as possible.

2. Starting at the base of the key blade, determine the lowest level visible in position No. 1.

3. Determine the lowest visible level for the remaining five positions. As each tumbler level is determined, write that number in the blank space above the position numbers.

After the key code has been determined, the correct tumblers should be installed as follows:

1. Beginning with slot next to head of cylinder (number one position) install tumblers in slots in sequence determined from key code.

2. Insert spring in each round cavity of each tumbler lock between slots.

NOTE: Do not pull springs apart; unscrew them.

3. Install spring retainer over springs with ends inserted in slots, and hold in place.

4. Check by inserting car key. Side bar will drop in place when key is inserted if correct tumblers have been installed.

5. Stake spring retainer in place using small punch and light hammer.

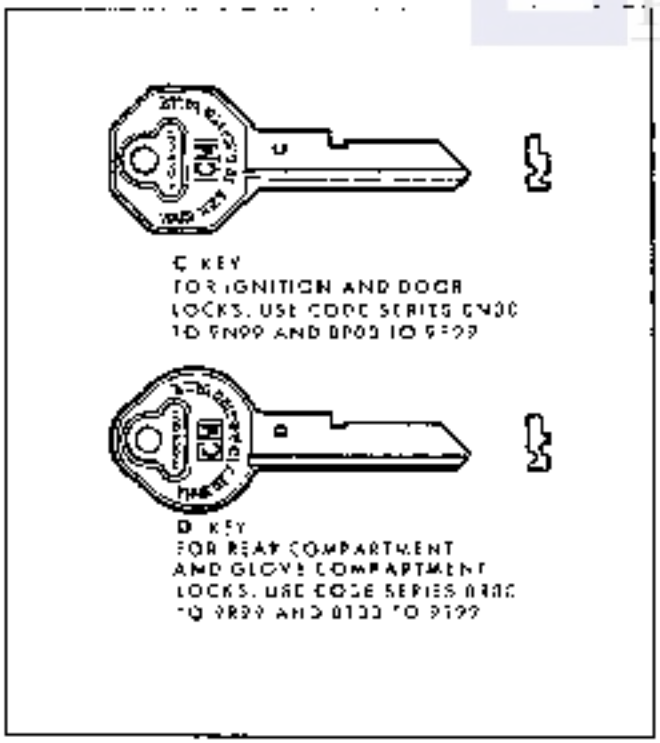


Fig. 0-9 Key Blanks

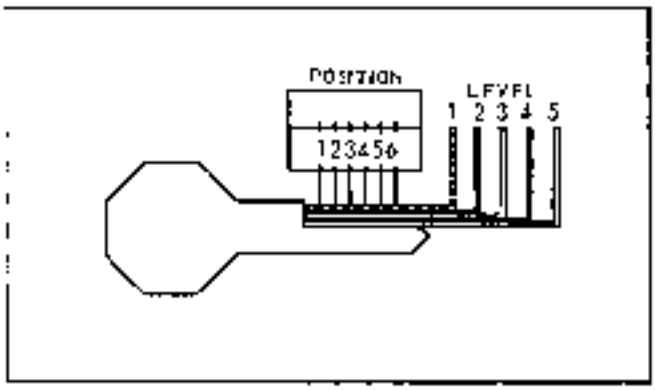
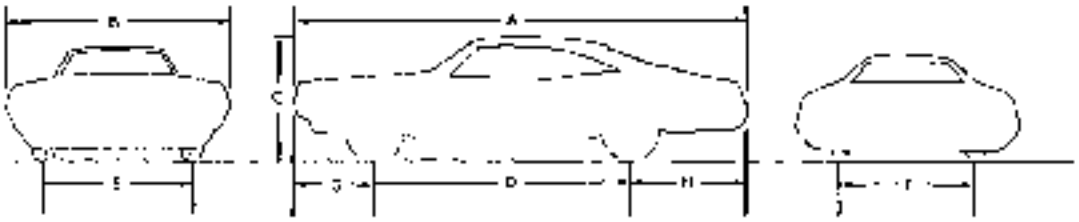


Fig. 0-10 Key Coding Diagram



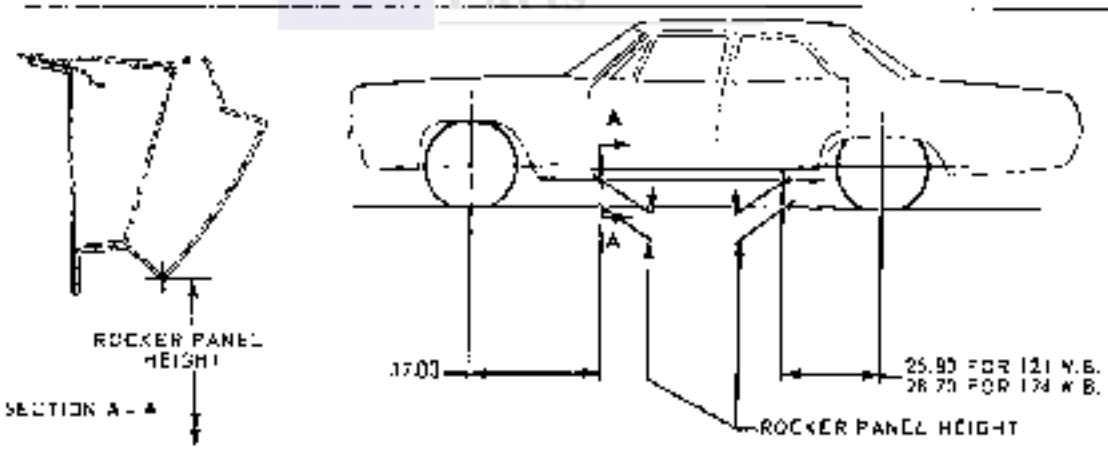
PONTIAC

SERIES	KEY	233						235					237				239	
STYLE		37	39	45	47	69	67	37	39	45	47	69	39	45	47	69	47	69
OVER-ALL LENGTH	A	216.4	216.4	218.4	218.4	218.4	218.4	216.4	222.6	218.4	222.6	222.6	222.6	218.4	222.6	222.6	218.4	218.4
WIDTH	B								77.4									
HEIGHT (Unloaded)	C	55.1	55.5	55.1	55.5	55.4	55.1	55.1	54.1	55.1	55.1	55.5	54.1	54.1	54.1	54.5	54.5	55.9
WHEELBASE	D	121	121	121	121	121	121	121	124	121	124	124	124	121	124	124	121	121
TREAD FRONT	E								60									
TREAD REAR	F								60									
OVERHANG FRONT	G								38.6									38.6
OVERHANG REAR	H	56.2	56.4	59.2	56.4	56.4	56.4	60.2	60.2	58.2	60.2	60.2	60.2	59.2	60.2	60.2	58.2	56.4

TEMPEST

SERIES	KEY	233		235						237				239		
STYLE		37	39	37	39	45	47	67	69	37	45	39	47	69	47	69
OVER-ALL LENGTH	A	206.6	206.6	206.6	206.6	206.6	206.6	206.6	206.6	206.6	206.6	206.6	206.6	206.6	206.6	206.6
WIDTH	B								76.4							
HEIGHT (Unloaded)	C	54.4	54.4	54.4	54.4	54.4	54.4	54.4	54.4	54.9	54.9	54.9	54.9	55.4	54.2	54.2
WHEELBASE	D								115							
TREAD FRONT	E								58							
TREAD REAR	F								59							
OVERHANG FRONT	G								35.6							
OVERHANG REAR	H	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7

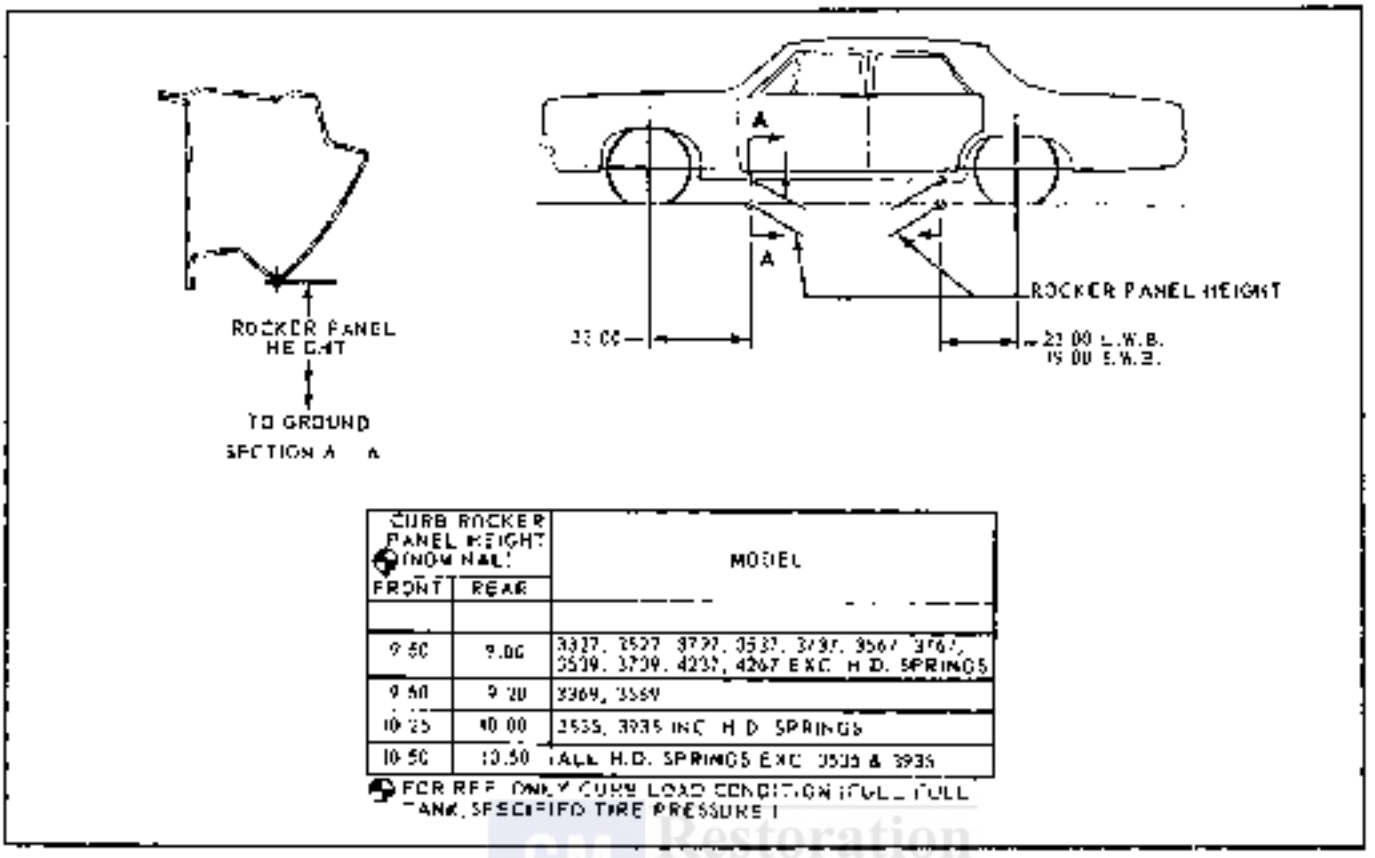
Fig. 0-1 Basic Dimensions



CURB ROCKER PANEL HEIGHT (NOMINAL) FRONT	REAR	MODEL
9.30	9.00	5211, 5269, 5239, 5267 & 5287 5629, 5669, 5687, 6239, 6267, 6287 EXC H.D. SPRINGS
9.10	8.70	5657
9.30	9.00	5235, 5245, 5635, 5645, 6345
9.85	9.00	ALL H.D. SPRINGS

(1) FOR REFERENCE ONLY-CURB LOAD CONDITION "FULL" TANK, SPECIFIED TIRE PRESSURE STD. EQUIP. SPRINGS

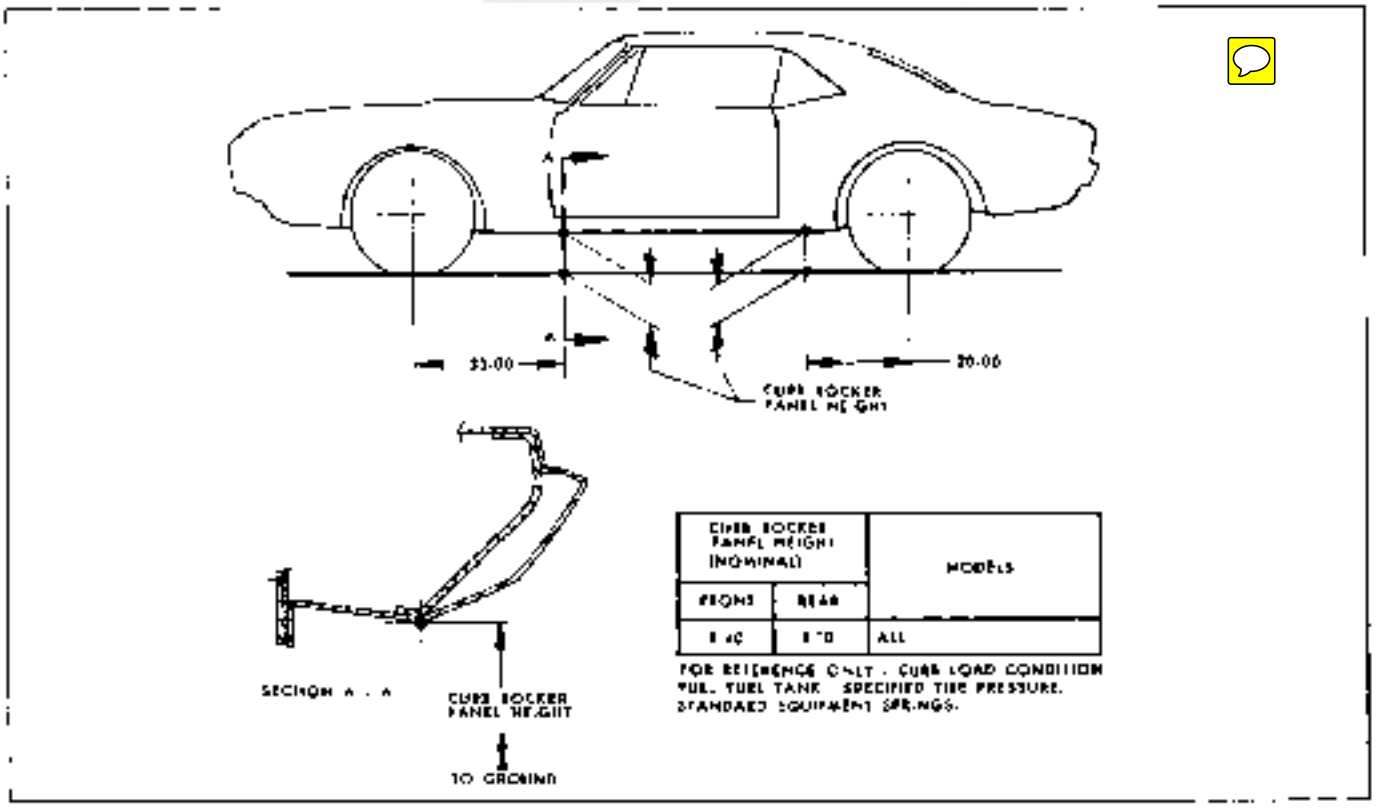
Fig. 0-2 Rocker Panel Heights—Pontiac



CURB ROCKER PANEL HEIGHT (NOMINAL)		MODEL
FRONT	REAR	
9.60	9.00	3337, 3527, 3737, 3537, 3737, 3567, 3767, 3539, 3739, 4237, 4267 EXC. H.D. SPRINGS
9.60	9.20	3369, 3569
10.25	10.00	3535, 3935 INC. H.D. SPRINGS
10.50	10.50	ALL H.D. SPRINGS EXC. 3535 & 3935

FOR REF. ONLY CURB LOAD CONDITION (FULL FUEL TANK, SPECIFIED TIRE PRESSURE)

Fig. 0-13 Rocker Panel Heights—Tempest



CURB ROCKER PANEL HEIGHT (NOMINAL)		MODELS
FRONT	REAR	
8.40	8.70	ALL

FOR REFERENCE ONLY - CURB LOAD CONDITION FULL FUEL TANK - SPECIFIED TIRE PRESSURE. STANDARD EQUIPMENT SPRINGS.

Fig. 0-14 Rocker Panel Heights—Firebird

DRILL SIZES

Letter Sizes	Drill Diameter Inches	Wire Gage Sizes	Drill Diameter Inches	Wire Gage Sizes	Drill Diameter Inches	Wire Gage Sizes	Drill Diameter Inches
Z	0.413	1	0.2280	28	0.1405	55	0.0520
Y	0.404	2	0.2210	29	0.1360	56	0.0465
X	0.397	3	0.2130	30	0.1285	57	0.0430
W	0.386	4	0.2090	31	0.1200	58	0.0420
V	0.377	5	0.2055	32	0.1160	59	0.0410
U	0.368	6	0.2040	33	0.1130	60	0.0400
T	0.358	7	0.2010	34	0.1110	61	0.0390
S	0.348	8	0.1990	35	0.1100	62	0.0380
R	0.339	9	0.1960	36	0.1065	63	0.0370
Q	0.332	10	0.1935	37	0.1040	64	0.0360
P	0.323	11	0.1910	38	0.1015	65	0.0350
O	0.316	12	0.1890	39	0.0995	66	0.0330
N	0.302	13	0.1850	40	0.0980	67	0.0320
M	0.295	14	0.1820	41	0.0960	68	0.0310
L	0.290	15	0.1800	42	0.0935	69	0.0292
K	0.281	16	0.1770	43	0.0890	70	0.0280
J	0.277	17	0.1730	44	0.0860	71	0.0260
I	0.272	18	0.1695	45	0.0820	72	0.0250
H	0.266	19	0.1660	46	0.0810	73	0.0240
G	0.261	20	0.1610	47	0.0785	74	0.0225
F	0.257	21	0.1590	48	0.0760	75	0.0210
E	0.250	22	0.1570	49	0.0730	76	0.0200
D	0.246	23	0.1540	50	0.0700	77	0.0180
C	0.242	24	0.1520	51	0.0670	78	0.0160
B	0.238	25	0.1495	52	0.0635	79	0.0145
A	0.234	26	0.1470	53	0.0595	80	0.0135
		27	0.1440	54	0.0550		

DECIMAL EQUIVALENTS

1/64	.015625	17/64	.265625	33/64	.515625	49/64	.765625
1/32	.03125	9/32	.28125	17/32	.53125	25/32	.78125
3/64	.046875	19/64	.296875	35/64	.546875	51/64	.796875
1/16	.0625	5/16	.3125	9/16	.5625	13/16	.8125
5/64	.078125	21/64	.328125	37/64	.578125	53/64	.828125
3/32	.09375	11/32	.34375	19/32	.59375	27/32	.84375
7/64	.109375	23/64	.359375	39/64	.609375	55/64	.859375
1/8	.125	3/8	.375	5/8	.625	7/8	.875
9/64	.140625	25/64	.390625	41/64	.640625	57/64	.890625
5/32	.15625	13/32	.40625	21/32	.65625	29/32	.90625
11/64	.171875	27/64	.421875	43/64	.671875	59/64	.921875
3/16	.1875	7/16	.4375	11/16	.6875	15/16	.9375
13/64	.203125	29/64	.453125	45/64	.703125	61/64	.953125
7/32	.21875	15/32	.46875	23/32	.71875	31/32	.96875
15/64	.234375	31/64	.484375	47/64	.734375	63/64	.984375
1/4	.25	1/2	.5	3/4	.75	1	1.

WEIGHTS AND MEASURES

LINEAR MEASURE

1/12 foot (ft.)	1 inch (in.)
12 inches	1 foot
3 feet	1 yard (1 yd.)

AREA MEASURE

1/144 square foot (sq. ft.)	1 square inch (sq. in.)
144 square inches	1 square foot
9 square feet	1 square yard (sq. yd.)

LIQUID MEASURE

1/16 pint (pt.)	1 ounce (oz.)
1 pint	16 ounces
2 pints	1 quart (qt.) 32 ounces
4 quarts	1 gallon (gal.)
31-1/2 gallons	1 barrel (bbl.)

DRY MEASURE

1/2 quart (qt.)	1 pint (pt.)
2 pints	1 quart (qt.)
8 quarts	1 peck (pk.)
4 pecks	1 bushel (bu.)
105 quarts	1 barrel

CUBIC MEASURE

1,728 cubic inches	1 cubic foot
27 cubic feet	1 cubic yard

COMMON WEIGHT

16 ounces	1 pound
100 pounds	1 hundred weight (cwt.)
2000 pounds	1 ton

COMMON U.S.A. EQUIVALENTS
LENGTH

1 inch	25.4001 millimeters
1 millimeter	0.03937 inches
1 foot	0.304801 meters
1 meter	3.28083 feet
1 yard	0.914402 meters
1 meter	1.093611 yards
1 mile	1.609347 kilometers
1 kilometer	0.621370 miles

LIQUID CAPACITY

1 quart	0.94833 liters
1 liter	1.05571 quarts
1 gallon	3.78533 liters
1 liter	0.26418 gallons

DRY CAPACITY

1 quart	1.1012 liters
1 liter	0.9081 quarts
1 peck	8.071 liters
1 liter	.32562 pecks

LUBRICATION

ITEMS REQUIRING LUBRICATION OR SERVICE AT 4 MONTHS OR 6,000-MILE INTERVALS, WHICHEVER OCCURS FIRST

Engine Oil . . . . . Change

Atmospheric Temperatures Expected	Recommended SAE Viscosity Number	Alternate
Above Freezing (32°F. and above)	20W	10W-30
Below Freezing (0° to 32°F.)	10W	10W-30
Below Zero	5W	5W-20

NOTE: All engines are equipped with specially engineered pistons rings. These rings allow oil to flow freely on the cylinder walls during break-in period. Therefore, oil consumption may be higher during break-in period than it will be afterward.

Oil which according to the label on can is intended for service MS and conforms to GM Standard 6041M should be used.

ITEMS REQUIRING LUBRICATION OR SERVICE AT 4 MONTHS OR 6,000-MILE INTERVALS, WHICHEVER OCCURS FIRST (Continued)

Oil Filter	Change at first oil change; every other oil change thereafter.
Manifold Heat Control Valve	Observe for freedom of movement. Lubricate with heat valve lubricant.
Sta. Wag. Tail Gate Hinge and Linkage	Engine oil every six months, more often if required.

ITEMS REQUIRING LUBRICATION OR SERVICE AT 4 MONTHS OR 6,000-MILE INTERVALS, WHICHEVER OCCURS FIRST

Chassis Lubrication	Lubricate all normally greased suspension parts including ball joints.
Power Steering System and Pump Reservoir	Maintain lubricant level with GM power steering fluid, part 1050017. If this lubricant is not available, use DEXRON automatic transmission fluid.
Standard Differential	Check for leaks, maintain lubricant level with SAE-80 oil where available or SAE-90 Multi-Purpose gear lubricant meeting requirements of MIL-L-2105B. Change lubricant only when necessary to disassemble.
Saf-T-Trak Differential	Check for leaks. Refill with part 1050081 lubricant only. Change lubricant only when necessary to disassemble.
Manual Transmission	Check for leaks. Maintain lubricant level with SAE-90 where available or SAE-90 Multi-Purpose gear lubricant meeting requirements of MIL-L-2105B. Change lubricant only when necessary to disassemble.
Clutch Linkage — Manual Transmission	Check lash and adjust as required. Lubricate with chassis grease at push rod to clutch fork joint and at cross-shaft.
Manual Transmission Shift Linkage, Column Shift	Engine oil at all joints below steering column shift levers. Chassis grease at cross shaft bearing points.
Manual Transmission Shift Linkage, Floor Shift	Engine oil at all joints under body (lubricate shifter mechanism liberally).
Brake System and Master Cylinder	Check system for adequate brake pedal reserve and for evidence of leaking, correct. Use only SAE-70R3 fluid such as Delco Supreme II.
Hood Latch	Engine oil on pivots and spring anchor points, and light grease on release pawl, every six months or as required.
Hood Hinges	Engine oil on hinge pins and spring anchor points, every six months or as required.
Accelerator Linkage	Engine oil at all pivot points. Do not lubricate the linkage which is a part of the carburetor assembly. Tempest and Firebird cable must not be lubricated.

ITEMS REQUIRING LUBRICATION OR SERVICE AT 4 MONTHS OR 6,000-MILE INTERVALS, WHICHEVER OCCURS FIRST (Continued)

Automatic Transmission Shift Linkage	Lubricate with chassis grease at cross shaft pivot points. Console control cable must not be lubricated.

ITEMS REQUIRING LUBRICATION OR SERVICE AT 12 MONTHS OR 12,000 MILE INTERVALS, WHICHEVER OCCURS FIRST

Positive Crankcase Ventilation . . .	Check hose between valve cover and air cleaner, for clear passages; replace if clogged. Clean and re-oil Ventilation filter in air cleaner. Replace valve. *NOTE: This filter should be cleaned and re-oiled after each occasion of driving under severe dust conditions.*
Carburetor Fuel Filter - Integral	Remove and clean bronze filter and filter cavity, replace paper element.
Air Cleaner Element (Paper) . . . . . Standard on All 2Bbl. and 4Bbl. V-8 and all 6-cylinder 1 Bbl. and 4 Bbl. engines.	Replace. *NOTE: Clean and re-oil after each occasion of driving under severe dust conditions. Allow excess oil to drain out of filter prior to installation.*

ITEMS REQUIRING LUBRICATION OR SERVICE EVERY 24 MONTHS OR 24,000 MILES, WHICHEVER OCCURS FIRST

Automatic Transmission	Replace transmission fluid. Also replace oil filter in sump of Turbo Hydra-Matic. Refill with DEXRON automatic transmission fluid. Under heavy-duty operating conditions or excessive stop-and-go driving, replace oil (and filter on Turbo Hydra-Matic) at 12,000-mile intervals.

ITEMS REQUIRING LUBRICATION OR SERVICE AT SPECIAL INTERVALS

Tires	Rotate tires every 6,000 miles and rebalance tire and wheel assemblies as required.
Parking Brake Cables	Clean and lubricate during major brake service. Use light water-resistant grease.
Front Wheel Bearings	Lubricate at time of major brake service. Use high melting-point, water-resistant grease, and only enough to thoroughly coat the rollers. Do not fill the wheel hub cavity. Wipe any grease off exposed surface of hub and seal.

ITEMS REQUIRING LUBRICATION OR SERVICE AT SPECIAL INTERVALS (Continued)

Brake Assemblies	Clean and lubricate shoe pads, anchor pins, shoe hold-down spring pins (at contact area with backing plate) and adjusting screw at time of major brake service. Use only a high melting point lubricant and apply sparingly. *CAUTION: Grease must be kept off brake linings; remove by sanding.*
Manual Steering Gear	Add lubricant as necessary. Change lubricant only when necessary to disassemble. Use water resistant EP grease to level of center side cover ball hole.
Body Door Locks and Strikers	Stick-type lubricant – use sparingly as required.
Door Hinge Hold-Opens	Light grease on friction surface. Use sparingly as required.
Body Door Hinge Pins	Engine oil as required.
Station Wagon Folding Seat	Engine oil on points as required. Use sparingly.
Fuel Door Hinge	Engine oil on hinge pin and spring anchor points as required.
Rear Compartment Lid Hinges	Engine oil as required.
Convertible Front Door-to-Lock Wedge Plates	Stick-type lubricant, use sparingly as required.
Windshield Washer Solvent	Use Pontiac solvent, part 1050416, or equivalent and follow instructions on label to ensure proper operation of washer, and to prevent paint damage from excessively strong solutions.
Air Conditioning Condenser Core	Clean off leaves and bugs and flush outside of condenser and radiator core to remove dirt annually each spring. *CAUTION: Do not use steam.*
Battery	Add distilled water every 30 days. May require more frequent additions during high ambient temperatures and/or extended trip operation. Clean terminals yearly and apply petroleum.

ITEMS NOT NORMALLY REQUIRING SERVICE

STARTING MOTOR

No lubrication required except on overhaul. When overhauling starting motor add a few drops of engine oil to the bronze bushings in both end frames.

ALTERNATOR

The alternator is designed and constructed to give long periods of trouble-free service with a limited amount of maintenance. The rotor is mounted on a ball bearing and a roller bearing. Both bearings have a grease supply which eliminates the need for periodic lubrication. The alternator brushes are extra long and under normal operating conditions will provide extended service.

CONVERTIBLE HYDROELECTRIC PUMP MOTOR

The hydroelectric pump motor does not require periodic service.

CLUTCH RELEASE BEARING

The clutch release bearing requires no periodic lubrication. It is a ball bearing, lubricated and sealed for life.

SPEEDOMETER CABLE

Periodic lubrication is not required. When installing a new drive cable, apply a light coat of speedometer cable grease wiping off all excess the full length of the cable.

CAUTION: Excessive amounts of lubricant can cause speedometer head failure. Lubricate new drive cables only.

HEATING AND VENTILATION SERVICE

CONTENTS OF THIS SECTION

SERVICE AND ADJUSTMENTS

Service and adjustment procedures for Pontiac, Tempest and Firebird Heating and Ventilation Systems are covered in the following section. For component description, theory of operation, testing and diagnosis information see the Diagnosis Manual.

TEMPERATURE CABLE ADJUSTMENT

PONTIAC

1. Insure that cable is secured at control and at heater, and routed smoothly and free of sharp kinks or bends.

2. Rotate temperature switch counterclockwise to full cold position (no red bars exposed in control panel window).

3. Adjust turnbuckle until cam roller bottoms at end of heater cam slot (Fig. 1-1).

4. Rotate knob clockwise to maximum heat (all red bars exposed in control panel window) and back again to full cold position; control should remain with no red bars exposed and cam roller should be tight against end of cam slot.

5. If any of first red bars are exposed, repeat steps 3 and 4 until cable is properly adjusted.

TEMPEST

1. Make sure cable is secure at both ends.

2. Hold lever on top of heater case in full cold position (full left or clockwise when viewed from above).

3. Adjust cable turnbuckle so that temperature control lever will spring back 1/16" to 1/8" when pushed to the OFF position.

AIR CONTROL CABLE ADJUST

TEMPEST AIR CONTROL CABLE ADJUST

1. Place air control lever in OFF position.

2. Hold air door crank on heater case in a closed position (crank rotated full clockwise when viewed from above).

3. While holding air control door in closed position, adjust turnbuckle to move lever against bottom of slot in control panel, then turn turnbuckle in opposite direction to move control lever 1/16" to 1/8" away from end of slot.

4. Move lever to DE-ICE position, then back to OFF.

5. Lever must have slight spring back from end of slot, not to exceed 1/8".

HEATER CONTROL PANEL REMOVAL AND INSTALLATION

PONTIAC

1. Pull off control knobs from panel and remove bezels from left and right switches (Fig. 1-1).

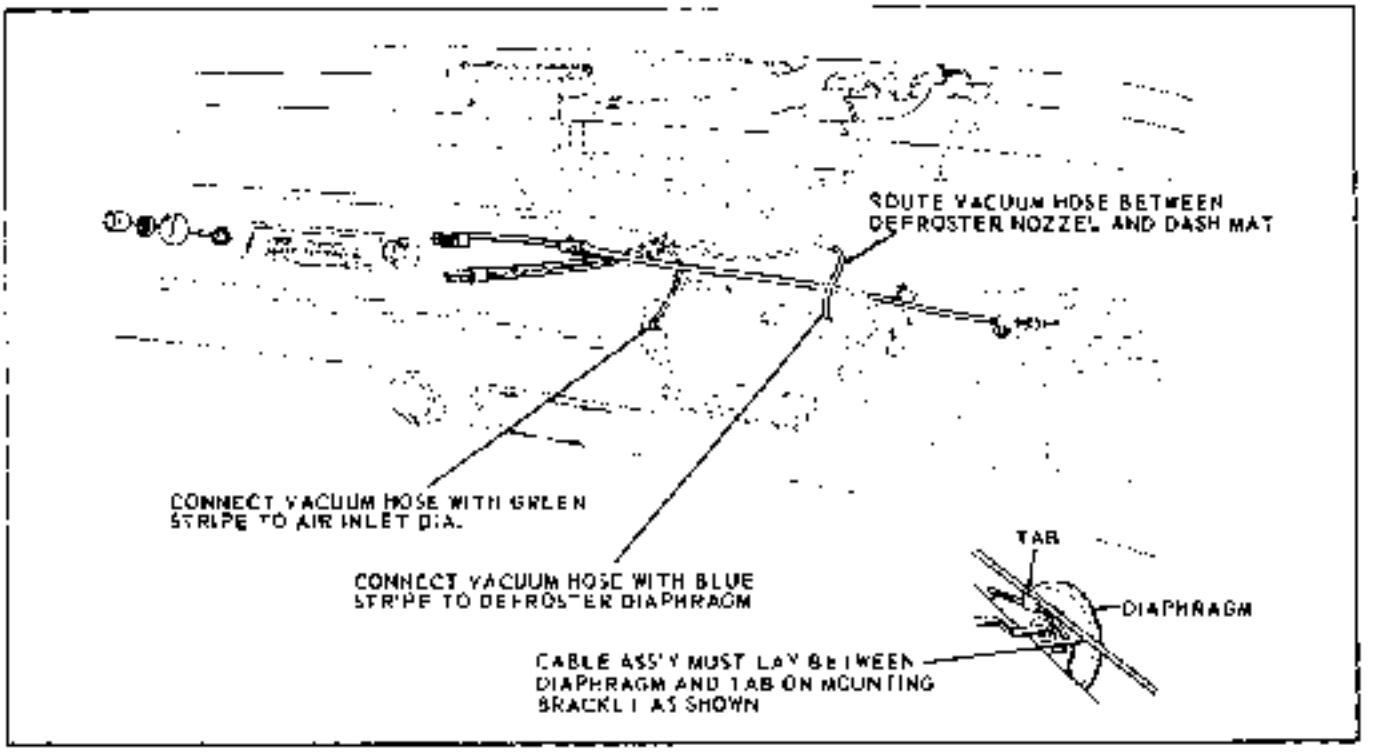


Fig. 1-1 Passenger Compartment Details—Pontiac

Reach behind instrument panel and remove control panel.

2. Remove temperature control cable at heater control switch.

3. Detach heater wire harness from temperature switch and select switch.

4. Remove vacuum hoses from select switch.

5. Remove control panel lamp.

6. Install by reversing the above.

7. Adjust temperature control cable.

TEMPEST

1. Remove screws retaining heater control panel to instrument panel and brace (Fig. 1-2).

2. Remove blower speed switch connector and light connector.

3. Drop panel from dash area and remove 2 screws and 2 clips retaining control cables.

4. To replace, reverse procedure, making sure that I.P. wire harness retainer clip is secured under upper attaching screw.

5. Check operation and adjustment of cables.

FIREBIRD

1. Remove instrument panel trim plate (Fig. 1-3).

2. Remove control panel retaining screws.

3. Move panel rearward.

4. Remove fan switch connector, light and cables.

5. Remove panel.

6. To install, reverse removal procedure.

SELECT AND VACUUM VALVE SWITCH REPLACEMENT (Fig. 1-4)

PONTIAC

1. Remove two 1/4" hex screws from the switch mounting bracket.

2. Around one strand of the dial cord, place a paper clip between the switch mounting bracket and the back-plate of the escutcheon.

CAUTION: Dial cord is spring-loaded and cord will vanish into the escutcheon if paper clip is not used.

3. Remove dial cord from pulley on switch shaft and remove switch.

4. Reassembly is the reverse of disassembly.

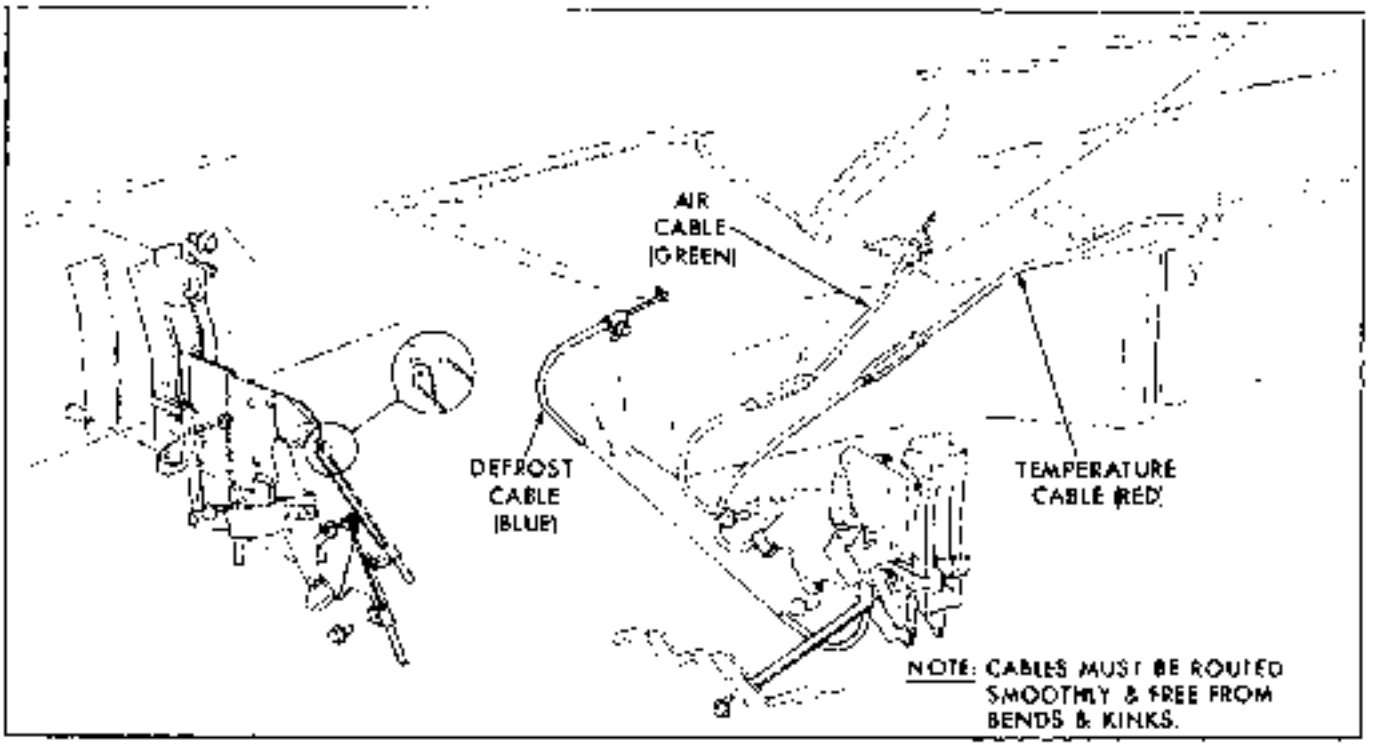


Fig. 1-2 Control Panel and Cable Routing—Tempest

BLOWER SPEED SWITCH REMOVE AND REPLACE

PONTIAC

NOTE: When replacing this switch, note the position of the defective switch and mount the new switch in the same position. If the blower does not function properly use the procedure below.

1. Turn control knob counterclockwise to the stop.

2. Remove two 1/4" hex screws and remove switch.

3. Attach new switch leaving screws loose enough, so that the switch can be rocked in its slots.

4. Make sure that the control knob is all the way counterclockwise, bend the wire link until no red bars can be seen.

5. Attach the electrical connector to the new switch.

6. Rotate the control knob until four red bars are seen.

7. Rotate the switch in the slots until the blower just passes into the MED-2 operating speed (there are four speeds: LO, MED-1, MED-2, & HI).

8. Be careful that the switch does not rotate; tighten screws.

9. Check to see that the blower passes from MED-1 to MED-2 when four red bars are showing on the front of the control head to insure proper blower operation.

TEMPEST

1. Disconnect battery.

2. Disconnect wires from blower switch (Fig. 1-2).

3. Remove plastic knob from lever.

4. Remove switch from panel.

5. Replace by reversing the above procedure.

FIREBIRD

1. Remove instrument panel trim plate.

2. Remove control assembly-to-instrument panel reinforcement attaching screws and push the control toward the front of the vehicle and down.

3. Remove the two switch attaching screws and electrical connector.

4. Install switch, screws, and electrical connector.

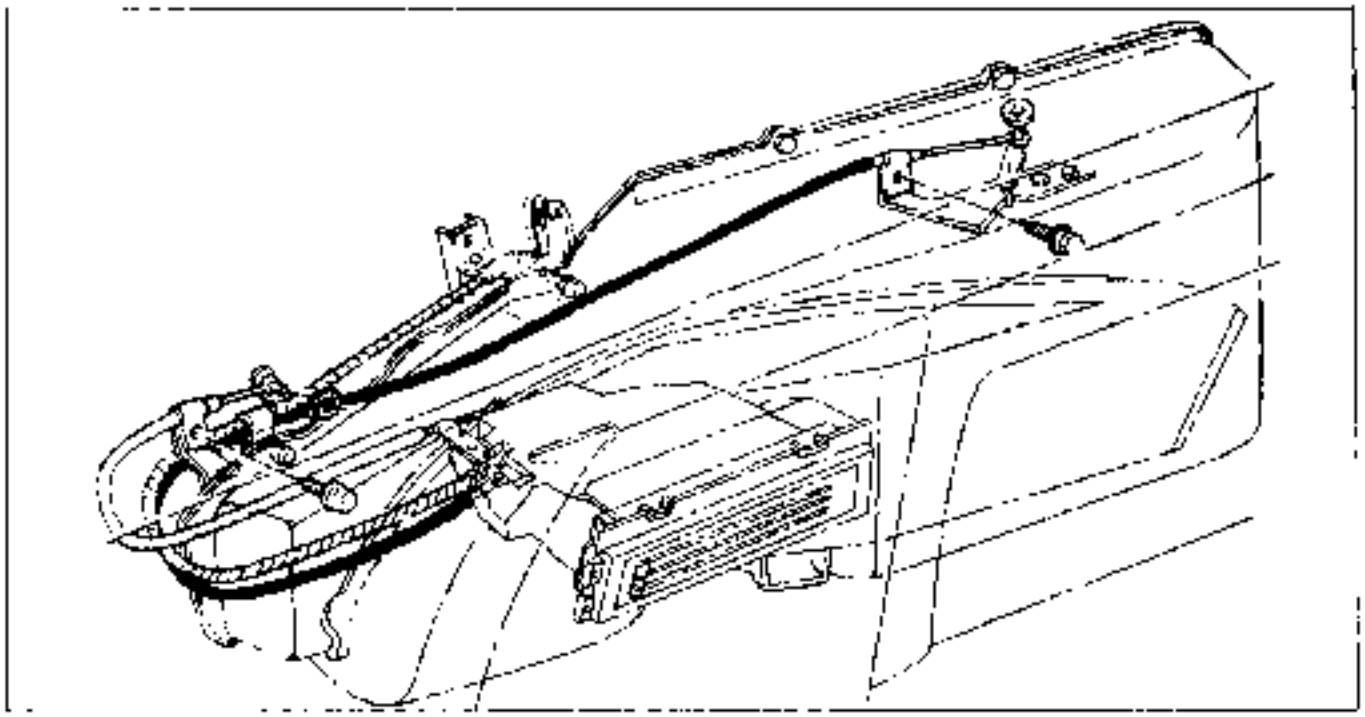


Fig. 1-2 Control Panel Center Attachments—Firebird

5. Place control in instrument panel and secure with attaching screws.

6. Replace trim plate.

BLOWER MOTOR RESISTOR—ALL REMOVE AND REPLACE (Fig. 1-1) TYPICAL

1. Remove glove compartment.

2. Remove resistor connector.

3. Remove resistor.

4. Replace by reversing removal procedure.

5. Check for operation.

HEATER WIRING HARNESS—ALL REMOVE AND REPLACE (Fig. 1-5)

1. Remove connector at blower motor and feed through dash.

2. Remove blower switch connector.

3. Remove connector at accessory feed.

4. Remove resistor connector.

5. To replace, reverse removal procedure.

6. Check for operation.

TEMPERATURE CONTROL CABLE REMOVE AND REPLACE

PONTIAC

1. Disconnect temperature control cable at top of heater (Fig. 1-3).

2. Disconnect temperature control cable at the heater control switch (Fig. 1-4).

3. Remove cable, taking care not to bend or kink same.

TEMPEST

1. Remove glove box (Fig. 1-2).

2. Remove temperature control bowden cable from heater core and case assembly.

3. Remove temperature control bowden cable from control assembly.

4. Replace by reversing the above procedure.

5. Adjust the temperature control bowden cable.

6. Replace glove box.

FIREBIRD

1. Remove glove compartment (Fig. 1-3).

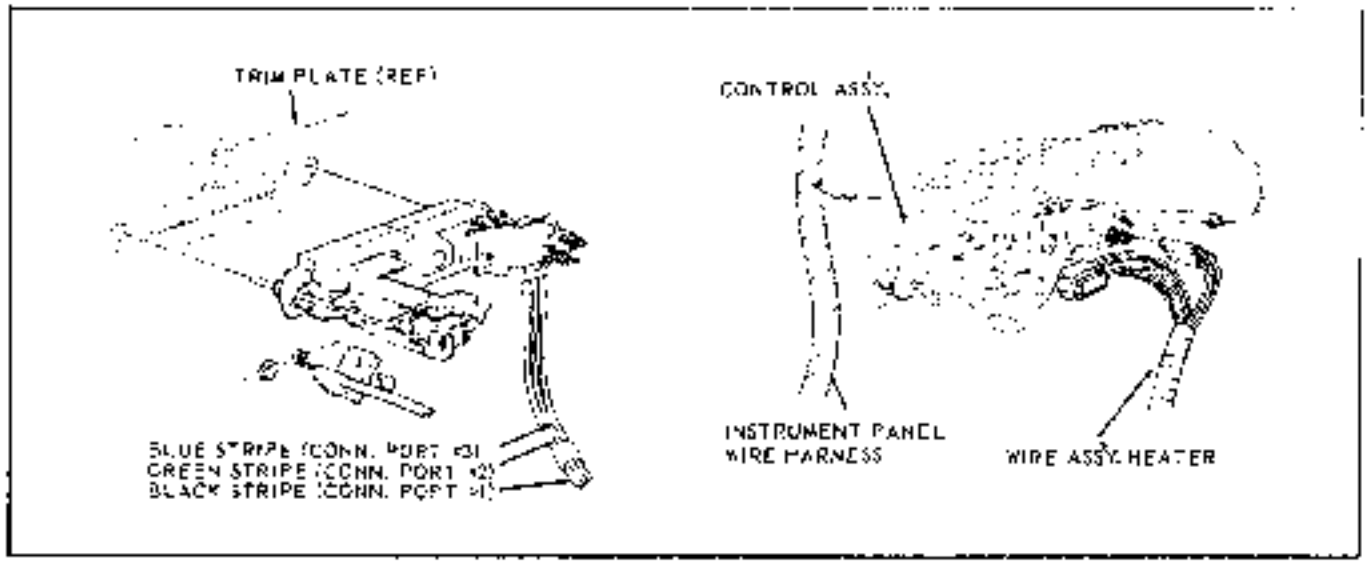


Fig. 1-4 Control Panel Connection—Partial

2. Remove cable and heater core.

3. Remove trim plate and control panel retaining screws.

4. Pull panel rearward and remove cable.

5. Replace by reversing above.

6. Check for operation.

AIR CONTROL CABLE—REPLACEMENT

TEMPEST

1. Remove glove compartment.

2. Remove air control bowden cable from heater core and case assembly (Fig. 1-2).

3. Remove air control bowden cable from control assembly.

4. Replace air control bowden cable.

5. Adjust air control bowden cable.

6. Replace glove compartment.

FIREBIRD

1. Remove glove compartment.

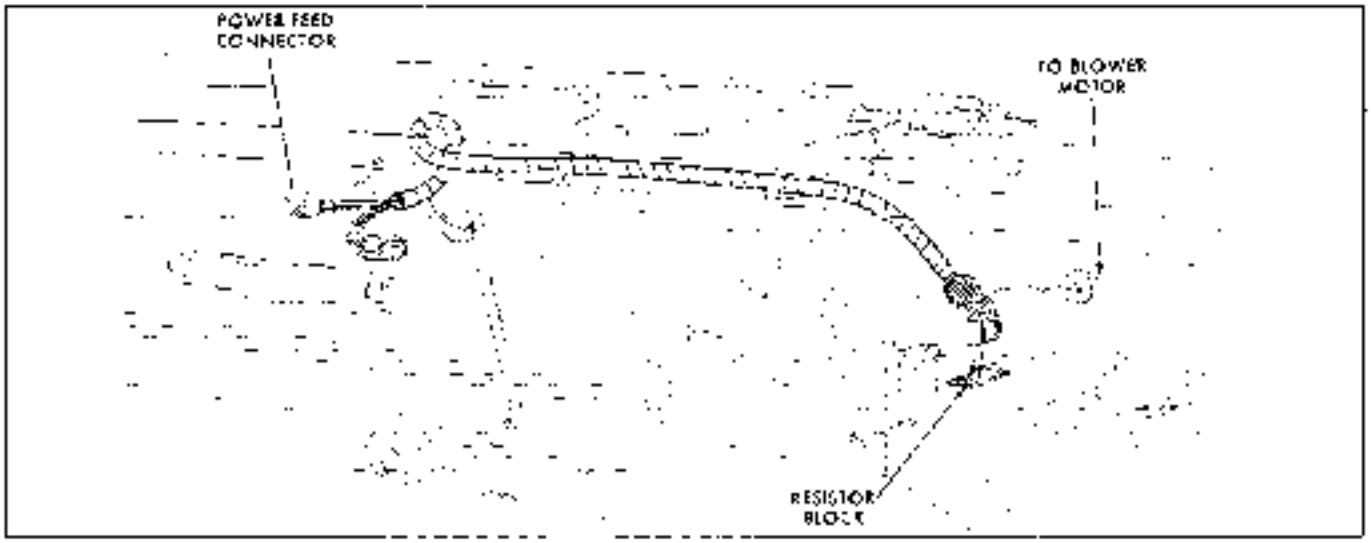


Fig. 1-5 Heater Harness (typical)

2. Disconnect cable at heater case (Fig. 1-3).

NOTE: It may be necessary to use a small screwdriver to free cable retaining clip.

3. Remove trim plate and control retaining screws.

4. Move control rearward and disconnect cable.

5. To replace, reverse removal procedure.

6. Check operation.

DEFROSTER CONTROL CABLE—REPLACEMENT

REMOVE AND REPLACE

TEMPEST

1. Remove defroster control cable from heater core and case (Fig. 1-2).

2. Remove cable from control.

3. Replace by reversing removal procedure. No adjustment is necessary.

FIREBIRD

1. Disconnect cable from pivot on heater case (Fig. 1-3).

2. Remove trim plate and control panel retaining screws.

3. Disconnect cable at control panel.

4. To replace, reverse removal procedure.

5. Check for operation.

DEFROSTER DIAPHRAGM AND HOSE REMOVE AND REPLACE

PONTIAC

1. Remove blue vacuum supply hose from diaphragm (Fig. 1-6).

2. Remove heater outlet.

3. Remove diaphragm retaining screws from below.

4. To replace, reverse removal procedure.

AIR DIAPHRAGM AND HOSE REMOVE AND REPLACE

PONTIAC

1. Remove green supply hose (Fig. 1-6).

2. Remove diaphragm retaining screws and spring.

3. Remove diaphragm.

4. To replace, reverse removal procedure.

VACUUM SUPPLY HOSE REMOVE AND REPLACE

PONTIAC

1. Disconnect supply hose from carburetor.

2. Pull through grommet in dash to inside of car.

3. Disconnect hose from control panel.

4. To replace, reverse removal procedure.

BLOWER MOTOR, IMPELLER AND/OR INLET DUCT—REMOVE AND REPLACE

PONTIAC

1. Remove hood hinge to fender retaining bolts (Fig. 1-7).

2. Prop hood and rest hinge on plenum.

3. Remove blower motor or duct retaining screws as desired.

NOTE: If removing duct drill two (2) one inch holes in fender skirt for removal of outboard duct retaining screws.

4. Remove motor electrical lead.

5. Remove motor or duct.

6. To replace, reverse removal procedure and plug holes with one inch rubber grommet.

TEMPEST

1. Remove battery and tray (Fig. 1-8).

2. Remove fender skirt.

3. Remove blower feed wire.

4. Remove blower motor or duct retaining screws as desired.

5. Remove motor or duct as desired.

6. To install, reverse removal procedure using care to reseal duct if removed.

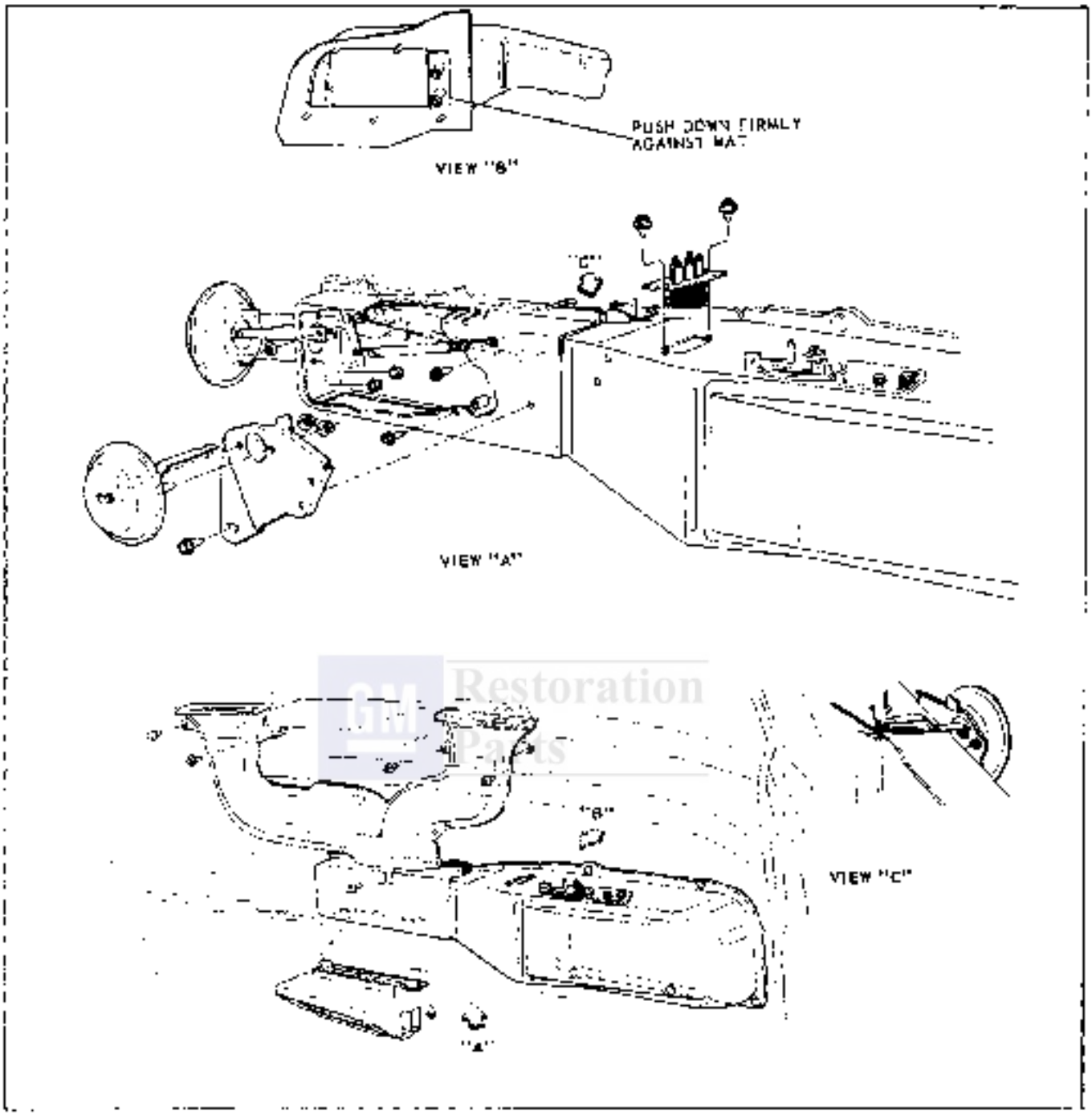


Fig. 1-6 Cowl Ventilator—Firebird

FIREBIRD

1. Disconnect battery ground and positive cables, and remove battery and tray (Fig. 1-6).

2. Unclip heater hoses from fender skirt.

3. Scribe alignment marks and remove hood.

4. Remove right front fender and skirt as an assembly.

5. Disconnect the blower motor wire at the motor flange.

6. Either remove the motor to case mounting screws and remove motor or remove the two screws and five nuts at dash to remove motor and duct assembly. Pry duct gently if the sealer acts as an adhesive.

7. Remove the blower wheel retaining nut to separate blower and motor.

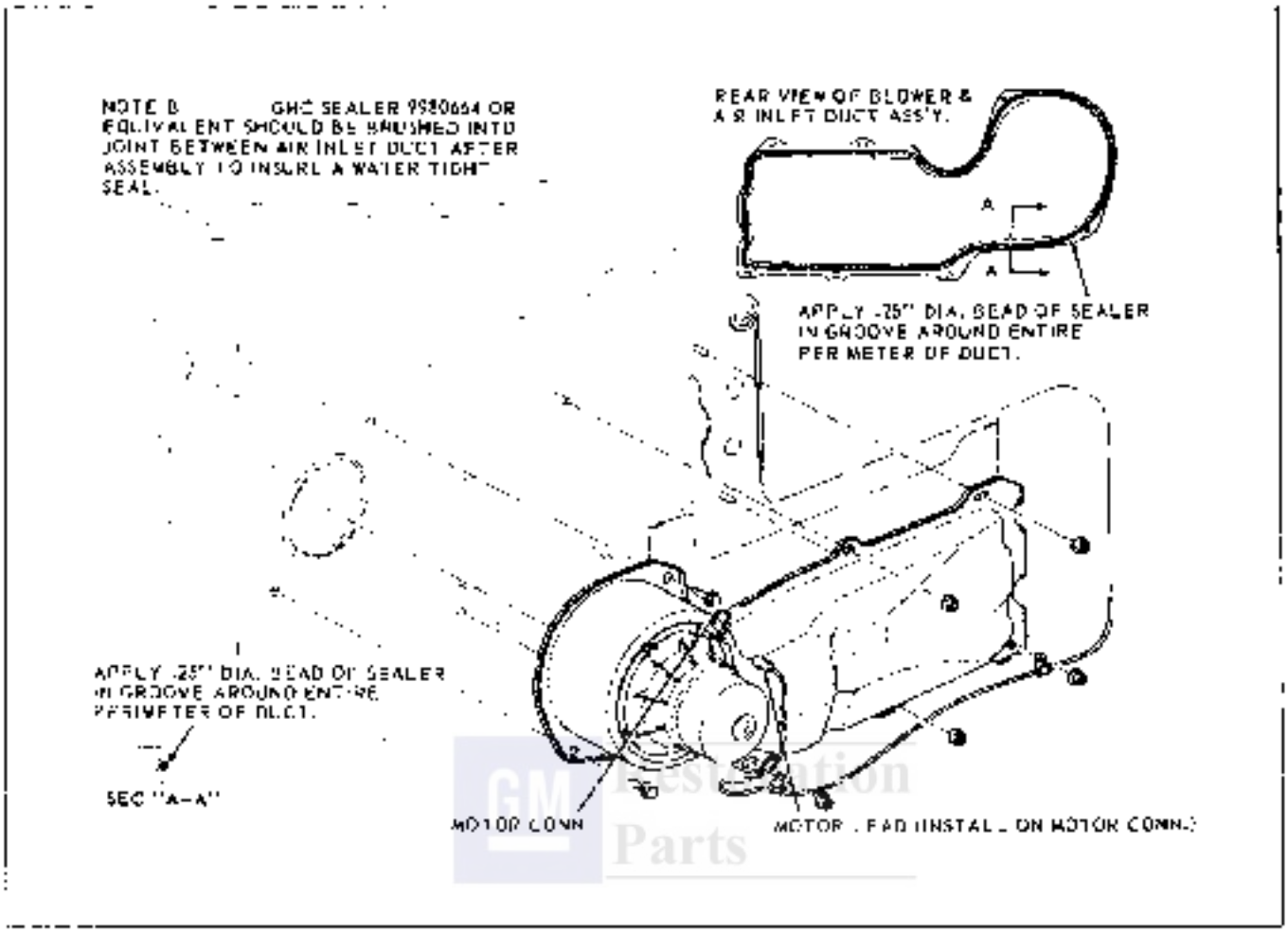


Fig. 1-7 Engine Compartment Details—Pontiac

8. To install, assemble the blower impeller to motor.

9. Place the assembly into case and install mounting screws. Connect the blower motor wire to motor and replace duct if applicable.

10. Install fender and skirt assembly.

11. Clip the heater hoses to fender skirt, replace battery and tray and connect cables.

12. Install hood.

HEATER CORE AND/OR CASE REMOVE AND REPLACE

PONTIAC (Fig. 1-7)

1. Drain radiator.

2. Disconnect heater inlet and outlet water hoses at heater.

3. Disconnect temperature control cable at top of heater core and case.

4. Disconnect vacuum hose from defroster and air inlet diaphragms.

5. Remove wire connector from resistor assembly at top of air outlet duct by prying up with flat blade screwdriver.

6. Remove nuts and screws securing heater to air inlet duct assembly.

7. Remove heater core and case assembly.

8. Remove heater core.

9. Replace by reversing above procedures.

10. Adjust temperature control cable.

TEMPEST (Fig. 1-8)

1. Disconnect heater inlet and outlet water hoses at heater allowing coolant to drain.

2. Remove glove compartment.

3. Remove five nuts retaining heater case to dash.

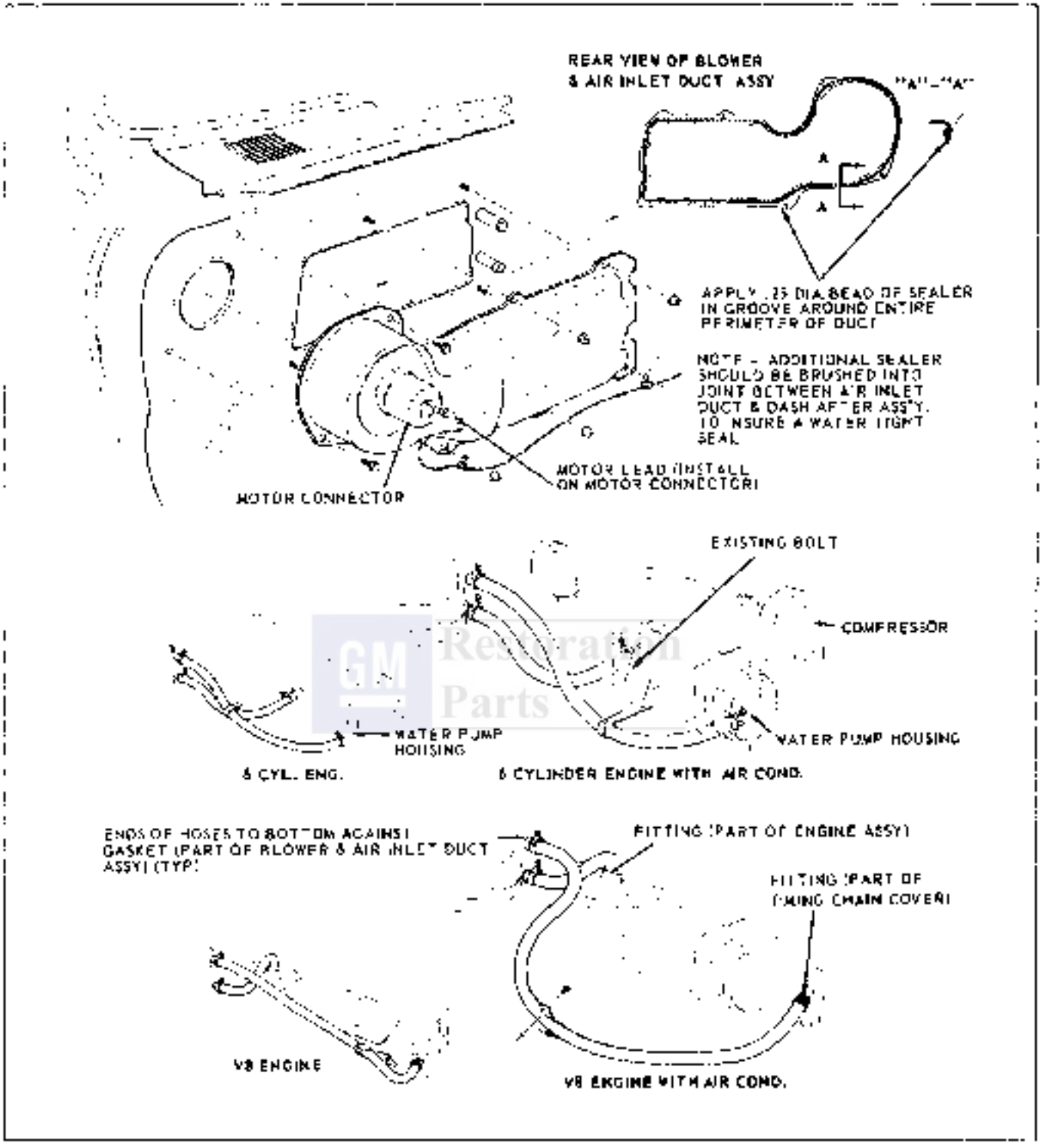


Fig. 1-9 Engine Compartment Details - Tempest

4. Pull case from dash, then disconnect cables and wire connector from resistor.

FIREBIRD (Fig. 1-10)

1. Drain radiator.

2. Remove heater hoses at their connections beside the air inlet assembly.

NOTE: The hose from the water pump must go to the top heater core pipe; the other hose runs from the rear of the R.H. cylinder head with V-8 engines or the center of the block with L-6 engines to the lower core pipe.

3. Remove nuts from case case studs on the engine side of the dash.

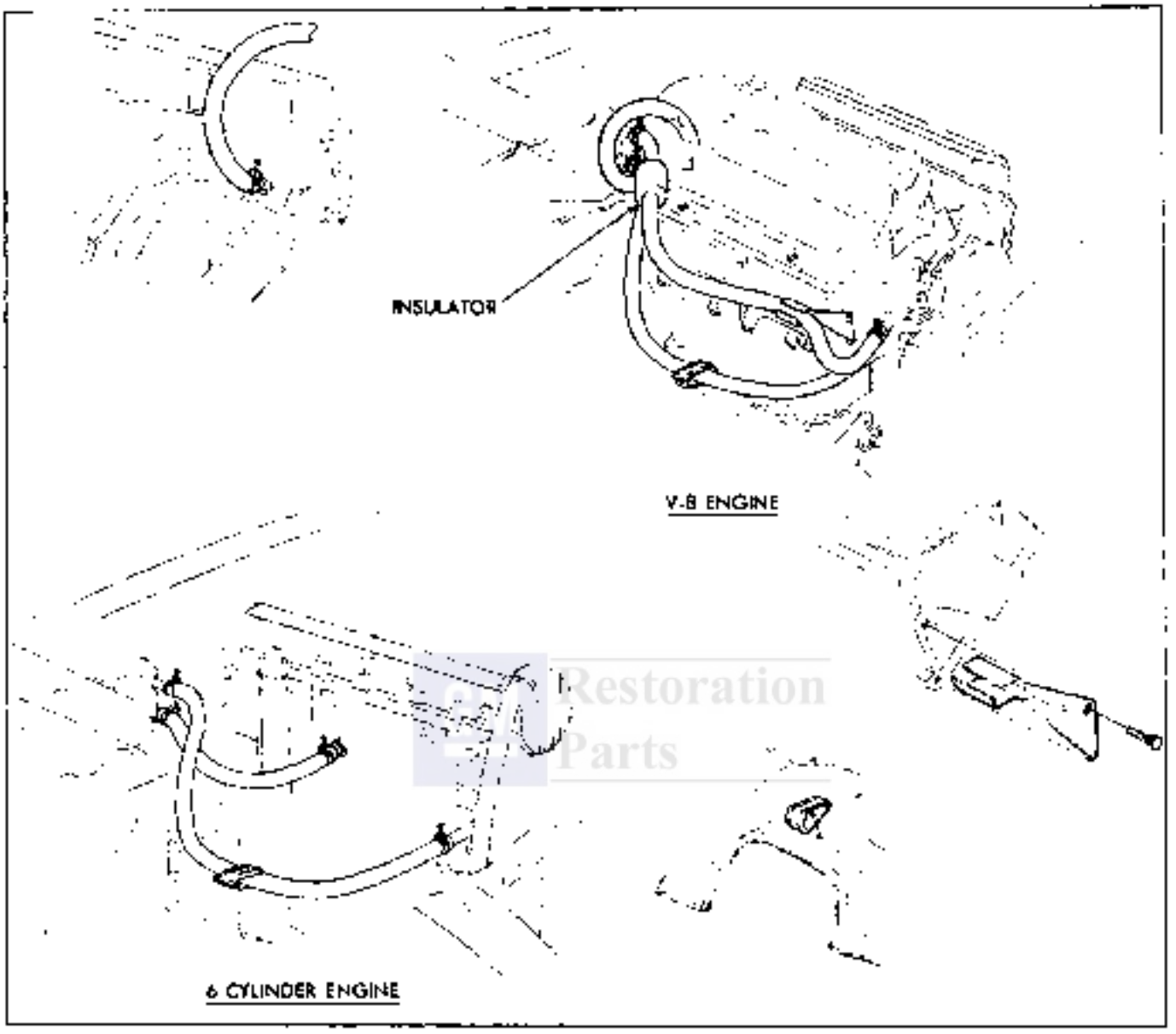


Fig. 1-9 Engine Compartment Details—Firewall

4. Inside the vehicle pull the entire heater assembly from the firewall.

5. Remove the bowden cables and all electrical connectors from the heater assembly and remove assembly.

6. Remove the core tube seal and core assembly retaining springs and remove core.

7. Install the replacement core.

NOTE: Be sure the core to case sealer is installed before installing core. Use new sealer if necessary.

8. Install core retaining springs and core tube seal.

9. Within the vehicle insert the five studs on heater through the holes in cowl and blower and air inlet assembly. Install the case to firewall mounting nuts (on engine side).

NOTE: It may be necessary to first insert coolant tubes through the dash followed by the five studs.

10. Replace the remaining bowden cables and electrical connectors.

11. Replace heater hoses, being careful to install them in their proper location.

12. Refill radiator.

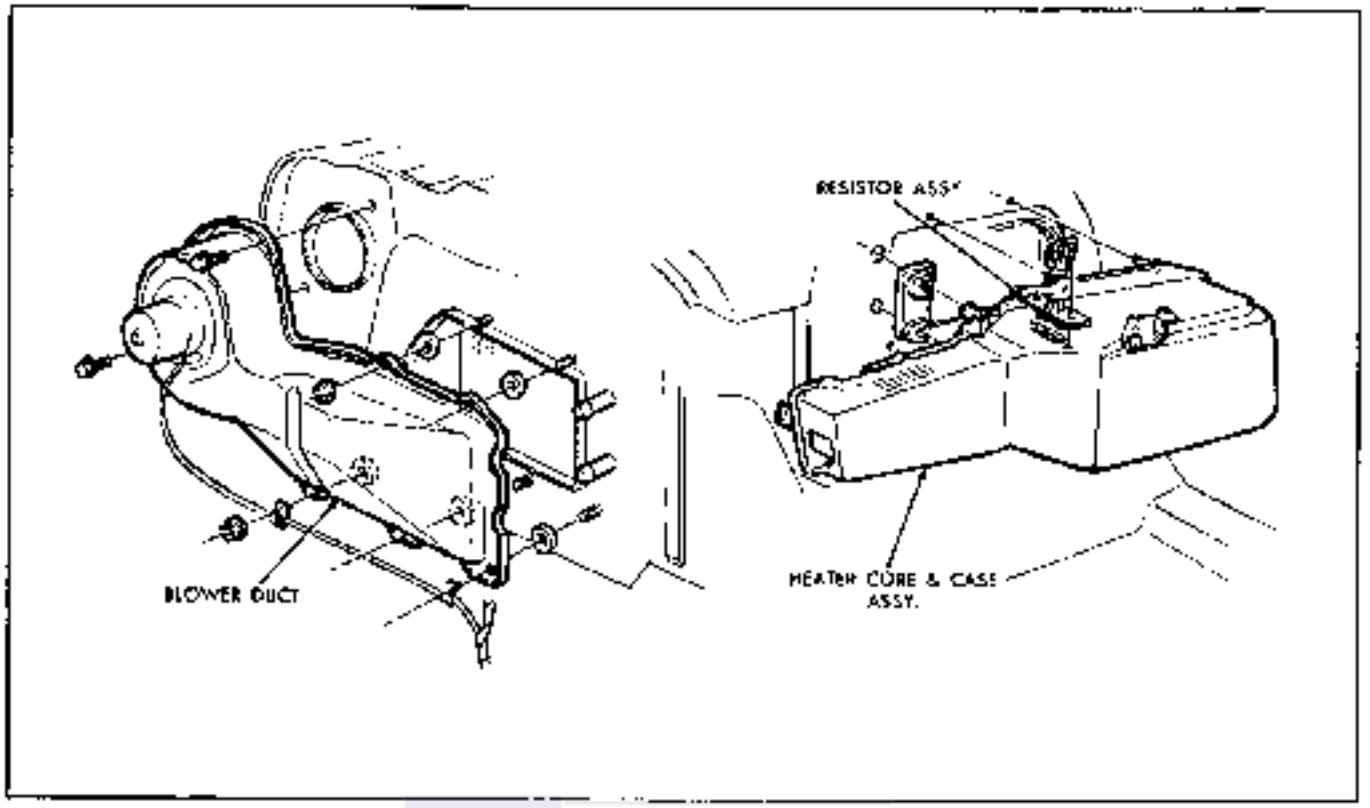


Fig. 1-10 Heater Blower and Air Inlet

HEATER HOSE INLET AND OUTLET REMOVE AND REPLACE—ALL MODELS (Figs. 1-7, 1-8 and 1-9)

DEFROSTER DUCT—REMOVE AND REPLACE

PONTIAC

1. Disconnect battery.
2. Remove radio.
3. Remove IP pad.
4. Remove glove compartment box.
5. Remove screws retaining duct to chuck and heater case.
6. Remove duct.
7. Check for air flow leaks.
8. Replace by reversing removal procedure.

TEMPEST

1. Disconnect battery.
2. Remove glove compartment
3. Remove radio.
4. Remove screw retaining duct to heater case
5. Bend four tabs retaining upper portion of duct.
6. Remove duct.
7. Replace by reversing above procedure.

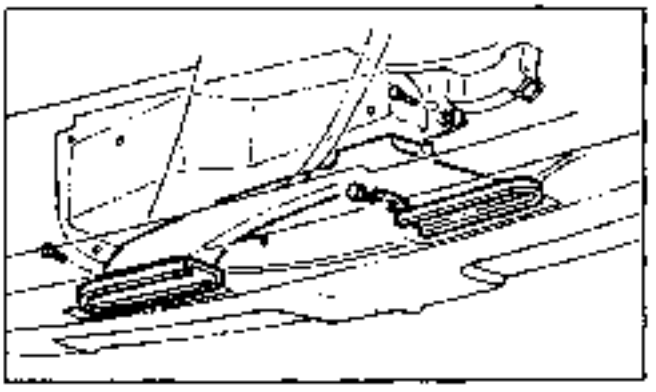


Fig. 1-11 Defroster Duct Installation—Firebird

FIREBIRD (Fig. 1-11)

For removal and installation of defroster duct refer to Fig. 1-4.

1. Remove glove compartment, ash tray bracket and radio.

2. Remove two duct retaining screws.

3. Pull heater case from firewall as described under heater case remove and replace.

4. Remove duct.

CUSTOM AIR CONDITIONER
COMPONENT REPLACEMENT AND ADJUSTMENT

CONTENTS OF THIS SECTION

PRECAUTIONARY SERVICE MEASURES

Before any service is attempted which requires opening of refrigeration pipes or units, the person doing the work should be thoroughly familiar with the material in the Diagnosis Manual - Basic Air Conditioning Information. Also, he should follow very carefully the instructions given on the following pages for the unit being serviced.

The major reasons behind these measures are for safety and to prevent dirt and moisture from getting into system. Dirt contaminant is apt to cause leaky valves or wear in the compressor, and moisture will freeze into ice at expansion valve and freeze valve stem.

The presence of moisture can also cause the formation of hydrochloric or hydrofluoric acids in the system.

REFRIGERATION SUB-ASSEMBLIES

1. All sub-assemblies are shipped, sealed and dehydrated. They are to remain sealed until just prior to making connections.

2. All sub-assemblies should be at room temperature before uncapping. (This prevents condensation of moisture from the air that enters the system.)

3. If, for any reason, caps are removed or the connections are not made, then the tubes and other parts should not remain unsealed for more than 15 minutes. Reseal connections if period is to be longer. This applies particularly to partially built-up systems that will be left overnight.

4. Compressors are shipped with 10-11 oz. of Frigidaire 525 viscosity oil and charged with a mixture of Refrigerant-12 and dry nitrogen to provide an internal pressure at slightly above atmospheric pressure.

ASSEMBLY

1. All precautions should be taken to prevent damage to fittings or connections. Even minute damage to a connection could cause it to leak.

2. Any fittings getting grease or dirt on them should be wiped clean with a cloth dampened with alcohol. Do not use chlorinated solvents such as trichloroethylene for a cleaning agent, as they are contaminants. If dirt, grease or moisture gets inside pipes and cannot be removed, pipe is to be replaced.

3. Sealing caps should be removed from sub-assemblies just prior to making connections for final assembly.

4. Use a small amount of clean refrigeration oil (525 or 1000 viscosity) on all tube and hose joints, and dip the O-ring gasket in oil before

assembling joint, as this oil will help in making a leak-proof joint.

When tightening joints, use another wrench to hold stationary part of the connection, so that a solid feel can be attained, which will indicate proper assembly.

CAUTION: Tighten all tubing connections as shown in Fig. 1A-1. Insufficient torque when tightening can result in loose joints and excessive torque when tightening can result in deformed joint parts, either condition can result in refrigeration leakage.

5. Do not connect receiver dehydrator indicator assembly until all other sealed sub-assemblies have been connected. This is necessary to insure optimum dehydration and maximum moisture protection of the refrigeration system.

CAUTION—LIQUID INDICATOR

PONTIAC AND TEMPEST

Under normal conditions, receiver-dehydrator will show clear with about 3-1/2 pounds of refrigerant in the system. However, the air conditioner will not produce its best performance until 4-1/2 pounds of refrigerant are in the system. Do not overcharge with refrigerant, as this will result in extremely high head pressures and the compressor safety valve will blow.

FIREBIRD

Under normal conditions, liquid indicator will show clear with about 2-3/4 pounds of refrigerant in the system. However, the air conditioner will not produce its best performance until 3-3/4 pounds of refrigerant are in the system. Do not overcharge with refrigerant, as this will result in extremely high head pressures and the compressor safety valve will blow.

DEPRESSURIZING THE SYSTEM

1. Remove caps from suction gauge fitting on

Metal Tube Outside Diameter	Thread and Fitting Size	Steel Tubing Torque Lb-Ft	Aluminum or Copper Tubing Torque Lb-Ft	Nominal Crowfoot Wrench Size
1/4	7/16	10-15	8-9	5/8
5/16	1/2	30-35	11-14	3/4
3/8	5/8	30-45	11-13	3/4
1/2	3/4	30-35	18-21	1"
5/8	1 1/16	30-35	23-25	1 1/4

If a connection is made with steel to aluminum or copper, use torques for aluminum. In other words, use the lower torque specification.

Fig. 1A-1 Pipe and Hose Connection Torque Chart

P.O.A. valve and discharge valve gauge fitting on compressor.

2. With both valves on manifold gauge set J 5725-01 closed (clockwise), attach manifold to P.O.A. valve and compressor, using J 5420 Schrader valve adapter at suction gauge fitting and J 6163 Schrader valve adapter at discharge gauge fitting.

3. Crack open high pressure valve on manifold gauge set to allow slow escape of refrigerant from system through the manifold gauge set and the center fitting and hose. (Place end of hose in clean container.) If oil drips from hose into the container, refrigerant is escaping too rapidly.

4. When hissing ceases (indicating all refrigerant has escaped) close high pressure valve on manifold gauge set by turning valve clockwise.

EVACUATING THE SYSTEM

When refrigeration system is depressurized and opened for service, some air will enter lines regardless of how quickly openings are capped. In order to remove this air and as much as possible of the moisture it contains, the complete system must be evacuated. Evacuating is merely the process of removing all air from the system, thereby creating a vacuum in the system.

CAUTION: Under no circumstances should alcohol be used in the system in an attempt to remove moisture, regardless of the successful use of alcohol in other refrigeration systems.

PREPARATIONS FOR EVACUATING COMPLETE SYSTEM

1. Check the low pressure gauge for proper calibration, with the gauge disconnected from the refrigeration system. Be sure that the pointer on the gauge indicates to the center of O. Tap gauge a few times lightly to be sure pointer is not sticking. If necessary, calibrate as follows:

a. Remove cover from gauge.

b. Holding gauge pointer adjusting screw firmly with one hand, carefully force pointer in the proper direction in proper amount to position pointer through the center of O position. Tap gauge a few times to be sure pointer on gauge is not sticking. Replace gauge cover.

2. If gauge set is not already connected to P.O.A. valve and compressor, connect as follows (Fig. 1A-2).

a. Close hand shut-off valves on gauge set by turning clockwise.

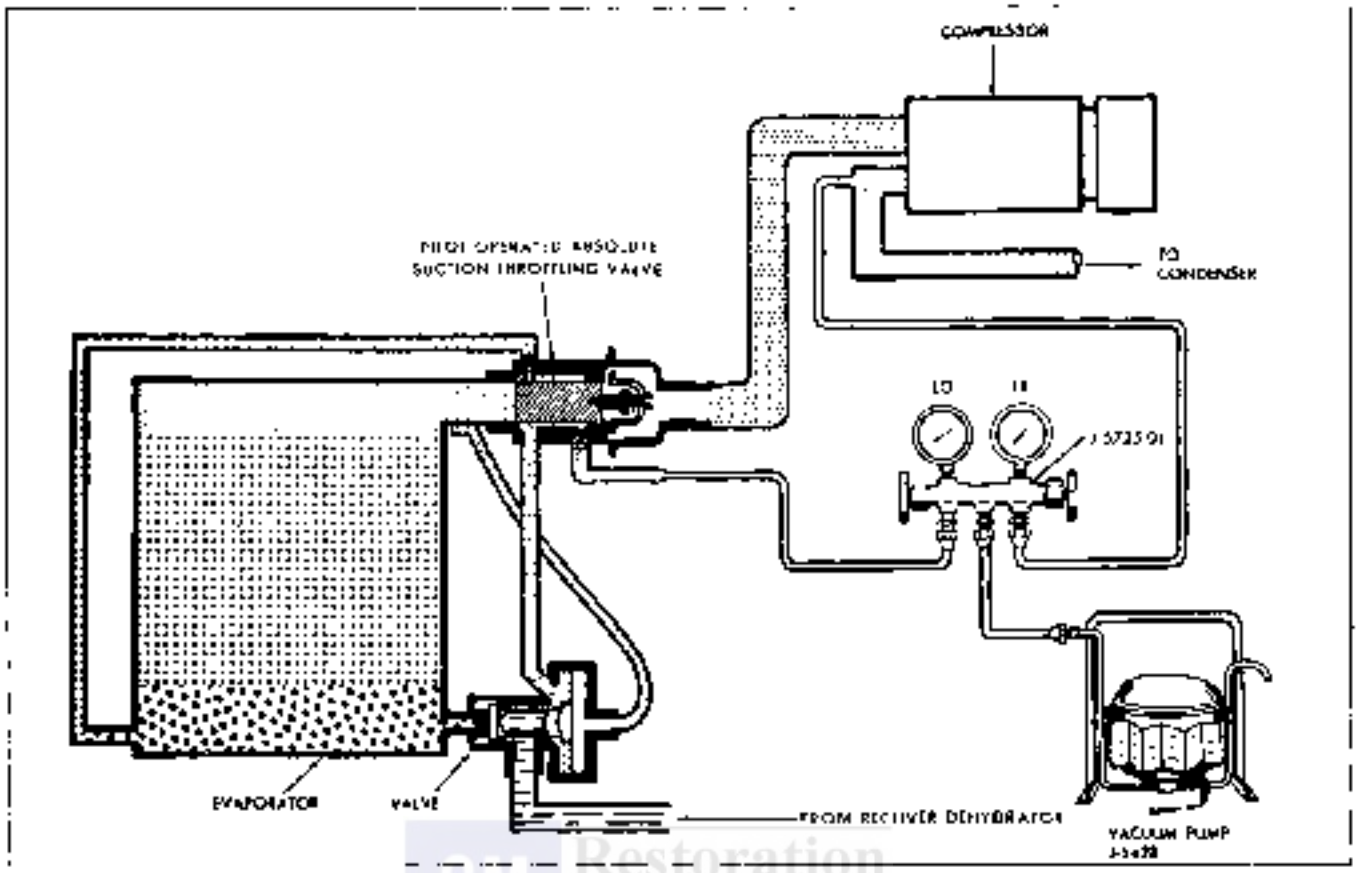


Fig. 1A-2 Schematic – Evacuating Refrigerant System

b. Remove caps from gauge fittings on P.O.A. valve and compressor.

c. Attach Schrader valve adapter J 5420 to end of hose from low pressure gauge and connect this adapter fitted hose to suction gauge fitting.

d. Attach Schrader valve adapter J 6163 to end of hose from high pressure gauge and connect this adapter fitted hose to discharge gauge fitting.

3. Attach a flexible gauge hose to center fitting of the gauge set and attach the other end of this hose to the vacuum pump J 5428 or J 5428-01 (Fig. 1A-2).

4. The system can now be evacuated.

EVACUATING COMPLETE SYSTEM

1. Turn hand shut-off valve on low pressure gauge of gauge set to full clockwise position.

2. Slowly turn valve on high pressure gauge counterclockwise from full clockwise position, letting any pressure build-up escape completely. Close high pressure valve.

3. Check oil level in vacuum pump and add Frigidaire 150 viscosity oil or equivalent, if necessary, to bring to proper level. Make sure dust cap on discharge side of vacuum pump has been removed.

4. Start the vacuum pump and slowly open low and high pressure sides of manifold gauge set to avoid forcing oil out of refrigeration system and the pump. Pressure is now being removed on both sides of refrigeration system.

NOTE: If oil is blown from vacuum pump, it should be refilled to the proper level with Frigidaire 150 viscosity oil or equivalent.

5. Observe low pressure gauge and operate vacuum pump until gauge shows 26-28" vacuum. Continue to run pump for ten additional minutes.

NOTE: In all evacuating procedures specification of 26-28 inches of vacuum is used. This evacuation can only be attained at or near sea level. For each 1000 feet above sea level where this operation is being performed, specification should be lowered by one inch of mercury vacuum. For example: at 5000 feet elevation only 21 to 23 inches of vacuum can normally be obtained.

If vacuum cannot be pulled to the minimum specification for the respective altitude, it indicates a leak in the system, gauge connections or a defective vacuum pump. In this case, it will be necessary to

check for leaks as outlined below, after a small amount of Refrigerant-12 has been added to the low side of the system.

a. Turn hand shut-off valves at the low and high pressure gauge of the gauge set to full clockwise position with the vacuum pump operating, then stop pump.

b. Connect flexible line from center fitting of the gauge set to refrigerant drum (drum should be at room temperature).

NOTE: It may be necessary to use reducer J 5176-4 with washer J 5162-9 to attach flexible hose to refrigerant drum.

c. Open shut-off valve on drum and loosen flexible line fitting at center fitting at gauge set so that refrigerant will purge all air from line. Tighten flexible fitting when certain all air has been purged from line.

d. Open suction valve on gauge set. This will allow refrigerant to pass from the drum into the system. When pressure stops rising, close suction valve on gauge set and valve at refrigerant drum (as refrigerant drum is at room temperature, only a small refrigerant charge will enter the system).

e. Using leak detector J 6084, check all fittings in the system, compressor shaft seal and on gauge set for evidence of leakage. When general area of leak has been found with the leak torch, a liquid leak detector may be helpful in locating the exact point of leakage. After leak has been corrected, evacuate the system again.

5. Turn the hand shut-off valves at the low and high pressure gauge of the gauge set to the full clockwise position with the vacuum pump operating, then stop pump. Carefully check low pressure gauge to see that vacuum remains constant. If vacuum returns, it indicates a leak in the system or gauge connections. See NOTE in step 5 above for method of locating leak.

CHARGING THE SYSTEM

The system should be charged only after being evacuated as outlined in EVACUATING THE SYSTEM.

REFRIGERANT DRUM METHOD

1. Connect center flexible line of gauge set to refrigerant drum.

NOTE: It may be necessary to use reducer J 5176-4 with washer J 5162-9 and fitting J 5162-8 to attach flexible line to refrigerant drum.

2. Place refrigerant drum in a pail of water which has been heated to a maximum of 125°F.

CAUTION: Do not allow temperature of water to exceed 125°F., high temperature will cause excessive pressure and possible softening of fusible safety plugs in the refrigerant drum. It may not be necessary to use hot water if a large drum is used (over approximately 100 lbs.).

3. Place refrigerant drum (in pail of water) on scales (bathroom or commercial, preferably commercial), Fig. 1A-3.

CAUTION: Do not turn refrigerant drum upside down as this would allow liquid refrigerant to enter compressor which may cause damage.

4. If line at center gauge fitting has not been purged of air, loosen line at center fitting on gauge set and crack valve on refrigerant drum to blow air from line. Retighten line at center fitting and record exact weight of refrigerant tank in water on the scales.

5. Open valve on refrigerant drum and both valves on gauge set to allow refrigerant to flow into system. Continue charging until the scales show that 4 1/2 pounds of refrigerant have been transferred from refrigerant drum to system for Pontiac or Tempest. THE FREON CHARGE FOR THE FIREBIRD CUSTOM AIR CONDITIONING SYSTEM IS 3-3/4 LBS.

NOTE: If full charge cannot be obtained, close both valves on gauge set, start engine, and turn temperature control knob to full cold position with NORMAL or A/C button depressed. Open low pressure valve on gauge set slowly and leave open until full charge is added.

CAUTION: Observe high pressure gauge while charging with compressor running. Shut off engine if pressure exceeds 275 psi. A fan placed in front of the car will help reduce excessively high head pressures.

6. Close both valves on gauge set (high pressure valve will already by closed if charging was completed by running compressor) and close valve on refrigerant drum.

NOTE, If the engine was used to complete the Refrigerant-12 charge into the system, close valve on refrigerant drum to permit compressor to draw any refrigerant left in the line from the drum to the center fitting of the gauge set, then close the low pressure valve on the gauge set.

7. Operate engine at 2000 rpm with temperature control knob at full cold position and blower control for high speed with NORMAL or A/C button depressed. After ten minutes of operation observe appearance of refrigerant in receiver-dehydrator. If bubbles are observed, open low pressure gauge

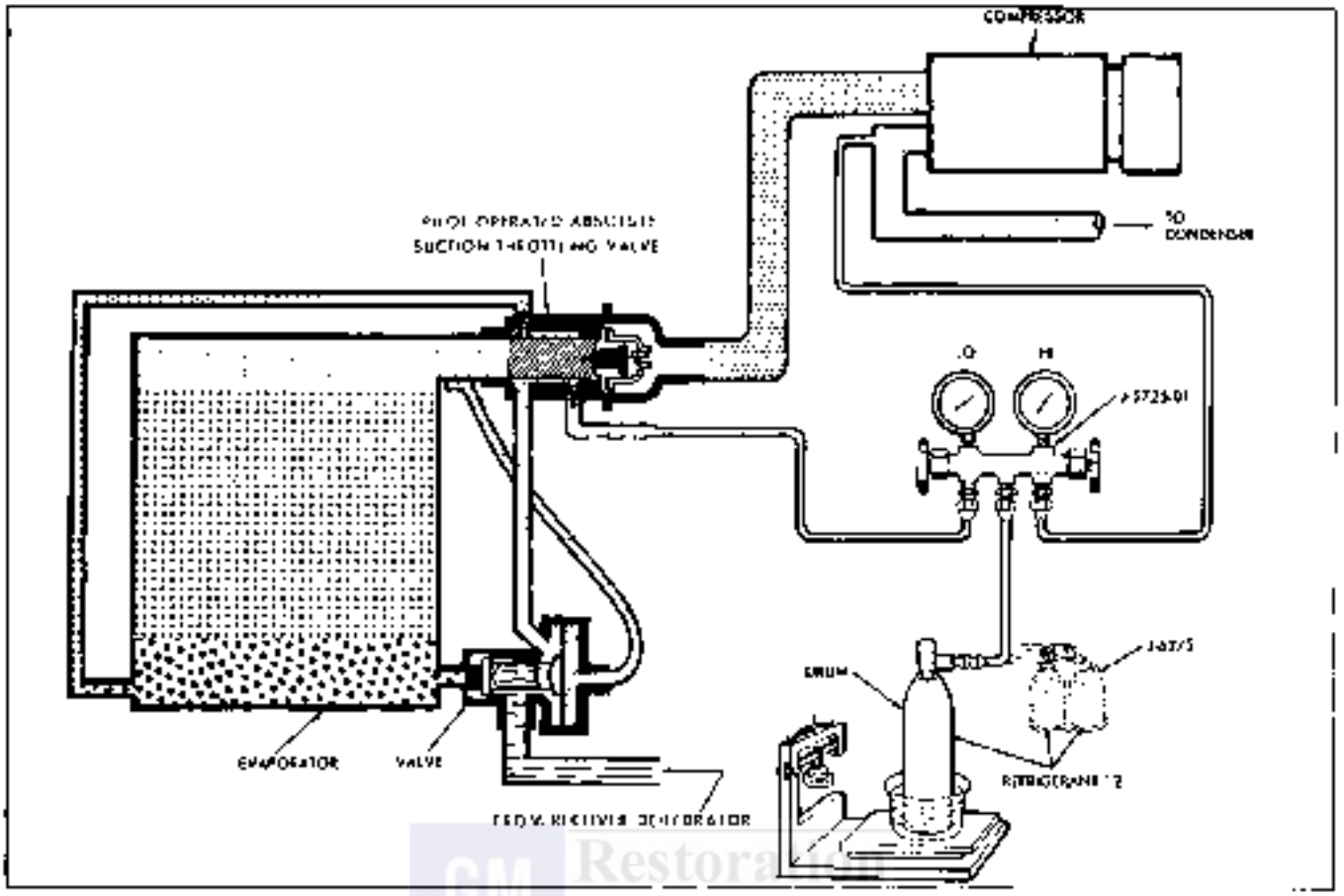


Fig. 1A-3 Schematic - Charging Refrigeration System

valve and valve on refrigerant drum to allow more refrigerant to enter system. Close valve when receiver-dehydrator clears up.

NOTE: If air inlet temperature is below 70°F when this check is made, bubbles may appear even though the proper amount of refrigerant is in the system. Air inlet temperature must be 70°F. or above to make an accurate check.

8. When refrigerant has been installed, continue to operate system and test for proper operation as outlined under OPERATIONAL TEST.

9. When satisfied that air conditioning system is operating properly, stop engine, remove gauge set and replace protective caps on P.O.A. valve and compressor fittings.

NOTE: A considerable amount of refrigerant will collect in the high pressure line, since some of this refrigerant will have condensed into liquid refrigerant. Wrap the high pressure gauge fitting at the compressor with a shop cloth before disconnecting the Schrader valve from the gauge fitting, to prevent injury to personnel.

10. Using leak detector J 6084, check complete system for leaks, as explained under LEAK DETECTORS.

REFRIGERANT-12 DISPOSABLE CAN METHOD

After having depressurized, repaired (if necessary), and evacuated the refrigerant system, the system may be charged as follows when using Refrigerant-12 disposable cans:

1. Obtain four (for Firebird) or five (for Pontiac or Tempest) "one" pound cans of Refrigerant-12.

2. Mount three cans in J 6272 No. 3 Multi-opener or attach J 6271 Fitz-All valve (single can opener valve) on one can.

CAUTION: Make sure outlet valve on opener is closed (clockwise) before installing opener.

a. If the J 6272 No. 3 Multi-opener is used, raise locking lever, position three cans of refrigerant and force locking lever down to secure cans and at same time puncture top of can to make it ready for charging.

b. If the J 6271 Fitz-All valve is used, back off the valve from the can top retainer, slip the valve on to the can and turn the valve into retainer until tight. DO NOT open outlet valve during this operation as turning the valve into the retainer punctures top of can to make it ready for charging.

3. Connect center flexible line of gauge set to fitting on a can opener valve.

NOTE: If line at center gauge fitting has not been purged of air, loosen line at center fitting on gauge set and "crack" valve of can opener for a second or two to force air from the line. Retighten line at center fitting.

4. Open valve on No. 3 Multi-opener (or at single can) and also low pressure and high pressure valves on manifold gauge set. Leave can valve open until all refrigerant has entered the refrigerating system. Close valve on can.

a. If the system is charged using single cans and the J 6271 valve, disconnect valve from can, leaving valve closed to flexible line to the center fitting of the manifold gauge set. Install valve on a new and full disposable can of Refrigerant-12, and repeat until four and one quarter one pound cans of refrigerant have been used to charge system.

Actual net weight of refrigerant is 15 ozs. per can, therefore it will be necessary to use four and one-third cans for Pontiac or Tempest, four cans for Firebird.

b. If system is charged using the 3 can Multi-opener, J 6272, close the valve of opener after all cans are empty. Release the locking lever and discard the three empty cans. If this tool will be used to complete the charge with additional cans to bring the required refrigerant charge, then leave two of the cans emptied in position, locate the one full can and lock the lever into place. (These empty cans balance the assembly and prevent the loss of refrigerant out the open "series" passage.)

NOTE: Align the pierced hole in the empty can with the punch in the cover of the tool.

If the J 6271 Fitz-All valve for single cans is available, complete charging as explained in 4a above.

5. Close valves on manifold gauge set.

6. Operate engine at 2000 rpm with temperature control knob at full cold position and blower control for high speed in A/C mode.

NOTE: If air inlet temperature at the condenser is below 70°F. when this check is made, bubbles may appear even though the proper amount of refrigerant is in the system. Air inlet temperature must be 70°F. or above to make an accurate check.

7. When refrigerant has been installed, continue to operate system and test for proper operation as outlined under OPERATIONAL TEST.

8. When satisfied that air conditioning system is operating properly, stop engine, remove gauge set and replace protective caps on suction and discharge fittings.

NOTE: A considerable amount of refrigerant will collect in the high pressure line, since some of this refrigerant will have condensed into liquid refrigerant. Wrap the high pressure fitting at the compressor with a shop cloth before disconnecting the Schrader valve from the gauge fitting to prevent damage or injury to personnel.

9. Using leak detector J 6084, check complete system for leaks as explained under LEAK DETECTORS.

SERVICE STATION METHOD

INSTALLING J 8393

1. Be certain compressor hand shut-off valves are closed to gauge fittings (counterclockwise).

2. Be certain all valves on charging station are closed.

3. Connect high pressure gauge line (with J 6163 attached) to compressor high pressure gauge fitting.

4. Turn high pressure hand shut-off valve one turn clockwise, and high pressure control (2) one turn counterclockwise (open). Crack open low pressure control (1) and allow refrigerant gas to hiss from low pressure gauge line for three seconds, then connect low pressure gauge line to low pressure gauge fitting on P.C.V. valve. (Place J 6163 adapter on hose, then attach adapter to gauge fitting.)

FILLING CHARGING CYLINDER

1. Open control valve on refrigerant container.

2. Open valve on bottom of charging cylinder allowing refrigerant to enter cylinder.

3. Bleed charging cylinder to valve (behind control panel) only as required to allow refrigerant to enter cylinder. When refrigerant reaches desired charge level (4 1/8 or 3 3/4), close valve at bottom of charging cylinder and be certain cylinder bleed valve is closed securely.

NOTE: While filling the cylinder, it will be necessary to close the bleed valve periodically to allow boiling to subside so that refrigerant level in the charging cylinder can be accurately read.

CHARGING THE SYSTEM USING J 8393

1. With charging station installed as previously

described, remove low pressure gauge line at P.O.A. valve.

2. Crack open high (No. 2) and low (No. 1) pressure control valves on station, and allow refrigerant gas to purge from system. Purge slowly enough so that oil does not escape from system along with refrigerant.

3. When refrigerant flow nearly stops, connect low pressure gauge line to P.O.A. valve.

4. Turn on vacuum pump and open vacuum control valve (No. 3).

5. With system purged as above, run pump until 26-28 inches of vacuum is obtained. Continue to run pump for 15 minutes after the system reaches 26-28 inches vacuum.

NOTE: In all evacuating procedures, the specification of 26-28 inches of mercury vacuum is used. These figures are only attainable at or near sea level. For each 1000 feet above sea level where this operation is being performed, the specifications should be lowered by 1 inch. Example: at 5000 ft. elevation, only 21 to 23 inches vacuum can normally be obtained.

6. If 26-28 inches vacuum (corrected to sea level) cannot be obtained, close vacuum control valve (No. 3) and shut off vacuum pump. Open refrigerant control valve (No. 4) and allow some refrigerant to enter system. Locate and repair all leaks.

7. After evacuating for 15 minutes, add 1/2 pound of refrigerant to system as described in step 6 above. Purge this 1/2 pound and re-evacuate for 15 minutes. This second evacuation is to be certain that as much contamination is removed from the system as possible.

8. Only after evacuating as above, system is ready for charging. Note reading on sight glass of charging cylinder. If it does not contain a sufficient amount for a full charge, fill to the proper level.

9. Close low pressure valve on charging station. Fully open station refrigerant control valve (No. 4) and allow all liquid refrigerant to enter system. When full charge of refrigerant has entered system turn off refrigerant control valve (No. 4) and close both hand shut-off valves.

10. If full charge of refrigerant will not enter system, close high pressure control and refrigerant control valves. Start engine and run at slow idle with compressor operating. Crack refrigerant control valve (No. 4) and low pressure control on station. Watch low side gauge and keep gauge below 30 psi by regulating refrigerant control valve. Closing valve will lower pressure. This is to prevent liquid refrigerant from reaching the compressor while the compressor is operating. When required charge has entered system, close refrigerant control valve and close low pressure control.

11. System is now charged and should be performance tested before removing gauges.

ADDING REFRIGERANT-12

The following procedure should be used in adding small amounts of refrigerant that may have been lost by leaks, or while opening system for servicing the compressor. Before adding refrigerant to replace that lost by leaks, check compressor oil level and add oil if necessary. See ADDING OIL.

NOTE: This procedure will only apply if the air inlet temperature is above 70°F. at the condenser.

1. Remove caps from P.O.A. valve and compressor gauge fittings. Attach gauge set to gauge fittings, making sure Schrader adapter J 5420 is between low pressure gauge hose and suction gauge fitting, and J 5421 is between high pressure gauge hose and discharge gauge fitting.

2. Start engine, turn air conditioning temperature control knob to full cold position, blower control for high speed A/C mode. Operate for ten minutes at 2000 rpm to stabilize system.

3. Observe the refrigerant through the glass cover of receiver-dehydrator with the system operating, to see if there are any bubbles evident.

a. If no bubbles are evident, then bleed system slowly through the discharge valve until bubbles appear in the receiver-dehydrator. Add one pound of refrigerant as explained under CHARGING THE SYSTEM.

b. If bubbles are visible in the receiver-dehydrator with the temperature control knob at the full cold position and the blower at "HIGH" speed, it indicates partial or complete plug in a line, or a shortage of refrigerant, or both. Correct condition. Add refrigerant as explained below until the sight glass clears, then add another one pound of refrigerant.

4. Attach flexible hose from center fitting of gauge set loosely to refrigerant drum or of disposable can valves. Open high and low pressure valves on the gauge set slightly to purge pressure gauge lines of air. Tighten fitting of refrigerant drum or can, when satisfied that all air has been removed from gauge lines. Close (clockwise) both hand shut-off valves of gauge set.

5. Partially charge system.

a. Refrigerant-12 Drum Method.

(1) Place pail containing hot water (not over

not have a temperature exceeding 125°F. on scales, place refrigerant drum in pan containing water, note weight, and only open low pressure valve on gauge set.

(2) Start engine, move temperature control knob to full cold position, and place blower control for high speed. Operate engine for ten minutes at 2000 rpm to stabilize system.

(3) With compressor operating, slowly open valve on refrigerant drum and allow refrigerant to flow into system (through manifold gauge set) until liquid indicator clears up and immediately shut off valve at gauge set or on refrigerant drum. Check weight of refrigerant drum and pail of water. Then slowly open valve on gauge set (or refrigerant drum) and add one more pound of refrigerant. Note total amount of refrigerant added.

b. Refrigerant-12 Disposable Can Method (15 oz. per can).

(1) Make sure the outlet valve on the J 6271 Fitz-All valve is fully clockwise and attach the J 6271 to a "one pound" can of refrigerant as follows: back off the valve from the top of the retainer, slip the valve onto the can and turn the valve into the retainer until tight. DO NOT accidentally open outlet valve during this operation as turning the valve into the retainer punctures the top of the can to make it ready for charging.

(2) Connect center flexible line of gauge set to the fitting on the valve.

(3) Start engine, move temperature control knob to full cold position and blower control for high speed A/C mode. Operate engine for ten minutes at 2000 rpm to stabilize system.

(4) With compressor operating, slowly open valve on refrigerant can and allow refrigerant to flow into system (through manifold gauge set) until liquid indicator clears up and immediately shut off valve at gauge set and on refrigerant can. Check weight of can and valve assembly and record.

(5) Add an additional one pound of refrigerant by adding refrigerant from the can just weighed until can is empty. Attach another can and add refrigerant until can and valve assembly weigh the same as recorded.

8. Close valves at refrigerant drum or can.

7. Test for leaks and make operational check of system as outlined under OPERATIONAL TEST.

CHECKING COMPRESSOR OIL LEVEL AND ADDING OIL

The refrigeration system with the six-cylinder axial compressor requires 11 fluid ozs. of 525 viscosity oil. After the system has been operated, oil circulates throughout the system with the refrigerant. Hence, while the system is running, oil is leaving the compressor with the high pressure gas and is returning to the compressor with the suction gas.

To enhance return of oil to the compressor, under partially depleted refrigerant charge conditions on the custom air conditioning system, an oil bleed line from the bottom of the evaporator to the suction line at the P.O.A. valve has been provided. The core in the bleed line fitting at the P.O.A. valve has a special low force spring in it which allows the core to open a 5 to 12 psi pressure difference. It is important that this core not be replaced with a standard type core.

NOTE: The oil level in the compressor should not be checked as a matter of course, such as is done in the car engine crankcase.

In general, the compressor oil level should be questioned only in cases where there is evidence of a major loss of system oil such as:

a. Broken hose or severe hose fitting leak.

b. Oil sprayed in large amounts under the hood due to a badly leaking compressor seal(s).

c. Collision damage to refrigeration system components.

REPLACING REFRIGERATION SYSTEM COMPONENTS OTHER THAN COMPRESSOR

When refrigerant system components other than the compressor are replaced, the compressor must also be removed and oil drained from the compressor. The amount of oil to put back into the compressor is found as follows: DO NOT add any more oil than is necessary, or maximum cooling will be reduced.

1. Remove the compressor and place in a horizontal position with the compressor drain plug downward, drain compressor in an empty graduated bottle, measure the amount of oil and discard this oil.

2. If the quantity of oil measured is more than 4 fluid ozs., replace into the compressor the same amount of clean oil as the oil drained, plus the following amount for the refrigeration system component being changed.

a. Evaporator-3 fluid ozs.

b. Condenser-1 fluid oz.

c. Receiver-dehydrator assembly-1 fluid oz.

Neglect any fluid oil existing loss in case of line change.

3. If the oil quantity drained from the compressor is less than 4 ozs., replace into the compressor 8 fluid ozs. of clean oil, plus the amount shown above for the respective component replacements.

4. Replace compressor and system components.

5. Evacuate, charge and perform operational test.

REMOVING AND INSTALLING COMPRESSOR

The compressor, when removed, must be closed immediately. If the system has been or can be operated for more than two minutes, circulation of oil from compressor to other components of system will require adjustment of the oil charge in the new compressor as explained above, under REPLACING COMPONENTS OTHER THAN COMPRESSOR.

After draining and measuring the oil from crankcase and head of the compressor removed, amount that has migrated to other parts of the system can be determined by subtracting the amount drained from the original oil charge of 11 fluid ozs. The amount of oil equal to this loss shall be drained from the new compressor before it is installed.

INSTALLING COMPRESSOR

After idling compressor (on car) to be replaced for 10 minutes at 1500-2000 engine rpm, at maximum refrigeration and blower at high speed. DO NOT add any more oil to the compressor than is necessary or maximum cooling will be reduced.

1. Compressor replaced with new compressor.

a. Remove compressor and place in a horizontal position with drain plug downward, drain compressor, measure quantity of oil drained and then discard it.

b. Drain oil from replacement compressor and save it.

c. (1) If amount of oil drained in "a" is more than 4 ozs., place into the new compressor the same amount of oil drained from the replaced compressor.

(2) If amount of oil drained in "a" is 4 ozs. or less, place 6 ozs. of oil in the replacement compressor.

d. Install compressor.

2. Compressor replaced with a field repaired (overhauled) compressor.

a. Proceed as in section 1 above, and then add one extra oz. of oil. (More oil is retained in a drained compressor than one that has been rebuilt.)

REPLACING AN INOPERATIVE COMPRESSOR

In the case when it is not possible to idle the compressor to be replaced to effect oil return to it the following will apply. DO NOT add any more oil than is necessary or maximum cooling will be reduced.

1. Remove compressor from car, drain and measure the oil.

2. If amount drained in "1" above is more than 1-1/2 fluid ozs., subtract this amount drained from the original oil charge of 11 ozs. to obtain "oil loss". Take new compressor assembly and drain from it the amount of "oil loss" above (provided the refrigeration system shows no evidence of a major leak, indicating that little or no oil has been lost from the system. Minor leak indicating very slow leakage.)

3. If the amount drained in "1" above is less than 1-1/2 ozs of oil and/or system appears to have lost an excessive amount of oil then:

a. Disconnect the expansion valve outlet connection (evaporator inlet).

b. Plug suction line connection at P.O.A. valve outlet.

c. Disconnect oil bleed line at P.O.A. valve, using care not to damage line.

d. Connect a cylinder of Refrigerant-12 regulated to not exceed 125 psi to this oil bleed fitting to force any retained oil from the evaporator out the evaporator inlet fitting. (Reverse flush the evaporator.) Catch any oil reverse flushed in this manner. If oil flushed from the system appears clean, install new compressor with 6-7 ounces of oil.

4. If oil drained in "1" above contains any foreign material such as chips, or there is evidence of moisture in the system, replace the receiver-dehydrator assembly and flush all component parts, or replace if necessary. After flushing refrigeration system in this manner, the full oil charge should be left in the new service compressor or 11 ozs. installed in an overhauled or repaired compressor.

COMPRESSOR REMOVAL

1. Connect the high and low pressure gauge lines from the gauge set to the respective connections on the P.O.A. valve and old compressor on the car. Be sure valves on gauge set are fully clockwise to close gauge set to center fitting, that a J 5420 or J 6063 Schrader adapter is between low pressure hose and

suction gauge fitting, and also at the discharge gauge fitting.

2. Remove the flare nut from center connection on gauge manifold or the plug in the gauge line attached to the center connection. Wrap the line at the outlet with a cloth to protect persons and car surfaces from oil or refrigerant.

3. Slowly depressurize refrigeration system.

4. While system is depressurizing remove clutch assembly and coil from old compressor as outlined under COMPRESSOR CLUTCH, COIL AND SEAL REPLACEMENT. If parts are not oil soaked and are in good condition, lay them aside on a clean surface as they may be installed on the new compressor.

5. After the system is completely depressurized, very slowly loosen screw which retains compressor fittings assembly to compressor. As screw is being loosened, work fittings assembly back and forth to break seal and carefully bleed off any remaining pressure.

CAUTION: High pressure may still exist at the discharge fitting. If this pressure is released too rapidly there will be a considerable discharge of refrigerant and oil.

6. When all pressure has been relieved, remove screw and remove fittings assembly and O-ring seals.

7. Immediately cover compressor openings. A simple way is with a plate (similar to the one on new compressor) which can be attached with fittings assembly screw, using the O-rings to provide a seal.

8. Disconnect compressor clutch coil wire and remove compressor mounting plates to bracket bolts, front and rear.

9. If there is any possibility that broken parts from the compressor got into the discharge line or the condenser, all refrigeration system parts should be cleaned and a new receiver-dehydrator assembly should be installed.

10. Drain all oil from compressor just removed in a clean dry container and replace compressor drain plug screw. Measure amount of oil drained. See CHECKING COMPRESSOR OIL LEVEL AND ADDING OIL.

COMPRESSOR REPLACEMENT

NOTE: Before installing a new compressor, rotate compressor shaft four or five times. This permits proper lubrication of compressor seal over all its surface. Before compressor clutch is mounted to the new compressor, wipe the front face of the compressor thoroughly with a clean dry cloth and, if necessary, clean front of compressor with a solvent to remove any excess oil. Cleaning compressor in this manner will prevent any oil from being thrown onto the clutch surfaces which would cause slippage and eventual clutch failure.

1. Stamp refrigerant charge of refrigerant system on new compressor in space on plate provided for this information.

NOTE: Follow procedure for replacing oil in new compressor explained under REMOVING AND INSTALLING COMPRESSOR.

2. Install new compressor on car, leaving compressor fittings opening cover plate on compressor.

3. Remove cover plate over compressor openings very slowly to bleed off pressure.

CAUTION: New compressors are charged with a mixture of nitrogen, Refrigerant-12 and 11 fluid ozs. of Frigidaire 525 viscosity oil. If the cover is removed too rapidly, the oil will be blown out violently with the sudden release of pressure.

4. Install coil and clutch parts if not already installed.

5. Evacuate, charge and perform OPERATIONAL TEST.

COMPRESSOR HUB AND DRIVE PLATE ASSEMBLY

REMOVE AND REPLACE

REMOVE

1. Hold the clutch hub with J 9403 wrench and using J 9399 (special thin wall 9/16" socket), remove hub and drive plate assembly lock nut from shaft (Fig. 1A-4).

2. Screw threaded hub puller J 9401 into the hub. Holding body of tool with a wrench, tighten the center screw to remove hub and drive plate assembly (Fig. 1A-5). Remove J 9401 puller.

3. Remove hub and drive plate assembly retainer ring, using J 5403 (No. 21 Truarc pliers). Remove spacer (Fig. 1A-6).

4. Remove hub and drive plate assembly key from shaft.

REPLACE

1. Insert square drive key into hub of drive plate so it projects approximately 3/16" out of end of keyway (Fig. 1A-7). Wedge into keyway with blunt tool.

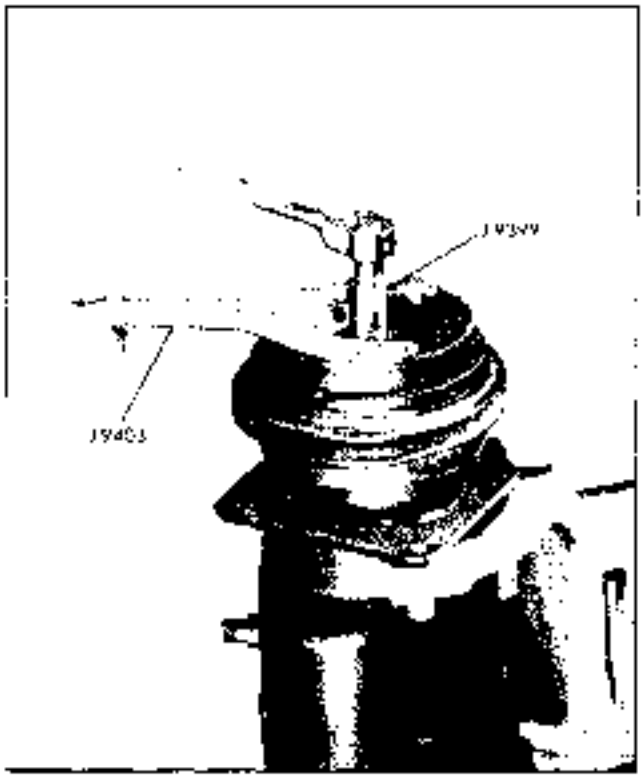


Fig. 1A-4 Removing Hub and Drive Plate Lock Nut

2. Line up key in hub with keyway in shaft.

CAUTION: To avoid internal damage to the compressor, DO NOT drive or pound on hub of drive plate assembly or on end of shaft. If proper tools to remove and replace clutch parts are not used, it is possible to disturb the position of shock plate keyed to main shaft) and result in compressor damage.

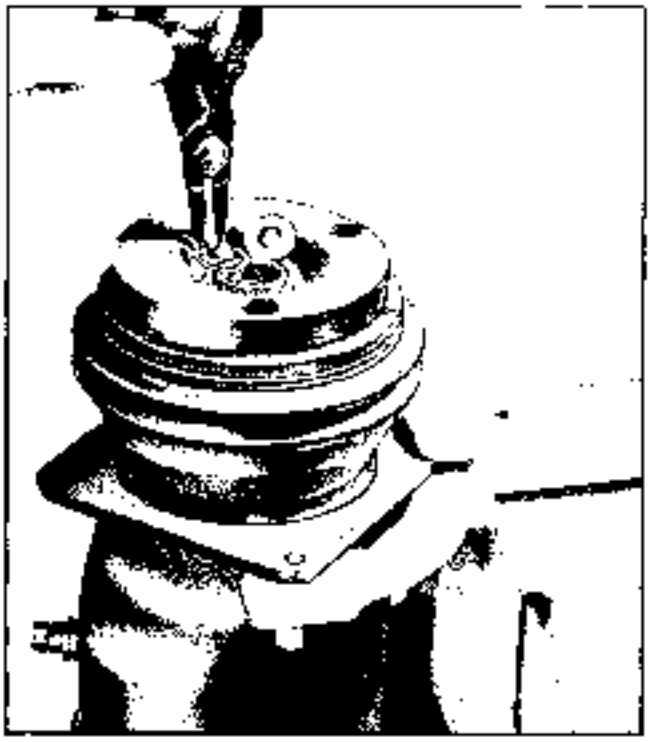


Fig. 1A-6 Removing Hub Retainer and Spacer

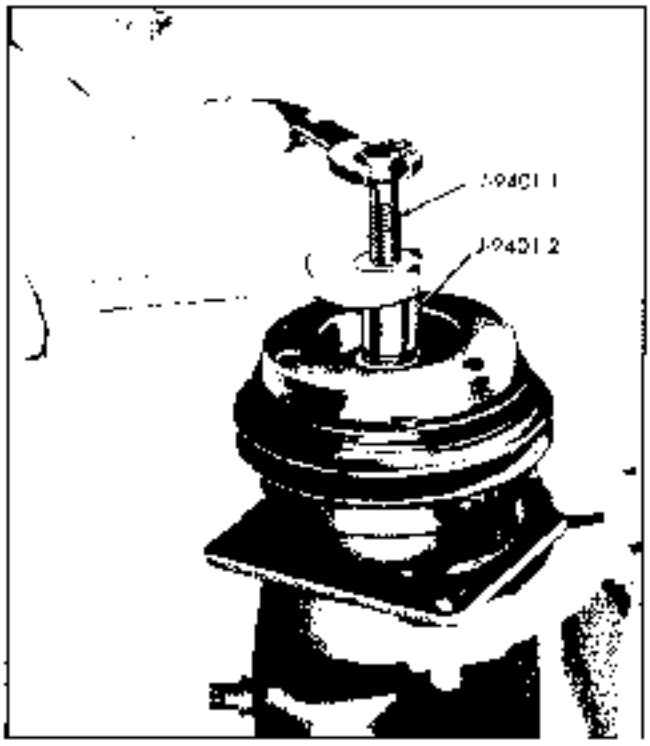


Fig. 1A-5 Removing Hub and Drive Plate Assembly

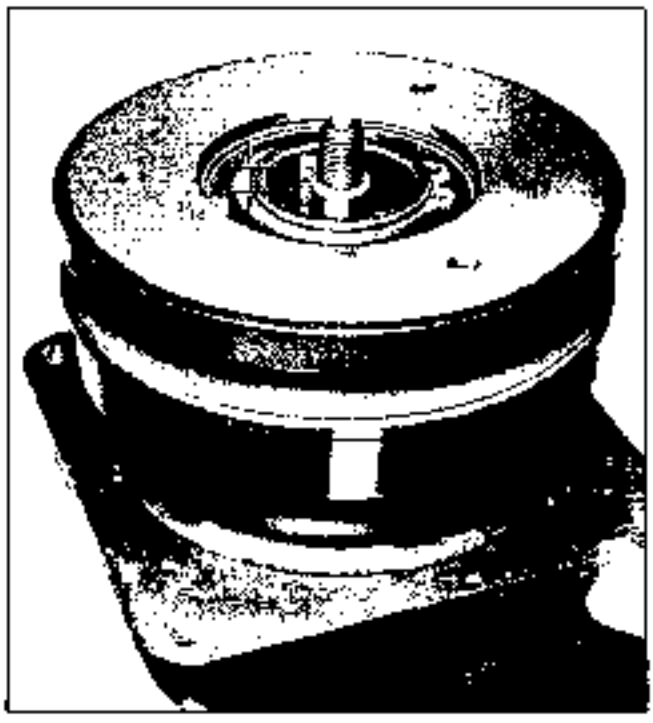


Fig. 1A-7 Proper Position of Hub and Drive Key

3. Position hub and drive plate assembly into compressor front end casting.

4. Place J 9480-2 "free" spacer on hub and drive plate assembly and screw J 9480 drive plate, installing tool on threaded end of compressor shaft approximately three full turns (to prevent tool from forcing key out of keyway).

CAUTION: Make certain key in hub remains in place when pressing hub on shaft!

5. Using wrench on end of tool body and another wrench on hex nut, tighten nut to press hub of drive plate assembly onto shaft approximately 1/4".

6. Remove tool and look into armature plate hub to make certain key remains in place.

7. Install J 9480 and press until there is approximately .002"-.052" (1/32"-1/16") space between the frictional faces of pulley and drive plate (Fig. 1A-8).

8. Remove J 9480 assembly.

9. Install hub spacer washer.

10. Install hub and drive plate assembly retainer ring with flat side of ring facing spacer, using J 5403 (No. 21 Truarc pliers). J 9399 can be used to "snap" retainer ring in place.

11. Install a new armature plate and hub lock nut, using J 9399 (special thin wall 9/16" socket). Tighten to 15 ± 1 lb. ft. torque. The air gap between the friction faces of pulley and drive plate should now be between .002" to .052" (1/32" to 1/16") clearance.

12. Operate engine and refrigeration system with suction pressure of at least 30 psig and discharge pressure at least 150 psig. Cycle clutch (by turning air conditioning off and on) at least twenty times at approximately one-second intervals to "seat" or "run-in" mating parts of clutch.

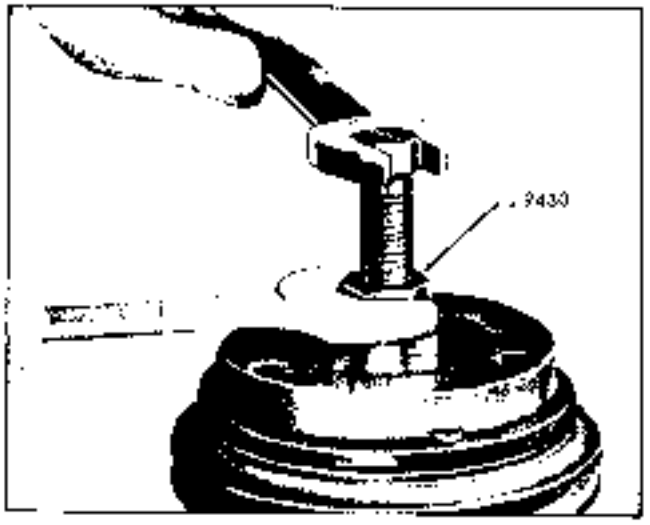


Fig. 1A-8 Installing Hub and Drive Plate Assembly

COMPRESSOR PULLEY AND/OR BEARING ASSEMBLY

REMOVE AND REPLACE—PONTIAC AND TEMPEST

REMOVE

1. Remove hub and drive plate assembly.

2. Remove pulley assembly retainer ring, using J 6435 (No. 26 Truarc pliers) (Fig. 1A-9).

3. Place J 9395 puller pilot over compressor shaft and remove pulley assembly, using J 8433 pulley puller.

4. Remove puller and J 9395 puller pilot.

5. Remove pulley bearing wire retainer ring with an awl or a small screwdriver (Fig. 1A-10).

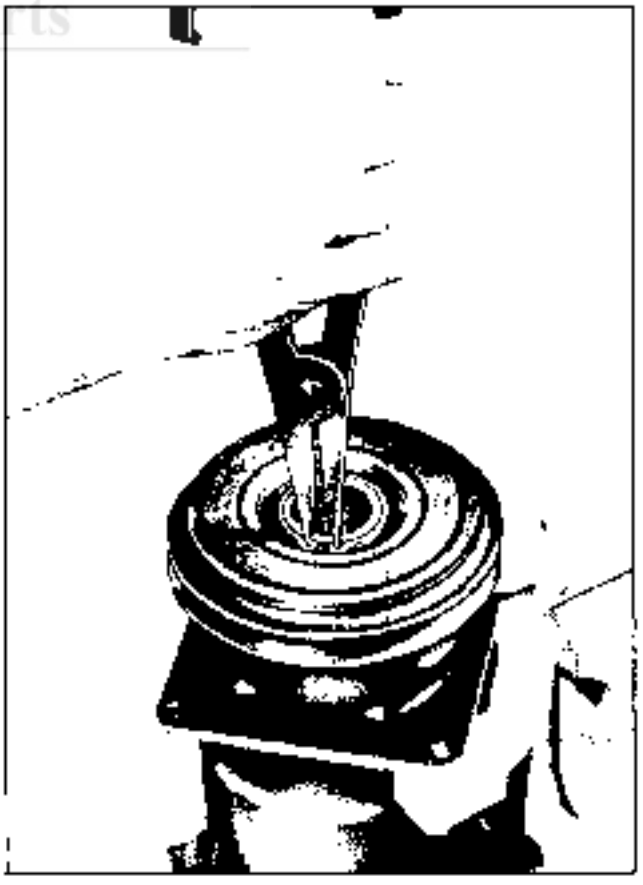


Fig. 1A-9 Removing Pulley and Bearing Assembly Retainer Ring

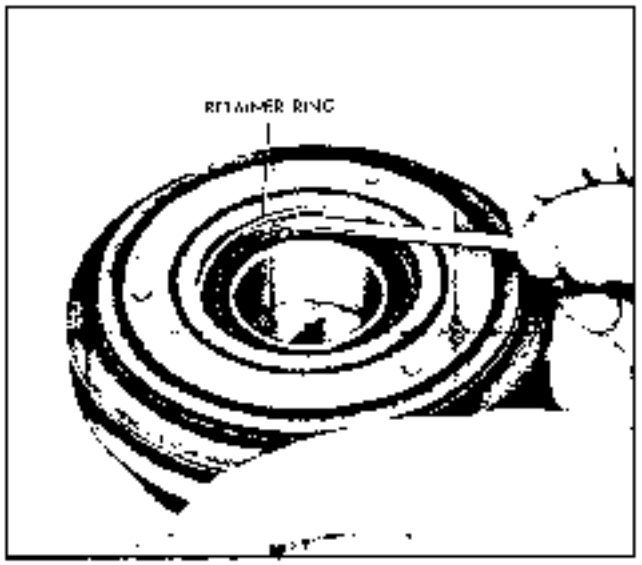


Fig. 1A-10 Removing Pulley Bearing Retainer Ring

6. Remove ball bearing assembly, using J 6646 and J 8092 handle to press out bearing.

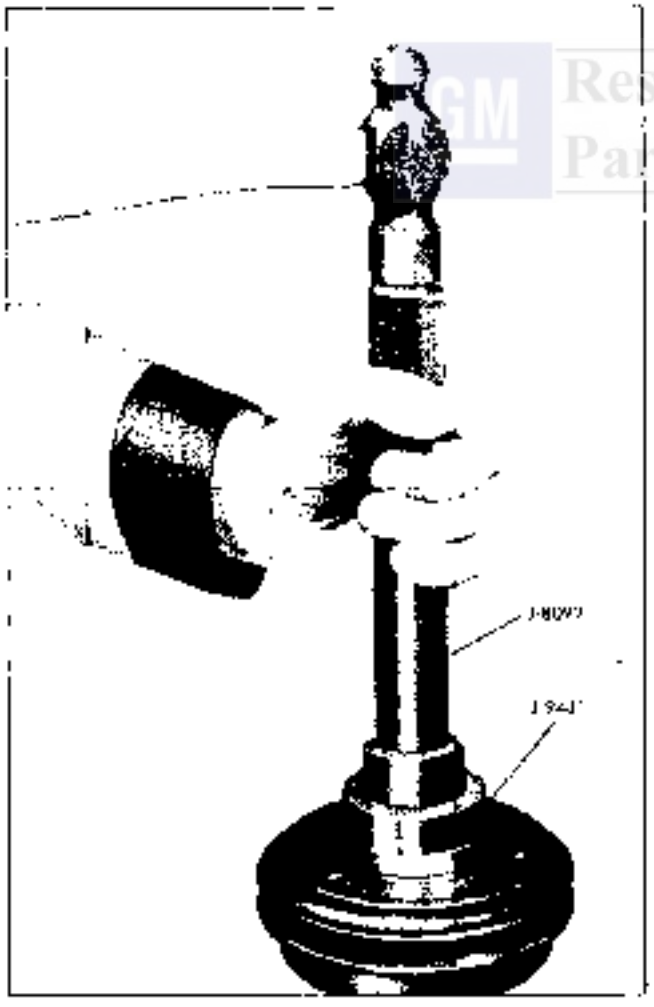


Fig. 1A-11 Installing Pulley Bearing

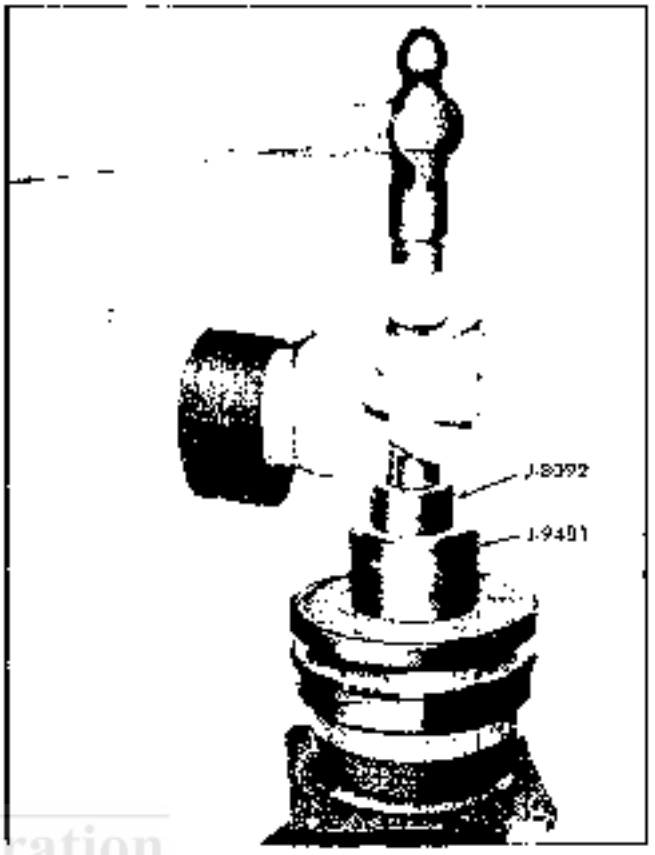


Fig. 1A-12 Installing Pulley Bearing

REPLACE

If the existing pulley and drive plate and hub assembly are to be reused, clean the drive faces on each part with alcohol or similar solvent. If these parts show evidence of warpage due to overheating, they should be replaced.

1. When replacing a new ball bearing assembly into pulley, use J 9481 pulley bearing installer (Fig. 1A-11).

2. Replace the pulley assembly wire retainer ring in pulley.

3. Press or tap pulley and bearing assembly on the neck of the compressor, using J 9481 (Fig. 1A-12).

4. The pulley should rotate freely.

5. Install pulley snap ring retainer, using J 6435 (No. 26 Truarc pliers). Assure installation of snap ring by tapping with J 9481.

6. Replace hub and drive plate assembly, making sure to use the proper tools to replace this assembly. DO NOT drive or pound on hub assembly.

COMPRESSOR CLUTCH COIL AND HOUSING ASSEMBLY

REMOVE AND REPLACE—PONTIAC, TEMPEST AND FIREBIRD

REMOVE

1. Remove hub and drive plate assembly.

2. Remove pulley and bearing assembly.

3. Remove electrical connection plug from terminals on coil.

4. Note position of electrical terminals and scribe location of coil housing terminals on compressor body.

5. Use J 6435 (No. 26 Truarc pliers) and remove coil housing retainer ring (Fig. 1A-13).

6. Remove coil housing assembly.

REPLACE

1. Position clutch coil on compressor front head casting so electrical terminals are in their proper location as previously scribed on compressor body.

NOTE: Make certain coil is properly seated on dowels

2. Replace the coil retainer ring with flat side of ring facing coil, using J 6435 (No. 26 Truarc pliers).

3. Connect electrical connection.

4. Replace pulley and bearing assembly.

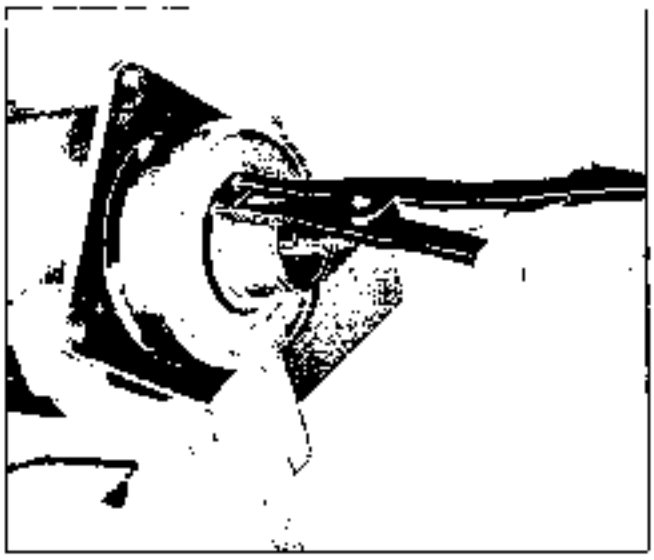


Fig. 1A-13 Removing Coil Housing Retainer Ring

5. Replace hub and drive plate assembly, making sure the proper coils are used to replace this assembly. DO NOT drive or pound on hub assembly.

REMOVE COMPRESSOR ASSEMBLY TO SERVICE ENGINE—PONTIAC AND TEMPEST

1. Disconnect compressor clutch coil ground wire at compressor and wire connector at coil.

2. Remove compressor drive belt.

3. Remove compressor rear brace to cylinder head brace bolt at compressor mounting bracket.

4. Remove compressor front plate to mounting bracket upper bolts and lower adjusting bolt.

5. Remove compressor rear plate to mounting bracket lower adjusting bolt.

6. Pad fender and fender skirt and place compressor near top of fender skirt, securing compressor to right fender brace (with wire, rope or similar means).

CAUTION: Do not kink any hoses or place excessive tension on the hose

7. Replace by reversing the above procedure.

8 Tighten compressor belt to give 100-105 lbs. indicated on the Borroughs Belt Tension Gauge.

COMPRESSOR SHAFT SEAL ASSEMBLY

REMOVE AND REPLACE

NOTE: When refrigeration system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor if oil was sprayed or large amounts due to leaks or broken shaft seal. See "Checking Compressor Oil Level and Adding Oil".

REMOVE AND REPLACE SHAFT SEAL

NOTE: Compressor shaft seals, other than those replaced during a compression unit test, are to be replaced only on the basis of actual refrigerant leakage as determined by test with a propane torch type leak detector in good condition.

REMOVE

1. Depressurize refrigeration system.

2. Remove hub and drive plate assembly, and shaft key.

3. If the compressor has an absorbent sleeve in neck, pry out sleeve retainer and remove sleeve.

4. Remove shaft seal seat retaining ring, using J 5403 (No. 21 Truarc pliers) (Fig. 1A-14).

5. Thoroughly clean the inside of compressor neck area surrounding shaft, exposed portion of seal seat, and shaft itself. This is absolutely necessary to prevent any dirt or foreign material from getting into compressor.

6. Remove shaft seal seat, using J 9393-1 and 2 to grasp flange on seal seat (Fig. 1A-15). Pull straight out at end of tool to remove seal seat.

7. Engage tabs on shaft seal assembly with locking tangs on J-9392 seal installer and remover. Press down on tool and twist clockwise to engage seal. Remove seal assembly by pulling straight out from shaft (Fig. 1A-16).

8. Remove O-ring from interior of compressor neck using J 9553. (A wire with a hook formed on end may be used. This hook may be made in a manner shown in Figure 1A-17.

9. Re-check the shaft and inside of the compressor neck for dirt or foreign material and be sure these areas are perfectly clean. Before installing new parts,

REPLACE

1. Coat the new seal seat O-ring with clean refrigeration oil and install it in its groove in the compressor neck. Tool J 21508 may be used.

2. Place seal protector J 22974 over end of the shaft. Coat the O-ring and seal face of the new seat assembly with clean refrigeration oil and install new seal assembly on the shaft, using J-9392.

3. Coat the seal face of the new seal seat with clean refrigeration oil and install the new seal seat.

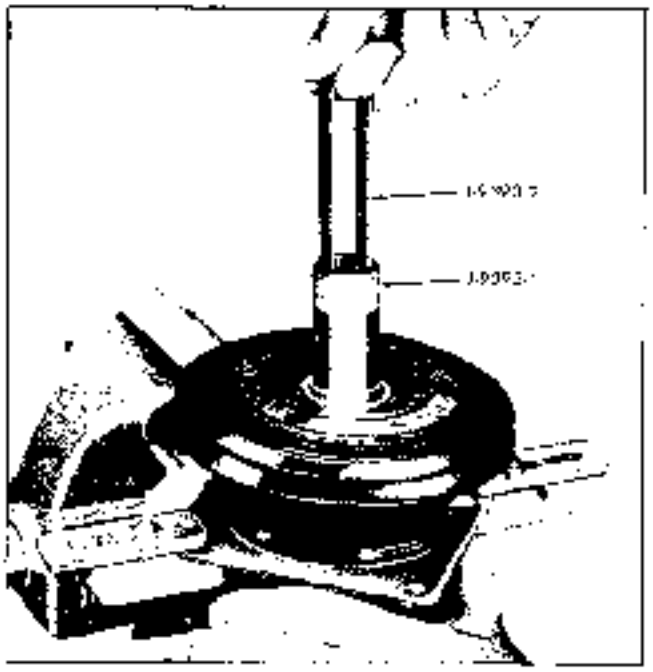


Fig. 1A-15 Removing Shaft Seal Seat

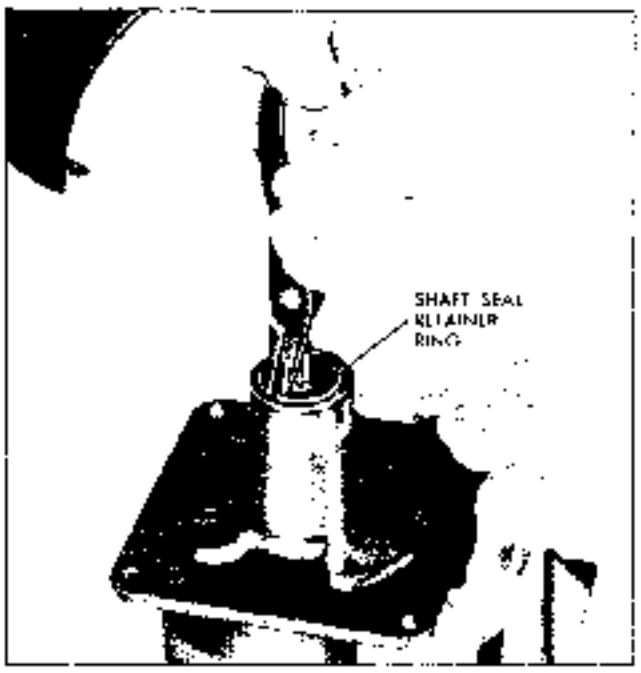


Fig. 1A-14 Removing Shaft Seal Seat Retainer

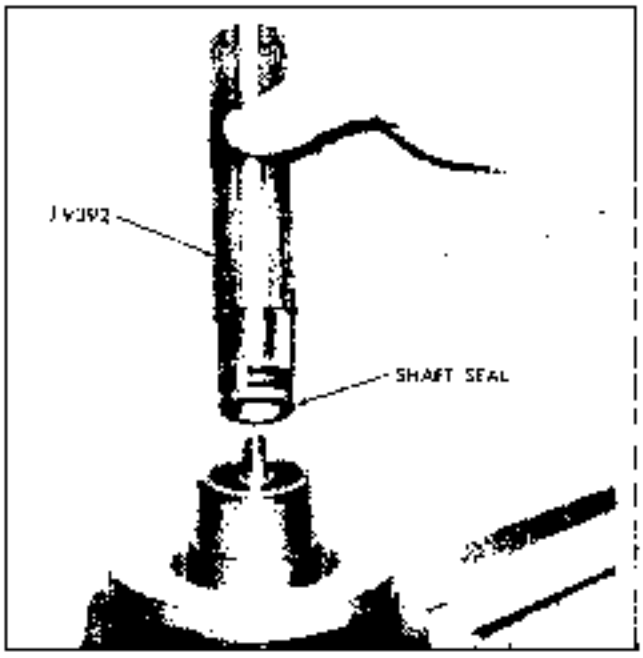


Fig. 1A-16 Removing Shaft Seal Assembly

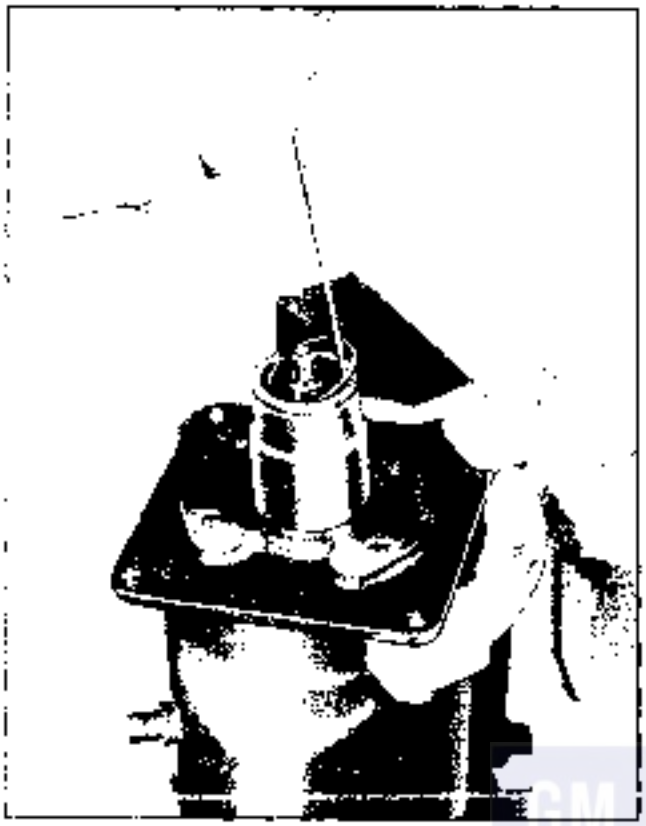


Fig. 1A-17 Removing O-Ring Seal

using J 9393-1 and 3. Be sure the seal seat O-ring is not dislodged and seal seat is making a good seal with O-ring.

4. Install new seal seat retainer ring, using J 5403 (No. 21 Tri arc pliers), with flat face against seal seat. The sleeve from J 9393 may be used to press on retainer ring so that it snaps into place. Remove seal protector J 22074 from the end of shaft.

5. Leak test compressor and correct any leaks found.

6. Wipe out any excess oil inside the compressor neck and on the shaft, resulting from installing the new seal parts.

7. Install new absorbent sleeve by rolling the material into a cylinder, overlapping ends, and slipping sleeve into compressor neck with overlap toward the top of compressor. With a small screwdriver or similar instrument carefully spread sleeve to remove the overlap so that in the final position the ends of sleeve will butt at top vertical centerline.

8. Position new metal sleeve retainer so that its flange face will be against the front end of the sleeve. Tool J 9395 or the sleeve from J 9393 may be used to install the retainer. Press and tap with a mallet, setting the retainer and sleeve into place, until the outer edge of the retainer is recessed approximately 1/32" from the face of the compressor neck.

9. Re-install the hub and drive plate assembly.

10. Evacuate and charge refrigeration system.

11. Perform operational test.

COMPRESSOR ASSEMBLY—OVERHAUL

INTRODUCTION

These operations are based on the use of recommended service tools and on condition that an adequate stock of service parts to select from is available.

Service parts should include:

1. Standard size piston drive balls.

2. Shoe discs—total of 10 sizes, including ZERO shoe.

3. Thrust races—total of 14 sizes, including the ZERO race.

4. Pistons—both standard head and re-expansion heads.

5. Main shaft needle bearings.

6. Thrust bearings.

7. Compressor shaft, swash plate and Woodruff key assembly.

8. Service cylinder assembly—front, rear halves, with main bearing in place and halves dowel-pinned together.

9. Major interior mechanism assembly.

10. Suction reed valve—front, rear.

11. Discharge valve assembly—front, rear.

12. Gasket kit—service containing all gaskets, seals, O-rings, etc. This is to be used each time a compressor is rebuilt after a teardown.

13. Shaft seal kit.

14. Nuts—head to shell and shaft.

15. Ring—retainers.

16. Cylinder locator pins.

17. Valve and head locator pins.

18. Service type—discharge crossover tube kit.

A clean work bench, orderliness of the work area and a place for all parts being removed and re-

placed is of great importance. Any attempt to use makeshift or inadequate equipment may result in damage and/or improper operation of compressor.

PRESERVATION AND PACKING SERVICE PARTS

All parts required for servicing will be protected by a preservation process and packaged in a manner which will eliminate the necessity of cleaning, washing or flushing of the parts. The parts can be used in the mechanism assembly just as they are removed from the service package.

In addition, some parts will be identified on the piece part to denote its size or dimension. This will apply to the piston shoe discs and the shaft thrust races.

To provide suitable and adequate quantities and grouping of parts for servicing the compressor, kits are available which will contain these necessary parts. The gasket kit should be used whenever it is necessary to overhaul or rebuild entire compressor internal mechanism, or when replacing some individual internal part.

OVERHAUL COMPRESSOR

Anytime a major overhaul or rebuilding operation is to be performed on this compressor, obtain and install compressor gasket kit. This kit includes all of the necessary O-rings and gaskets. Obtain also, an ample supply of piston rings.

1. Remove drive plate and hub assembly.

2. Remove pulley and bearing assembly.

3. Remove clutch coil and coil housing assembly.

4. Remove compressor assembly, leaving fittings assembly attached to refrigerant lines. Keep compressor horizontal at all times. Placing the compressor on either end will allow oil from the compressor sump to enter the head.

5. Seal compressor fittings opening and openings in compressor rear head.

6. Thoroughly clean exterior of compressor assembly and blow dry with compressed dry air.

7. Clean compressor assembly on clean, dry work bench.

NOTE: Under NO circumstances should compressor be placed on the pulley end.

COMPRESSOR REAR HEAD ASSEMBLY

REMOVE

1. Remove compressor oil plug, tilt compressor and drain oil into clean dry container. It may be possible to get only 4 to 6 ozs. of oil from the compressor at this time.

2. Attach J 9396 holding fixture to compressor and mount in vise.

3. Remove compressor pressure relief valve.

4. Remove four lock nuts from threaded studs welded to compressor shell and remove rear head.

NOTE: Some oil may drain when the head is removed.

5. Examine teflon surface on the rear head casting webs. If any damage is observed, the head should be replaced (Fig. 1A-18).

6. Remove suction screen and examine for damage or contamination. Clean or replace as necessary.

7. Remove oil pump gears noting how they are mated (end-to-end) and inspect for damage. Replace both gears if one or both show damage. Keep gears mated as they were when removed.

8. Remove rear head to compressor shell O-ring seal and inspect for damage, cuts, nicks or imperfections. A damaged seal may be the cause of a refrigerant leak. In any event, this O-ring seal must be replaced with a new one.

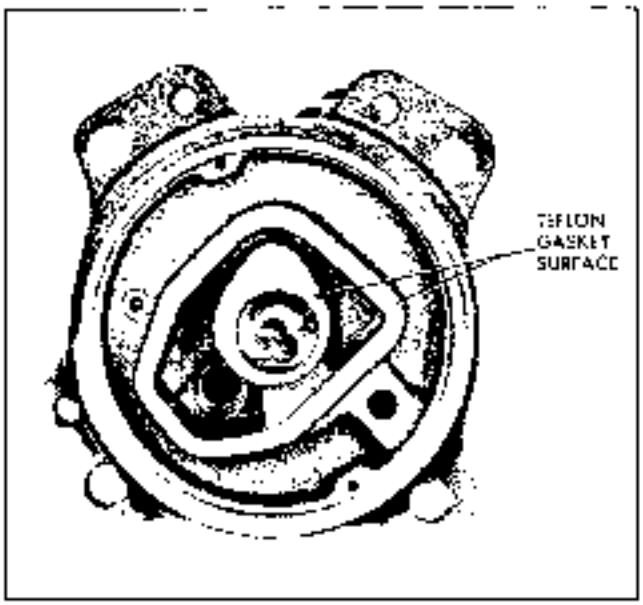


Fig. 1A-18 Sealing Surface on Head Casting Web

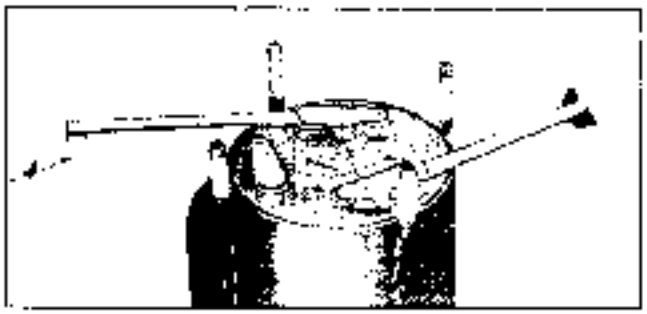


Fig. 1A-19 Removing Discharge Valve Plate

9. Carefully remove rear discharge valve plate assembly by prying up on assembly (Fig. 1A-19), and examine discharge valve reeds and seats. Replace entire assembly if excessively scored or if any one of the three reeds is broken or seats are damaged.

10. Carefully remove rear suction reed and examine for any damage. Replace if necessary (Fig. 1A-20).

COMPRESSOR MAJOR INTERIOR MECHANISM

REMOVE, INSPECT AND CHECK

1. Remove shaft seal seat retaining ring, using J 4245 (No. 23 Truarc pliers).

2. Remove shaft seal seat, using J 9389-1 and 2 to grasp flange on seal seat. Pull straight out at end of tool to remove seal seat.

3. Engage tabs on compressor shaft seal assembly with locking tangs on J 9392 seal installer and remover. Press down on tool and twist clockwise to engage seal. Remove seal assembly by pulling straight out from shaft.

4. Remove O-ring from interior of front head casting bore. (A wire with a hook formed on the end may be used. This hook may be made in a manner as shown in Fig. 1A-17)

5. Remove oil inlet tube and O-ring, using a wire with a hook formed on one end (Fig. 1A-21).

6. Push on front end of compressor head to remove mechanism from rear of shell. DO NOT hammer on end of compressor shaft or use undue force to remove the compressor internal mechanism. This assembly will slide out easily.

NOTE: Some oil will drain from compressor when mechanism assembly is removed.

7. Remove compressor front head casting assembly from compressor shell. Examine sealing surface for damage and/or deep scratches. Replace if necessary.

8. Remove compressor front head casting to shell O-ring seal and inspect for damage, cuts, nicks or imperfections. A damaged seal may be the cause of a refrigerant leak. In any event, this O-ring must be replaced with a new one.

9. Remove the front discharge reed plate and suction reed and examine for damage.

10. Examine mechanism for any obvious damage. Turn compressor shaft and check for smoothness of operation as well as for any scratches in bores, etc.

NOTE: If mechanism has sustained major damage due possibly to loss of refrigerant and/or oil, it may be necessary to use the service interior mechanism or the service cylinder assembly rather than replace individual parts.

11. Remove suction crossover cover by sliding out of slots.

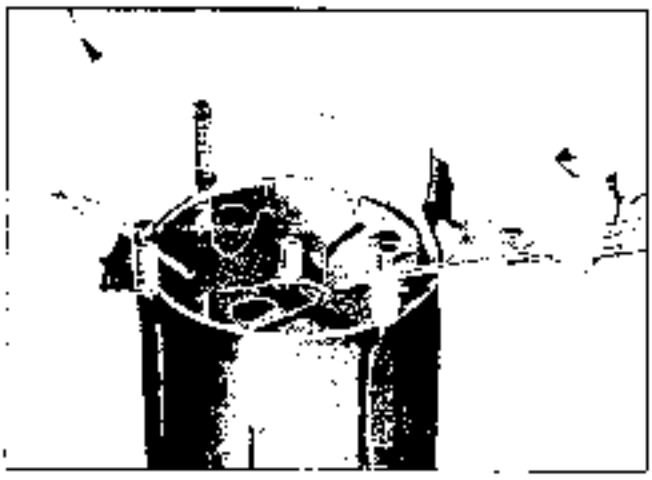


Fig. 1A-20 Removing Suction Reed

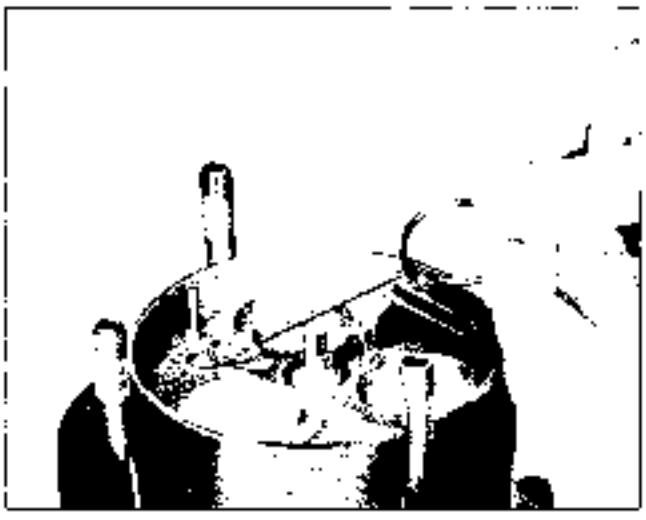


Fig. 1A-21 Removing Oil Inlet Tube

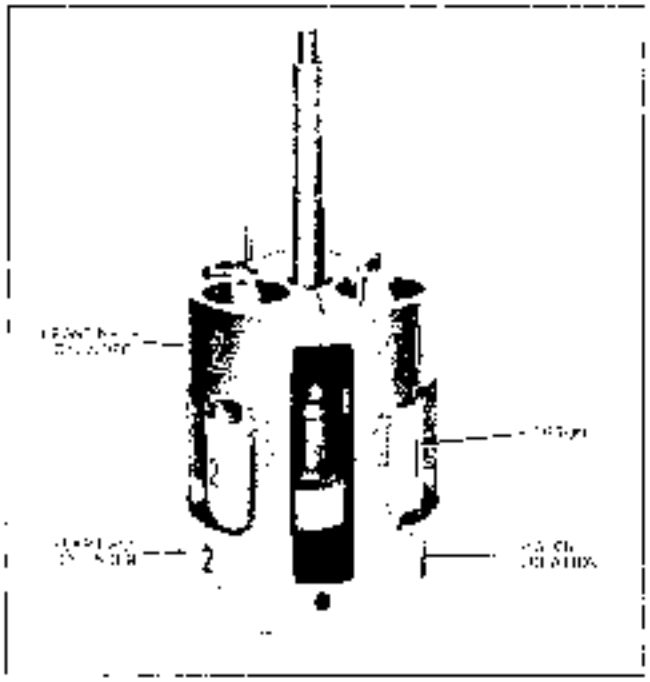


Fig. 1A-22 Pistons and Cylinder Bores Numbered

DISASSEMBLE

(Obtain clean J 9402 assembly parts tray to retain compressor parts during disassembly.)

1. Number pistons (1, 2 and 3) and their bores so parts can be replaced in their original locations (Fig. 1A-22).

2. Turn compressor shaft to position swash plate towards front of compressor in area of discharge crossover tube. Using J 9402, drive discharge crossover tube out of rear head assembly toward front of compressor or use a wooden block as shown in Fig. 1A-23. DO NOT drive toward rear of compressor as discharge crossover tube may damage swash plate.

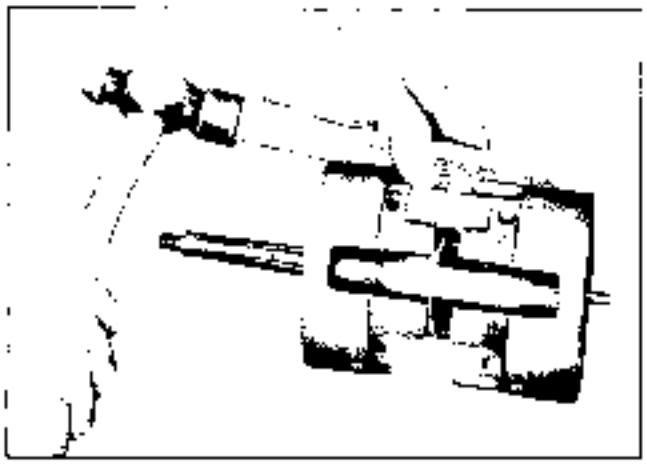


Fig. 1A-23 Separating Cylinder Halves

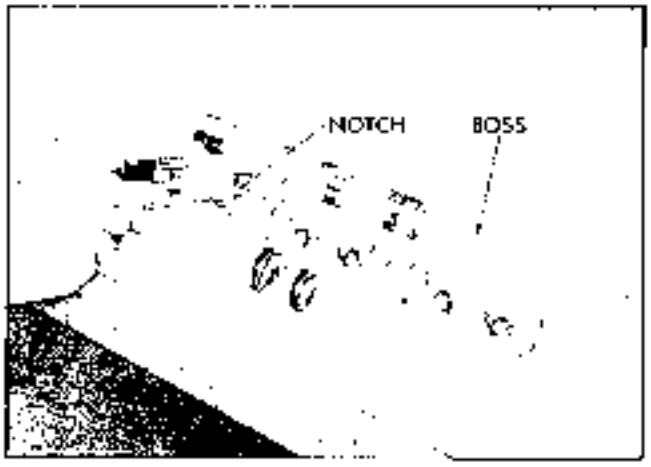


Fig. 1A-24 Compressor Parts in Tray

3. Separate front and rear cylinder assemblies being careful not to damage any parts during separation.

4. Remove rear half cylinder from pistons.

5. Drive discharge crossover pipe from front head, using J 9402.

6. Push on compressor shaft and carefully remove pistons, piston rings, shoes and balls; one assembly at a time. Place parts in the J 9402 tray to keep parts together (Fig. 1A-24). The front end of piston has an identifying notch in the casting web (Fig. 1A-25).

7. Remove all piston shoe discs, examine for indication of failure or probable cause of failure, then discard all shoe discs.

8. Examine piston balls and, if satisfactory for reuse, put aside in assembly tray in compartment associated with proper end of piston.

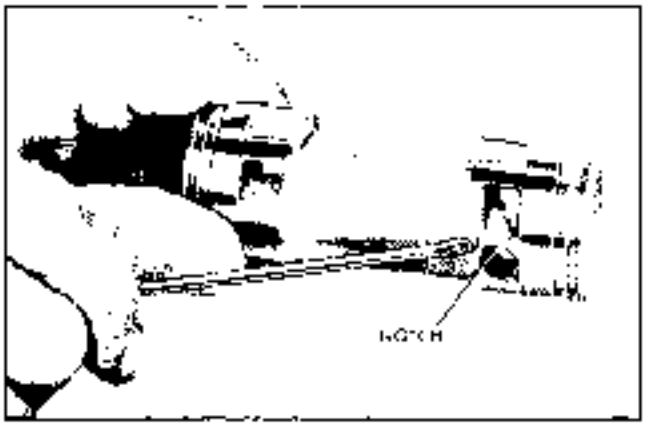


Fig. 1A-25 Identification of Front End of Piston

9. Remove rear combination of thrust races and thrust bearing. Discard all three pieces (Fig. 1A-26).

10. Push on shaft to remove shaft from front ball cylinder.

11. Remove front combination of thrust races and thrust bearing. Discard all three pieces.

12. Examine swash plate surfaces for excessive scoring or damage. If satisfactory, reuse. If necessary, replace main shaft and swash plate assembly.

13. Wash all parts to be reused in a tank of clean alcohol or similar solvent. Blow dry all parts using a source of clean, dry air.

14. Examine the front and rear cylinder halves and replace if cylinder bores are deeply scored or damaged.

NOTE: The service cylinder assembly will contain a front and rear half doweled together. This assembly will also include two main bearings and a needle bearing pressed into the proper location in the front half and the valve in its proper location in the rear half.

15. Check main shaft bearings for roughness and replace as necessary. Use J 9432 to replace bearings.

GAUGING FOR NEW PARTS

Obtain the parts discussed in the introduction of this section.

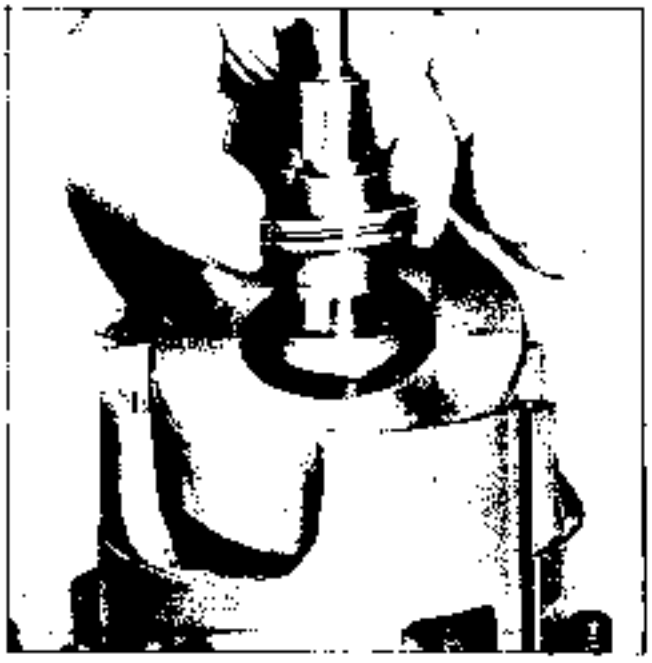


Fig. 1A-26 Removing Rear Thrust Races and Bearings

NOTE: If thrust bearings and races are to be replaced, use parts as indicated below; otherwise use existing bearings and races.

1. Secure four ZERO thrust races, three ZERO shoe discs and two new thrust bearings.

2. Stack a ZERO thrust race, a new needle thrust bearing and a second ZERO thrust race. Assemble this "sandwich" of parts to FRONT end of compressor main shaft.

3. Place FRONT half of cylinder on J 9367 compressing fixture. Insert threaded end of shaft (with front bearing assembly) through front main bearing and allow thrust race assembly to rest on hub of cylinder.

4. Stack a ZERO thrust race, a new thrust bearing and a second ZERO thrust washer. Assemble this "sandwich" of parts to REAR of compressor main shaft so it rests on hub of swash plate (Fig. 1A-28).

5. Apply a light coat of clean refrigerant oil to ball pockets of each of three pistons.

6. Place balls in piston pockets.

7. Apply a light coat of clean refrigerant oil to cavity of three new ZERO shoe discs.

8. Place a ZERO shoe over each ball in FRONT end of piston. Front end of piston has an identifying notch in casting web (Fig. 1A-30).

9. Place a ball only in rear ball pocket of each of three pistons (Fig. 1A-29).

NOTE: Do not assemble any piston rings at this time.

10. Rotate shaft and swash plate until high point of swash plate is over piston cylinder bore, which had been identified as No. 1. Insert front end of No. 1 piston (notched end) in cylinder bore (toward the front of compressor) and at same time, place front ball and shoe and rear ball only over swash plate (Fig. 1A-31).

NOTE: It may be necessary to lift shaft assembly to aid in installing pistons. Hold front thrust bearing pack tightly against swash plate hub while lifting shaft (Fig. 1A-30).

11. Repeat this operation for No. 2 and No. 3 pistons. Balls and shoes must adhere to piston during this assembly.

12. Align rear cylinder casting with bores, suction passage, discharge crossover holes, dowel pins, etc. Tap into place using a hard wood or plastic block and mallet (Fig. 1A-31).

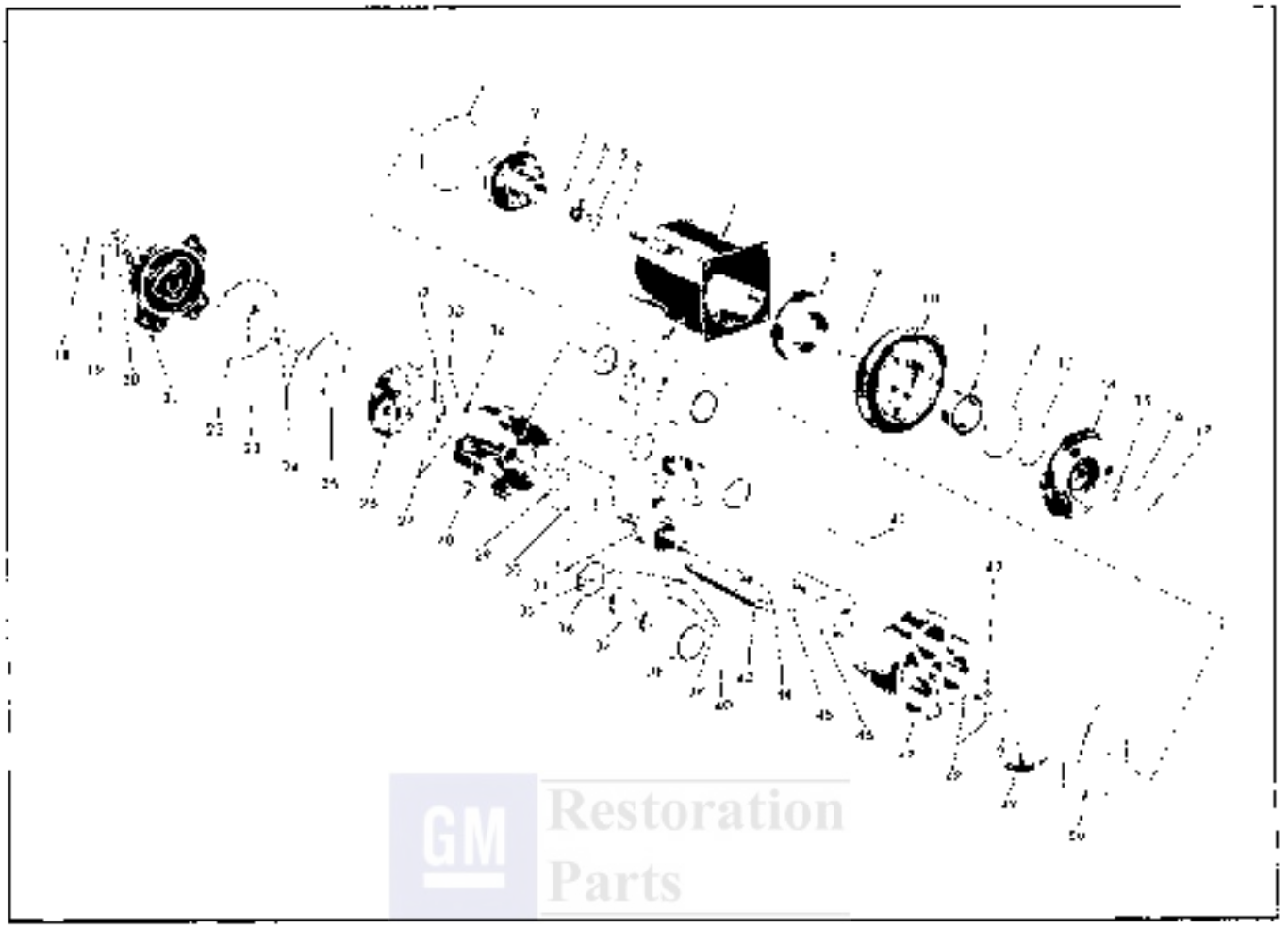


Fig. 1A-27 Exploded View - Compressor Assembly

1. Front Head to Shell O-Ring
2. Front Head Assembly
3. Seal Seat O-Ring
4. Shaft Seal Assembly
5. Shaft Seal Seat
6. Seal Seat Retainer Snap Ring
7. Compressor Shell
8. Clutch Coil
9. Clutch Coil Snap Ring
10. Pulley Assembly
11. Pulley Bearing
12. Pulley Bearing Retainer Ring
13. Pulley Bearing to Shell Ring
14. Armature Plate and Hub Assembly
15. Armature Plate and Hub Spacer
16. Armature Plate and Hub to Mainshaft Spacer Retainer
17. Armature Plate and Hub Lock Nut
18. Fittings O-Ring
19. Rear Head to Shell Locking Nut (4)
20. High Pressure Relief Valve and O-Ring
21. Rear Head Assembly
22. Rear Head to Shell O-Ring
23. Inlet Screen
24. Oil Pump Gears
25. Rear Discharge Plate Assembly
26. Rear Suction Reed
27. Discharge Crossover Tube Spacer and Gasket
28. Cylinder-Rear Half
29. Rear Thrust Bearing Selective Races
30. Rear Thrust Bearing
31. Swash Plate and Mainshaft Assembly
32. Mainshaft Rear Bearing
33. Oil Pick-Up Tube
34. Oil Pick-Up Tube O-Ring
35. Piston Drive Ball (6)
36. Piston Ring (6)
37. Piston (6)
38. Piston Ring
39. Piston Drive Ball
40. Piston Ball Shoe (6)
41. Suction Crossover Cover
42. Mainshaft Front Bearing
43. Discharge Crossover Tube
44. Armature Plate and Hub to Mainshaft Key
45. Front Thrust Bearing Selective Races
46. Front Thrust Bearing
47. Cylinder-Front Half
48. Discharge Crossover Tube Gasket and Spacer
49. Front Suction Reed
50. Front Discharge Plate Assy.
51. Abradant Sleeve
52. Sleeve Retainer

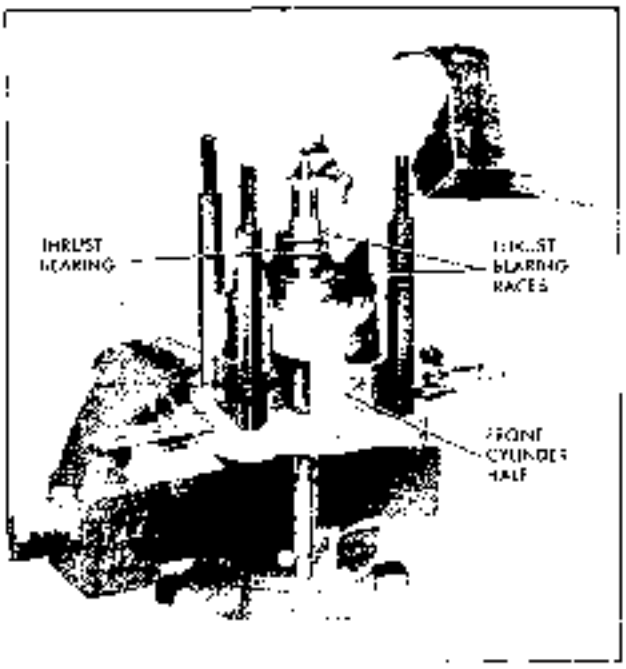


Fig. 1A-28 Meinecke Thrust Bearing Installed

13. Place cylinder assembly in J 9397 compressing fixture with front of compressor shaft pointing down, positioning discharge inlet opening between fixture bolts. This will permit access for the feeler gauge. Assemble fixture head ring and nut to the cage, tighten nuts evenly to 25 lb. ft. torque (Fig. 1A-32).

14. Use a leaf-type feeler gauge to check clearance between REAR ball and swash plate for each position as follows:

a. Use J 8661 gauge set selecting a suitable feeler gauge leaf until the result is a 4 to 8 oz.

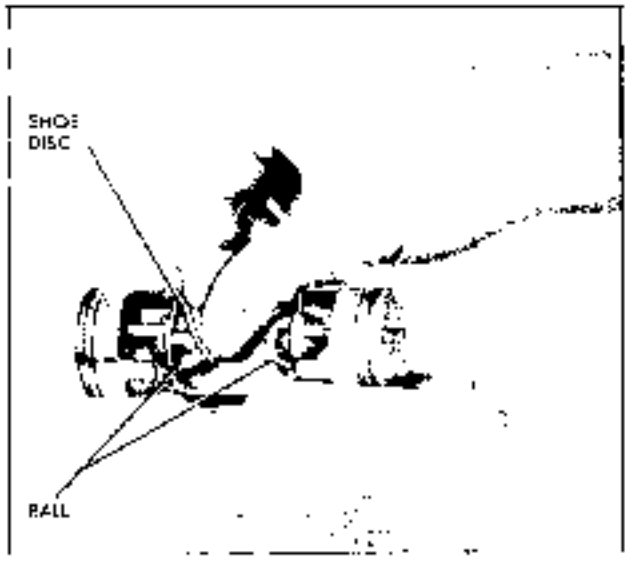


Fig. 1A-29 Zero Shoe and Ball at Front of Piston

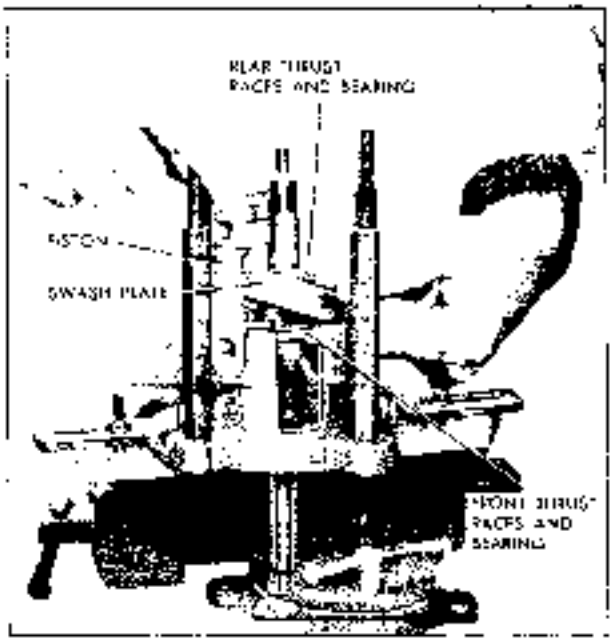


Fig. 1A-30 Installing Piston with Balls

pull on the scale between ball and swash plate (Fig. 1A-33). If the pull is just less than 4 ozs., add .0005" to the thickness of the feeler stock used to measure the clearance. If the pull on the scale reads just over 8 ozs. then subtract .0005" from the thickness of the feeler stock. Select a shoe accordingly.

b. Rotate the shaft approximately 120° and make a second check with feeler gauge between same ball and plate.

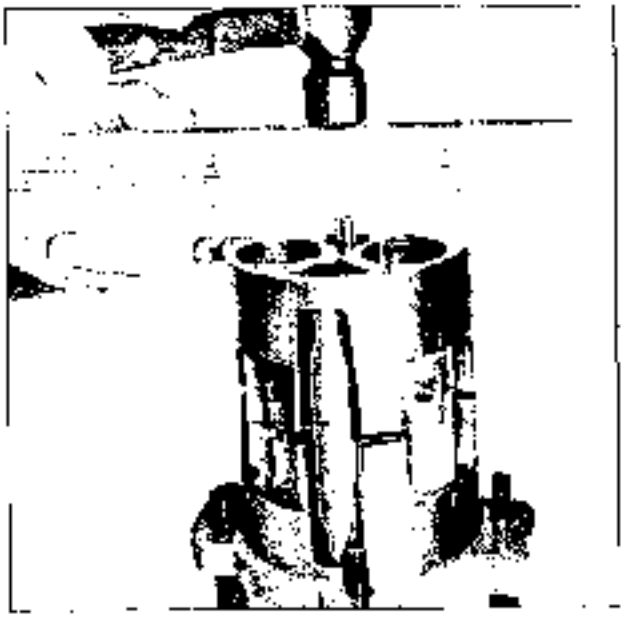


Fig. 1A-31 Installing Rear Cylinder Half or Front Cylinder Half

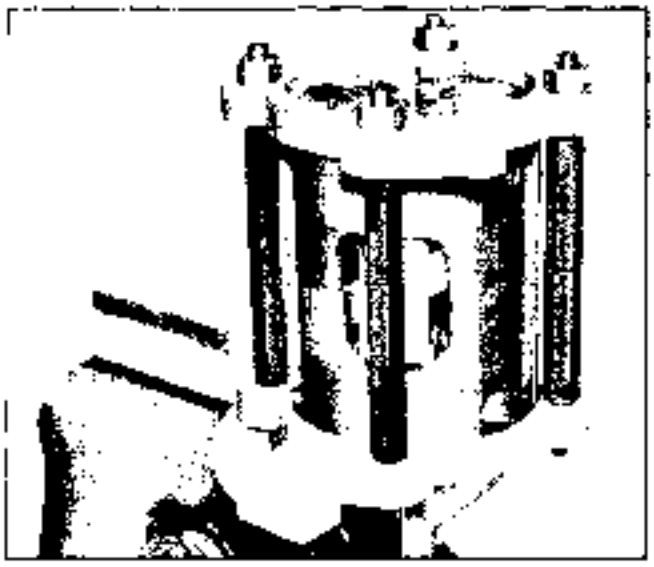


Fig. 1A-32 Internal Mechanism in Fixture

c. Rotate shaft again approximately 120° and repeat check with feeler gauge between these same parts.

d. From this total of three checks between the same ball and swash plate at 120° increments on swash plate for each piston, use the minimum gauge reading to select a numbered shoe to correspond to this reading (Fig. 1A-34).

NOTE: A selection will be made from shoe pack ages shown in Fig. 1A-24, which will provide a .0005" to .0010" total clearance between shoes and the swash plate at the tightest point throughout its 360 rotation. The reading of Feeler Gauge will correspond to the last three numbers of the part number of the part to be used.

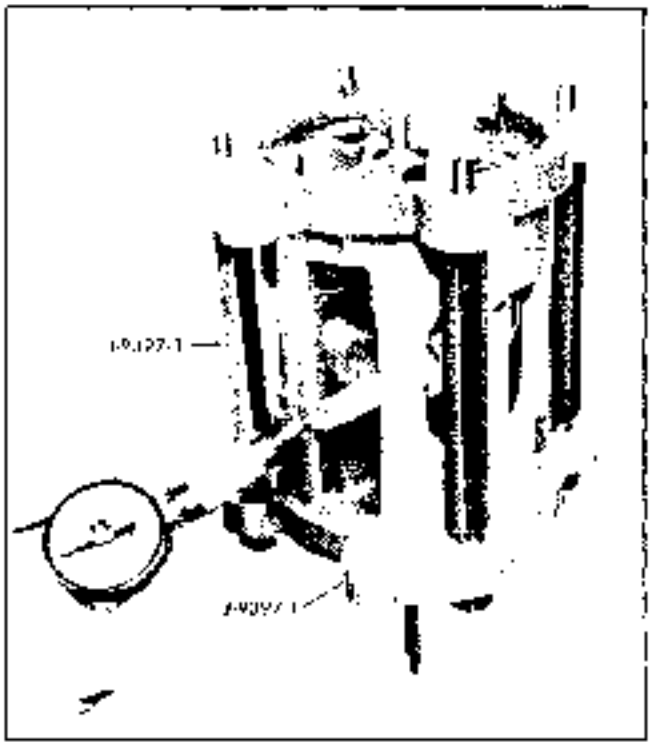


Fig. 1A-33 Measuring for Proper Shoe

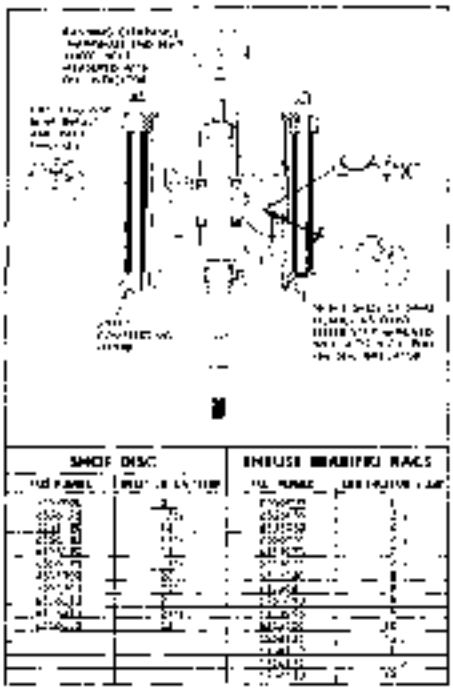


Fig. 1A-34 Measurements and Tools of Available Service Shoes and Thrust Faces

Once proper selection of shoes has been made, it is imperative that the matched combination of shoe to ball and spherical cavity in the piston be kept intact during disassembly after gauging operation and final reassembly of mechanism. An assembly parts tray (J 9402) with individual compartments for each component of the mechanism will keep parts in their proper relationship.

e. Mark piston number (1, 2 or 3) on shoe package.

f. Place shoes in J 9402 assembly tray in compartment corresponding to piston number and rear ball pocket position.

g. Repeat in detail same gauging procedure explained above for each of the other two pistons.

15. The next gauging operation is to determine space between REAR thrust bearing and upper or outer-rear thrust race. Check compressor shaft end play as follows (Fig. 1A-35).

a. Mount dial indicator to read clearance at end of compressor shaft.

b. Move compressor shaft along its longitudinal axis and measure end play.

Fig. 1A-35 Checking Compressor Mainshaft End Play

NOTE: Apply pull hand forces at end of mainshaft a few times before reading clearance. This will help squeeze the oil out from between mating parts.

c. An alternate method of selecting a proper race is to use J 9687 gauge for selecting a suitable feeler gauge leaf until the result is a 4 to 6 oz. pull on the scale between the rear thrust bearing and upper (or outer rear) thrust race (Fig. 1A-36). If the pull is just less than 4 ozs., add .0005" to the thickness of the feeler stock used to measure the clearance. If the pull on the scale reads just over 6 ozs., then subtract .0005" from the thickness of the feeler stock. Select a race accordingly.

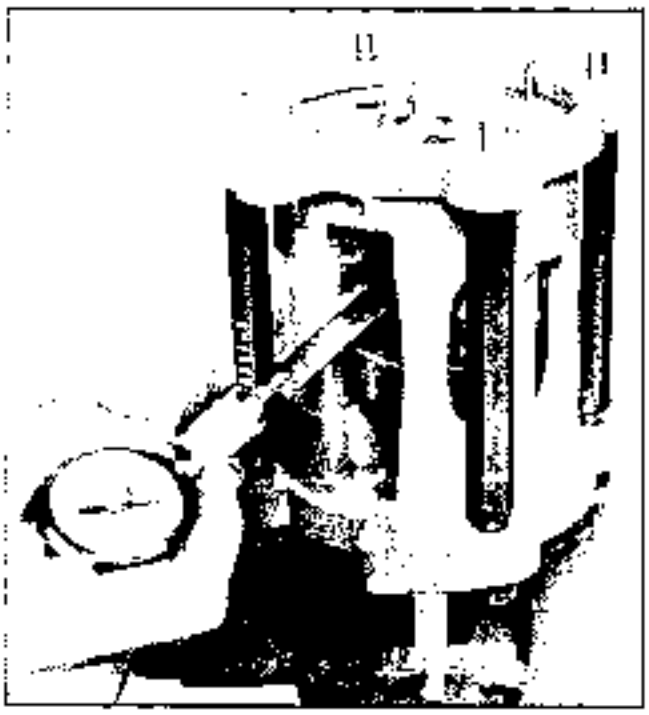


Fig. 1A-36 Measuring for Proper Thrust Race

d. Select from stock a numbered thrust race that corresponds to dial indicator reading (Fig. 1A-37).

NOTE: Thrust races are made of steel and ground to a fixed thickness. A total of fourteen thrust races are available for field service. They will have increments of .0005" thickness to provide the required clearance.

The thrust races will be identified on the part by their thickness, and the number on thrust race will correspond to the last three digits of the piece part number.

If an improper selection of thrust races or shoes is made and the tolerance is GREATER than the maximum clearance, noisy operation of the compressor will result. If the tolerance is LESS than the minimum clearance it is quite likely that the mechanism assembly will be too tight. This may result in galling and seizure of parts.

Therefore, it is very important that care be used during gauging operations and the proper selection of parts be made. Once selection has been made, be sure that they are assembled into the correct position in the mechanism.

e. Mark the package "REAR" thrust race or place it in J 9402 assembly parts tray corresponding to this position.

16. Loosen and remove nuts and ring from J 9397 compressing fixture.

17. Separate cylinder halves (It may be necessary to use a fiber block and mallet).

18. Remove rear half cylinder.

19. Carefully remove one piston at a time from swash plate and front half cylinder. Do not lose relationship or position of front ball and shoe and rear ball only. Transfer each piston, balls and shoe assembly to its proper place in the J 9402 assembly tray.

20. Remove REAR outer ZERO thrust race from shaft and replace it with numbered thrust race, determined in step No. 15. Apply a LIGHT smear of petrolatum to thrust races to aid in holding them in place during assembly.

NOTE: This ZERO thrust race may be put aside for re-use in additional gauging and/or rebuild operations.

21. Apply a light smear of petrolatum to numbered shoes and place them over correct ball in rear of piston.

ASSEMBLE WITH NEW PARTS

Be sure to install all new seals, gaskets and O-rings. These are all included in the compressor gasket kit.

1. Assemble a piston ring, scraper groove toward the center of piston, to each end of three pistons.

2. Place front half cylinder on J 9397 compressing fixture with compressor main shaft (threaded end) projecting downward through the fixture. Rotate swash plate so high point is above cylinder bore No. 1. With open end of ring toward center of compressor, carefully assemble No. 1 piston (complete with ball and a ZERO shoe on front end and ball and numbered shoe on REAR end) over swash plate. Compress and enter piston ring into front half cylinder. Repeat this operation for pistons No. 2 and No. 3.

3. Assemble one end of service discharge crossover tube into hole in front cylinder (Fig. 1A-37).

4. Rotate shaft to position pistons in a "stair step" arrangement. Place rear half cylinder over shaft and start pistons into cylinder bores.

5. Invert cylinder on fixture to complete assembly as follows:

a. Compress piston ring on each piston so as to permit its entrance into cylinder.

b. When all three pistons and rings are in their respective cylinders, align end of the discharge crossover tube with hole in rear half cylinder, making sure flattened portion of this tube faces inside of compressor (for swash plate clearance.)

c. When satisfied that all parts are in proper alignment, tap with a fiber block mallet to "seat" rear cylinder over locating dowel pins.

6. Generously lubricate all moving parts with clean Frigidaire 525 viscosity oil. Check for free rotation of mechanism.

7. Check operation and smoothness of piston travel before proceeding with remainder of assembly. If any improper operation is observed during this check, the mechanism may have to be regauged. Complete assembly when correct operation is obtained.

8. Install crossover cover in cylinder.

9. Place internal mechanism in J 9397 compressing fixture if cylinder head dowel pins are to be replaced.

10. Replace two dowel pins in front cylinder if previously removed.

NOTE: A rod drilled 1/4" deep to O.D. of dowel pins will aid in installing pins.

11. Remove internal mechanism from J 9397 fixture.

REPLACE

1. Install service discharge crossover pipe front O-ring and spacer (Fig. 1A-36).

2. Assemble suction reed valve to front end of cylinder. Align dowel pin holes, suction ports and oil return slot.

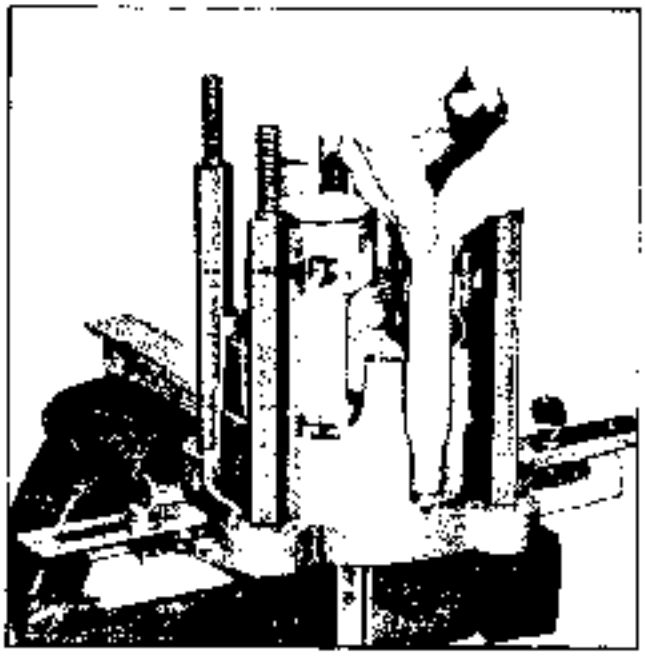


Fig. 1A-37 Installing Service Discharge Crossover Tube

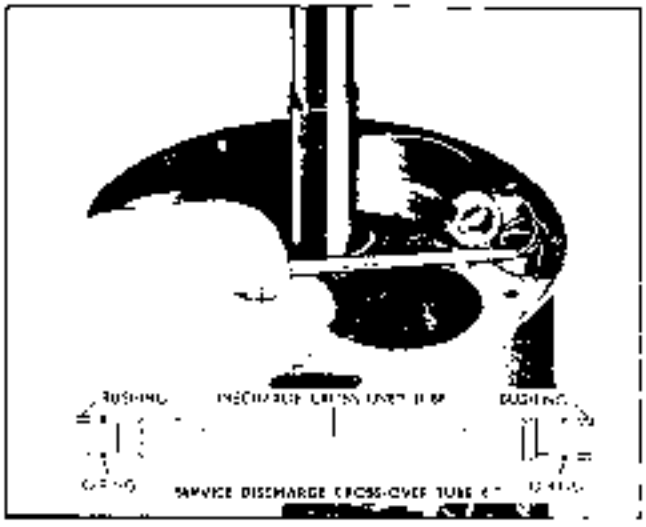


Fig. 1A-38 Installing Service Discharge Crossover Tube

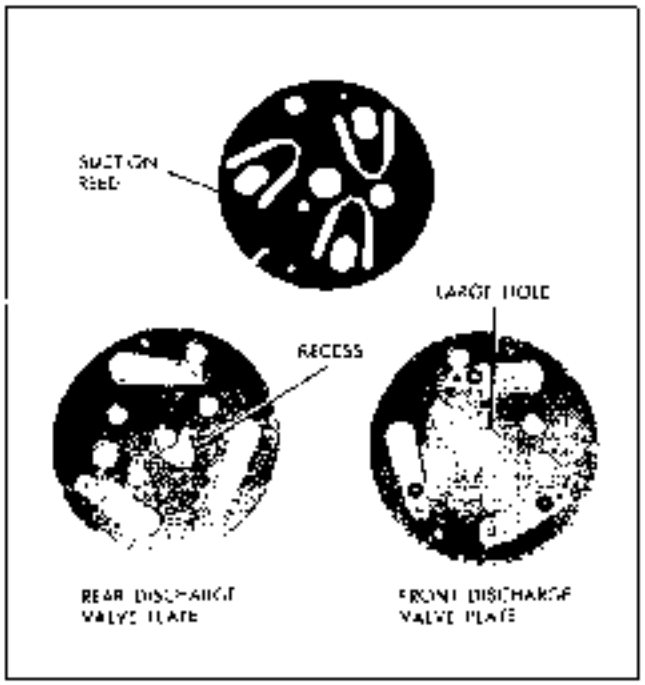


Fig. 1A-39 Identification of Front and Rear Discharge Valve Plate

3. Assemble front discharge valve plate, aligning holes with dowel pins and proper openings in head.

NOTE: The front discharge valve plate has a large diameter hole in the center (Fig. 1A-39)

4. Remove oil charging screw from compressor shell, inspect for damage, dirt or contamination, clean and replace.

5. Coat sealing surfaces on webs of compressor front head casting with clean 525 viscosity Frigidaire oil.

6. Examine interior of dowel pins and contour of webs (mark dowel location). Rotate so as to position it properly over discharge reed retainers. Use care to avoid damaging sealing surfaces. When in proper alignment, seat on compressor front head casting with light mallet taps (Fig. 1A-40).

7. If previously removed, place compressor shell with J 5956 holding fixture in vise so shell is up.

NOTE: Examine corners of oil baffle to be sure they do not damage O-rings on reassembly. Tap corners of oil baffle down carefully with small ball peen hammer.

8. Apply an ample amount of clean 525 viscosity Frigidaire oil around angle groove at the lower edge of casting. Coat large diameter head to shell O-ring and assemble O-ring on shoulder of shell (at front) (Fig. 1A-41).

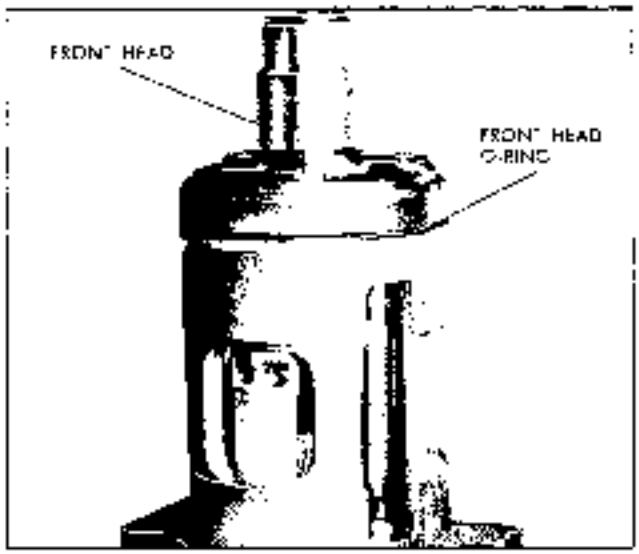


Fig. 1A-40 Installing Front Head Casing

9. Coat the inside machined surfaces of shell with clean 525 viscosity Frigidaire oil. Line up oil sump with oil intake tube hole and slide mechanism into shell. Maintain this alignment when lowering mechanism into place (Fig. 1A-41).

10. Place an O-ring on the oil pick-up tube, apply oil to cavity and O-ring. Insert tube and O-ring (Fig. 1A-42), rotating compressor mechanism as necessary and align tube with hole in the shell baffle. Be sure O-ring and intake tube are properly seated.

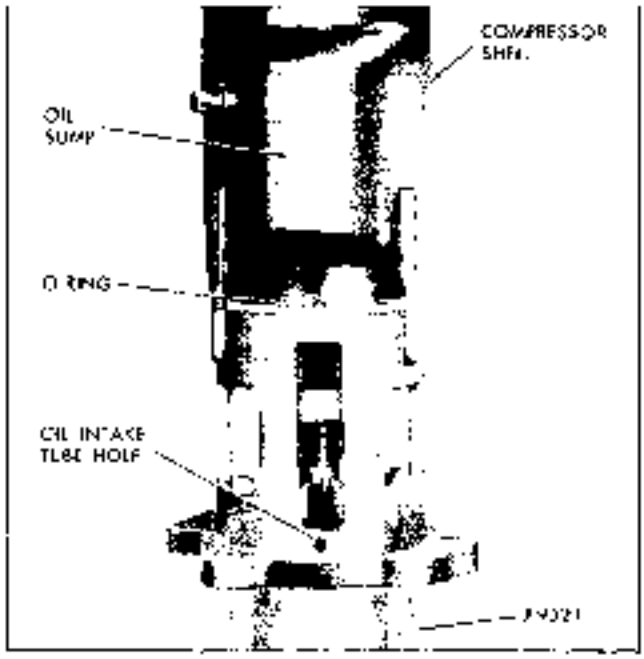


Fig. 1A-41 Installing Mechanism Assembly

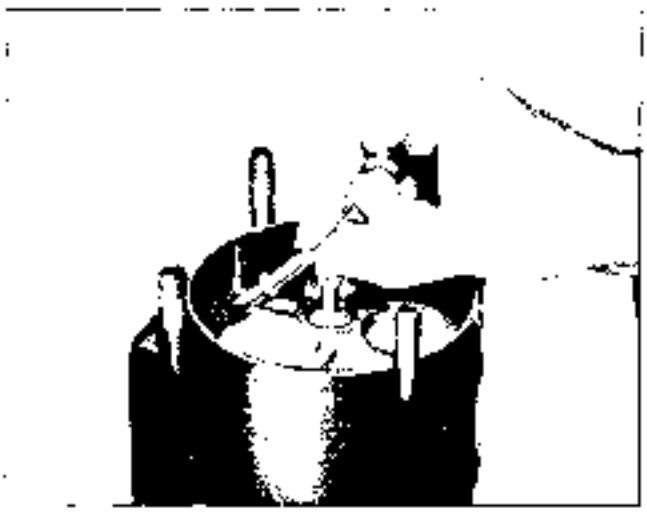


Fig. 1A-42 Installing Oil Intake (Pick-Up) Tube

11. Replace split dowel pins (in rear cylinder) if previously removed.

NOTE: A rod drilled 1/4" deep to O.D. of dowel pins will aid in installing pins.

12. Install service discharge crossover pipe rear O-ring and spacer.

13. Position rear suction reed valve to align with dowel pins, reed lips, and ports in head.

14. Position rear discharge valve assembly to align with dowel pins and ports and slide it into place over pins.

15. Position rear head casting to align with dowel pins. Rotate mechanism assembly back and forth by hand, if necessary, to permit this alignment and assure proper seating of front head cylinder assembly. Remove rear head from this trial assembly.

16. Assemble inner oil pump gear over "D" shaped flat on shaft. Place outer oil pump gear over inner oil pump gear.

NOTE: Before attempting the final assembly of the rear head casting, position outer gear as follows:

a. Observe position of oil sump in shell.

b. Locate approximate centerline of this sump.

c. While facing centerline of this sump and viewing from the back of compressor, move outer pump gear to LEFT until it is at approximately 90° (at 9 o'clock position) from centerline of oil sump (Fig. 1A-44).

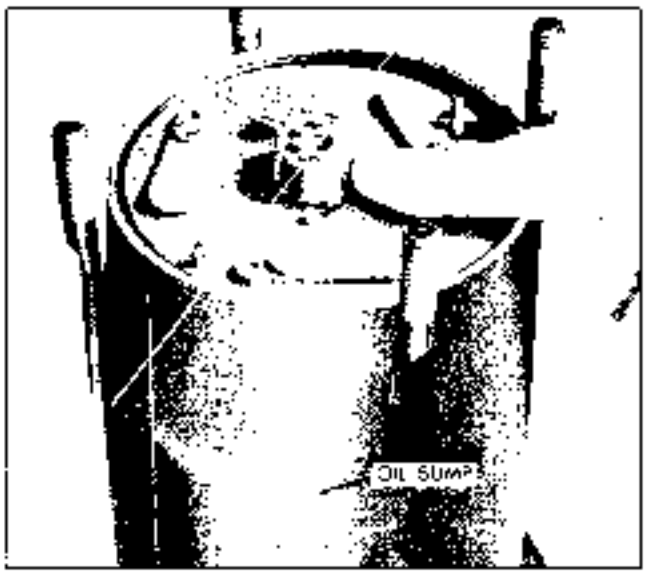


Fig. 1A-43 Positioning Oil Pump Outer Gear

COMPRESSOR REAR HEAD ASSEMBLY

REPLACE

1. Generously oil valve plate around outer edge where large O-ring will be placed. Oil valve reeds, oil pump gears, and area where Teflon gasket will contact valve plate.

2. Coat new head-to-shell O-ring with oil and place it on valve plate in contact with shell.

3. Replace suction screen in rear head.

4. Assemble rear head to compressor shell, using care not to damage Teflon gasket (Fig. 1A-45).

5. Assemble new nuts to threaded shell studs. Tighten 25-28 lb. ft. torque.

6. Replace pressure relief valve, if removed, using new copper washer.

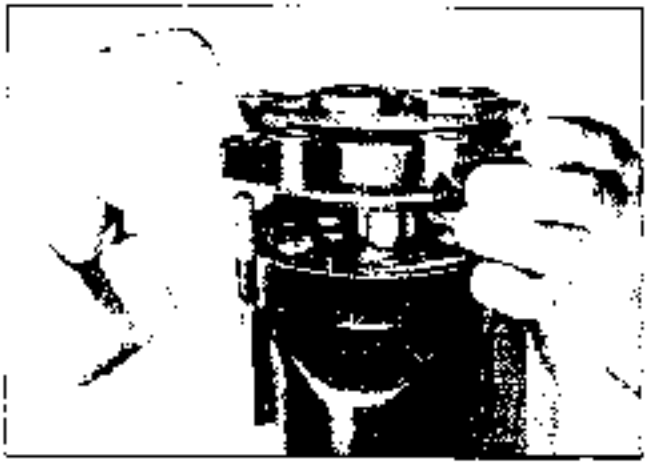


Fig. 1A-44 Installing Rear Head

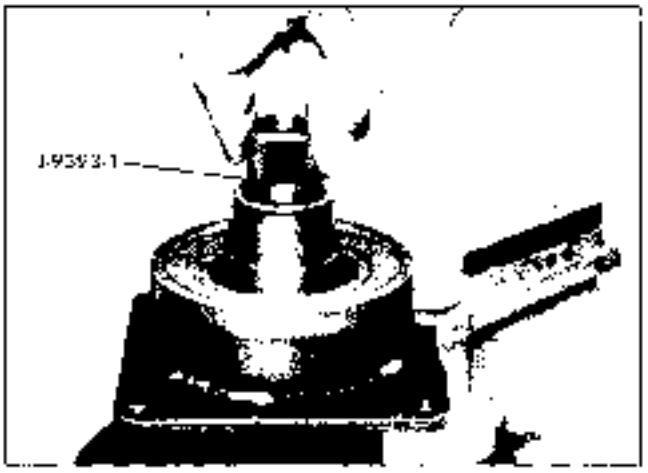


Fig. 1A-45 Seating Seal Seat Retainer

7. Coat the new seal seat O-ring with clean refrigerant oil and install it in its groove in the compressor neck. Tool J 21508 may be used.

8. Place seal protector J 21303 over the end of the shaft. Coat the O-ring and seal face of new seal assembly with clean refrigerant oil and install new seal assembly on shaft, using tool J 9392.

9. Coat the face of new seal seat with clean refrigerant oil and install new seal seat, using tool J 9393. Be sure seal seat O-ring is not distorted and seal seat is making a good seal with the O-ring. (Fig. 1A-45)

10. Install new seal seat retainer ring with tool J 9403, with flat face against seal seat. The sleeve from tool J 9328 may be used to press on the retainer ring so that it snaps into place. Remove tool J 21303 from end of shaft.

11. Leak test compressor as described under "Leak Testing the Compressor", using a propane torch type of leak detector, in good condition. Correct any leaks found.

12. Wipe out any excess oil inside compressor neck and on shaft, resulting from installing new seal parts.

13. Install new absorbent sleeve by rolling the material into a cylinder, overlapping the ends, and slipping sleeve into compressor neck with overlap toward the top of the compressor. With a small screwdriver or similar instrument carefully spread sleeve to remove overlap so that in final position ends of sleeve will lie at top vertical centerline.

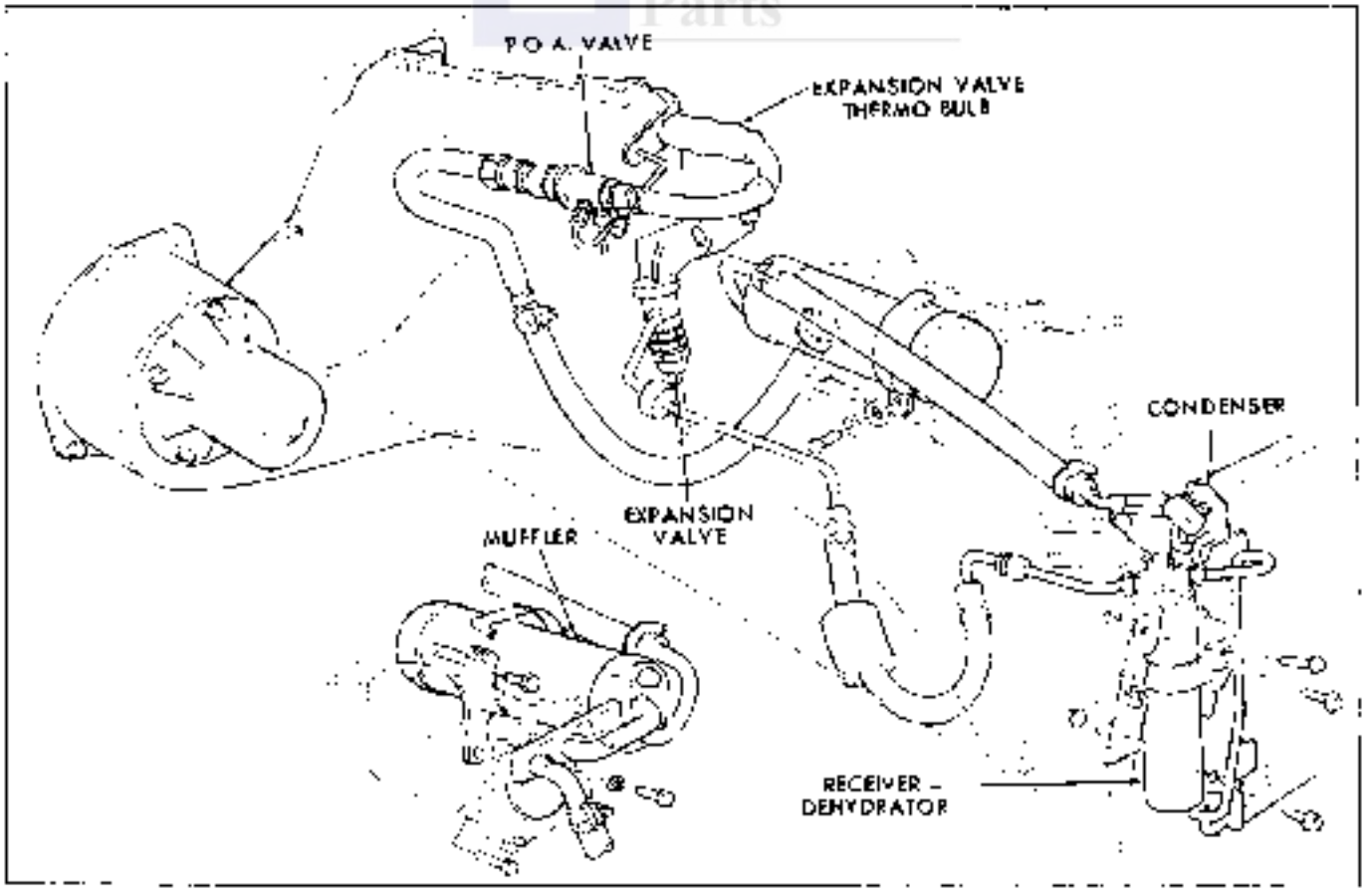


Fig. 1A-46 Refrigeration System Components – Pontiac

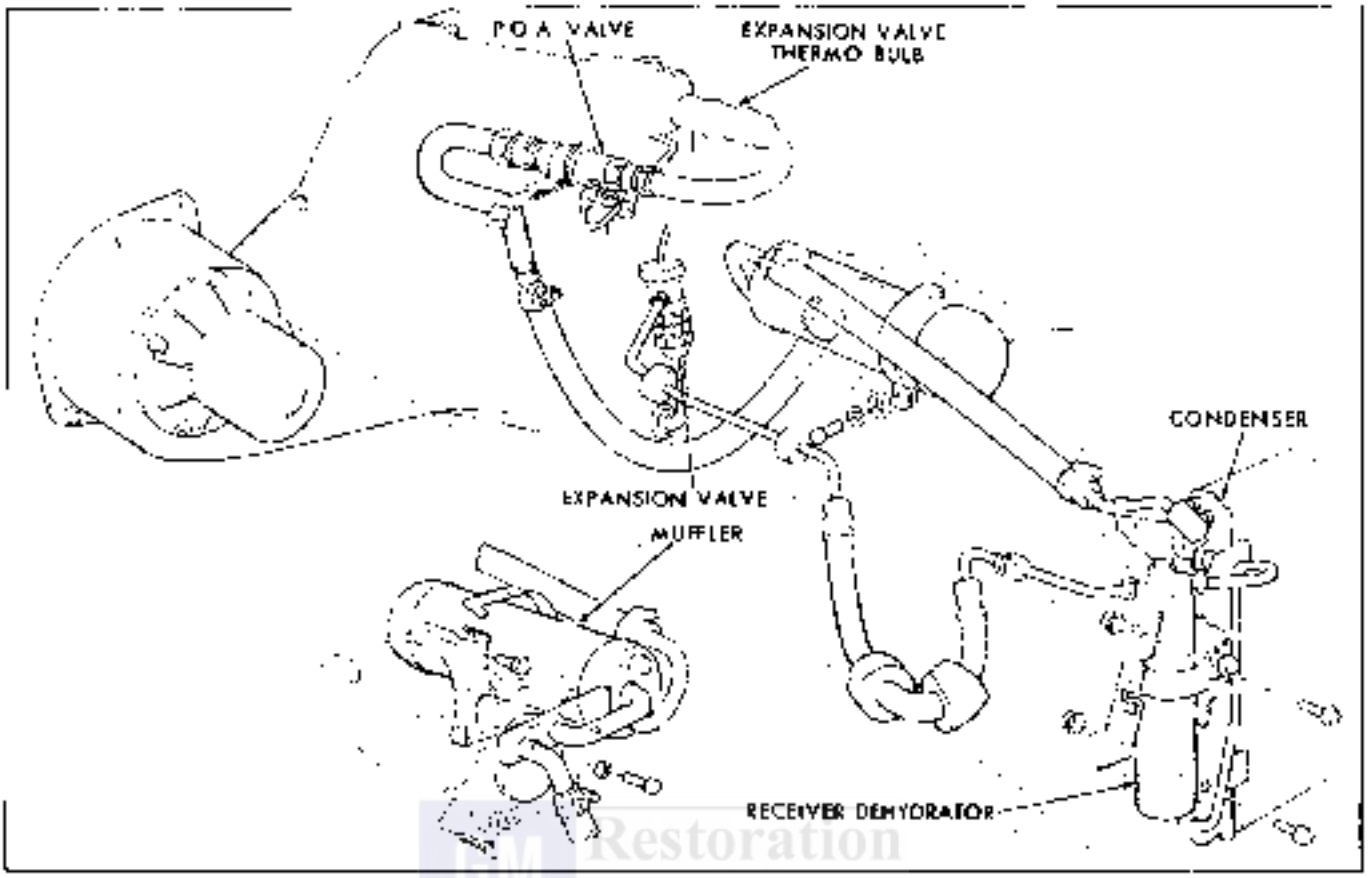


Fig. 1A-47 Refrigeration System Components - Tempest

14. Position new metal sleeve retainer so that its flange face will be against the front end of the sleeve. Tool J 9395 or the sleeve from tool J 9399 may be used to install the retainer. Press and tap with a mallet, seating the retainer and sleeve into place, until the outer edge of the retainer is recessed approximately 1/32" from the face of the compressor neck.

15. Re-install the clutch driven plate.

P.O.A. VALVE—REMOVE AND REPLACE

A.I.R. (Figs. 1A-46, 47 and 48)

1. Depressurize system.

2. Loosen oil bleed fitting.

3. Loosen equalizer fitting.

4. Loosen inlet and outlet fittings.

5. Remove valve from bracket.

NOTE: If valve is not immediately replaced, cap openings to prevent entry of dirt and moisture.

6. Replace by reversing above procedure using new O-ring seals coated with compressor oil.

7. Evacuate and charge system.

Compressor belt tension specifications are as follows:

	New	Old
A.I.R.	140-145 lbs.	100-105 lbs.

EXPANSION VALVE AND SEALS—REMOVE AND REPLACE (Figs. 1A-46, 1A-47 and 1A-48)

1. Depressurize system.

2. Remove thermo bulb from sealer at evaporator outlet.

3. Disconnect equalizer line at P.O.A. valve.

4. Remove inlet and outlet fittings of valve.

NOTE: On some models it may be necessary to loosen and tip the compressor to gain access to these fittings.

5. If valve is not immediately replaced cap openings to prevent entry of dirt and moisture.

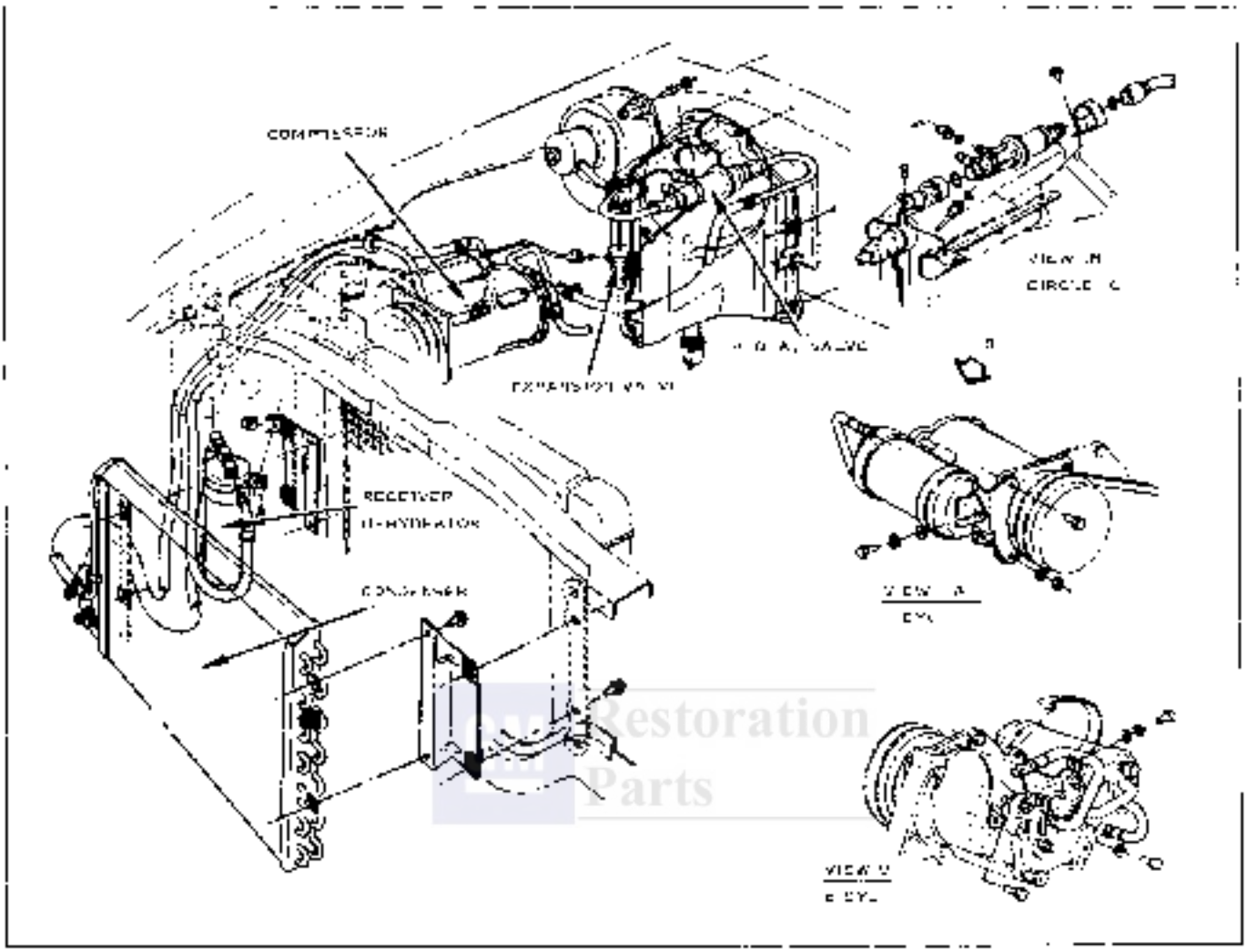


Fig. 1A-48 Refrigerant System Components - Firebird

6. Replace by reversing above procedure using new O-ring seals coated with compressor oil.

7. Evacuate and charge system.

EVAPORATOR CASE AND/OR CORE
(Figs. 1A-46, 1A-47 and 1A-48)

PONTIAC

1. Depressurize system.

2. Remove hood hinge at fender and support hood.

3. Remove fender skirt.

NOTE: Includes blower motor mounting and loosen lower fender attaching bolts.

4. Remove case to dash retaining screws.

5. Disconnect expansion valve inlet and P.O.A. valve outlet.

6. Remove water control valve.

7. Disconnect blower motor lead and resistor block lead.

8. Gently pull case from dash and remove from engine compartment.

9. Cap refrigerant openings to prevent entry of dirt or moisture.

10. Separate and replace defective component or assembly.

NOTE: Use care to reseal evaporator core to case halves.

11. To replace reverse removal procedure using care to properly seal evaporator to dash.

12. Evacuate and charge system with refrigerant.

TEMPEST OR FIREBIRD

1. Depressurize system.

2. Remove hood hinge at fender and support hood.

3. Remove fender and skirt as an assembly. (Includes disconnecting hoses from skirt, removal of battery tray and rocker moldings.)

4. Remove evaporator case to dash retaining screws.

5. Disconnect expansion valve inlet and P.O.A. valve outlet.

6. Remove water control valve.

7. Disconnect blower and resistor wires.

8. Gently pull case from dash and remove from engine compartment.

9. Cap refrigerant openings to prevent entry of dirt or moisture.

10. Separate and replace defective component of assembly.

NOTE: Use care when resealing evaporator case to case halves.

11. To replace reverse removal procedure using care to properly seal evaporator to dash.

12. Evacuate and charge system with refrigerant.

CONDENSER AND SEALS—REMOVE AND REPLACE (Figs. 1A-46, 1A-47 and 1A-48)

PONTIAC OR TEMPEST

1. Depressurize refrigeration system.

2. Remove front valance panel.

3. Remove hood hinge and support brace.

4. Disconnect receiver outlet fitting.

5. Disconnect condenser inlet fitting.

6. Remove condenser bracket retaining screws.

7. Remove condenser and receiver assembly.

8. Cap openings.

9. Separate condenser from brackets.

10. To replace, reverse removal procedure, add one ounce of refrigerant oil, and purge and recharge system with refrigerant.

FIREBIRD

1. Depressurize system.

2. Remove hood lock catch support, catch, and hoses wire.

3. Remove right and left baffle from grille to radiator support.

4. Remove brace and battery.

5. Disconnect inlet and outlet hose clamp connections and condenser to radiator support attaching screws.

6. Remove the condenser from the vehicle.

NOTE: Cap or tape the inlet and outlet connections at once.

7. Add one third oz. refrigerant oil after installing a new condenser. Purge and recharge system with refrigerant.

RECEIVER DEHYDRATOR—REMOVE AND REPLACE (Figs. 1A-46, 1A-47 and 1A-48)

PONTIAC

1. Depressurize system.

2. Remove valance panel.

3. Disconnect inlet and outlet fittings.

4. Remove bracket retaining screw.

5. Remove front strap.

6. Remove receiver.

7. To replace reverse removal procedure.

8. Evacuate and charge system.

TEMPEST

1. Depressurize system.

2. Remove plastic air deflector.

3. Disconnect receiver inlet and outlet fittings.

4. Remove lower valance panel.

5. Remove bracket retaining screw.

6. Remove receiver.

7. To replace reverse above procedure.

8. Evacuate and charge system.

FIREBIRD

1. Depressurize system.

2. Remove baffle covering receiver dehydrator assembly.

3. Remove the receiver inlet and outlet connections and attaching screw from bracket.

4. Remove from vehicle and plug openings.

5. Replace assembly and add one fluid oz. of refrigerant oil.

6. Purge and recharge system with 3-3/4 lbs. refrigerant.

AIR INLET AND VALVE—REMOVE AND REPLACE

PONTIAC (Fig. 1A-49)

1. Remove lower duct and outlet assembly.

2. Remove right kick pad.

3. Identify and disconnect vacuum hoses.

4. Remove air inlet diaphragm.

5. Remove six air inlet assembly retaining screws.

6. Remove air inlet assembly by pulling out from bottom and rotating (it may be necessary to pull carpeting out of way).

7. Replace by reversing above procedures, making certain air inlet assembly locating pin is in its proper location.

TEMPEST (Fig. 1A-50)

1. Remove kick panel.

2. Remove vacuum hoses.

3. Remove cold air distributor duct.

4. Remove inlet assembly retaining screws.

5. Remove evaporator case as outlined under Evaporator Case Removal.

6. Remove assembly three upper retaining screws.

7. To replace reverse above procedure.

A/C BLOWER MOTOR IMPELLER AND/OR INLET DUCT

PONTIAC OR TEMPEST

1. Unclip hoses from fender skirt.

2. Remove rocker molding.

3. Loosen lower rear fender retaining screws.

4. Remove fender skirt. TEMPEST - Remove fender and skirt as an assembly.

5. Remove blower motor or inlet duct retaining screws.

6. Remove motor lead wire and cooling tube.

7. Remove motor and impeller.

8. To replace reverse removal procedure.

FIREBIRD

1. Remove fender brace, battery and tray.

2. Remove hood (after scribing alignment marks).

3. Remove the right front fender and skirt as an assembly.

4. Disconnect the motor wire at the flange connector.

5. Disconnect the rubber motor cooling tube from the motor.

6. Remove the motor to case or inlet to dash attaching screws as desired.

7. To install, reverse removal procedure.

HEATER CORE AND CASE ASSEMBLY

PONTIAC (Fig. 1A-52)

1. Drain coolant.

2. Remove four heater case to cowl attaching nuts.

3. Remove two water hoses attached to heater core.

4. Remove lower duct and outlet assembly.

5. Remove glove box.

6. Disconnect vacuum hoses and temperature control cable.

7. Remove defroster duct attaching screw.

8. Remove three heater case to cowl attaching screws.

9. Move core and case assembly rearward to free attaching studs from cowl and remove core and case assembly.

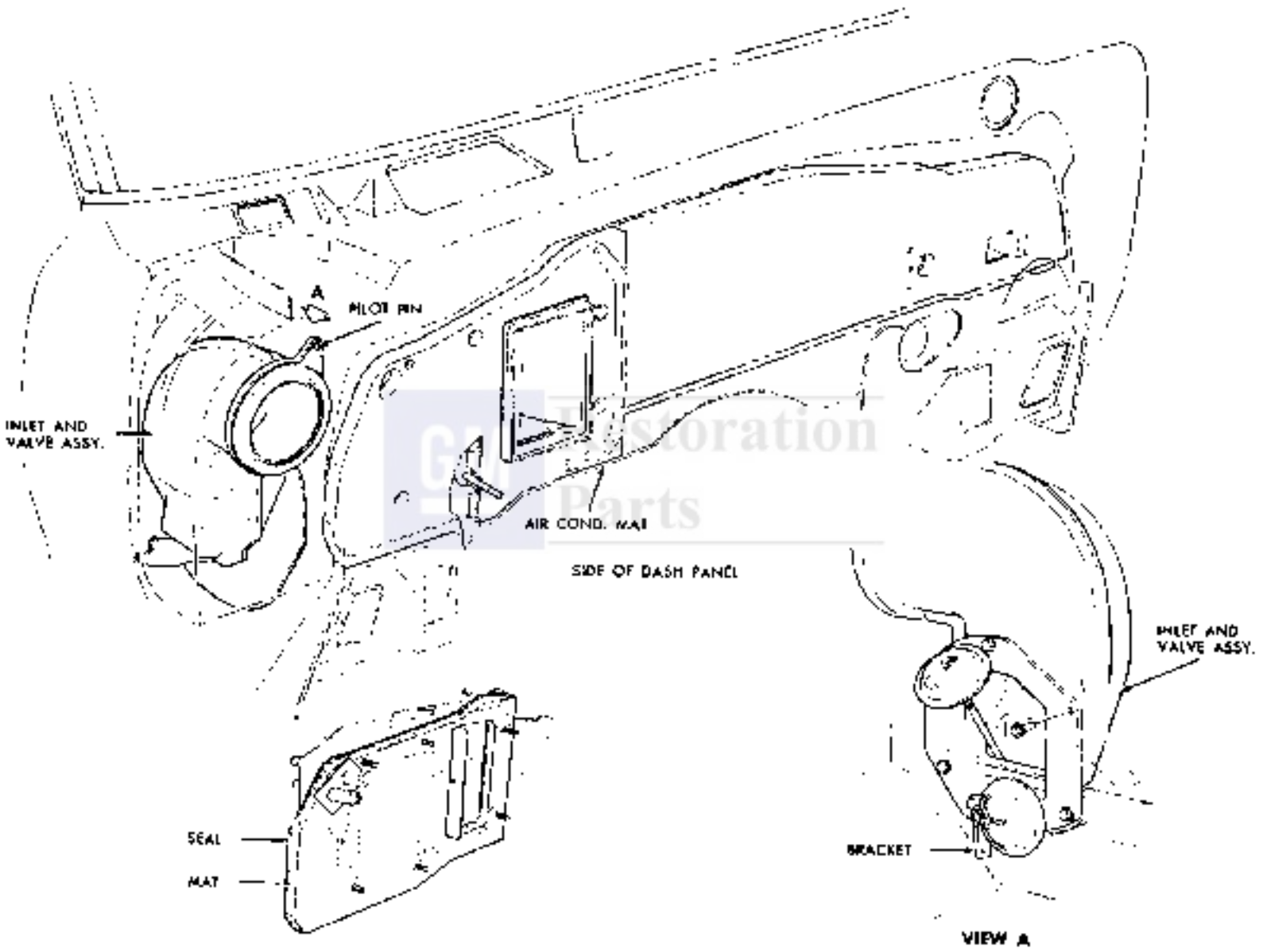


Fig. 1A-49 Air Inlet Assembly - Pontiac

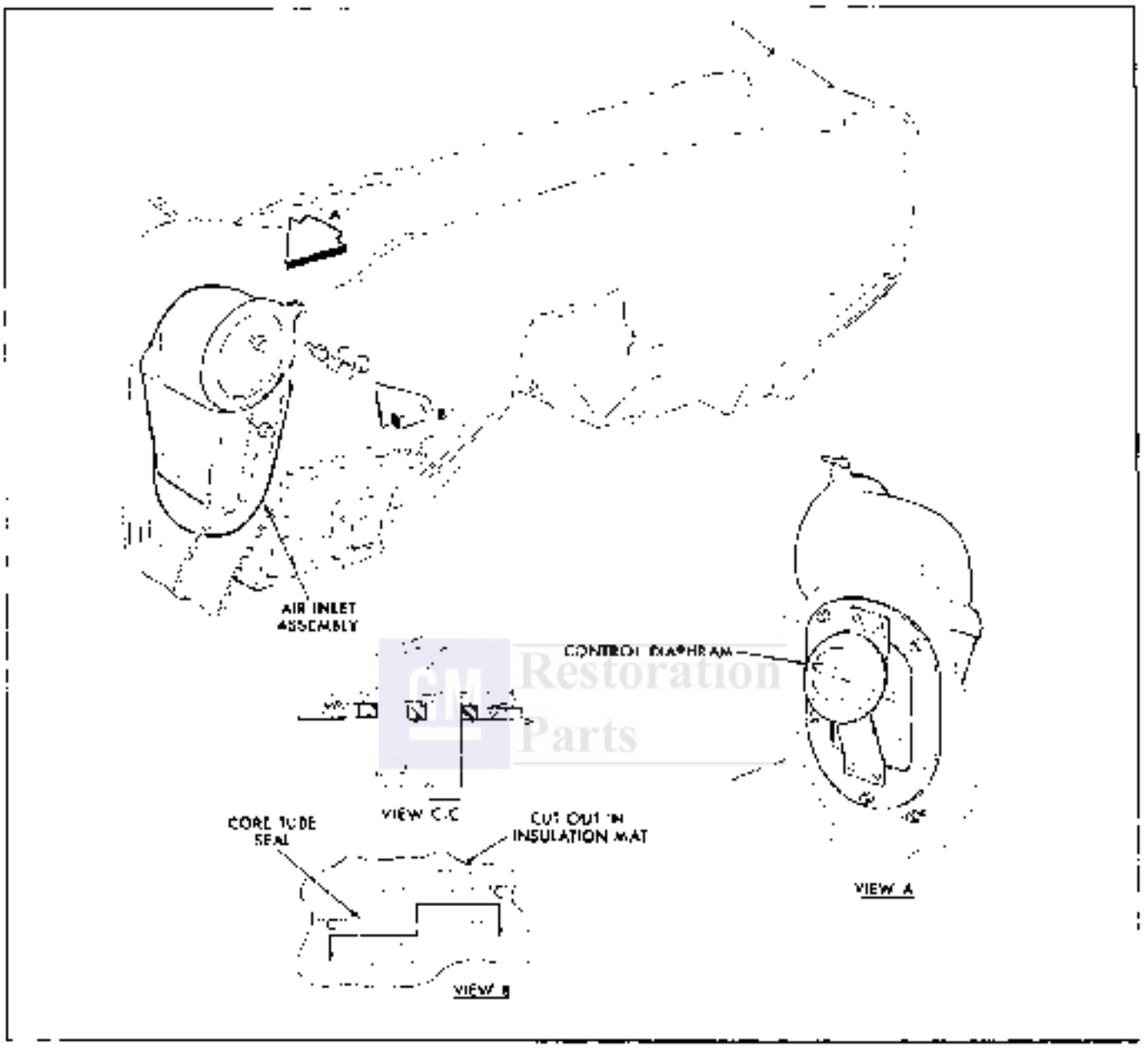


Fig. 1A-50 Air Inlet Assembly - Tempest

10. Adequately mark heater cam and bracket assembly in three places to insure proper reinstallation.

11. Remove heater cam and bracket assembly.

12. Remove front case to rear case attaching screws.

13. Separate front and rear case.

14. Remove screws retaining core attaching bands and remove core.

15. Replace by reversing the above procedure.

TEMPEST Fig. 1A-53

1. Remove glove box.

2. Remove lower instrument panel air conditioning duct and outlet assembly by removing five attaching screws and retainer.

3. Lower duct and outlet assembly after disconnecting right and left side nozzle connections.

4. Disconnect temperature control cable and vacuum hose connections.

5. Drain cooling system and remove two water hoses attached to heater core.

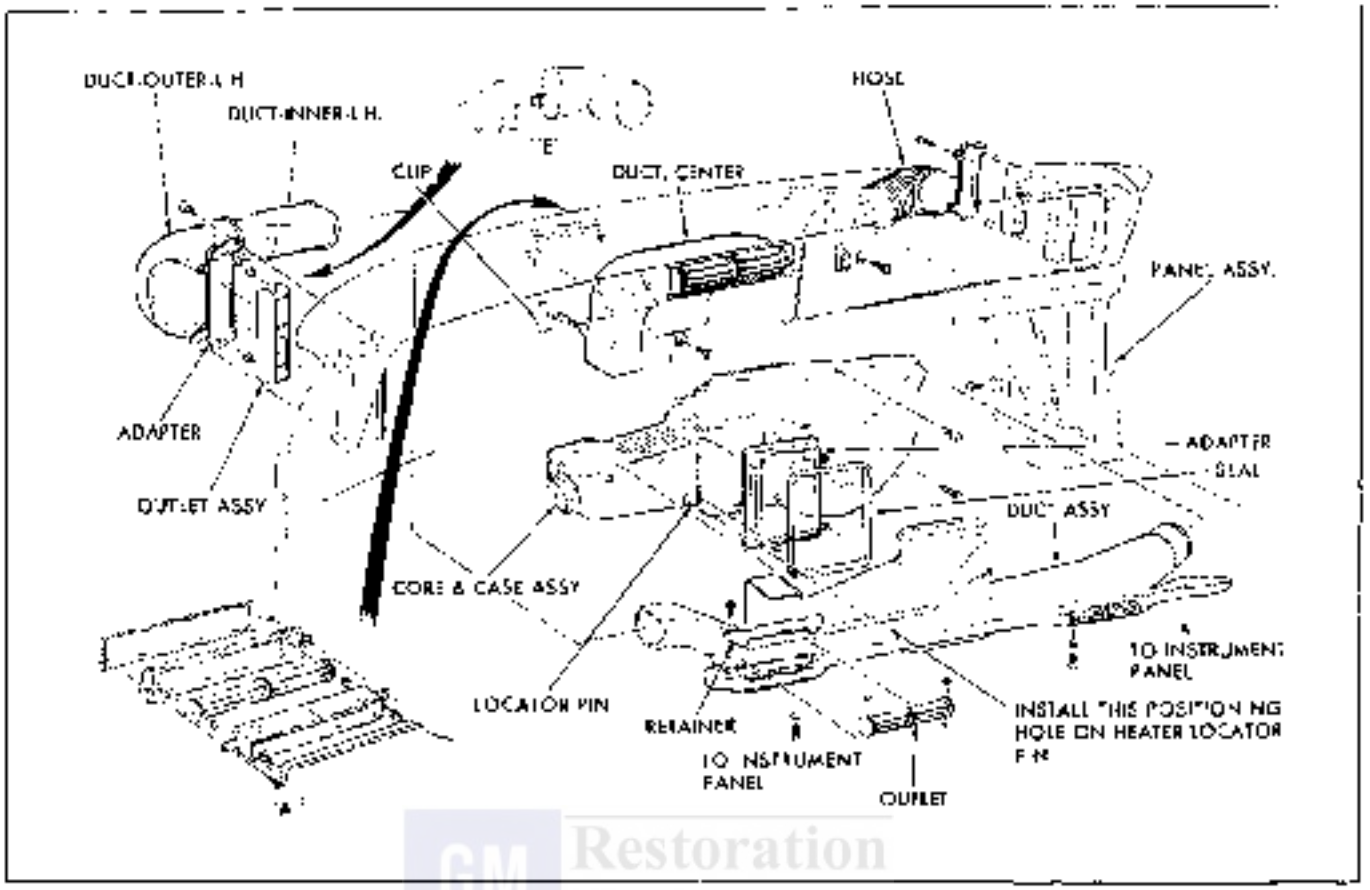


Fig. 1A-51 Air System Body Interior - Pontiac

6. Remove six heater core to cowl attaching nuts. It will be necessary to cut a 1" diameter hole at location bump on RIGHT HAND fender skirt to remove lower nut.

7. Remove two screws from heater core and case to evaporator housing seal and remove seal and retainer.

8. Remove heater core and case assembly.

9. Remove front case to rear case attaching screws.

10. Separate front and rear case.

11. Remove screws retaining core attaching bands.

12. Remove screws retaining core baffle plate (for clearance of core inlet and outlet pipe).

13. Remove core from front case.

14. To install, reverse removal procedure.

15. Adjust temperature control cable.

16. Replace glove box.

17. Use a 1" diameter plastic plug to seal hole cut in fender skirt.

FIREBIRD

1. Drain radiator.

2. Disconnect heater hoses at core tubes as described earlier.

3. Remove nuts from three studs on engine side of dash.

4. Inside car, remove distributor ducts and kick pad diaphragm.

5. Remove glove box.

6. Remove two bolts retaining heater case to passenger side of dash.

7. Pull heater case from dash and remove defroster extension, cables and wire connector.

8. With heater case removed from car, scribe location of plate retaining temperature door pivot and remove pivot.

9. Remove screws retaining casting to case.

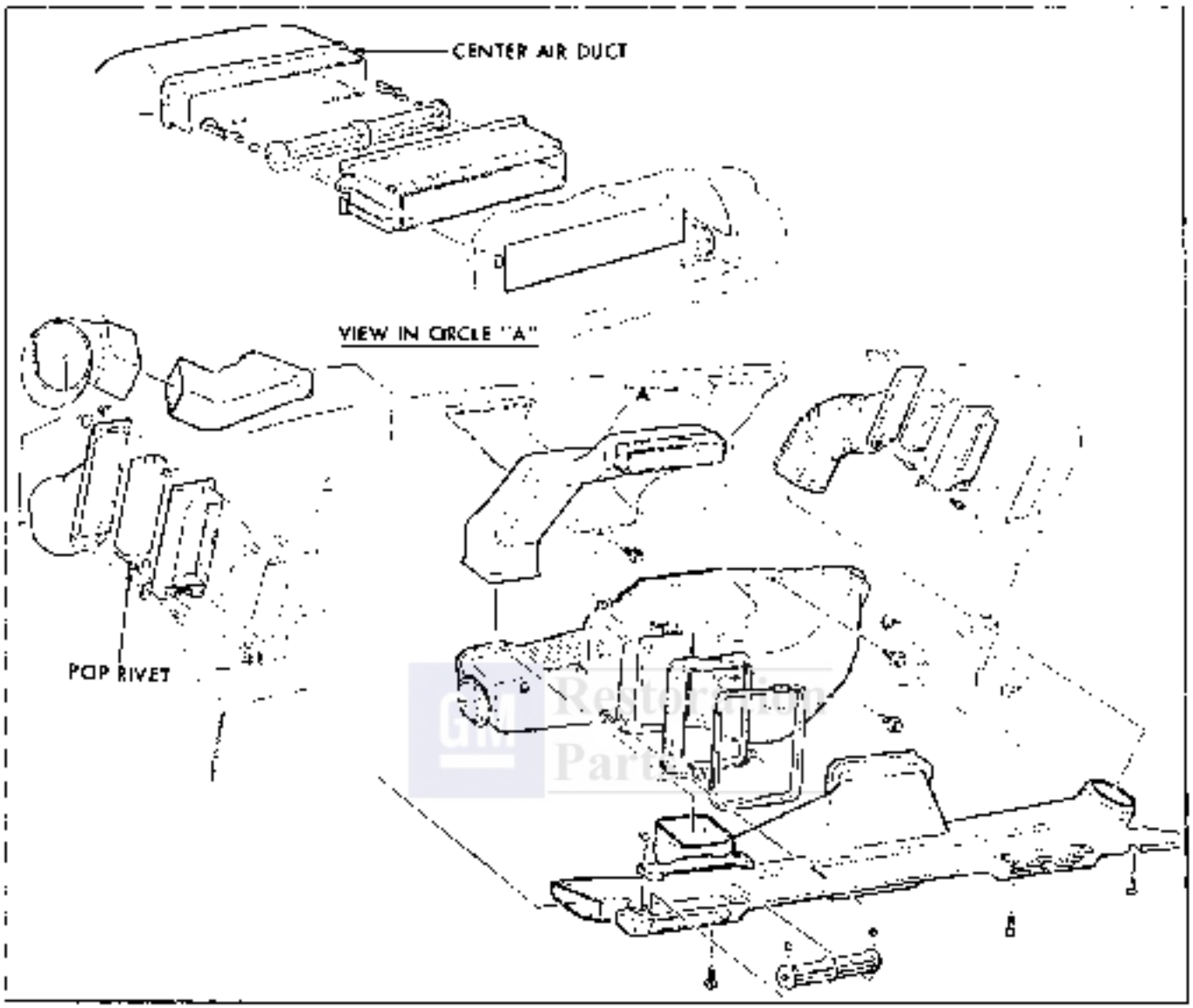


Fig. 1A-52 Air System Body Section - Tempest

10. Remove core tube seal and then core from casting.

NOTE: Be sure the core to case sealer is intact before replacing core. Replace with new sealer if necessary.

11. To replace reverse removal procedure.

CAM ASSEMBLY—TEMPERATURE DOOR—All

1. Remove glove compartment.

2. Scribe alignment marks on cast for cam placement.

3. Remove control cable.

4. Remove cam hold down screws.

5. Remove cam.

6. To replace reverse removal procedure.

7. Adjust cable.

TEMPERATURE CABLE REMOVE OR ADJUST (Fig. 1A-54)

PONTIAC

1. Remove cold air duct.

2. Disconnect cable at control panel.

3. Remove glove box.

4. Disconnect cable at cam assembly.

5. To replace reverse removal procedure.

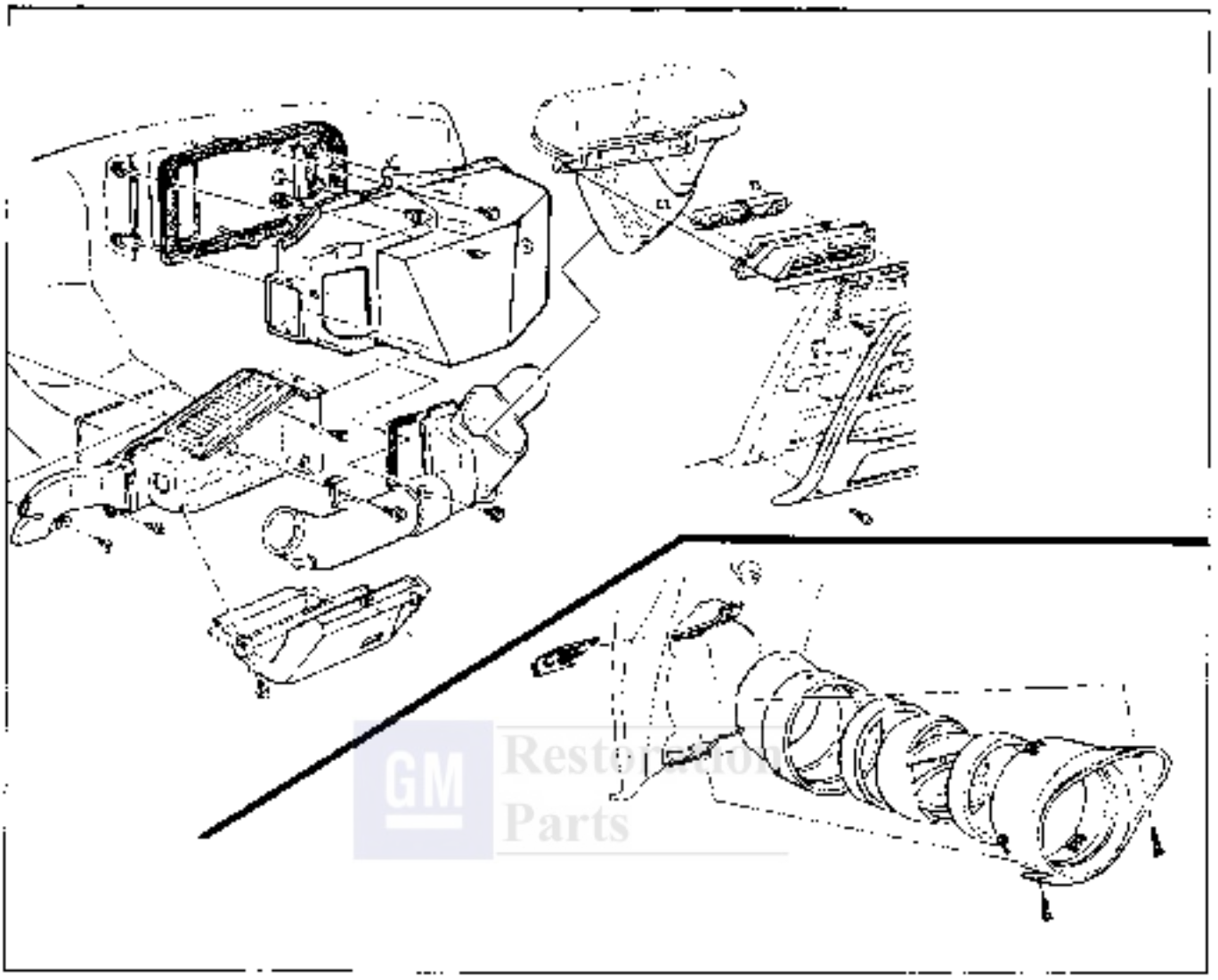


Fig. 1A-53 Air System Body Interior - Firebird

TO ADJUST

NOTE: All adjustments to be made after cable has been connected securely at both ends.

1. Cable is to be securely attached at control and heater.

2. Rotate temperature control knob counterclockwise to full cold (all blue bars showing in dial opening) and hold in this position.

3. Looking through glove box opening, insert 3/16" -diameter gauge pin into left indexing hole in heater cam.

4. Adjust turnbuckle by threading left or right until pin falls into matching indexing hole in cam bracket.

5. Remove gauge pin and turn temperature control knob clockwise to full heat position (all red bars showing).

6. Rotate knob back to full cold position and reinsert gauge pin.

7. If pin falls into both heater cam and cam bracket indexing holes and all blue bars shown on dial, the cable is properly adjusted.

8. If any of the red bars show, repeat steps 3 thru 7 until cable is properly adjusted.

TEMPEST

1. Remove cold air duct.

2. Disconnect cable at control panel.

3. Remove glove box.

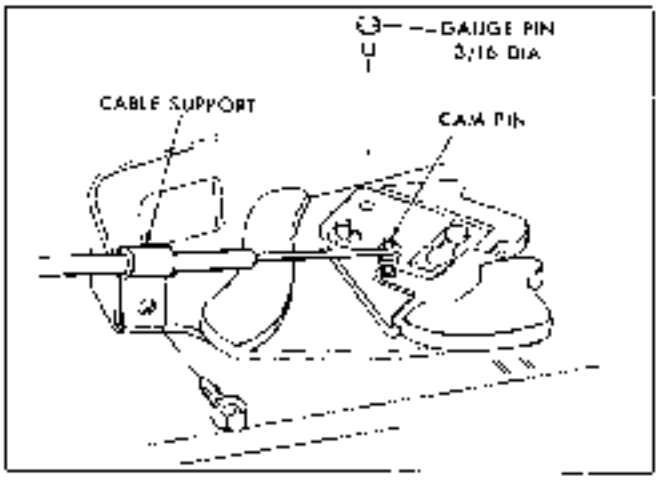


Fig. 1A-54 Temperature Cable Adjustment

4. Disconnect cable at cam assembly.

5. To replace reverse removal procedure.

TO ADJUST (Fig. 1A-55)

1. Remove glove box.

2. Place Temp lever in full cold or "Cooler" position.

3. Adjust turnbuckle as necessary to allow 3/16" gauge pin to pass freely through heater cam and cam bracket index holes.

4. With gauge pin in place, adjust turnbuckle to move lever against lower end of slot in control panel, then turn turnbuckle in opposite direction to move control lever 1/8" to 3/16" away from end of slot.

5. Remove gauge pin.

6. Move Temp lever to full heat or "Warmer" position, then back to off.

7. Gauge pin must fit freely through index holes.

8. Replace glove box.

FIREBIRD

1. Remove control panel from dash.

2. Disconnect cable at control panel.

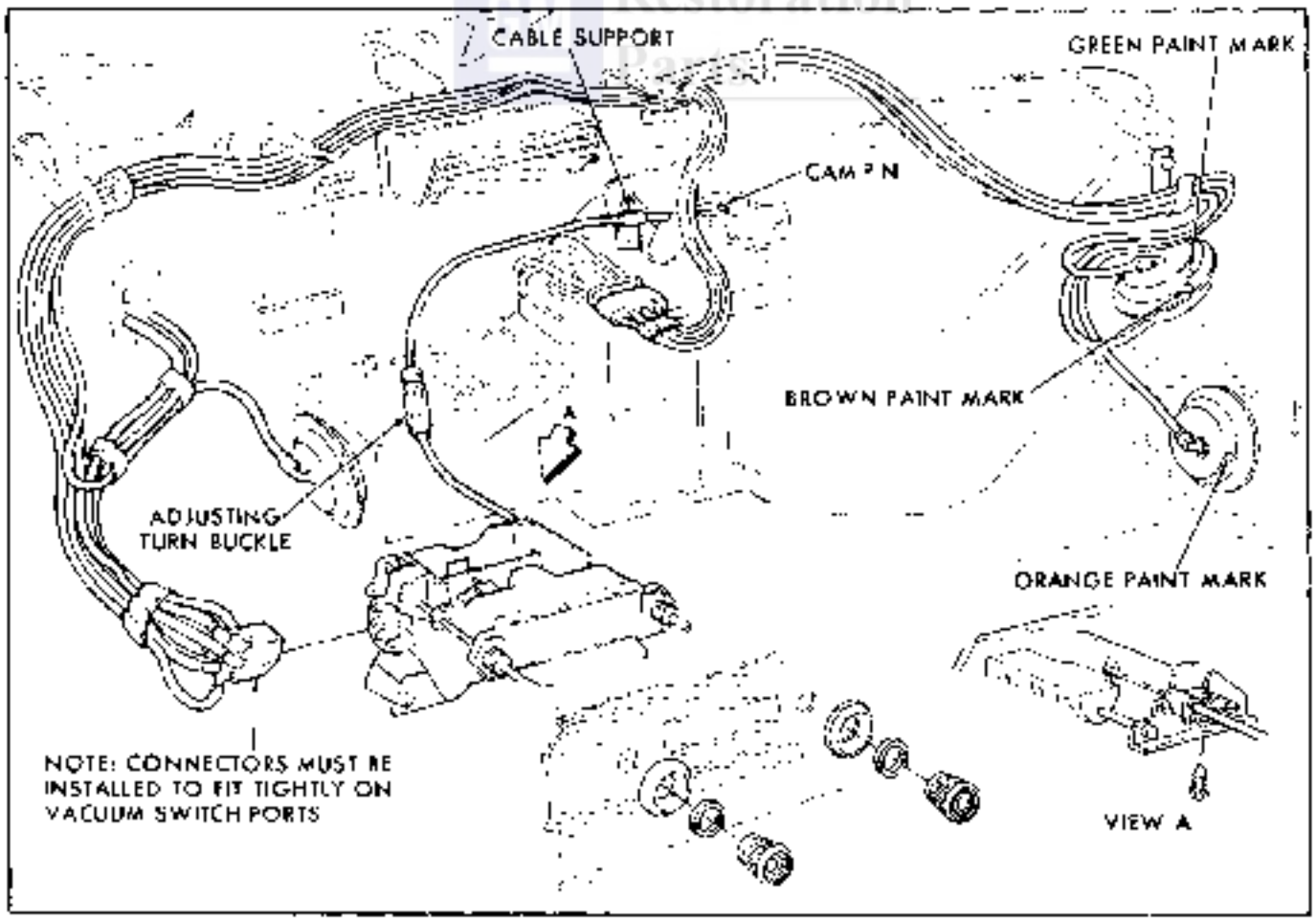


Fig. 1A-55 Control System - Firebird

3. Remove control panel.

4. Disconnect cable at cam assembly.

5. Remove cable.

6. To replace reverse removal procedure.

DIVERTER CABLE

FIREBIRD

1. Remove control panel.

2. Disconnect cable at control panel.

3. Remove glove compartment.

4. Disconnect cable at heater case.

5. Remove cable.

6. To replace reverse above procedure.

DEFROSTER CABLE

FIREBIRD

1. Remove ash tray and cold air ducts.

2. Remove defroster extension retaining screws.

3. Remove defroster extension.

4. Remove cable at extension.

5. Remove radio and ash tray bracket.

6. Drop control panel and remove cable.

7. To replace reverse removal procedure.

CONTROL PANEL—REMOVE AND REPLACE (Fig. 1A-55)

In servicing individual components of the control panel assembly, the assembly should be removed from the instrument panel as follows.

PONTIAC

1. Disconnect battery.

2. Remove lower duct and outlet assembly.

3. Remove wire and vacuum connections.

NOTE: Identify wire connectors to switches and vacuum connectors for correct reassembly and remove.

4. Remove blower switch and temperature control knobs and escutcheon nuts.

5. Lower control panel assembly.

6. Remove temperature control cable and remove control.

7. Replace by reversing the above procedures.

CAUTION: Do not reverse leads.

TEMPEST (Fig. 1A-56)

1. Remove cold air distributor duct.

2. Remove control panel attaching screws.

3. Drop panel from instrument panel area.

4. Mark and remove vacuum harness connector.

5. Remove cables and light.

6. Remove blower connector.

7. To replace reverse removal procedure.

8. To adjust cables see Cable Adjustment.

FIREBIRD

1. Remove screws retaining lower portion of trim plate to instrument panel. Remove trim plate.

2. Remove distribution duct.

3. Remove radio.

4. Remove retaining screws and remove control panel.

5. Lower control panel from instrument panel and remove cables, vacuum hoses and wire connectors.

6. To replace reverse removal procedure.

HI BLOWER RELAY

PONTIAC ONLY

1. Remove wire connector from relay. (Rear relay on bracket).

2. Remove relay retaining screws.

3. Remove relay.

4. To replace reverse removal procedure.

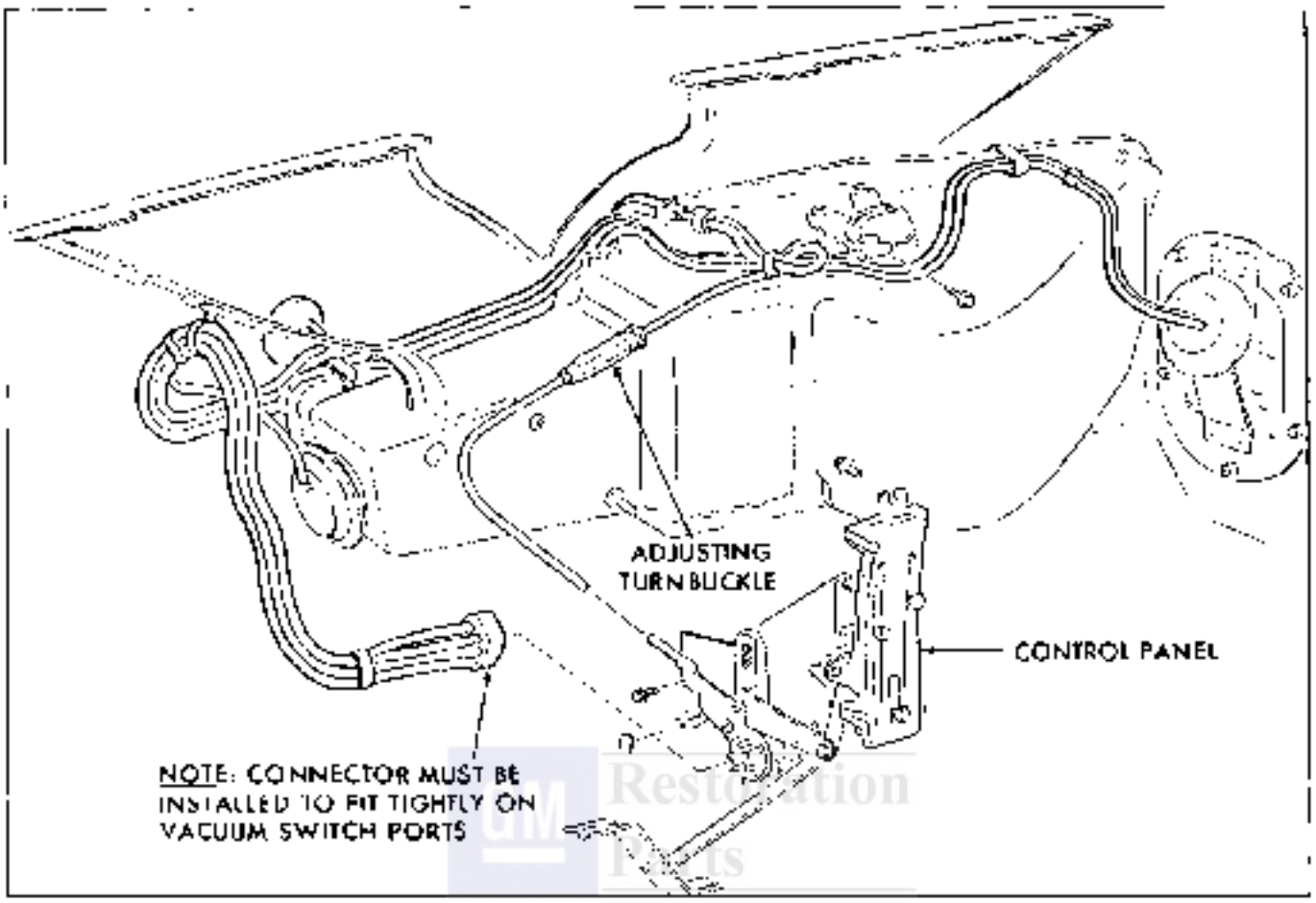


Fig. 1A-56 Control System - Tempest

BLOWER SPEED SWITCH—ALL
(Figs. 1A-57, 1A-58 and 1A-59)

1. Remove control panel from dash area. (Do not disconnect hoses or cables.)

2. On Tempest and Firebird models, remove switch attaching screws. On Pontiac models, secure string so that it is not pulled into assembly.

3. On Pontiac models, remove switch attaching screws.

4. Remove wire connector.

5. On Pontiac models, loosen set screws and remove pulley.

6. To replace, reverse removal procedure.

COMPRESSOR CLUTCH SWITCH OR MASTER SWITCH PONTIAC (Fig. 1A-57)

1. Remove control panel from dash area, leaving cables and hoses attached.

2. Remove connector from clutch switch.

3. Remove screws retaining contact set.

4. To replace, reverse removal procedure.

5. Check operation of switch.

BLOWER MOTOR RESISTOR ALL (Fig. 1A-60)

1. Remove wire connector.

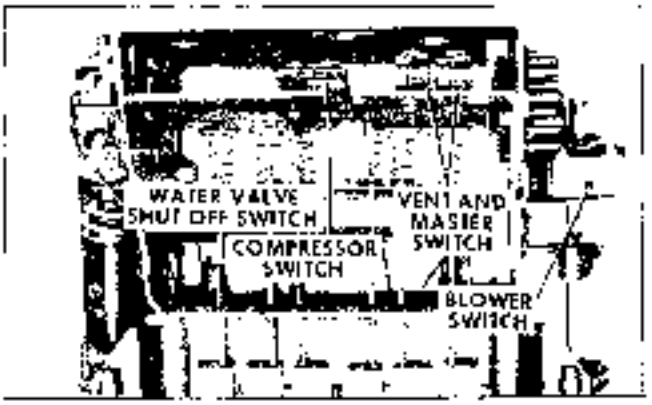


Fig. 1A-57 Pontiac Control - Panel

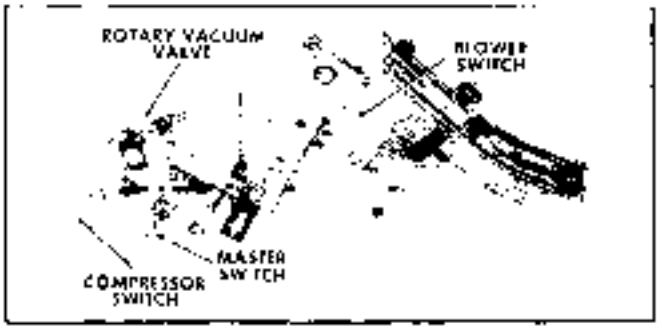


Fig. 1A-58 Tempest Control - Panel

Fig. 1A-59 Firebird Control - Panel

2. Remove resistor retaining screws.
3. Remove resistor assembly.
4. To replace, reverse removal procedure.

A/C IN-CAR HARNESS PONTIAC AND TEMPEST (Fig. 1A-61)

1. Remove cold air duct.

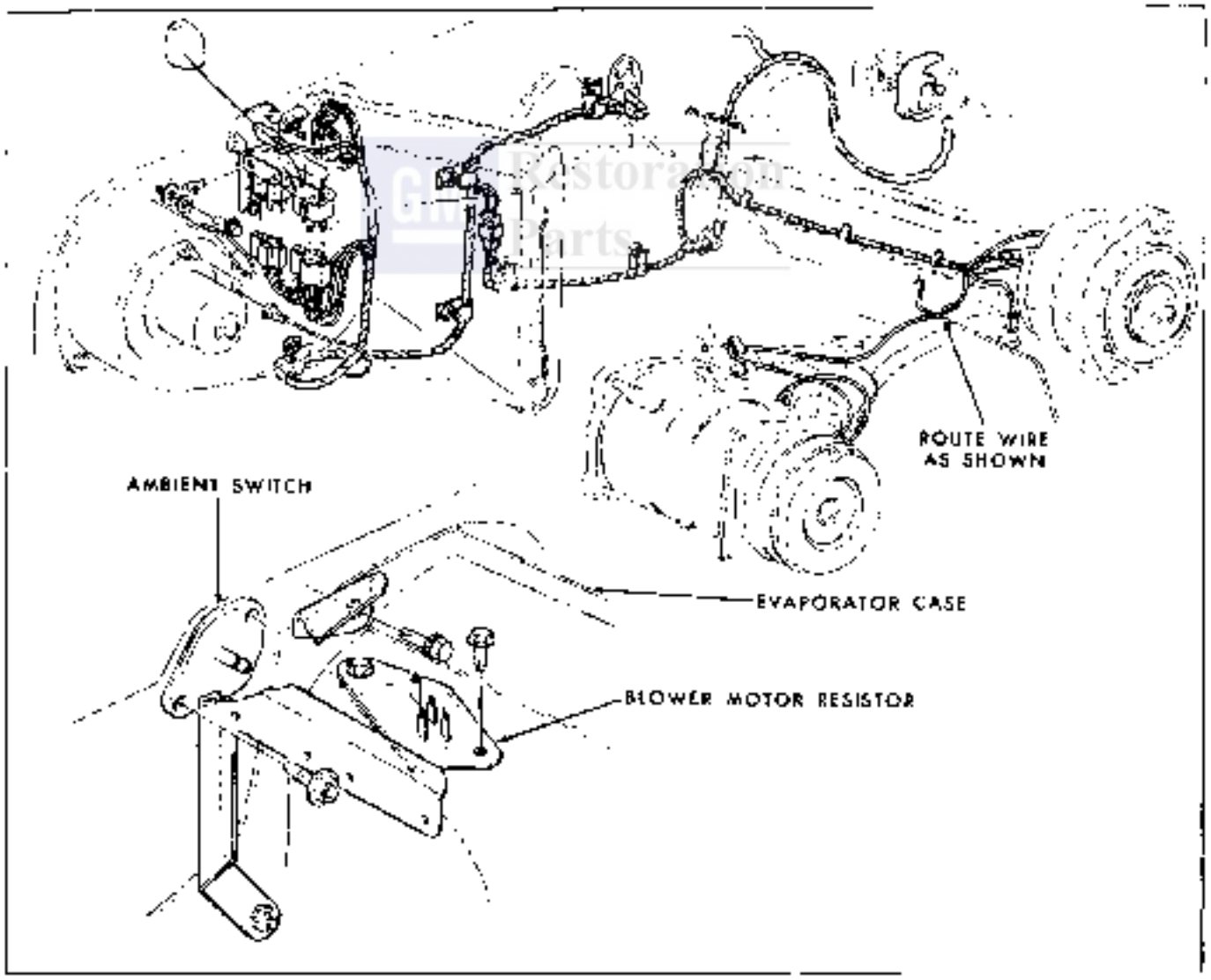


Fig. 1A-60 A/C Electric Harness - Pontiac

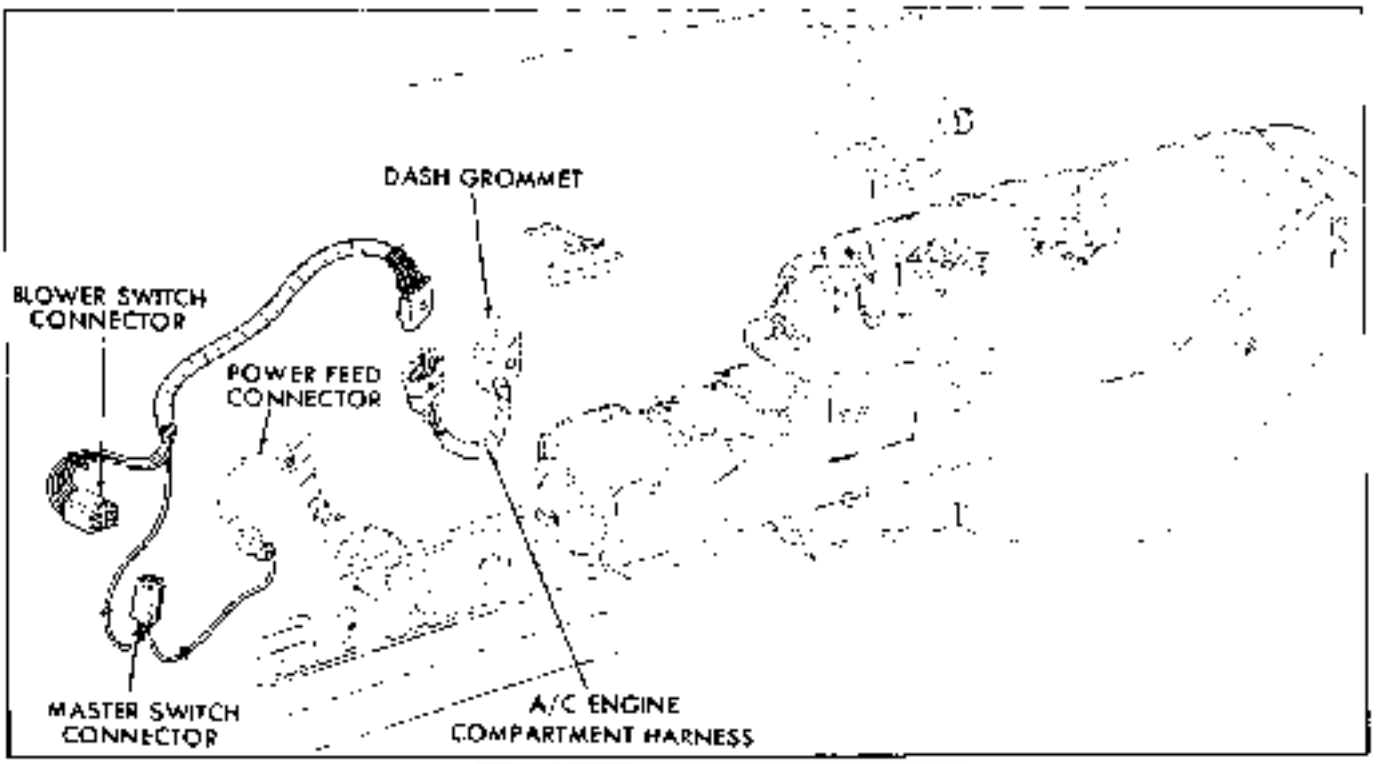


Fig. 1A-61 A/C In-Car Harness - Typical

2. Disconnect the blower switch, master switch, power-feed and line connectors.

3. Remove harness.

4. To replace, reverse removal procedure.

A/C ENGINE COMPARTMENT HARNESS
ALL (Fig. 1A-60)

1. Disconnect line connector in the car.

2. Remove dash grommet and pull connector thru dash.

3. Disconnect harness at relay, resistor block, blower motor, ambient switch and compressor feed connectors.

4. Remove harness.

5. To replace, reverse removal procedure.

MASTER RELAY
PONTIAC ONLY

1. Remove wire connector. (Front relay on bracket.)

2. Remove relay retaining screws.

3. Remove relay.

4. To replace, reverse removal procedure.

VACUUM CONTROL DIAPHRAGMS
PONTIAC OR TEMPEST
DIVERTER DOOR DIAPHRAGMS

1. Remove heater case assembly.

2. Remove vacuum hoses noting arrangement.

3. Remove retaining screws.

4. Remove actuator link attaching screw.

5. Remove diaphragms.

DEFROSTER DIAPHRAGM PONTIAC OR TEMPEST

1. Remove heater outlet duct.

2. Remove two retaining screws and actuator link retaining screw.

3. Remove vacuum hose then diaphragm.

4. To replace, reverse removal procedure.

AIR INLET DIAPHRAGMS PONTIAC, TEMPEST OR FIREBIRD (Fig. 1A-62)

1. Remove kick panel.

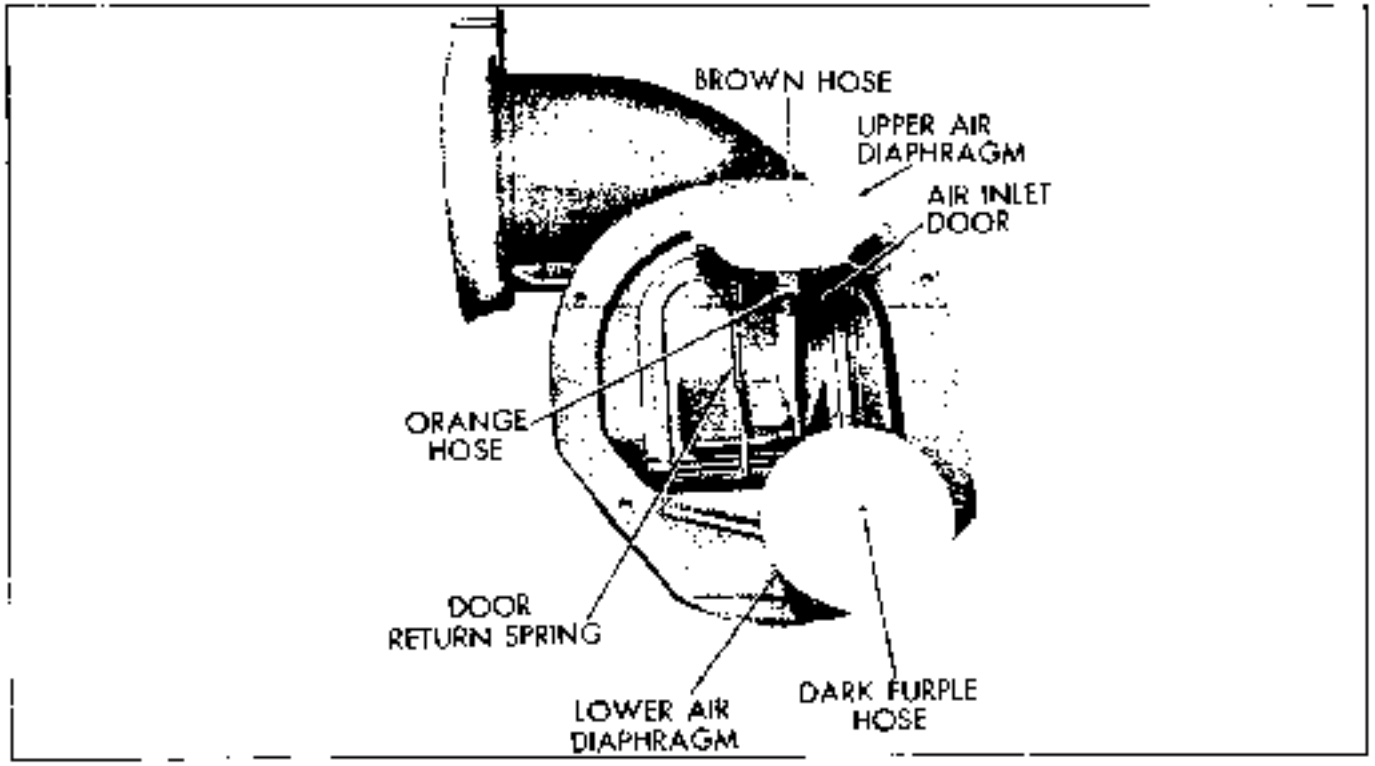


Fig. 1A-62 Air Inlet Diaphragm Attachment

2. Remove vacuum hose.

3. Remove two attaching screws.

4. Remove link actuator attaching screws.

5. Remove diaphragm.

6. To replace, reverse removal procedure.

PLENUM AIR VALVE DIAPHRAGM

1. Remove windshield wiper arms.

2. Remove air vent grille.

3. Remove attaching screws and link actuator screw.

4. Remove diaphragm.

5. To replace reverse above procedure.

HOSES AND CONNECTIONS
All

Air conditioning refrigerant hose routing is shown on Figs. 1A-47, 1A-48 and 1A-49.

These connections should be tight and contaminant free. Use the torque chart in Fig. 1A-1 as a guide for securing hose fittings.

COLD AIR DISTRIBUTION DUCT— REMOVE AND REPLACE

PONTIAC OR TEMPEST
(Figs. 1A-51, 52 and 53)

1. If equipped with stereo tape, remove.

2. Remove three retaining screws.

3. Slide right hose and left duct from distributor duct.

4. Pull duct straight back to clear locating pin and remove from car.

5. If replacing with new duct, remove nozzles and install in new duct. Paint to match.

6. To replace, reverse removal procedure.

FIREBIRD

1. Remove duct flex hoses.

2. Remove duct retaining screws.

3. Remove both portions of duct.

4. To replace, reverse removal procedure.

DEFROSTER DUCT

PONTIAC OR TEMPEST

1. Remove cold air duct.
2. Remove instrument panel face pad.
3. Remove glove compartment.
4. Remove radio.
5. Remove duct retaining screws.
6. Remove duct.
7. To replace reverse above procedure.

FIREBIRD

1. Remove cold air duct.
2. Remove glove compartment, ash tray bracket and radio.
3. Remove duct retaining screws.
4. Remove heater core assembly.
5. Remove duct.
6. To replace, reverse removal procedure.

OUTLET NOZZLE
RIGHT OR LEFT

PONTIAC

1. Remove instrument panel face pad. If right side, remove cold air duct.
2. Remove nozzle retaining screws.
3. Slide duct adapter from nozzle.
4. Remove nozzle.

TEMPEST

1. Remove upper retaining screws.
2. Remove lower retaining screws.
3. Separate and remove nozzle.
4. To replace, reverse removal procedure.

NOTE: The rear half of the bezel is riveted to instrument panel face pad. Should it become necessary to replace the bezel, use pop rivets and not screws.

FIREBIRD

1. Remove two exterior retaining screws.
2. Pull assembly from dash.
3. Remove flex hose from rear of nozzle.
4. Separate components.
5. To replace, reverse removal procedure.

UPPER AIR OUTLET

PONTIAC

1. Remove instrument panel face pad.
2. Remove outlet retaining screws.
3. Bend duct rearward and remove outlet assembly.
4. To replace, reverse removal procedure.

TEMPEST

1. Remove instrument panel face pad.
2. Remove outlet retaining screws.
3. Remove outlet assembly and separate components.
4. To replace, reverse removal procedure.

FIREBIRD

1. Remove instrument panel trim plate.
2. Remove screws retaining outlet to dash.
3. Remove cold air duct.
4. Remove glove compartment.
5. Pull assembly down from dash area and separate components.
6. To replace, reverse removal procedure.

AMBIENT SWITCH

PONTIAC

1. Disconnect A/C relay connectors.
2. Remove relay bracket.
3. Remove ambient switch connector.

4. Remove switch retaining screws.

5. Remove switch and sensor assembly.

6. Reverse removal procedure to replace.

TEMPEST

1. Remove wire connector from switch. (Under right rear side of hood at top of plenum chamber.)

2. Remove switch connectors.

3. Remove switch.

4. Reverse removal procedure to replace.

VACUUM HOSE HARNESS PONTIAC OR TEMPEST (Figs. 1A-56 and 1A-57)

1. Remove cold air duct, and instrument panel face pad.

2. Remove hoses at air inlet assembly.

3. Five clips hold the harness. Bend them to allow removal.

4. Remove connector at heater case.

5. Remove hose at defroster diaphragm and at control panel.

6. Remove dash grommet and pull supply and water valve hoses thru dash.

7. To replace, reverse removal procedure.

AUTOMATIC TEMPERATURE CONTROL

CONTENTS OF THIS SECTION

AUTOMATIC TEMPERATURE CONTROL

REMOVE IN-CAR SENSOR (Fig. 1B-1)

PONTIAC

1. Remove glove box.
2. Remove wire connector.
3. Remove aspirator hose.
4. Remove retaining screws.
5. Remove sensor.

When checking with an ohmmeter, the resistance value of this sensor should be approximately 1000 ohms at 75°.

TEMPERATURE CONTROL SWITCH VARIABLE RESISTOR REPLACEMENT (Fig. 1B-2)

PONTIAC

1. Remove control panel.
2. Unsolder leads at back of switch.
3. Remove cord and retain with paper clip or wire.
4. Remove switch retaining screws.
5. Remove switch and save bushing and spring from shaft.
6. Calibrate dial before replacing control panel in dash (see below).

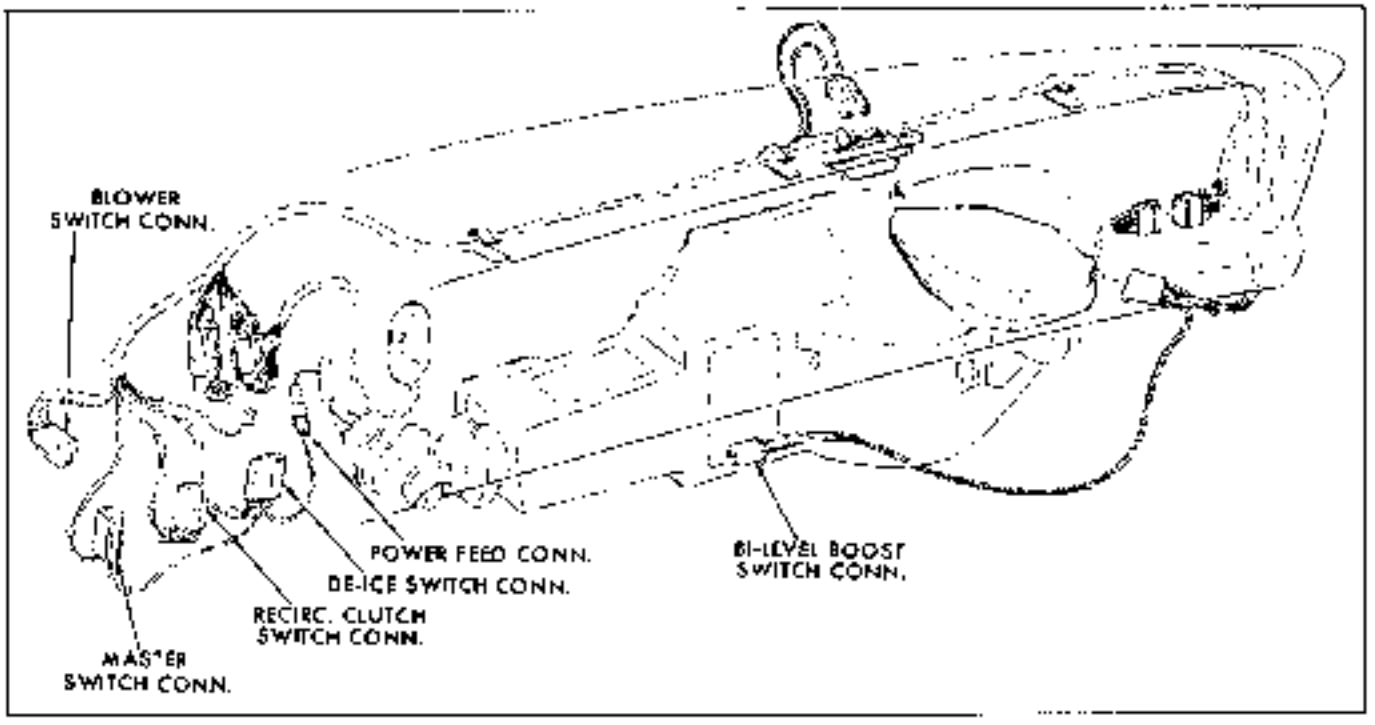


Fig. 1B-1 Automatic Temperature Control - In Car Housing

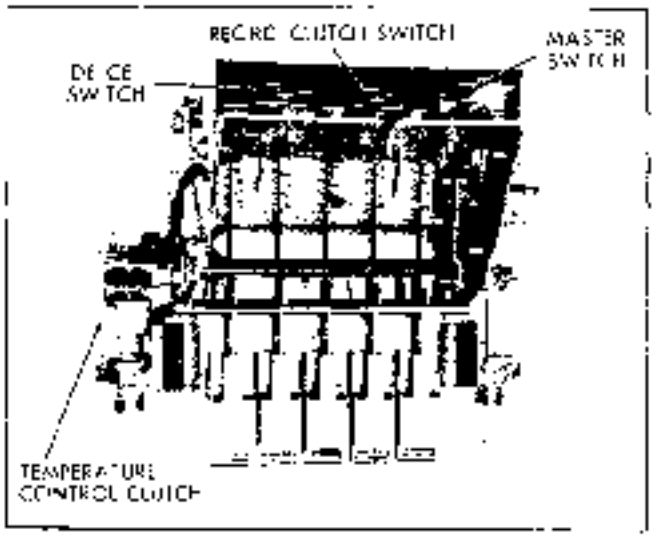


Fig. 1B-2 Bottom View Control Panel

7. To replace, reverse removal procedure.

TEMPERATURE CONTROL SWITCH VARIABLE RESISTOR ADJUSTMENT

1. Connect ohmmeter across resistor.

2. Calibrate ohmmeter.

3. Turn temperature dial until the meter reads 560 ohms.

4. Disengage the friction clutch by pulling outward on shaft.

5. Rotate shaft until it reads exactly 75 (Fig. 1B-3).

NOTE: An alternate procedure for this adjustment is to use Automatic Temperature Control Tester, J 22681.

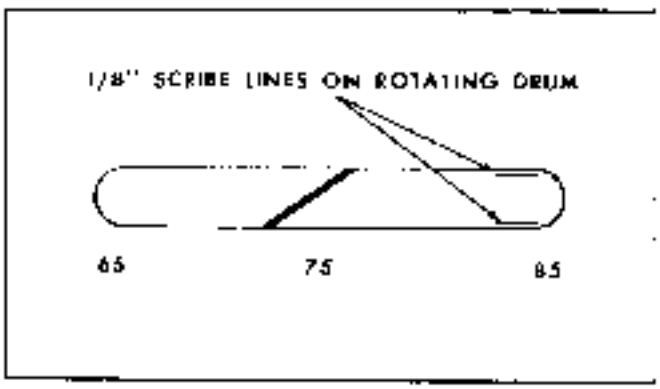


Fig. 1B-3 Control Window Adjustment

PROGRAMMER REPLACEMENT (Fig. 1B-47)

1. Remove cold air duct and glove compartment.

2. Remove programmer link screw.

3. Remove screw retaining vacuum harness connector to programmer.

4. Disconnect two electrical connectors.

5. Remove programmer retaining screws.

6. Pull programmer carefully rearward so as not to break heat sensor.

7. To replace, reverse removal procedure.

ADJUST DOOR LINK

1. Remove distribution duct.

2. Remove glove compartment.

3. Loosen screw retaining link to programmer arm and separate the units.

4. Disconnect programmer connector shown in Fig. 1B-5.

5. With ignition on and OFF button depressed on control head, ground terminals 2, 3 and 4 (Fig. 1B-6 identifies terminals).

6. Apply +12 volts DC (available at BAT terminal of fuse block) to terminal number 2 only. This will cycle programmer to full cold position.

7. Remove +12 volts DC from terminal number 1 and apply to terminal No. 9 only. This will cycle programmer to the AC park position.

8. Push lower diverter door inward if necessary and install tool J 22667 in hole in heater core and case assembly (Fig. 1B-7).

9. Position temperature door against tool, attach link to programmer arm and tighten adjusting screw.

10. Apply +12 volts DC to terminal number 1 only. Programmer will cycle to full cold allowing removal of tool.

11. Connect programmer connector.

12. Replace glove compartment and distribution duct.

PROGRAMMER SERVICE

REMOVAL

1. To remove programmer, remove positive battery terminal, remove glove compartment and disconnect harness from programmer.

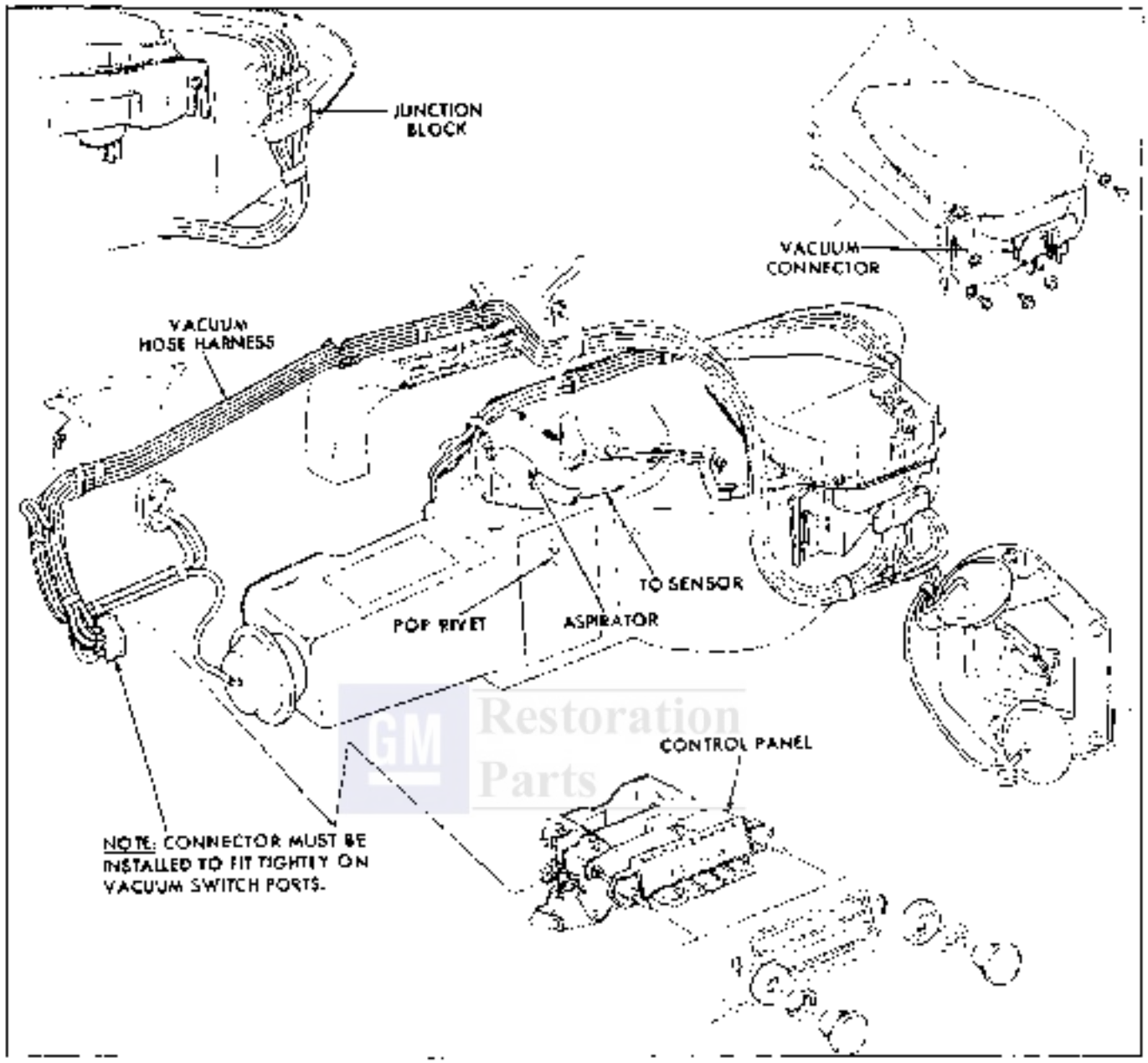


Fig. 1B-4 Details Automatic Temperature Control

2. Remove vacuum hoses from vacuum valve and disengage door link by removing screw.

3. Remove three screws from programmer frame and lift unit out.

DISASSEMBLY

Remove cover from programmer by removing five screws and carefully lift away cover from programmer without bending fingers on finger block assembly.

AMPLIFIER REPLACEMENT

1. Remove finger block out of way.

2. Unsolder seven leads (two orange, one light green, one dark green, one brown, one gray and one red lead).

The nine leads (two orange, two red, two green, one light green, one dark green, one brown) must be disconnected (Fig. 1B-8). Remove two circuit board mounting screws. Lift board carefully straight up and off finger block mounting post.

3. Install new board by reversing removal procedure and secure with two mounting screws making certain that ground lug is under the mounting screw nearest wheel. Note that circuit board comes with a new finger block and lead cable attached.

4. Solder previously disconnected leads according

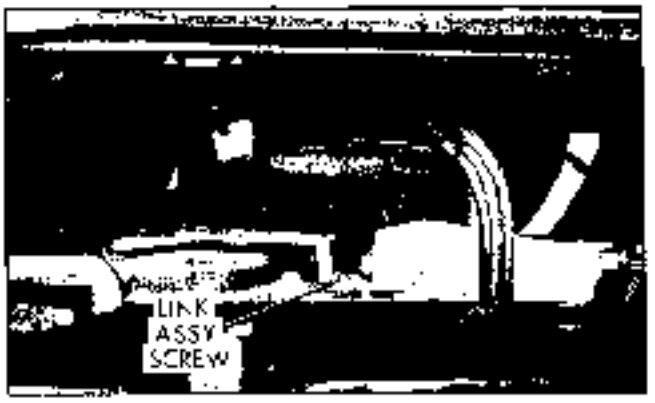


Fig. 1B-5 Programmer Link Assembly

to attached wiring diagram. Use resin core solder for all soldering operations.

5. Install finger block and cable clamp. Make certain that cable clamp is properly seated in its bracket.

6. Replace cover with five screws.

PROGRAM WHEEL REMOVAL

1. Scribe a thin line (using a screwdriver, knife or other sharp instrument) on the potentiometer clip in line with edge of wheel rib so that clip can be replaced in same position on wheel, Fig. 1B-6. There is a white paint mark in this area.

2. Remove finger block assembly and move out of way.

3. Remove retaining screw in hub of wheel and remove potentiometer clip. Program wheel may now be slipped off.

GEAR INSPECTION

1. Remove program wheel as described above.

2. Carefully remove wire clamps by placing a small screwdriver under the higher of the two locking tabs and gently work clips off mounting studs.

3. Remove two mounting screws on circuit board and lift board off finger block mounting post out of way. Do not put undue strain on attached wiring.

4. Remove potentiometer bracket being careful of attached leads. The gears and motor are located directly below the bracket.

5. Inspect gears for broken teeth or other ab-

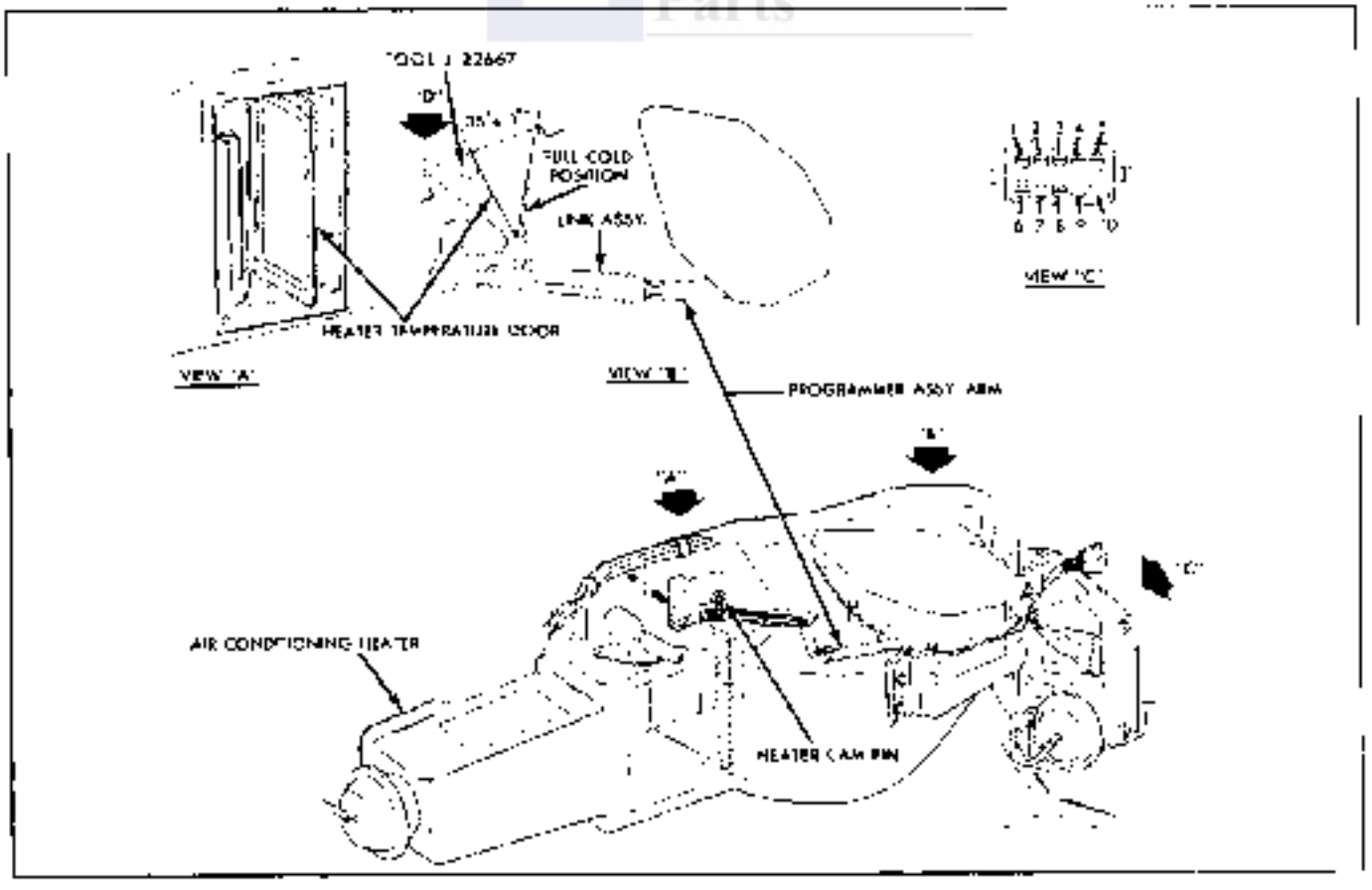


Fig. 1B-6 Temperature Door Adjustment

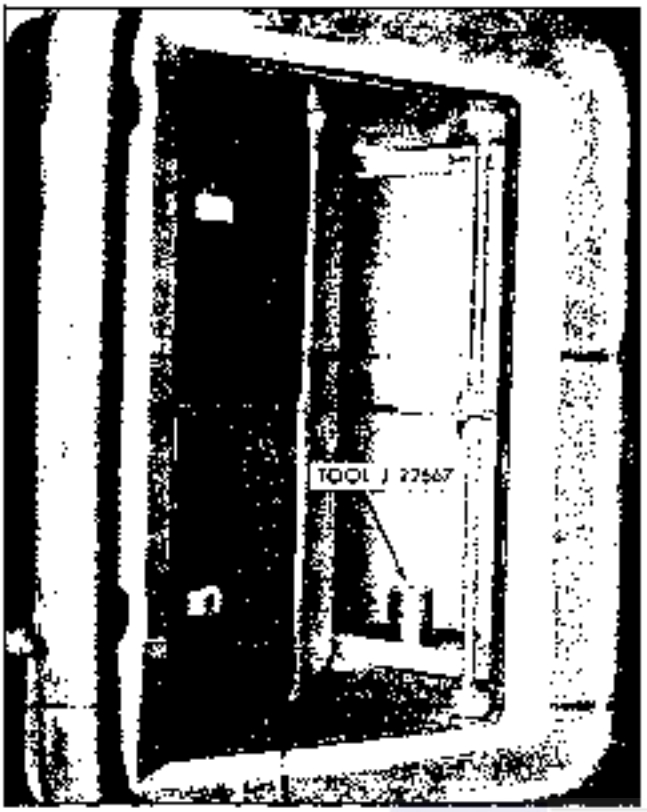


Fig. 1B-7 Tool J-22667 Installed

normal conditions. Replace gears if broken or inoperative.

MOTOR REPLACEMENT

1. Follow procedure for program wheel removal and gear inspection.

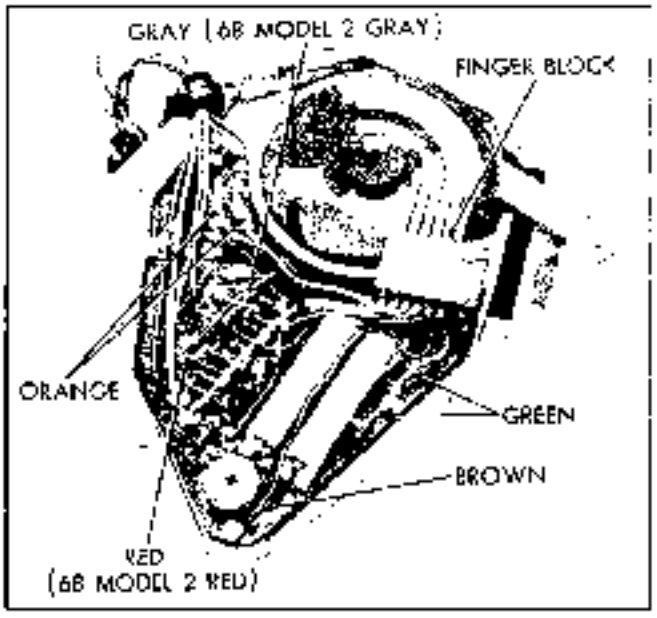


Fig. 1B-8 Programmer Amplifier

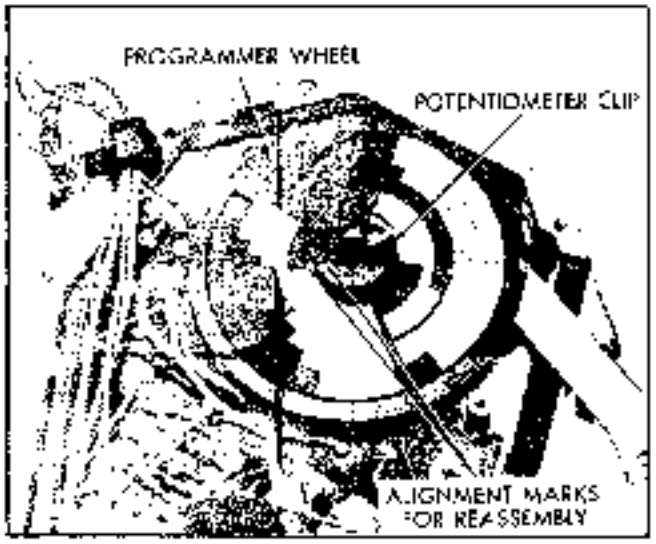


Fig. 1B-9 Marking Programmer Wheel

2. Remove motor by moving it back and up from its normal position.

3. Unsolder orange lead to old motor from circuit board and solder orange lead from new motor to same point. Replace green ground wire in same manner. Be sure to use rosin core solder.

4. Install new motor making certain that worm gear is properly seated in its bearing block and properly meshed with helical spur gear.

5. Reassemble unit by reversing disassembly procedure. When reinstalling program wheel, follow special instructions provided.

PROGRAM WHEEL INSTALLATION PROCEDURE

1. Position vacuum valve approximately in center of its travel.

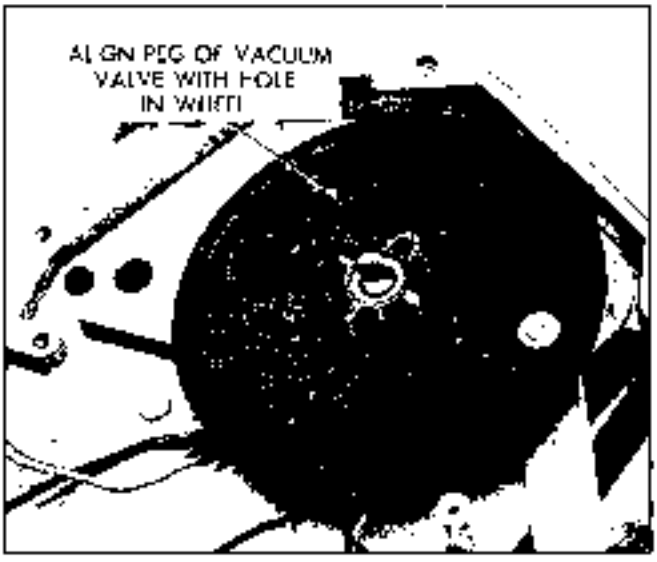


Fig. 1B-10 Aligning Programmer Wheel

2. Install program wheel so that peg on vacuum valve is visible through alignment hole in program wheel (Fig. 13-10). It may be necessary to move the vacuum valve slightly to accomplish this.

3. Install potentiometer clip and rotate so that scribe marks (made previously) on program wheel and clip line up. Tighten retaining screw on program wheel hub.

4. Slip the round circuit board off of wheel and check to be certain that four ball bearings are still in their proper positions in bearing retainer cups. Replace board and reinstall finger block with two screws.

BI *LEVEL BOOST SWITCH REPLACEMENT*

1. Remove cover plate on bottom of heater core and case.

2. Remove wire connector.

3. Remove retaining screws, then switch.

4. Replace by reversing removal procedures.

FRAME AND BODY MOUNTINGS

PONTIAC AND TEMPEST

FRAME

The frame is of swept up perimeter design (Fig. 2-1) for easier servicing. It also permits use of a simplified two-piece propeller shaft and exhaust system.

Frames are supplied by various manufacturers. All convertibles are equipped with A.O. Smith frames while all other models utilize frames built by both A.O. Smith and Parrish Pressed Steel.

Frames can be identified by the number of holes located at left front outer side bar in steering gear mounting area (Fig. 2-2).

The perimeter frame has two advantages; first, the body comes down over the frame and forms an integrated structure with body sheet metal contributing greatly to the strength of the car; secondly, although the body and frame strengthen each other, there is no metal-to-metal contact, because they are connected by means of rugged butyl rubber body mounts which isolate the driver and passenger from engine, transmission drive-line, and road disturbances.

The dimensions given in (Fig. 2-3) may be used in checking frames. Dimensions for X, Y, and Z are not given, but are used merely to illustrate points for taking diagonal measurements for checking squareness of frame. Holes or rivet heads are located on the frame at approximate terminal point of arrowheads, and can be used for this purpose.

Of the seven basic frames used by Pontiac, four are for the 121" wheelbase vehicles, and three for the 124" wheelbase vehicles.

The convertible, hardtop, 124" wheelbase sedan, station wagon and Grand Prix frames are essentially the same as other corresponding wheelbase frames but have the center side rail fully boxed for additional stiffness.

Five different frames of two wheelbases are used on Tempest models; all 4-door styles and station wagons are 116" and all 2-door styles 112". The basic frame for the sedans and station wagons has a fully boxed front section and open 'C' section center side rails extending to the rear tip area. The convertible frame is of heavier metal thickness and has a boxed section front and center side rail with an additional inner side bar stiffener (boxed section) beginning at the rear wheelhouse fourteen six body bolt; and extending rearward to the rear impact bar attaching bolts. The frame for 4-door hardtop models is similar to the standard frame, but with added metal thickness.

LIFTING PONTIAC CARS WITH HOISTS

Lifting can be accomplished without adapters when using drive-on or twin-post type hoists, with hoists or lifts making contact with front suspension lower arms or rear axle. Since the frame is perimeter type, some hoists designed to contact side rails require adapters to raise the car without damage to parts of exhaust system, body, floor, etc. Suppliers of original lifting equipment should have information on adapters to use with Pontiac cars. Fig. 2-4 shows proper lift point locations.

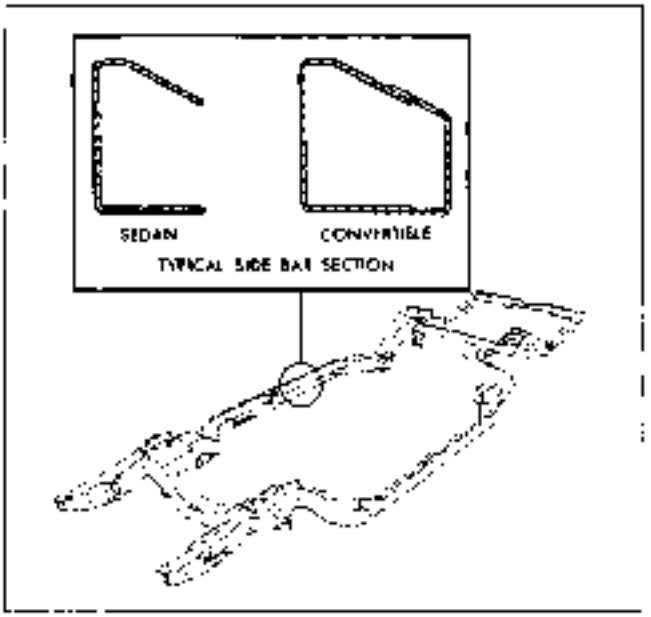


Fig. 2-1 Typical Perimeter Design Frame

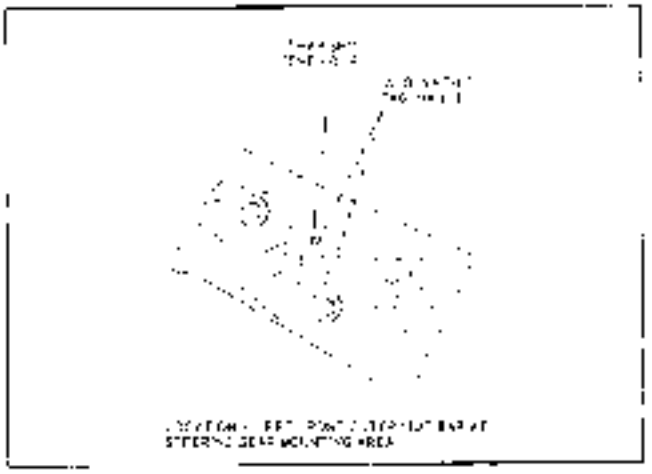
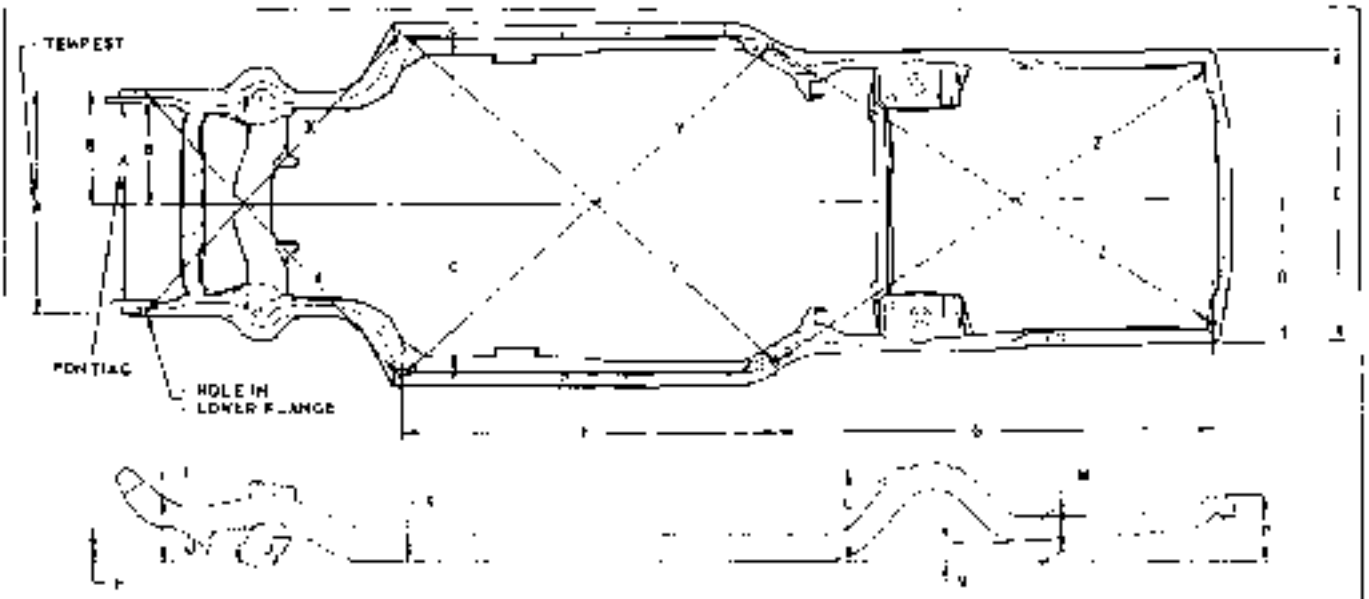


Fig. 2-2 Frame Alignment Identification



PONTIAC

BODY STYLES	A	B	C	D	E	F	G	H	J	K	L	M	N	P
5217, 5269	38.40	19.20	60.20	25.32	50.64	68.10	78.64	6.64	11.51	4.75	16.03	7.79	3.52	11.08
5287, 5239	38.40	19.20	60.20	25.34	50.68	68.10	78.64	6.64	11.51	4.75	16.03	7.79	3.52	11.08
5267	38.40	19.20	60.20	25.34	50.68	68.10	78.64	6.64	11.51	4.78	16.06	7.84	3.50	11.08
5235, 5245 5635, 5645 6245	38.40	19.20	60.20	25.34	50.68	68.10	78.64	6.64	11.51	4.75	16.03	7.79	3.52	11.08
5639, 5669 5687, 6239 6287	38.40	19.20	60.20	25.34	50.68	68.10	85.64	6.64	11.51	4.78	16.06	7.83	3.53	11.11
6267	38.40	19.20	60.20	25.34	50.68	68.10	85.64	6.64	11.51	4.78	16.06	7.83	3.53	11.11
6657	38.40	19.20	60.20	25.34	50.68	68.10	78.64	6.64	11.51	4.75	16.03	7.79	3.52	11.08

TEMPEST

BODY STYLES	A	B	C	D	E	F	G	H	J	K	L	M	N	P
3369, 3569, 3539, 3739	41.30	20.65	52.36	21.59	43.18	66.19	68.18	7.03	11.05	4.30	12.24	7.91	4.59	10.63
3327, 3537 3527, 3727 3737, 4237	41.30	20.65	52.36	21.59	43.18	62.19	68.18	7.03	11.05	4.30	12.24	7.91	4.59	10.63
3535, 3735	41.30	20.65	52.36	21.59	43.18	66.19	74.38	7.03	11.05	4.30	12.24	7.91	4.59	9.43
3567, 3767 4267	41.34	20.67	52.36	21.59	43.18	62.19	68.18	7.05	11.05	4.30	12.24	7.91	4.59	10.63

Fig. 2-2 Frame Alignment Chart

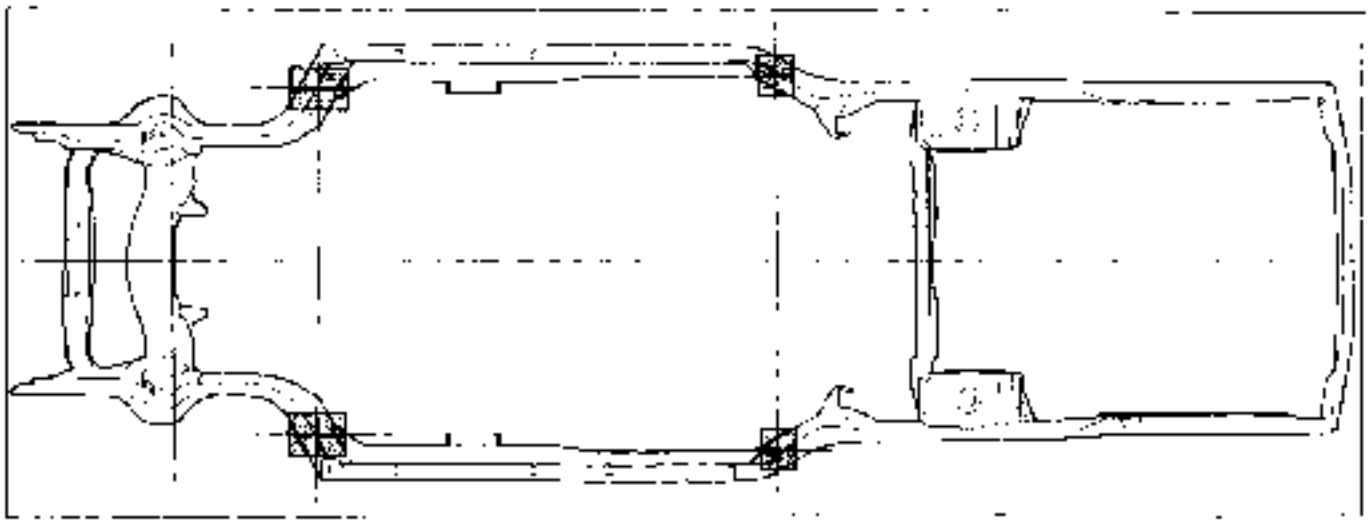


Fig. 2-4 Lift Point Locations

BODY TO FRAME MOUNTINGS

With the use of a perimeter frame, noise isolation from the body is accomplished with soft butyl-rubber mounts, see Figures 2-5 and 2-6.

FIREBIRD

UNDERBODY ALIGNMENT

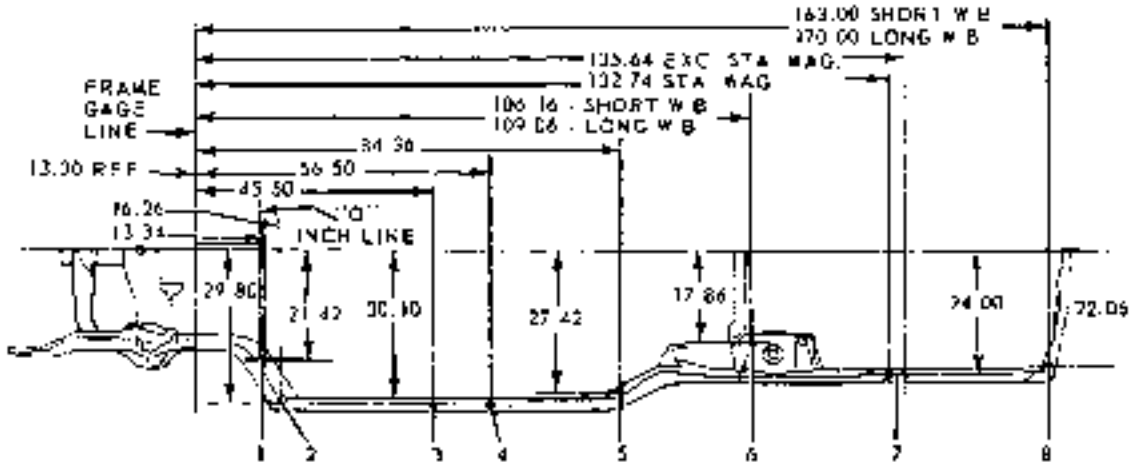
Firebird bodies are of unitized construction. A partial frame supports the front end sheet metal, front suspension, engine and other mechanical components. Unitized construction demands that underbody components be properly aligned to ensure correct suspension location. In the event of collision damage it is important that the underbody be thoroughly checked and, if necessary, realigned in order to accurately establish suspension locations.

To assist in checking alignment of the underbody components, repairing minor underbody damage or locating replacement parts, the following underbody dimensions and alignment checking information is presented.

For additional information see Section 3 of the Fisher Body Service Manual.

REFERENCE POINT DIMENSIONS

Dimensions to gauge holes are measured to dead center of the holes and flush to adjacent surface metal unless otherwise specified. The master gauge holes adjacent to the No. 1 body mount (Fig. 2-7) and in the side rails near the rear spring front attachment are key locations and should be used wherever possible as a basis for checking other reference points.



MODELS	#1 BOLT INNER	#1 BOLT OUTER	#3 BOLT	#4 BOLT	#5 BOLT R.H	#5 BOLT L.H	#7 BOLT	#8 BOLT	#9 BOLT
5211, 5269 W/F 35	B	B	B	B	-	-	B	B	B
5235, 5245, 5635, 5645, 6245	A	A	A	A	F	H	A	A	A
5639, 5669, 5287, 5687, 6287, 6239, 5239, W/F 35	B	B	F	F	-	-	B	B	B
6267	D	D	D	D	F	H	D	D	D
5211, 5269 W/F 35	B	B	A	A	F	H	B	B	B
6240, 6250, 6290	D	D	D	D					
6657	A	A	A	A	-		A	A	A
5639, 5669, 5287, 6267, 6239, 5239, 5687 W/F35	B	B	F	F	F	H	B	B	B
5267	D	D	D	D		-	D	D	D

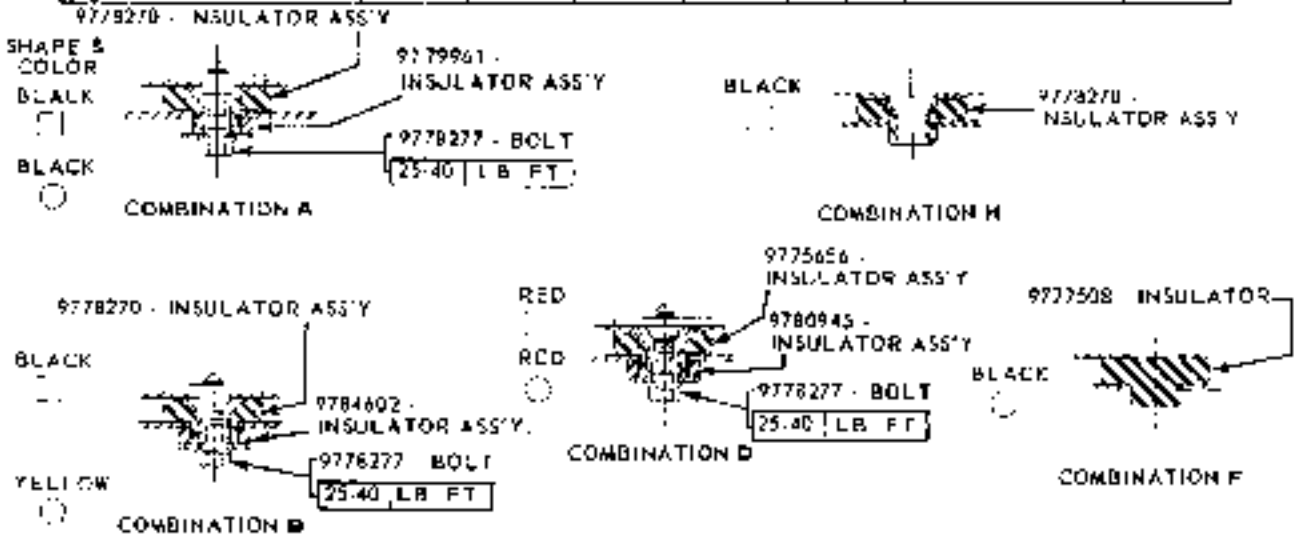
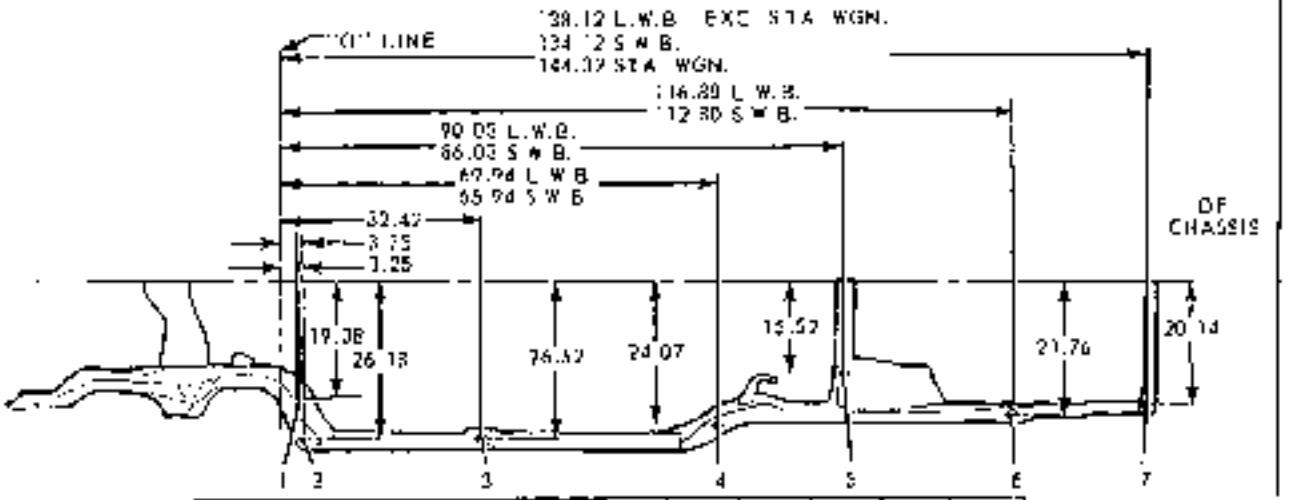
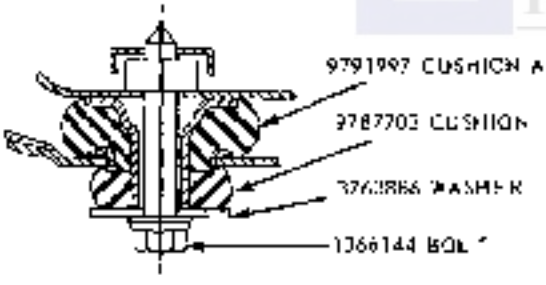


Fig. 2-5 Pontiac Body Bolts and Frame Gauge Line Dimensions

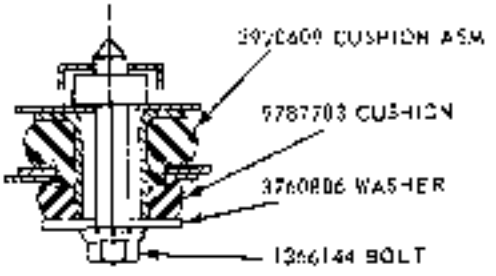


MODELS	#1 BOLT	#2 BOLT	#3 BOLT	#4 BOLT	#5 BOLT	#6 BOLT	#7 BOLT
3535, 3567, 2767, 3935, 4267	A	A	C	A	E	A	D
3527, 3527, 3537, 3727, 3737, 4327, 4237	B	A	C	E	E	A	D
3069, 3539, 3569 3729	B	A	C	A	B	A	D

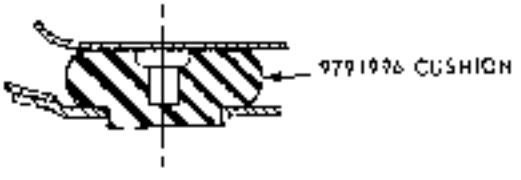
COMBINATION E



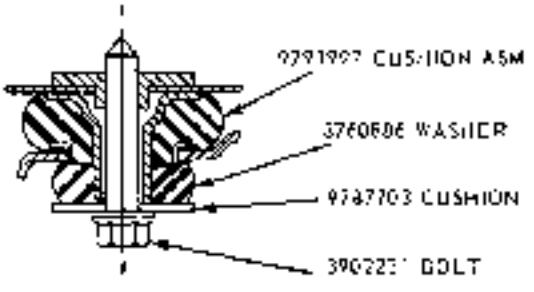
COMBINATION A



COMBINATION D



COMBINATION B



COMBINATION C

Fig. 2-6 Tempest Body Bolt and Frame Gauge Line Dimensions

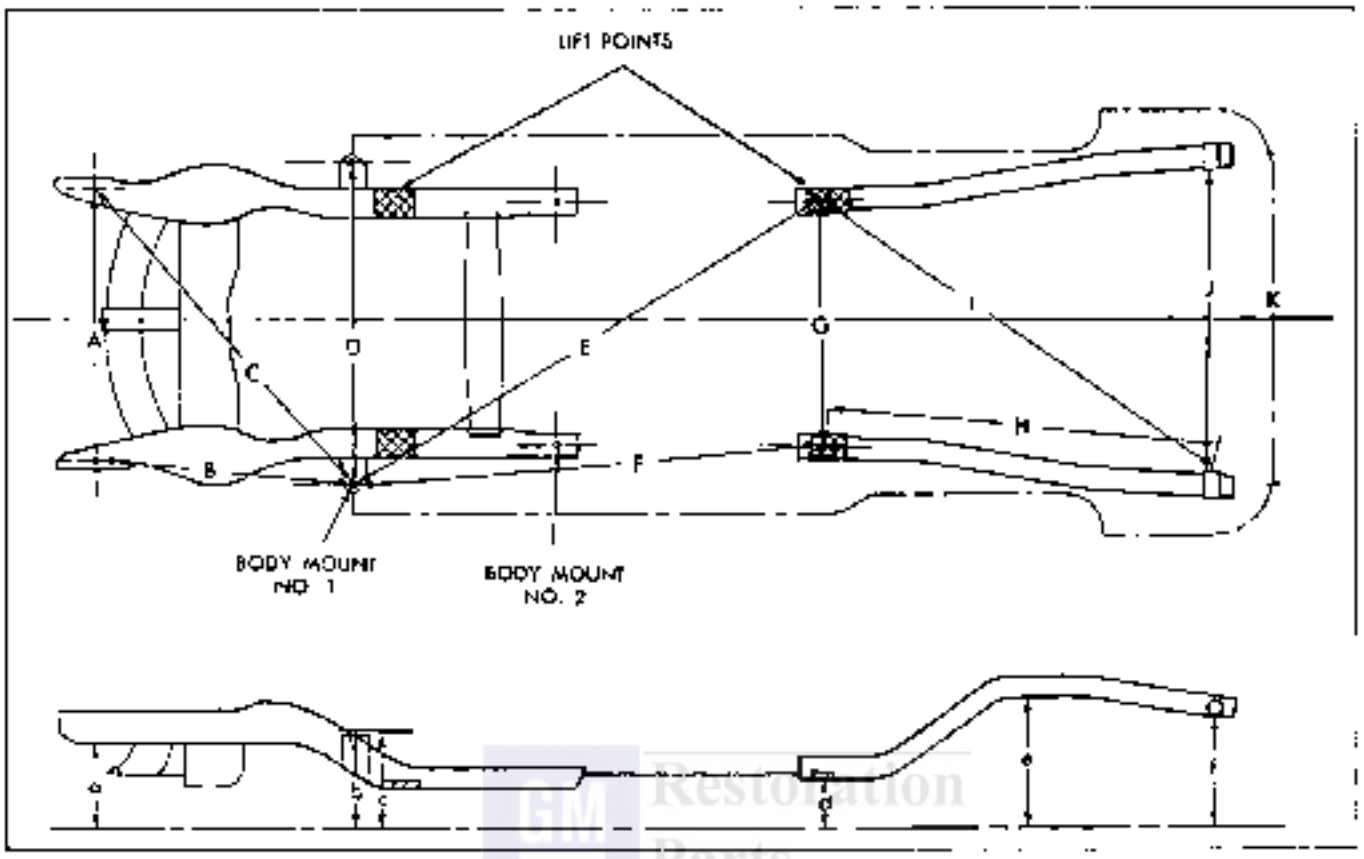


Fig. 2-7 Fire'd Checking Dimensions, Lift Points and Body Bolt Locations

HORIZONTAL DIMENSIONS (Fig. 2-7)

Fig. Ref.	Dimension	Location
A	38 3/16"	Rear edge at centerline of 1" gauge hole.
B	34 15/16"	Rear edge at centerline of gauge hole and center of master gauge hole adjacent to No. 2 body mount on same side of frame.
C	54 1/8"	Rear edge at centerline 1" master gauge hole adjacent to No. 1 body mount on opposite side of frame.
D	44 5/16"	Center of master gauge hole adjacent to No. 1 body mount.
E	75 7/8"	Center of master gauge hole adjacent to No. 1 body mount and center of master gauge hole in side rail on opposite side of body.
F	65 1/4"	Center of master gauge hole adjacent to No. 1 body mount and center of master gauge hole in side rail on same side of body.
G	33 1/2"	Center of master gauge hole in side rail.
H	55 3/16"	Center of master gauge hole in side rail and a point at inboard edge of same side rail at centerline of shackle bolt hole (Fig. 2-8).
I	66 11/16"	Center of master gauge hole in side rail and a point at inboard edge of opposite side rail at centerline of shackle bolt hole (Fig. 2-8).
J	42 7/8"	Inboard edge of side rail at centerline of shackle bolt hole (Fig. 2-8).
K	44 7/8"	Center of rear bumper lower attaching bolts.

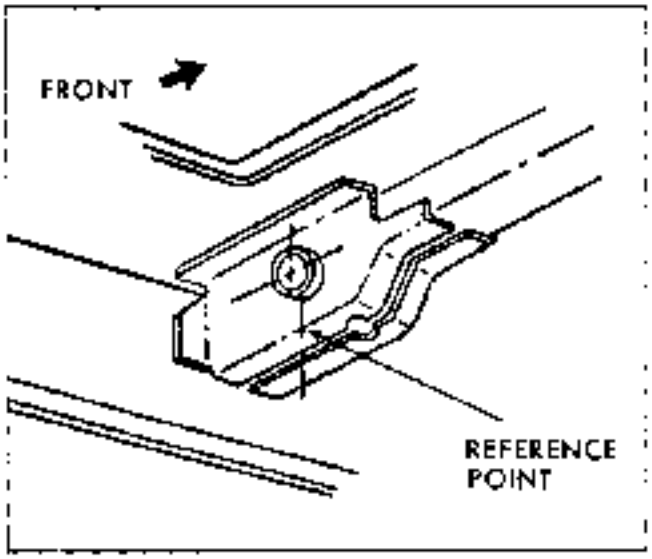


Fig. 2-8 Side Rail at Spring Rear Shackle Hole

VERTICAL DIMENSIONS (Fig. 2-7)

Fig. Ref.	Dimension	Location
a	11 15/16"	3" gauge hole at front of frame.
b	13"	Master gauge hole adjacent to No. 1 body mount in frame.
c	13 13/16"	Master gauge hole adjacent to No. 1 body mount on body.
d	6 15/16"	Master gauge hole in side rail
e	11 3/4"	Lower surface of side rail at kick up rather side of rear axle housing.
f	15 11/16"	Lower surface of side rail at centerline of shackle bolt hole.

LIFTING

Lifting can be accomplished without adaptors when using a drive-on hoist or with a twin-post type hoist by making contact with front suspension lower control arms and rear wheels. Since there is a bolted on stub frame in front and welded side rails at the rear, the car may also be lifted at the points illustrated in Fig. 2-7. Proper adapters must be used to prevent damage to the various parts of the underbody. Caution should be exercised so as not to nick the rear springs.

BODY VIBRATION DAMPENERS

All convertible styles contain four body vibration dampers, one of which is mounted at each corner of the vehicle as shown in Fig. 2-9. Rear dampers are mounted to the vertical quarter panel brace and floor pan. Front dampers are mounted to the radiator support.

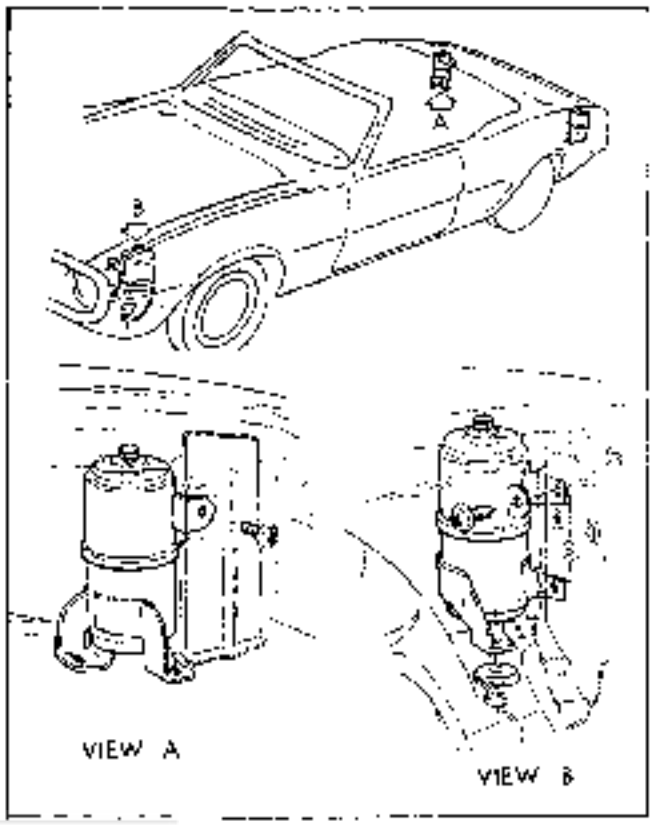


Fig. 2-9 Body Damper Locations

FLOOR PAN REINFORCEMENT

Convertible styles have a bolt on floor pan reinforcement as shown in Fig. 2-10. It is of stamped steel and straddles the drive shaft tunnel.

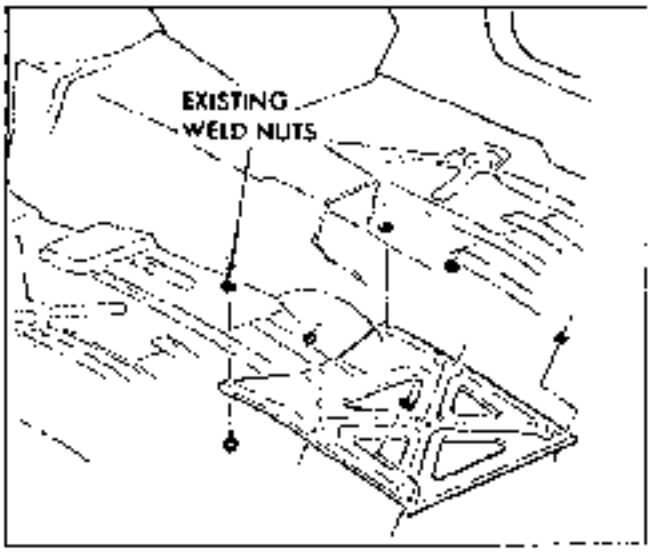


Fig. 2-10 Convertible Floor Pan Reinforcement

FRONT SUSPENSION

PONTIAC, TEMPEST AND FIREBIRD

PERIODIC SERVICE

Periodic service of the suspension system consists of regular lubrication as outlined in the GENERAL LUBRICATION section.

Lubrication fittings are provided at the front suspension ball joints. Shock absorbers do not require lubrication and, in case of leaks or malfunction, they should be replaced.

ADJUSTMENTS AND CHECKS ON CAR

Periodically it may be necessary to make certain adjustments and checks of the suspension system to maintain desirable handling and steering characteristics and minimize tire wear. These checks are: front wheel bearings, wheel and tire balance, lateral run-out, upper and lower control arm spherical ball joints, chassis springs, shock absorbers, and wheel alignment. They are made with the parts on the car.

CHECK AND ADJUST FRONT WHEEL BEARINGS

NOTE: Tapered roller bearings have a slightly loose feel when properly adjusted. This differs from ball bearings which may be pre-loaded without adverse effect. Tapered roller bearings can be damaged by the steady thrust or roller ends which comes from pre-loading, Fig. 3-1.

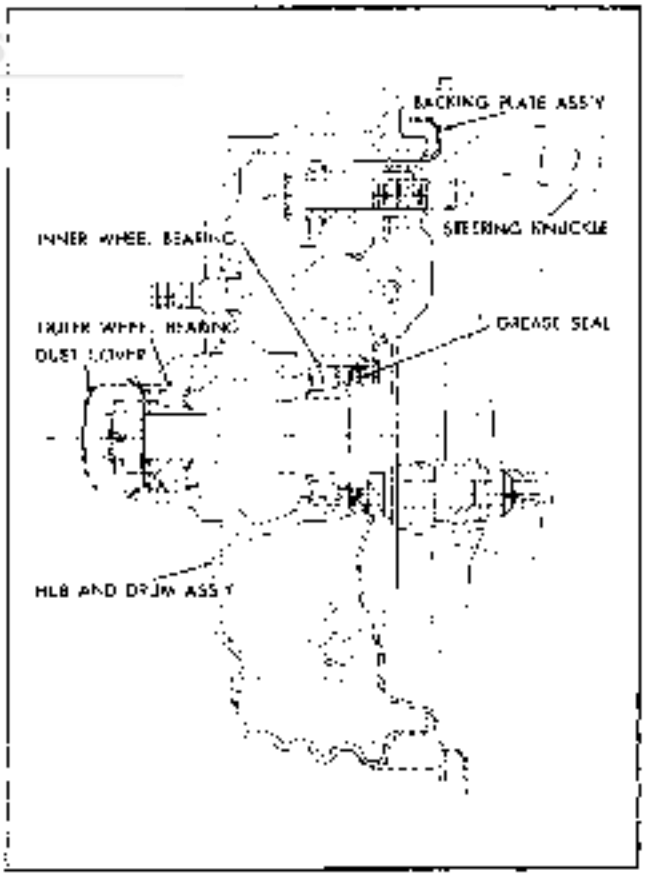


Fig. 3-1 Cross Section of Front Wheel

To Check:

1. Place lift or car jack under lower frame front crossmember and raise wheel off floor. This will maintain load on the ball joints.

2. Spin wheel to check for unusual noise.

3. If bearings are noisy or excessively loose, they should be cleaned and inspected prior to adjustment.

NOTE: To check for loose bearing, mount a dial indicator to the adjusting nut (Fig. 3-2) with the indicator foot on a smooth portion of the wheel hub. Grip the tire at the top and bottom and move the wheel assembly in and out on the spindle. Movement greater than .001" indicates a loose bearing. If necessary to inspect bearings, see Minor Repairs - Wheel Bearing Remove and Replace.

To Adjust:

TORQUE WRENCH METHODS (Preferred) (Fig. 3-3)

1. Raise wheel and tire assembly off ground.

2. Remove dust cap and cotter pin from adjusting nut.

3. Adjust bearing as follows:

a. Fully seat bearing parts by continuously rotating the drum while tightening the adjusting nut to 10-16 lb. ft. torque.

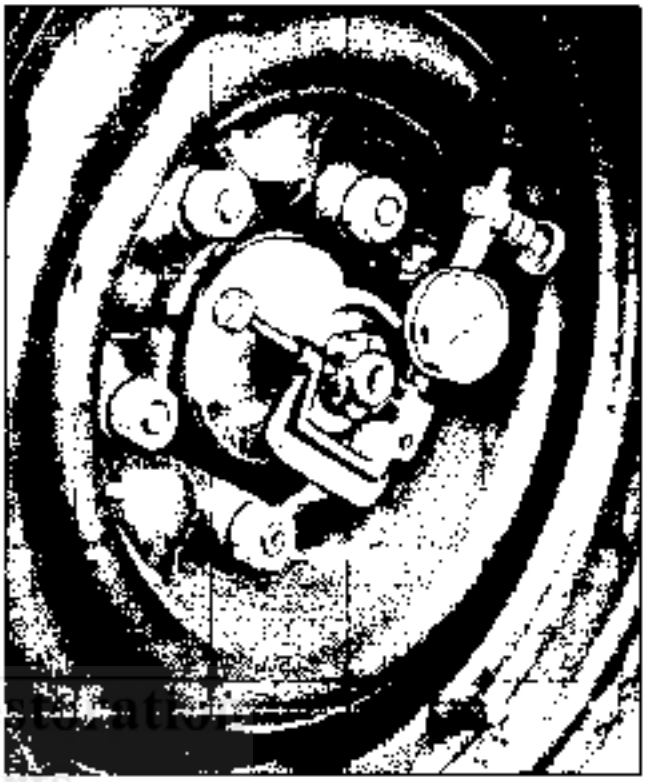


Fig. 3-2 Checking Front Wheel Bearing Adjustment

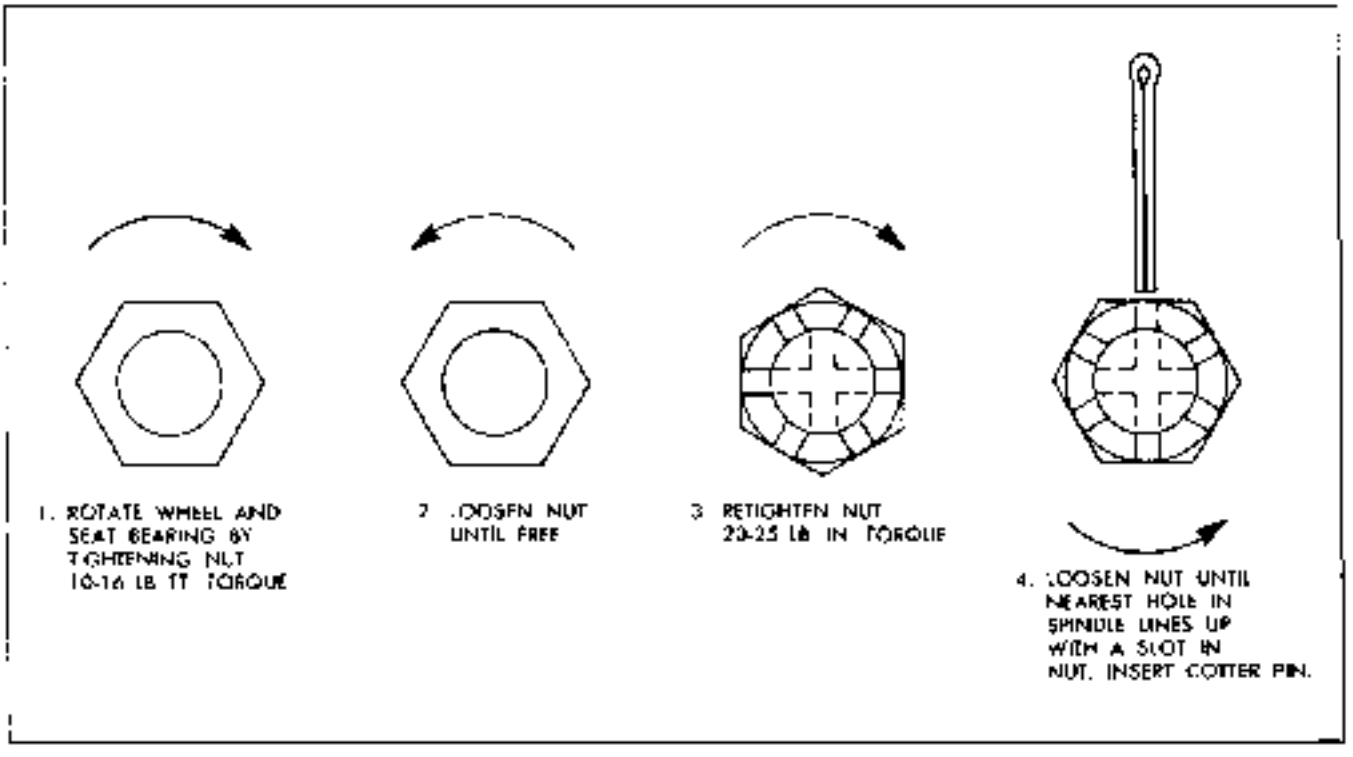


Fig. 3-3 Wheel Bearing Adjustment

b. Back off the adjusting nut until loose.

c. Tighten adjusting nut 20–25 lb. in. torque.

d. Loosen adjusting nut until nearest cotter pin hole in spindle lines up with a slot in the adjusting nut.

NOTE. There are two locking holes.

e. This should result in the desired limits of .001" to .005" end play.

4. Insert cotter pin, and clinch over. Be sure ends do not interfere with dust cap.

5. Install dust cap and lower tire to ground.

HAND FEEL METHOD (Optional)

1. Raise wheel and tire assembly off ground.

2. Remove dust cap and cotter pin from adjusting nut.

3. Adjust bearing as follows:

a. Tighten adjusting nut with 6" or 10" wrench, using enough arm length leverage to ensure parts are properly seated while spinning wheel.

b. Back off nut until loose, then tighten nut finger tight.

c. If hole in spindle lines up with slot in nut, install cotter pin. If not, back off nut to next slot and install cotter pin.

d. Spin wheel – if wheel feels tight then, back off one more slot and readjust, be sure brake shoes are not dragging.

4. Clinch cotter pin and cut off extra length to ensure ends will not interfere with dust cap.

5. Install dust cap and lower tire to ground.

SUSPENSION ALIGNMENT

Front suspension components are adjusted to a specific alignment while the vehicle is motionless so that suspension components can properly function together when vehicle is moving to minimize tire wear and maintain desirable steering and handling characteristics.

INSPECTION BEFORE CHECKING FRONT WHEEL ALIGNMENT

Before any checking or corrective work is started on wheel alignment elements, including toe-in, caster, camber, steering axis inclination, and toe-out on turns, the following items which will affect steering should be considered:

1. Check tire inflation and bring to recommended pressure.

2. Check front wheel bearing adjustment and correct if necessary.

3. Check wheel and tire run-out.

4. Check wheel and tire for excessive unbalance which would affect steering.

5. Check spherical ball joints.

6. Check steering linkage for looseness. Replace or tighten parts.

7. Check shock absorbers for leaks or lack of control.

8. Check for extraordinary load in car. Remove load or compensate for setting height. (Samples, tools, etc., carried regularly should not be considered extraordinary load.)

9. Check for proper lubrication of front end.

CHECKING AND ADJUSTING SEQUENCE— FRONT WHEEL ALIGNMENT

All measurements and adjustments should be made in the following order.

a. Curb height (see Curb Height chart in section 0).

b. Caster and camber.

c. Toe-in.

d. Steering axis inclination.

e. Toe-out on turns.

ADJUST CASTER AND CAMBER

Caster and camber are adjusted to specifications by placing shims between the upper pivot shafts and the frame (Fig. 3-4). Both adjustments can be made at the same time. In order to remove or install shims, raise car to remove weight from front wheel, then loosen the control arm shaft to frame bolts. Addition to camber angles moves top of wheel outsubstraction in. Fig. 3-5, shows tool J 22618 which must be used to loosen upper control arm shaft to frame bolts on the Pontiac

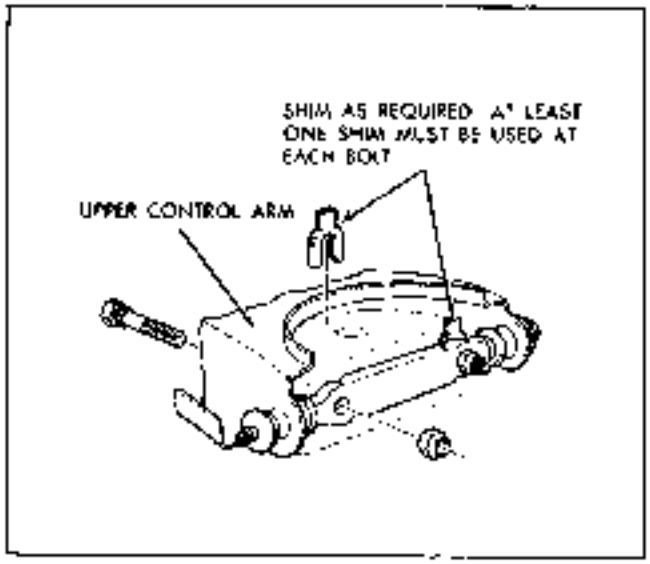


Fig. 3-4 Caster - Camber Shims (Tempest Shown)

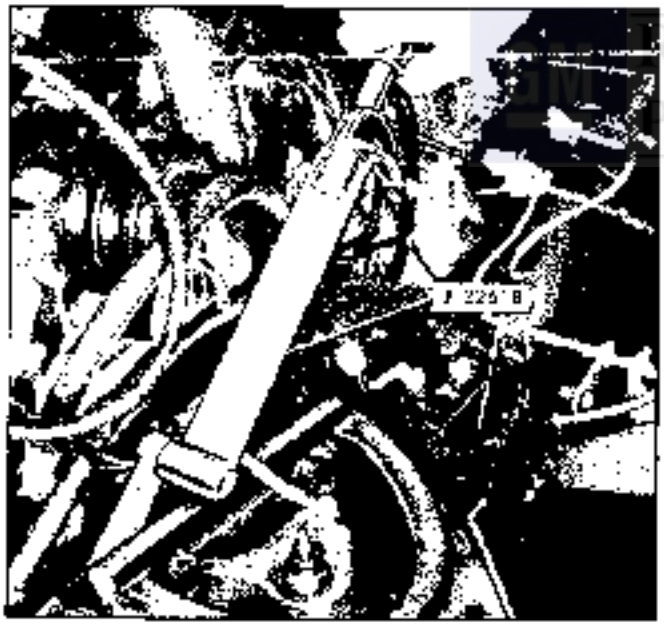


Fig. 3-5 Tool J 22618 to Remove Upper Control Arm Bolts

2. To increase negative caster add shims to front bolt or remove shims from rear bolt.

2. To decrease negative caster remove shims from front bolt or add shims to rear bolt.

3. To increase positive camber remove shims from both front and rear bolts.

4. To decrease positive camber add shims to both front and rear bolts.

NOTE: By adding or subtracting an equal amount of shims from front and rear bolts, camber will be changed without affecting caster.

CHECK AND SET TOE-IN

Check and set toe-in (see SPECIFICATIONS) with a trammel or with other reputable front end aligning equipment, measuring from sidewall of tire or wheel bellows, using methods given below.

MEASURING BY TRAMMEL

1. After moving car forward on level floor, chalk tread on both front tires at point 9" above floor.

2. With trammel set at center-to-center distance of front tires, make mark with chalk on each front tire exactly trammel width apart.

3. Push car forward (never backward) until chalk with trammel marks is 9" above floor at rear of wheels.

4. Measure difference from trammel marks made when chalk was in front of wheel; if trammel marks are now greater than when marked at front, wheels toe-in by this amount (see SPECIFICATIONS).

EQUIPMENT MEASURING FROM SIDEWALL OR WHEEL PELLOWS

When using this type of equipment, wheel run-out will have a very direct bearing on the readings. Since the allowable run-out is 1/8", the readings could possible be off as far as 1/8" on each wheel if the effect of run-out is not cancelled. By taking the average of three readings with the wheel rotated 120° for each reading, the error due to wheel run-out can be cancelled. This should be done as follows:

1. After moving the car forward on level floor, take first reading.

2. Mark sidewall of both tires with the number "1" at rear of tire where instrument bears.

3. At 120° intervals (i.e. 1/3 and 2/3 distance around the tire) mark the numbers "2" and "3" on both tires.

4. Jack up and turn wheels until the number "2" is in the position which number "1" occupied when the first reading was taken.

5. Push car back one foot and bring forward to position and take second reading. This reading will

then be taken with the instrument bearing 120° around the wheel from where the first reading was taken.

6. Use the same procedure for taking the third reading.

7. Average the three readings to find the actual toe-in.

SET TOE-IN

1. Remove horn button and set gear on high point of worm by turning steering wheel until mark on shaft is exactly at top. This mark locates the high point, or middle of gear travel.

2. a. On Pontiac and Firebird loosen tie rod end clamp bolts. To increase toe-in turn right tie tube in direction of rotation of wheels, when car moves forward; turn left tie rod tube in opposite direction. Turn both tubes an equal amount until toe-in is 0" to 1/8".

b. On Tempest loosen tie rod sleeve clamp bolts. To increase toe-in – turn left tie rod sleeve in direction of rotation of wheels, when car moves forward, turn right tie rod sleeve in opposite direction. Turn both sleeves an equal amount until toe-in is 0 to 1/8".

3. Make sure front wheels are straight ahead by measuring from a reference point at same place on each side of frame center to front of wheel rims. If measurements are not equal, turn both tie rod tubes in same direction (so as not to change toe-in) until measurements become equal. Re-check toe-in since toe-in measurement is accurate only with wheels in straight-ahead position.

4. Tighten tie rod adjuster sleeve bolts to 17 lb. ft. torque, making sure bolts are in low side of tie rod and at a 0-15° angle rearward from horizontal position on Pontiac and Tempest. 0-15° angle forward from horizontal position with bolts on the high side of tie rod on Firebird models.

CHECK STEERING AXIS INCLINATION

Generally there is no need to check steering axis inclination unless a problem exists after setting caster and camber to specification. Failure to obtain correct measurement indicates a bent or damaged steering or suspension part.

CHECK TOE-OUT ON TURNS

Check toe-out after any necessary corrections to camber, caster, and toe-in have been made.

1. Check with any reputable front end aligning equipment, using full floating turn tables. With front wheels resting on turn tables, turn wheels to left until left wheel has been turned 20° from straight ahead. The right wheel should have turned 18° to 19°.

2. Turn wheels to right until right wheel has been turned 20° from straight ahead. Left wheel should have turned 18° to 19°.

3. Incorrect toe-out on turns may be caused by incorrect front end adjustments, but generally indicates bent steering arms which must be replaced.

Replacement of one or both steering arms should be followed by a complete front end check.

MINOR REPAIRS

FRONT WHEEL BEARING REPLACEMENT (Fig. 3-1)

1. Remove hub caps and raise vehicle.

2. Pry out dust cap and remove cotter pin, wheel adjustment nut and washer.

3. Remove tire, wheel and brake drum unit from spindle with a gentle rocking motion. If car is equipped with disc brakes remove brake caliper prior to removing disc hub from spindle.

CAUTION: When wheel is partially loose on spindle, remove outer wheel bearings. DO NOT DROP BEARINGS.

NOTE: In some cases it may be necessary to back off brake adjustment to remove brake drum and wheel assembly.

4. Remove inner bearing from hub by tapping out inner grease seal with a brass drift. Discard seal.

5. Wipe old grease out of wheel hub and from steering knuckle.

6. Wash bearings in solvent and air-dry. Do not spin dry with compressed air. Inspect bearings and races for cracking, pitting, etching, etc.

NOTE: Bearings and outer races are mated pairs. If necessary to replace either one, both bearing assembly and outer race MUST be replaced.

7. If necessary to replace a bearing outer race, drive out with a brass drift inserted behind race in notches in hub. Use care when installing new race to start it squarely into hub, to avoid distortion and possible cracking. Install outer race of outer bearing with J 8849. Install outer race of inner bearing with J 8914. Use handle J 8092 with both installers.

8. When inspecting or replacing bearings, make sure the bearing cone (inner race) is free to creep on spindle of steering knuckle. The cones are designed to creep on the spindle in order to afford a constantly changing load contact between the cones and the roller bearings. Polishing the spindle or applying bearing lubricant will permit creeping and prevent rust forming between cone and spindle.

9. Be sure bearing parts have been thoroughly cleaned and air-dried because bearing lubricant will not adhere to wet or oily surfaces.

10. Use a bearing packer if available and thoroughly pack both bearing assemblies with new high melting point wheel-bearing lubricant. Remove any excess lubricant.

11. Apply a light coat of lubricant to spindle and inside surface of wheel hub.

12. Place inner bearing in race of wheel hub and install a new grease seal.

13. Clean loose material from brake drum with compressed air. Be sure inner hub and bearings are covered. Inspect lining contact area for oil and grease. Clean with a non-flammable non-toxic solvent (such as denatured alcohol). Make sure wiping cloth and fluid do not become loaded with grease from repeated use.

14. Inspect brake linings for oil and grease contamination. Clean by wiping with a non-flammable, non-toxic solvent (such as denatured alcohol). Sand lightly to rough up surface of linings.

15. Carefully install tire, wheel and brake drum assembly on spindle.

16. Install outer wheel bearing.

17. Install washer and adjusting nut.

18. Adjust wheel bearings as outlined under Checks and Adjustments.

19. Check brake adjustment.

FRONT SHOCK ABSORBERS—

REMOVAL

1. Raise car sufficiently to allow removal of shock.

2. Remove nut, retainer and grommet which attach upper end of shock absorber to frame bracket.

NOTE: Shock absorber piston rod must not turn while loosening nuts. If necessary, use pliers or wrench to hold top of shock absorber stud mounting while removing nuts.

3. Remove two lower bolts and washers retaining shock absorber and remove shock absorber through lower control arm.

INSTALLATION

1. Install new shock absorber by reversing the above procedure. Make sure all grommets and retainers are correctly installed (Fig. 3-7).

NOTE: Upper stud nuts must be pre-tightened until they bottom at end of steel threads.

2. Tighten upper stud nuts 90 lb. in. torque (Tempest and Firebird), 15 lb. ft. (Pontiac). Torque lower bolts 20 lb. ft. on all models.

FRONT STABILIZER SHAFT—

REMOVAL

1. Disconnect both links from stabilizer shaft by removing nut from link and rotating shaft up from lower control arm.

2. Remove screws holding two stabilizer shaft brackets to frame and remove shaft.

INSTALLATION

1. Replace stabilizer shaft to frame by placing two brackets over rubber insulators on bar and installing mounting bolts to frame. Tighten bolts 30 lb. ft. torque on Pontiac and 12 lb. ft. on Tempest and Firebird with car at curb height.

2. Install link assembly as shown in Fig. 3-8. Tighten nut 15 lb. ft. torque (Pontiac and Tempest) 90 lb. in. torque (Firebird).

MAJOR REPAIRS

FRONT SPRING (PONTIAC)

REMOVAL

1. Raise front end of car, supporting so that lower control arm hangs free.

2. Remove wheel and brake drum.

3. Disconnect stabilizer link from lower control arm.

4. Remove shock absorber.

5. Install spring compressor J 7592-01 (Fig. 3-9).

a. Install one J 7592-7 cast plate in spring with bows down making certain that angled center hole of plate is aligned with axis of spring. Rotate plate upward into highest possible position in coil.

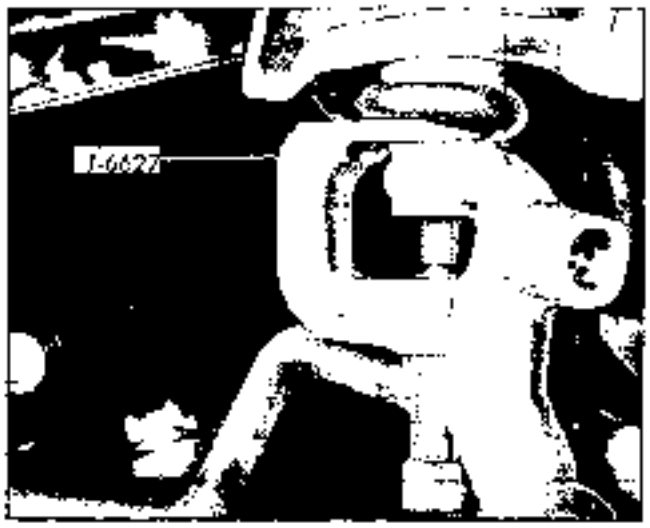


Fig. 3-6 Removing Ball Joint Stud With J 6627

b. Install another J 7592-7 cast plate under the 3rd coil from the bottom with boss up and center hole aligned with axis of spring. This plate should be slanted in the same direction and parallel with the upper plate.

c. Install long bolt up through both plates with thread end down. Install J 7592-4 retainer (cup up) and J 7592-2 locking clip through opening at upper shock bracket to secure bolt to upper plate.

d. Place J 7592-6 (ball up), thrust bearing, and J 7592-5 nut (threads down) on the bolt and screw up snug.

e. While holding upper end of rod, turn nut at lower end to compress spring.

7. Support lower control arm with a jack.

8. Disconnect lower ball stud from steering knuckle with J 6627 (Fig. 3-6)

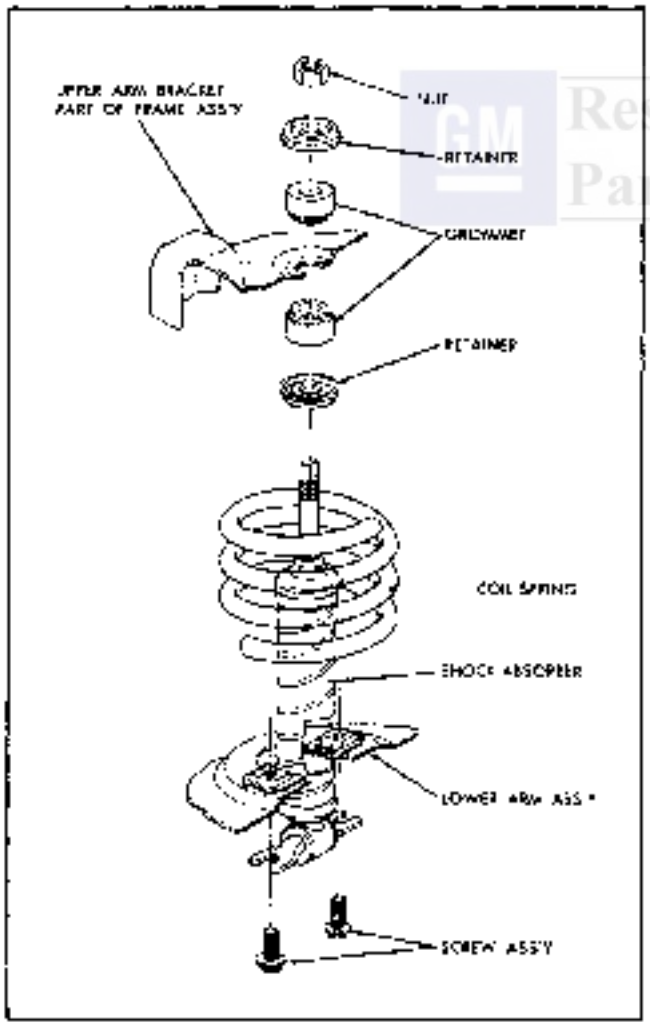


Fig. 3-7 Typical Shock Absorber Installation

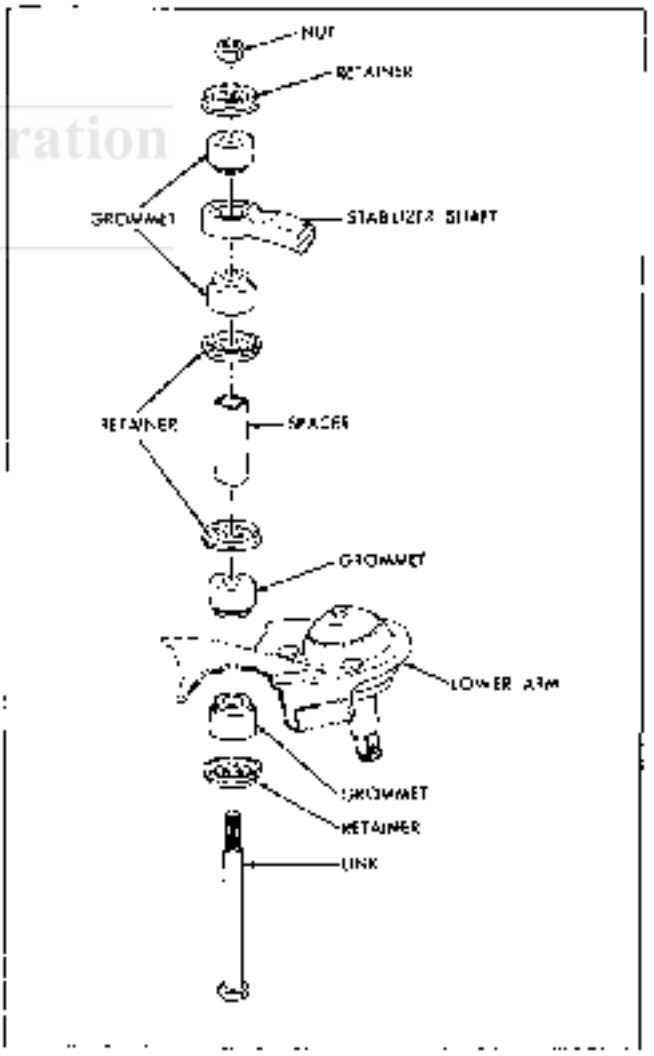


Fig. 3-8 Exploded View of Stabilizer Link

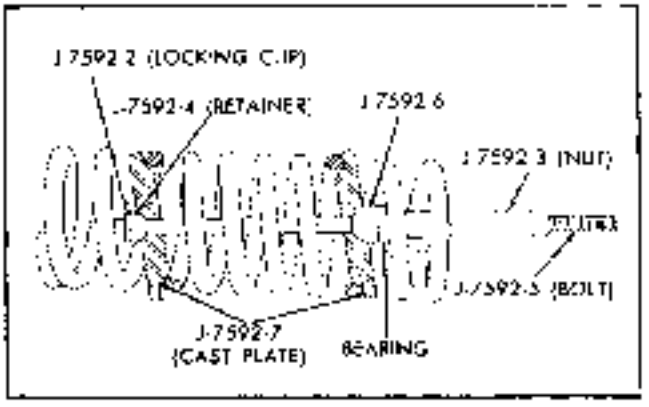


Fig. 3-9 Pontiac Coil Spring Compressor J 7592

8. Support upper control arm and steering knuckle assembly by inserting a wood block between upper control and frame.

10. Carefully lower jack, allowing outer end of lower control arm to swing down until spring is free, remove spring.

INSTALLATION

1. If spring is to be replaced, assemble compressor J 7592 on a new spring (Fig. 3-9).

2. Replace spring by placing one end in the frame seat and the other end in the lower control arm seat.

NOTE: Be sure that spring is positioned so that end of coil can be seen through small drain hole in lower control arm spring seat.

3. Place jack under lower control arm and carefully raise until lower ball stud can be connected to steering knuckle. Tighten ball stud to 50 lb. ft. torque on Pontiac. Install cotter pin or continue to tighten until cotter pin can be installed.

4. Carefully loosen and remove spring compressor.

5. Lower and remove jack under lower control arm.

6. Install shock absorber. Tighten lower screws to 20 lb. ft. torque and upper nut to 15 lb. ft. torque.

7. Connect stabilizer link to lower control arm. Tighten nut to 15 lb. ft.

8. Replace wheel and drum. Adjust wheel bearing as illustrated in Fig. 3-3.

FRONT SPRING—(TEMPEST)

REMOVAL

1. Raise front end of car—supporting so that lower control arm hangs free.

2. Remove wheel and drum assembly.

3. Remove shock absorber.

4. Disconnect stabilizer link from lower control arm.

5. Using tool J 22654 compress spring until coil leaves lower control arm, Fig. 3-10. Insert plate in the lowest possible coil.

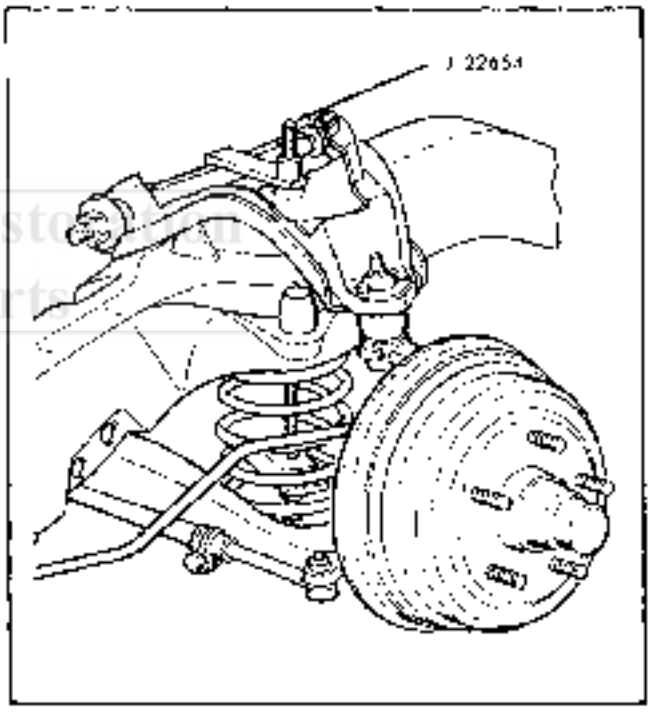


Fig. 3-10 Tempest Coil Spring Compressor J 22654

CAUTION: Do not compress spring coils to the point of complete contact with each other.

6. Remove backing plate from steering knuckle and position backing plate out of way.

CAUTION: Brake line is still connected. Support backing plate so that line is not damaged.

7. Disconnect lower ball stud from steering knuckle, using tool J 6627 (Fig. 3-6) and position backing plate and steering knuckle out of the way.

CAUTION: Ball stud rubber seal is not serviced. Removal or damage to seal necessitates replacement of complete ball stud assembly.

8. Carefully lower arm until spring is free.

INSTALLATION

1. Install by reversing removal procedure.

NOTE: Upper end of coil spring must be visible in frame pocket hole by upper control arm shaft.

2. Tighten shock absorber lower bolts to 20 lb. ft. torque and upper stud nut to 90 lb. in.

3. Install stabilizer link and tighten link nut to 10 lb. ft. torque.

4. Tighten upper ball stud retaining nut to 50 lb. ft torque and lower to 85 lb. ft. torque

5. Adjust wheel bearing as outlined in this section under Adjustment and Checks on the car.

FRONT SPRING (FIREBIRD)

REMOVAL

1. Remove top nut on shock

2. Raise car on hoist and support front end with stands at frame rail.

3. Remove two lower shock absorber bolts and remove shock.

4. Remove stabilizer link, bushings, bolt and nut.

5. Using a hydraulic transmission jack, bolt spring removal tool J 22736 to the jack and position under the two inner control arm bushings (Fig. 3-11).

6. Remove two inner control arm to front crossmember bolts.

7. With care, lower control arm by lowering jack.

CAUTION: Allow spring to completely expand before attempting to remove it.

8. Remove spring.

INSTALLATION

1. Install by using the reversal of the removal procedures. Take care to ensure that spring is properly installed.

2. Tighten lower control arm attaching bolts to 80 lb. ft. with lower control arm in normal curb height position.

3. Tighten backing plate top bolt to 100 lb. ft. and two lower attaching nuts to 80 lb. ft.

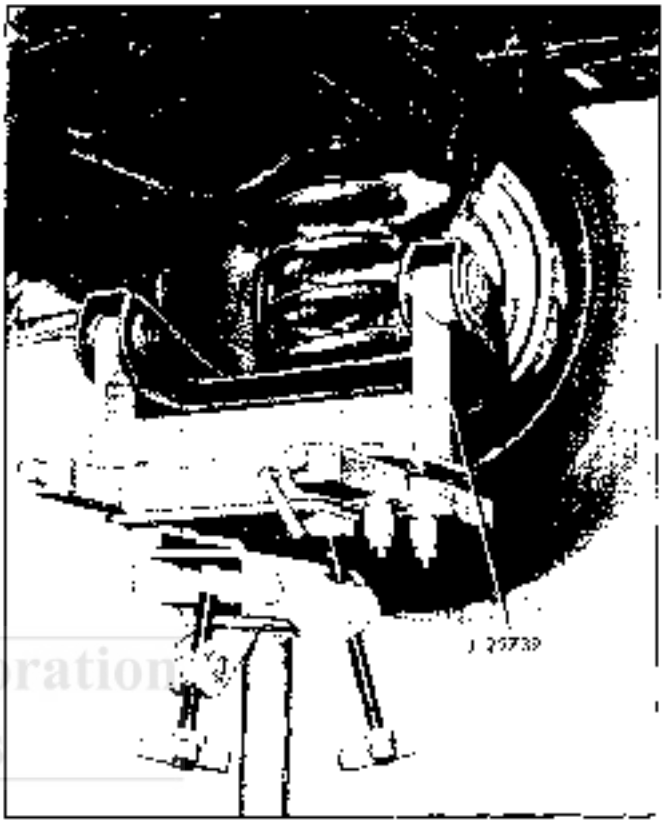


Fig. 3-11 Firebird Coil Spring Removal Tool

4. Tighten shock absorber lower bolts to 20 lb. ft. torque and upper stud nut to 90 lb. in.

5. Tighten stabilizer link nut to 90 to in

6. Adjust wheel bearing as outlined in this section under Adjustments and Checks on the car.

STEERING KNUCKLE—

REMOVAL

1. Hoist car and support at front lower control arms.

2. Remove wheel and brake drum.

3. Remove backing plate from steering knuckle and move steering arm out of way.

CAUTION: Brake line is still connected to backing plate. Support backing plate so that brakeline is not damaged.

4. Remove upper and lower ball studs with J 6627 and remove steering knuckle (Fig. 3-6).

INSTALLATION

1. Replace steering knuckle by reversing removal procedure.

2. Tighten upper and lower ball stud nut on Pontiac and upper ball stud nut on Tempest and Firebird to steering knuckle 50 lb. ft. torque. Tighten Tempest and Firebird lower ball stud nut to 95 lb. ft. Insert cotter pin or continue to tighten nut until cotter pin can be installed.

3. Position backing plate onto steering knuckle, install and tighten backing plate top bolt to 100 lb. ft. torque and two lower nuts to 80 lb. ft. torque.

4. Adjust wheel bearings as outlined in this section under Adjustments and Checks on the Car.

5. Tighten wheel stud nuts to 70 lb. ft. torque on Tempest and Firebird 75 lb. ft. on Pontiac, if wheel and tire was removed.

FRONT UPPER CONTROL ARM

REMOVAL

1. Place jack under lower control arm, raise car and remove wheel and tire assembly.

2. Remove upper ball stud from steering knuckle with J 6627 (Fig. 3-6).

3. Remove two bolts and self-locking nuts holding upper control arm shaft to frame; remove shims and control arm and shaft assembly. Use tool J 22518 on Pontiac (Fig. 3-5).

NOTE: Firebird models equipped with air conditioning and V8 engine, Follow steps below before loosening upper control arm attaching bolts.

a. Remove the three front and two rear compressor mounting bolts and disconnect clutch wires.

b. Remove A/C belt and tip compressor up and move to rear of engine compartment.

INSTALLATION

1. Position upper control arm and shaft assembly on frame cross-member and install two bolts, washers, shims and self-locking nuts. Tighten nuts 75 lb. ft. torque on Pontiac and 60 lb. ft. on Tempest and Firebird while holding bolts.

2. Connect upper ball stud to steering knuckle and tighten nut 50 lb. ft. torque. Insert cotter pin or continue to tighten nut until cotter pin can be installed.

3. Tighten the bushing to shaft nuts if control arm bushing have been replaced. Torque nuts on Pontiac to 70 lb. ft.; Tempest and Firebird to 50 lb. ft.

4. Replace wheel. Tighten nuts 70 lb. ft. torque on Tempest and Firebird, 75 lb. ft. on Pontiac.

5. Lower car and check front end alignment.

6. Firebird models with V8 engine and air conditioning reposition A/C compressor and install mounting bolts. Reconnect all clutch wires to compressor clutch.

UPPER CONTROL ARM CROSS SHAFT AND/OR BUSINGS (CONTROL ARM REMOVED FROM CAR) FIREBIRD MODELS

REMOVE

1. Remove cap screws, lock washers and collars from both ends of cross shaft.

2. Install a 3/8" 24 cap screw in one end of cross shaft.

3. Support control arm in an arbor press on tool J 22899 and J 21462-2 as shown in Fig. 3-12.

NOTE: Be certain flange of bushing does not contact support.

4. Press out bushing using tools shown in Fig. 3-12, invert control arm and repeat process on other bushing. Discard bushings.

5. Remove cap screw from cross shaft.

NOTE: If bushing rubber is deteriorated to the extent that the bushing sleeve cannot be pushed out, release the press, install J 8092-3 as shown in Fig. 3-12 and press out the sleeve.

REPLACE

1. Install arm in arbor press with tool J 21462 in place and press in one bushing using J 21474-2 as shown while supported on tool J 22899 as shown in Fig. 3-13.

2. Install cross shaft in arm, invert in press, and press in second bushing as above.

3. Cross shaft should be able to be turned by hand.

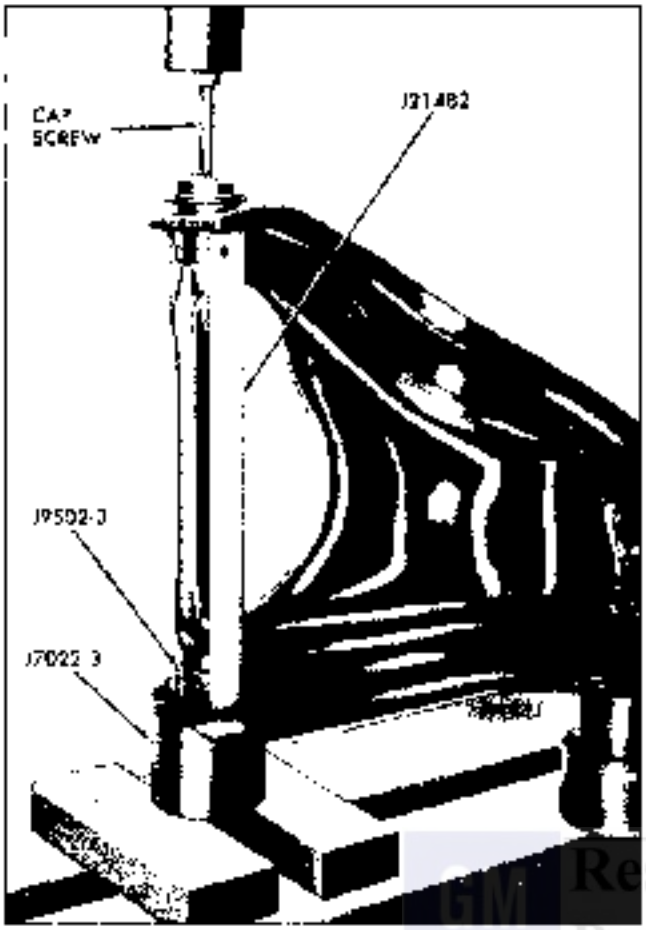


Fig. 3-12 Removing Upper Control Arm Bushing (Firebird)

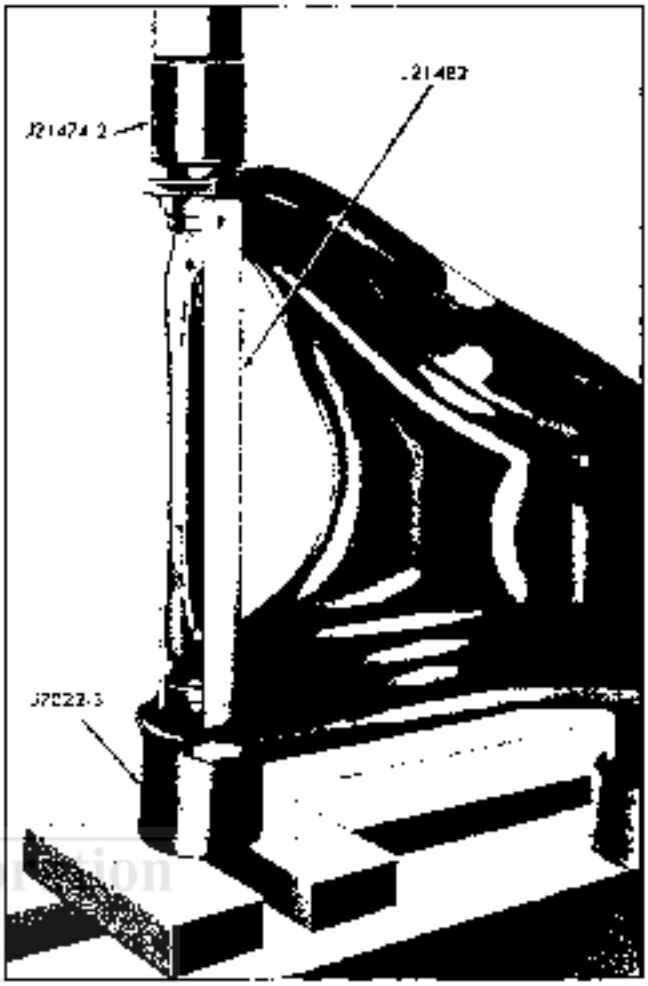


Fig. 3-13 Installing Upper Control Arm Bushing (Firebird)

4. Install collar, lock washer and cap screw in ends of cross shaft. Do not tighten cap screws until arm is installed on car.

UPPER CONTROL ARM BUSHING AND SHAFT—PONTIAC AND TEMPEST

REMOVE

1. Invert control arm as shown in Fig. 3-14, and press bushing out.

2. Remove other bushing in same manner.

REPLACE

1. Install cross shaft in control arm as follows:

a. Place tool J 7167 in position as shown in Fig. 3-15 and expand until tool is snug between inner faces of arm.

b. Position cross shaft in control arm.

c. Insert bushings on ends of shaft

d. Press bushings in control arm with arbor press, using two large sockets or J 9502-1 bar installers as shown in Fig. 3-15.

2. Install washers and retaining nuts on ends of shaft. do not tighten nuts until control arm is installed in car.

3. Rotate cross shaft so that when installed the mounting holes in shaft will line up with holes in frame and install arm on car.

LOWER CONTROL ARM

REMOVAL

1. Refer to Front Spring Removal
Pontiac Models: Steps 1 through 10
Tempest Models: Steps 1 through 8.
Firebird Models: Steps 1 through 8.

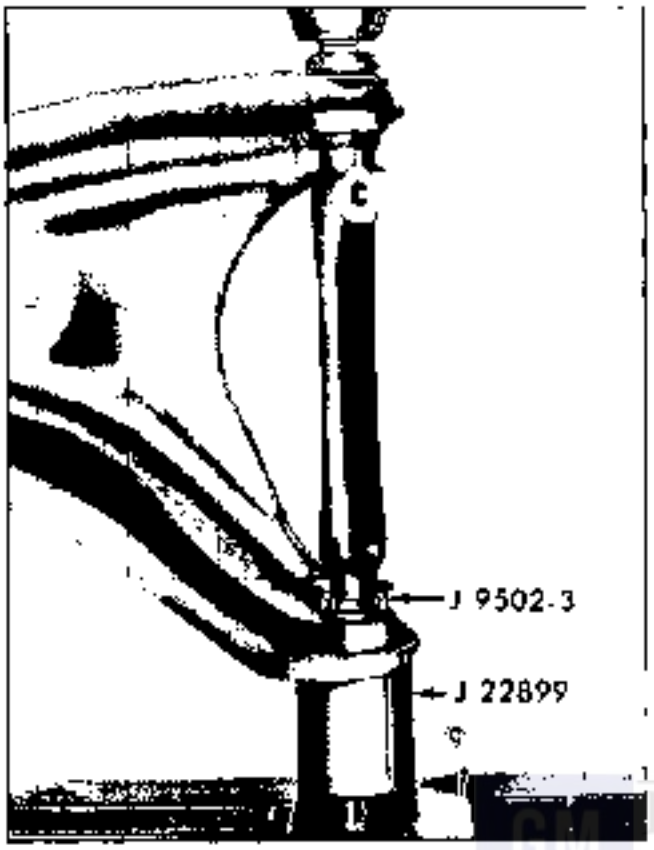


Fig. 3-14 Removing Upper Control Bushing (Pontiac and Tempest)

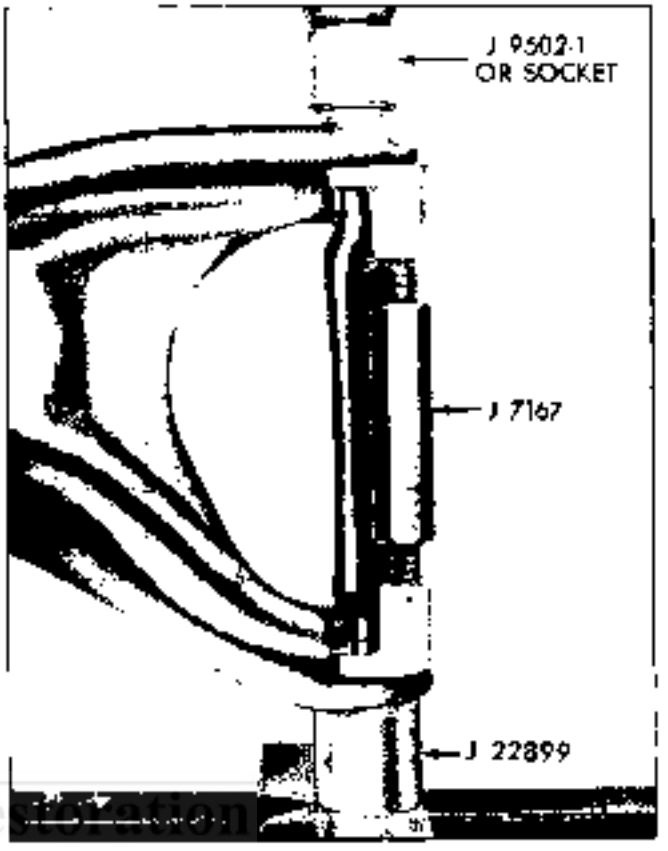


Fig. 3-15 Installing Upper Control Arm Bushing (Pontiac and Tempest)

2. Disconnect inner ends of lower control arm from frame cross member by removing pivot bolts on Pontiac and Tempest models. Firebird models disconnect the lower control arm from the steering knuckle, using tool J 9627 (Fig. 3-6).

INSTALLATION

1a. On Firebird Models with the control arm ball joint stud in place at steering knuckle, install lower ball joint retaining nut, tighten to proper torque and install cotter pin.

NOTE: When installing lower ball joint stud, be sure stud and nut are free of dirt and grease before tightening. Do not loosen nut to insert cotter pin, tighten to next hole that lines up with nut.

1b. On Pontiac and Tempest Models tighten bolts retaining inner ends of lower control arm to frame cross member while holding nuts to 110 lb. ft. torque or hold bolt and tighten nut to 80 lb. ft. torque.

NOTE: On Pontiac, lower control arm to frame bolts must be assembled with head of bolt towards rear of car, and on Tempest bolt head must be toward front of car. Tighten with car at curb height.

2. Refer to Front Spring Installation Procedure for remaining steps of this repair.

LOWER CONTROL ARM BUSHINGS REPLACE

REPLACE

NOTE: If the control arm is not removed from car. The bushings can be replaced without removing control arm from car by disconnecting control arm from frame at the two pivot bolts. When performing the repair in this manner, care must be taken to raise car off ground and support weight of car at frame side rail. Then place a jack under the lower control arm, remove pivot bolts and carefully lower control arm until there is clearance to install bushing removal tools. After bushings are replaced reposition control arm to frame and install pivot bolts, tighten bolts to proper torque with control arm at curb height position. On Firebird models use tool J 22759 to lower and raise control arm.

REAR BUSHING—TEMPEST
FRONT BUSHING—PONTIAC

1. Remove lower control arm as outlined above.

2. Remove bushing by arranging tools as shown in Fig. 3-16.

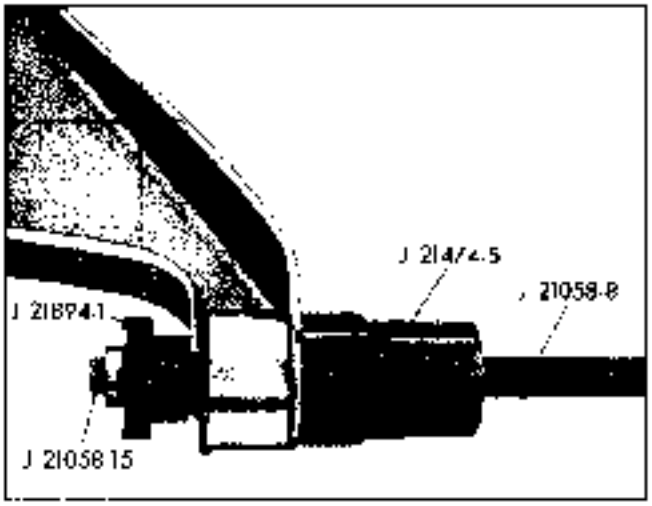


Fig. 3-16 Removing Pontiac Lower Control Arm Front Bushing or Tempest Lower Control Arm Rear Bushing

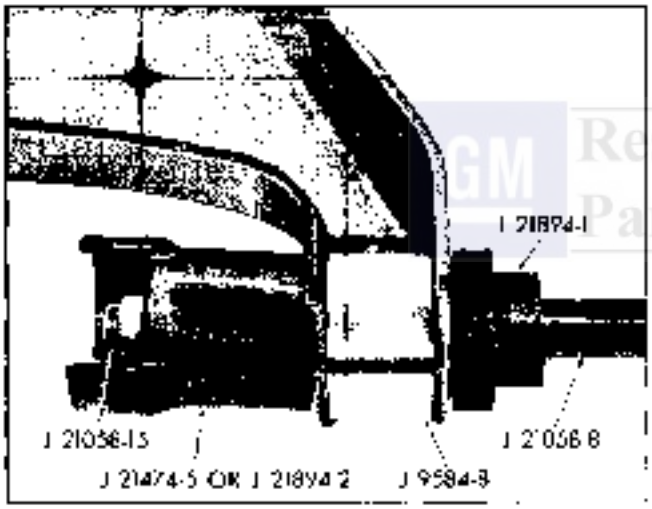


Fig. 3-17 Installing Pontiac Lower Control Arm Front Bushing or Tempest Lower Control Arm Rear Bushing

3. To replace bushing in lower control arm, arrange tools as shown in Figure 3-17 and press bushing into arm.

4. Install lower control arm on car as outlined above.

FRONT BUSHING—TEMPEST, FIREBIRD
REAR BUSHING—PONTIAC

1. Remove lower control arm as outlined above.

2. Remove bushing by arranging tools as shown in Fig. 3-18.

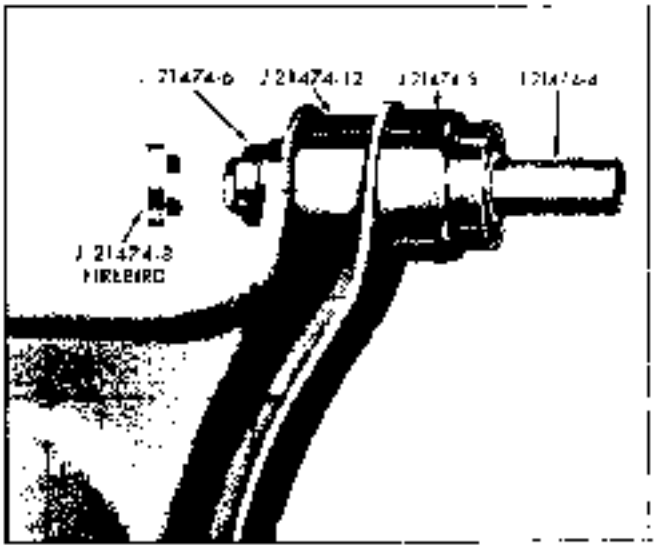


Fig. 3-18 Removing Lower Control Arm Front Bushing (Firebird, Tempest) and Rear Bushing (Pontiac)

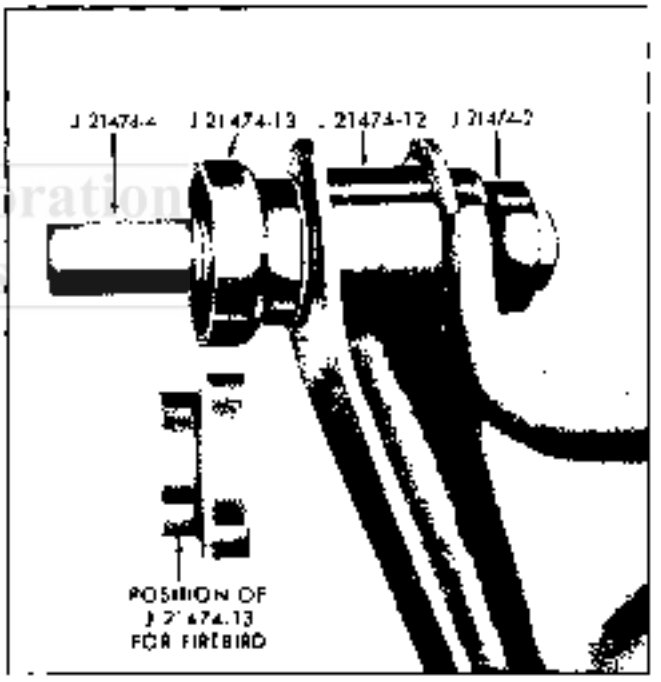


Fig. 3-19 Installing Lower Control Arm Front Bushing (Firebird, Tempest) and Rear Bushing (Pontiac)

3. To replace bushing in lower control arm arrange tools as shown in Fig. 3-19.

4. Install lower control arm on car as outlined above.

REAR BUSHING—FIREBIRD

1. Remove control arm as outlined above.

2. Remove bushing in control arm by arranging tools as shown in Fig. 3-20.

3. Replace bushing in control arm by arranging tools as shown in Fig. 3-20.

4. Install control arm as outlined above.

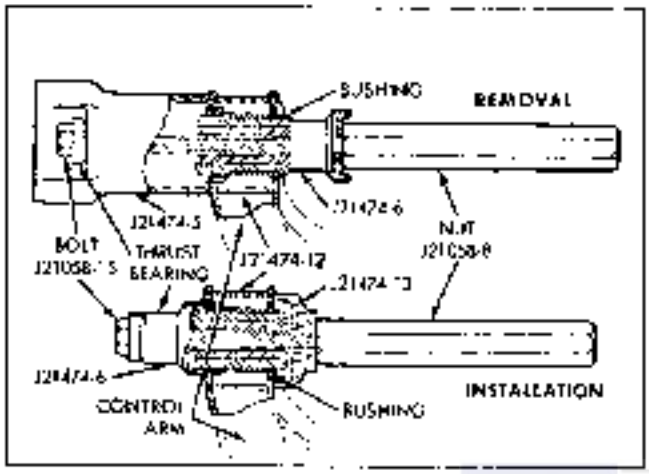


Fig. 3-20 Lower Control Arm Rear Bushing (Firebird)

UPPER BALL JOINT—

REMOVAL

1. Hoist car and support lower control arm.

2. Remove wheel.

3. Remove ball stud from steering knuckle with J 6627 (Fig. 3-6)

4. Remove ball stud from upper control arm by chiseling or drilling rivet heads which retain ball stud to control arm, and drive out rivets.

INSTALLATION

1 Install new ball joint, using the special bolts, nuts and washers supplied with ball joint package.

CAUTION: Use only the special alloy bolts supplied with ball joint package.

2. Tighten nuts to 11 lb. ft. torque.

3. Install ball stud in steering knuckle. Tighten nut to 50 lb. ft. torque. Insert cotter pin or continue to tighten nut until cotter pin can be installed.

4. Install wheel. Tighten nuts 70 lb. ft. torque on Tempest and Firebird, 75 lb. ft. torque on Pontiac.

5. Lower car.

LOWER BALL JOINT—PONTIAC

REMOVE

1. Hoist car and support lower control arm.

2. Remove wheel tire and brake drum.

3. Remove backing plate from steering knuckle, wire backing plate and brake assembly out of way (Do not disconnect brake line).

4. Remove ball stud from steering knuckle with J 6627 (Fig. 3-6), move steering knuckle out of way.

5. Remove ball joint from lower control arm by chiseling or drilling rivet heads which retain ball joint to control arm, and drive out rivets.

REPLACE

1 Install new ball joint, using the special bolts, nuts and washers supplied with ball joint package.

CAUTION: Use only the special alloy bolts supplied with ball joint package.

2. Tighten nuts 11 lb. ft. torque.

3. Install ball stud in steering knuckle and tighten nut 50 lb. ft. torque. Insert cotter pin or continue to tighten nut until cotter pin can be installed.

4. Install backing plate. Tighten backing plate bolt 100 lb. ft. torque and nuts 80 lb. ft. torque.

5. Install brake drum and wheel assembly. Adjust wheel bearing as outlined under ADJUSTMENTS AND CHECKS ON THE CAR.

6. Lower car.

LOWER BALL JOINT

REMOVE—TEMPEST AND FIREBIRD

1. Support lower control arm at outer end with hoist or jack pad clear of lower ball stud. Remove the wheel and brake drum.

2. Remove backing plate bolts and anchor pin bolt, wire backing plate and brake assembly out of way (Do not disconnect brake line)

3. Remove lower ball stud cotter pin and nut. Separate steering knuckle from ball stud using tool J 6627 (Fig. 3-6) and move steering knuckle out of way.

4. Use a screwdriver to pry off the seal and retainer. Install tools J 9519-10, J 9519-17 and J 9519-7, as shown in Fig. 3-21 and turn down on the hex head screw until the ball stud is pushed out.

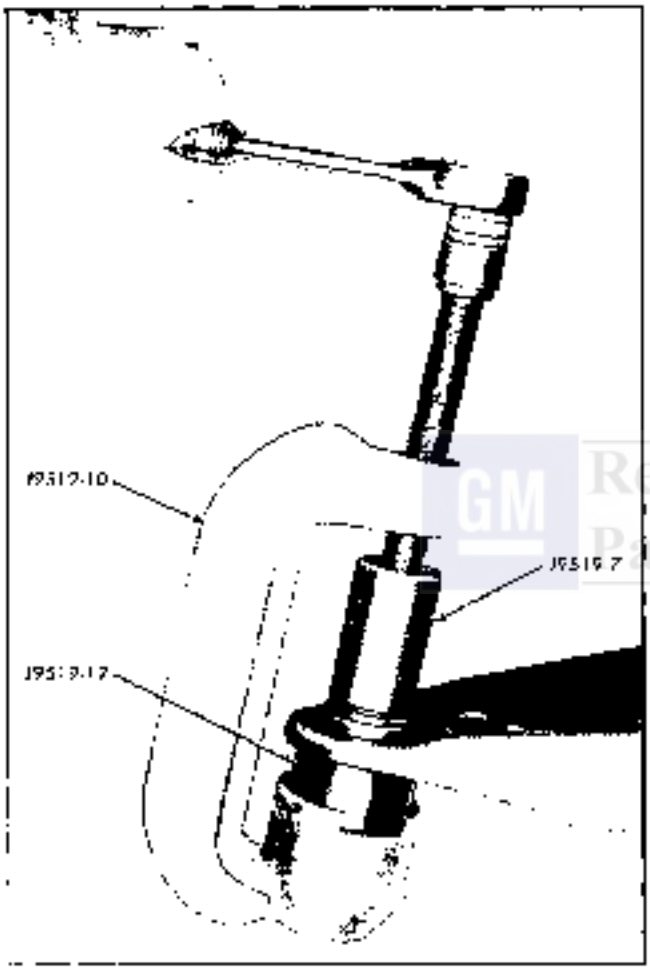


Fig. 3-21 Ball Joint Removal

REPLACE

1. Start the replacement ball stud into the control arm and install tools J 9519-10, J 9519-16 and J 9519-17 as shown in Fig. 3-22.

2. Turn down on the hex head screw until the ball stud is seated properly in the control arm.

3. Install steering knuckle on ball stud and tighten nut to 85 lb. ft.

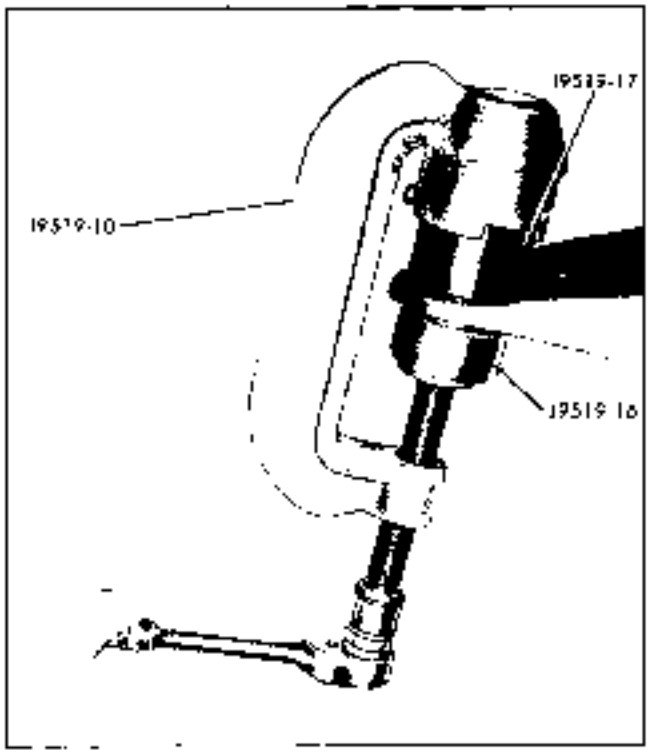


Fig. 3-22 Ball Joint Installation

CAUTION. Care should be taken to ensure that steering knuckle hole and ball stud are clean and dry. Tighten nut to proper torque and insert cotter pin or continue tightening until cotter pin can be installed.

4. Install steering arm and backing plate to steering knuckle with (2) backing plate bolt and anchor pin bolt, tighten backing plate bolts to 90 lb. ft. and anchor pin to 100 lb. ft.

5. Replace the wheel and drum assembly, adjust wheel bearing as outlined under ADJUSTMENTS AND CHECKS ON THE CAR.

6. Lower the vehicle.

TORQUE SPECIFICATIONS

	Ft. Lb.
Nut, Upper Control Arm Bushing	
Pontiac	70
Tempest	50
Bolt, Upper Control Arm Bushing (Firebird)	35
Nut, Upper Ball Joint to Steering Knuckle	60
Nut, Lower Ball Joint to Steering Knuckle	
Pontiac	50
Tempest and Firebird	85
Nut, Tie Rod Adjusting Clamp	27

Nut, Wheel Stud	
Pontiac	75
Tempest and Firebird	70
Nut, Steering Arm to Tie Rod End	35
Nut, Backing Plate to Steering Arm	60
Bolt, Backing Plate to Steering Knuckle	100
Nut, Upper Control Arm to Frame	
Pontiac	60
Pontiac (using J 22811 and 12" Torque Wrench)	65
Tempest and Firebird	50
Nut, Lower Control Arm to Frame	80
Nut, Shock Absorber Upper Stud	12
Bolt, Shock Absorber to Lower Control Arm	20
Nut, Stabilizer Link to Shaft	
Pontiac and Tempest	15
Firebird	12
Bolt, Stabilizer Shaft Bracket to Frame	
Pontiac	30
Tempest and Firebird	12

FRONT WHEEL ALIGNMENT SPECIFICATIONS

Caster	
Pontiac	+1 1/2° ±1/2°
Tempest (Except Station Wagon)	+1 1/2° ±1/2°
Tempest Station Wagon	+2 ±1/2°
Firebird	+3, 2 ± 1/2
Camber - All Models	+1/4° ±1/2°
Toe In - (All Models Except Firebird)	0" to 1/8"
Toe In (Firebird Only)	1/8" to 1/4"
Steering Axis Inclination	
Pontiac	8 1/2° ± 1/2° (with 1° camber)
Tempest	9° ± 1/2° (with 0° camber)
Firebird	8 3/4° ± 1/2° (with +1/2 camber)
Toe Out on Turns	2°
(Difference in Left to Right Direction of Toe-Out at 20° Turn of Inside Wheel)	

NOTE: Give left wheel up to 1/4° more camber than right wheel to correct for road crown.

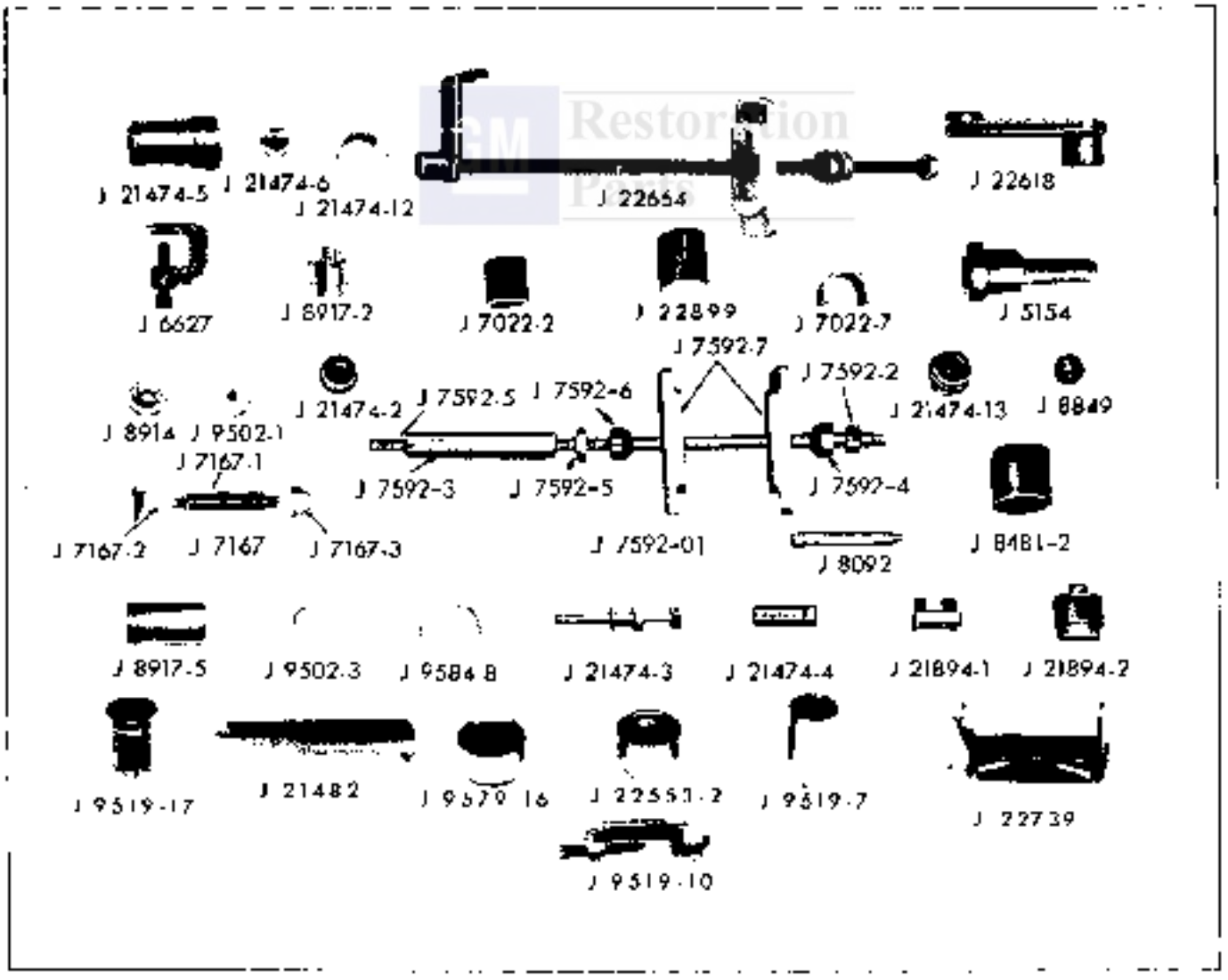


Fig. 3-23 Special Tools

REAR SUSPENSION

CONTENTS OF THIS SECTION

PERIODIC SERVICE

Periodic service of the suspension system consists of regular lubrication as outlined in the GENERAL LUBRICATION section.

Lubrication fittings are provided at the front suspension ball joints. Shock absorbers do not require lubrication and in case of leaks or malfunction, they should be replaced.

ADJUSTMENTS AND CHECKS ON CAR

Periodically it may be necessary to make certain adjustments and checks of the suspension system to maintain desirable handling and steering characteristics and minimize tire wear. These checks and adjustments are explained in section 3.

REPAIRS—REAR SUSPENSION

REAR SHOCK ABSORBER—PONTIAC AND TEMPEST

REMOVAL

CAUTION: If car is elevated, support rear axle assembly so it will not swing down and damage brake line when shocks are removed.

1. Remove nuts and washer head screws from upper end of shock absorber.

2. Remove nut and lock washer from lower end and remove shock absorber.

3. Clean and inspect rubber inserts. If rubber inserts have shifted from their original position in either eye, replace shock absorber.

INSTALLATION

1. Install shock absorber by reversing the above steps.

2. Tighten upper screws to 20 lb. ft. torque. Tighten lower nut to 65 lb. ft. torque. When tightening lower nut, shock absorber stud must not turn and car must be at curb height.

SHOCK ABSORBER—FIREBIRD

REMOVAL (Fig. 4-1)

1. Raise rear of vehicle and support rear axle assembly.

2. Remove shock absorber lower attaching nut

3. Remove shock absorber upper mounting bracket-to-underbody retaining screws and withdraw shock absorber and bracket.

4. Remove nut, upper retainer and grommet and retainer from the shock absorber rod.

5. Inspect rubber grommets and gasket for damage and deterioration. Replace as required.

INSTALLATION (Fig. 4-1)

1. Assemble lower retainer and grommet, bracket and gasket, upper grommet and retainer and nut to the shock absorber rod. Torque nut to specifications.

2. Position shock absorber bracket to underbody. Install and torque bracket retaining screws to specifications.

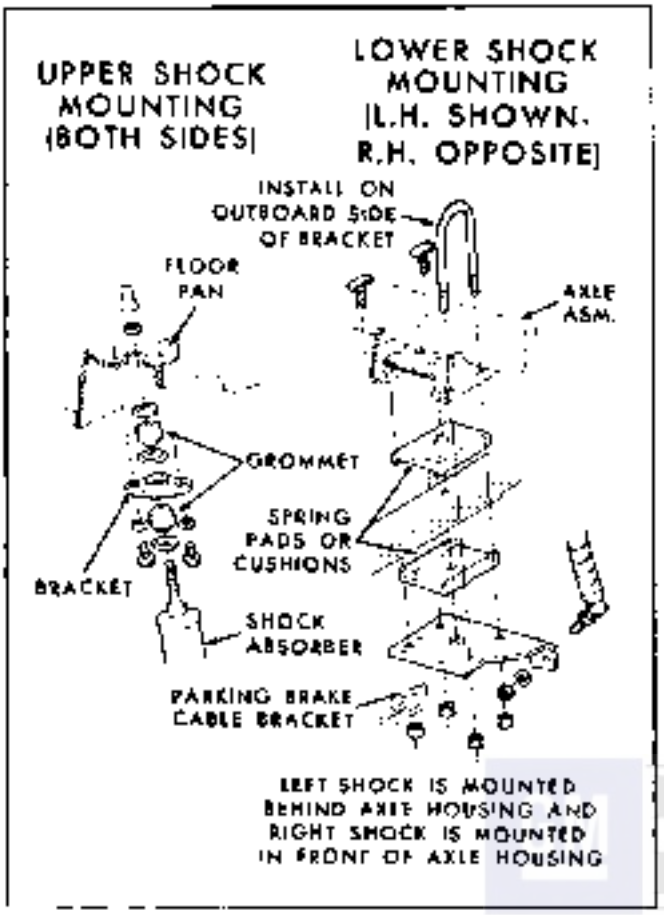


Fig. 4-1 Rear Shock Absorber Installation—Firebird

3. Insert shock absorber eye into lower bracket; install bolt with head toward front of vehicle. Torque nut to specifications.

4. Lower vehicle and test shock absorber action.

SHOCK ABSORBER LOWER MOUNT OR SPRING PADS—FIREBIRD

REMOVAL

1. Raise car at axle housing.

2. Remove lower shock bolt and compress shock to move out of way.

3. Place jack stands under frame and lower axle to relieve spring tension.

4. Remove four nuts attaching lower shock mount and withdraw mount. Right and left shock mounts will not interchange.

5. Raise axle up to provide clearance to remove upper spring pad.

INSTALLATION

1. Reverse removal procedure.

NOTE: When installing spring pad, be sure center bolt and nut in spring and spring pad line up with lower shock mount before tightening attaching nuts.

2. See torque specification at end of section.

REAR SPRING—PONTIAC AND TEMPEST

REMOVAL

1. Raise car at frame.

2. Place safety stands under frame at both sides to support car.

3. Remove brake connector and line from axle housing. Do not disconnect brake hose from connector.

4. Support axle housing with hydraulic jack or with safety stands.

CAUTION: Care must be taken to prevent contact between the rear lower control arm upper flange and the rear lower control arm axle housing bracket when lowering the axle housing.

5. Remove nuts from lower ends of right and left shock absorber and disconnect shock absorbers from axle housing brackets.

6. If axle housing is supported by jack, carefully lower axle housing by lowering jack. If axle housing is supported by safety stands, carefully raise car by frame.

7. Remove spring.

8. Remove rubber insulator from upper spring seat, inspect and replace if in poor condition.

INSTALLATION

1. Install spring, making sure that the end of the bottom coil is positioned between the limits of the two tabs located at the rear of the spring bracket on axle housing.

2. Either raise axle housing or lower car until shock absorbers can be connected to axle housing.

3. Attach brake connector and line to axle housing. Torque attaching bolt to 8 lb. ft.

4. Install lock washer and tighten nut on shock absorber to 65 lb. ft. torque.

NOTE: Car must be at curb height when tightening nut. Shock absorber stud must not rotate while tightening nut.

LEAF SPRING, SPRING SEAT PADS AND SPRING EYE BUSHING—FIREBIRD

NOTE: Right and left lower shock mounts will not interchange.

REMOVAL

1. Raise rear of vehicle at axle housing and support weight of vehicle at both frame side rails near front eye of springs with jack stands.

2. Loosen and remove shock absorber lower attaching nut.

3. Loosen the front spring eye-to-bracket retaining bolts.

4. Remove the screws securing the spring retainer bracket to the underbody.

5. Lower axle assembly sufficiently to permit access to spring retainer bracket and remove bracket from spring.

6. The spring eye bushing can be replaced without completely removing the spring from the vehicle. If bushing requires replacement, proceed as follows:

a. Insert wood wedge or plank between spring and frame to pry spring eye down for clearance to use bushing removal tool.

b. Position remover adapter J 21978-1 over puller screw J 21058-15 so that adapter is against head of puller screw. Refer to Fig. 4-2 for view of removal tools.

c. Position puller screw through eye of bushing so that remover adapter J 21978-1 is against unflanged side of bushing.

d. Position large end of barrel J 22553-1 over puller screw and seat barrel against spring eye.

e. Position thrust bearing on puller screw. Then install and tighten nut J 21058-8 against thrust bearing.

f. Check to make sure that all puller parts are properly aligned. Then proceed to tighten nut until bushing is pulled free of spring eye. Disassemble puller tool.

g. Position installer adapter J 22553-2 over flange end of bushing. Then position puller screw J 21058-15 through installer adapter and bushing. Refer to Fig. 4-3 for view of installation tools.

h. Position puller screw through spring eye until bushing contacts spring. Install small end of barrel J 22553-1 over puller screw and seat barrel against spring.

i. Install thrust bearing and nut J 21058-8. Check puller tools and bushing for proper alignment, then tighten nut to pull bushing into spring. Install bushing until bushing is centered in spring eye.

NOTE: Do not apply additional torque to nut J 21058-8 after bushing flange contacts spring. Torque applied after flange is seated will tend to distort flange and reposition bushing in spring.

j. Disassemble bushing installation tools and remove from spring.

7. Pry parking brake cable nut of the retainer bracket mounted on the spring mounting plate.

8. Remove spring bracket-to-axle bracket retaining nuts, remove upper and lower rubber spring pads and bracket.

9. Support spring, then remove lower bolt from spring rear shackle. Separate shackle and withdraw spring from vehicle.

10. Remove rear spring shackle upper bolt and withdraw shackle bushings from frame.

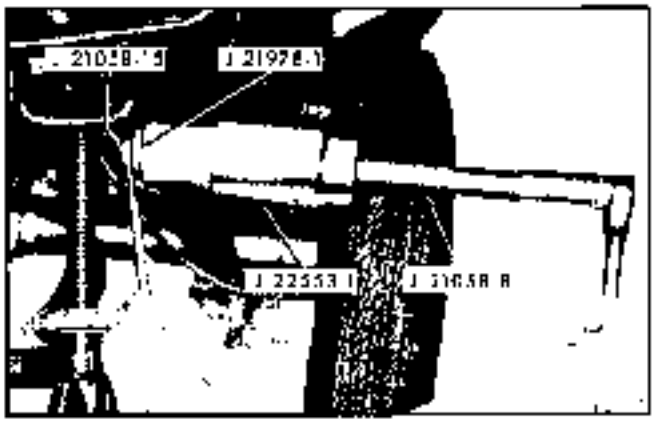


Fig. 4-2 Removing Spring Front Bushing—Firebird

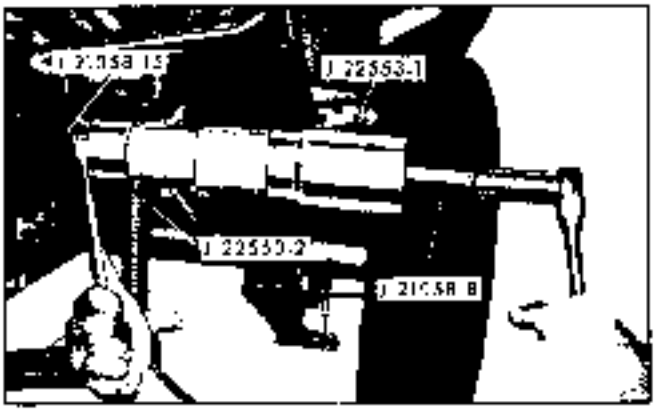


Fig. 4-3 Installing Spring Front Bushing—Firebird

INSTALLATION

1. Position spring front mounting bracket to spring front eye. Spring attaching bolt must be installed so that head of bolt is toward center of vehicle.

2. Position spring shackle upper bushing in frame position shackles to bushings and loosely install bolt and nut.

3. Install bushing halves in spring rear eye, place spring to shackles and loosely install shackle lower bolt and nut.

NOTE: When installing spring, make sure spring is positioned so that parking brake cable is on underside of spring.

4. Raise front end of spring and position bracket to underbody. Guide spring into position so that it will index in the axle bracket and also make sure that the tab on spring bracket is indexed in slot provided in the underbody.

5. Loosely install spring-to-underbody bracket.

6. Position spring upper cushion between spring and axle bracket so that spring cushion ribs align with axle bracket locating ribs.

7. Place lower spring cushion on spring so that cushion is engaged on locating bolt and nuts. Upper cushion and lower cushion will be aligned if installation is correct.

8. Place lower mounting plate over locating dowel on spring lower pad and loosely install retaining nuts.

9. If new mounting plate was installed, transfer parking brake cable retaining bracket to new plate.

10. Position shock absorber to spring mounting plate and loosely install nut.

11. Position parking brake cable in retaining bracket and securely clamp bracket to retain cable.

12. Remove stand jacks and lower vehicle so that weight of vehicle rests on suspension components. Torque all affected parts to specifications.

MAIN LEAF OF LEAF SPRING REPLACE - FIREBIRD (Fig. 4-4)

NOTE: The main leaf is the only leaf of this spring that is replaceable. If any of the smaller leafs require replacement, the entire spring assembly must be replaced.

REMOVE

1. Remove the leaf spring from the car as outlined above.

2. With the spring placed on a work bench, remove the center locating nut and bolt.

3. With a screwdriver, pry the tabs of the spring leaf clips up and remove insulator and clip from spring.

4. Separate the smaller leafs of the spring from the main leaf. Be sure to note the position of each leaf in regard to the front of the spring. If a leaf is installed backwards, the spring will be damaged and the designed strength of the spring, be affected.

REPLACE

1. Reverse the above procedure for reassembly. If any leaf clips or insulators are damaged or worn, they must be replaced.

LEAF SPRING TIP INSERTS OR INSULATORS REPLACEMENT - FIREBIRD

1. Raise rear of car until wheel and tire assembly is off of ground. Spring must be able to hang in relaxed position.

NOTE: On some leafs, the leaf spring clip may have to be removed prior to separating the leaf for insert removal.

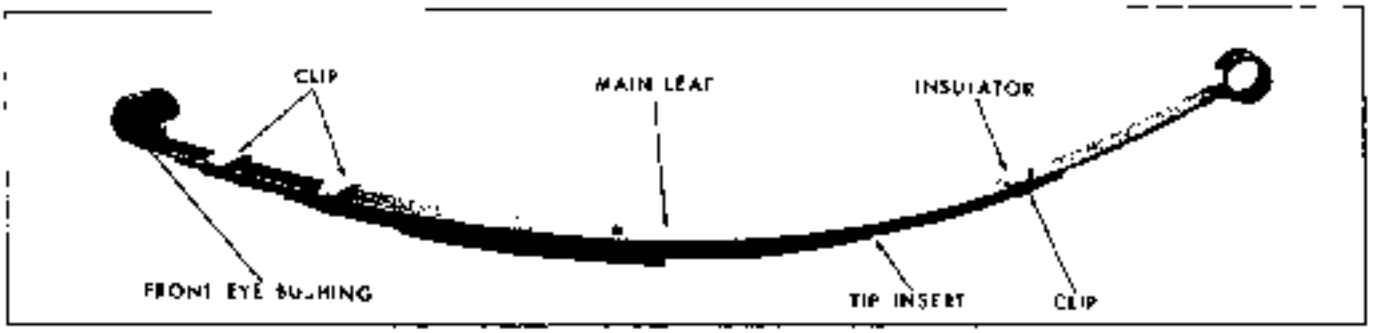


Fig. 4-4 Main Leaf of Leaf Spring - Firebird

2. Using a suitable pry bar placed between spring leafs, separate leaf enough to allow removal of insert.

3. With leaf pryed down with pry bar, install new insert.

4. Remove pry bar and lower car to ground.

REAR UPPER CONTROL ARM— PONTIAC AND TEMPEST

REMOVAL

If both control arms are to be replaced, the axle may roll or slip sideways with both upper control arms removed, making replacement difficult. Remove and replace one control arm at a time.

1. Place car on hoist and raise rear end.

2. Support nose of axle housing with a stand.

3. Remove pivot bolt at rear axle housing and let upper control arm to clear boss on axle housing.

4. Remove pivot bolt at frame cross-member and remove upper control arm.

5. Clean and inspect rubber bushings. If worn, replace as outlined in this section.

INSTALLATION

1. Replace upper control arm by reversing above steps.

2. While holding nut, tighten pivot bolt to 105 lb. ft. torque or while holding pivot bolt, tighten nut to 80 lb. ft. torque.

NOTE: Car must be at curb height when tightening pivot bolts.

REAR UPPER CONTROL ARM BUSHING— PONTIAC AND TEMPEST

REAR BUSHING (IN AXLE HOUSING) REPLACEMENT

1. Remove pivot bolt from upper control arm at axle housing.

2. Arrange tools as shown in Fig. 4-5 and press bushing from axle housing.

3. Install new bushing in axle housing by arranging tools as shown in Fig. 4-6 and press into place. Use care to keep bushing properly aligned. Lightly lubricate bushing to increase ease of installation.

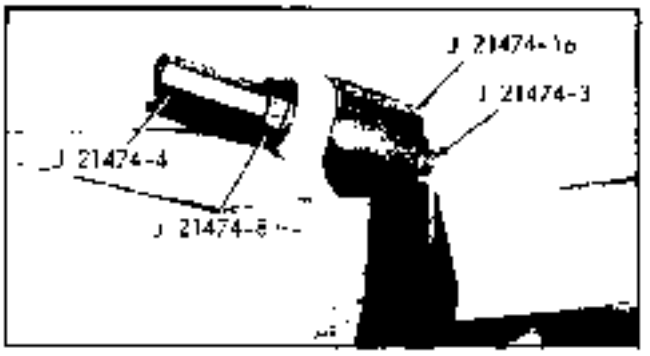


Fig. 4-5 Removing Upper Control Arm Rear Bushing - Pontiac and Tempest

4. Position control arm in place and install pivot bolt. While holding nut, tighten pivot bolt to 105 lb. ft. torque or while holding pivot bolt, tighten nut to 80 lb. ft. torque.

NOTE: Car must be at curb height when tightening pivot bolts.

FRONT BUSHING (IN CONTROL ARM) REPLACEMENT

1. Remove upper control arm from car.

2. Arrange tools as shown in Fig. 4-7 and press bushing from control arm.

3. Install new bushing in control arm by arranging tools as shown in Fig. 4-8 and press into place. Use care to keep bushing properly aligned. Lightly lubricate bushing to increase ease of installation.

4. Position control arm in place and install pivot bolt. While holding nut, tighten pivot bolt to 105 lb. ft. torque or while holding pivot bolt, tighten nut to 80 lb. ft. torque.

NOTE: Car must be at curb height when tightening pivot bolts.

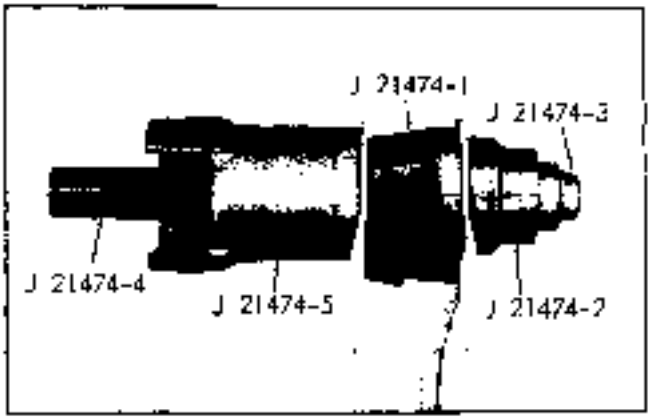


Fig. 4-6 Installing Upper Control Arm Rear Bushing - Pontiac and Tempest

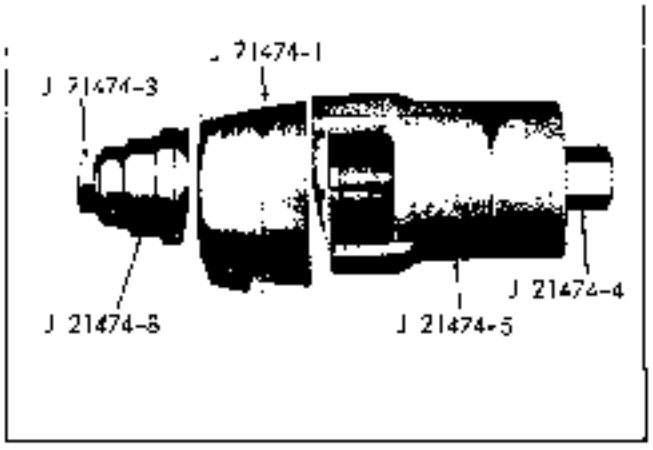


Fig. 4-7 Removing Rear Control Arm Bushings - Pontiac and Tempest

REAR LOWER CONTROL ARM— PONTIAC AND TEMPEST

REMOVAL

If both control arms are to be replaced, the axle may roll or slip sideways with both lower control arms removed, making replacement difficult. Remove and replace one control arm at a time.

1. Place car on hoist and raise rear end of car.

2. Support nose of axle housing with a stand.

3. Remove pivot bolt at rear end of lower control arm (below axle housing).

4. Remove pivot bolt from front of lower control arm at frame and remove control arm.

5. Clean and inspect rubber bushings and if worn, replace.

INSTALLATION

1. Replace lower control arm by reversing removal procedure.

2. Tighten pivot bolt while holding nut to 110 lb. ft. torque or tighten nut while holding pivot bolt to 80 lb. ft. torque.

NOTE: Car must be at curb height when tightening pivot bolts.

REAR LOWER CONTROL ARM BUSHINGS (EXCEPT PONTIAC REAR BUSHING)

REPLACEMENT

1. Remove control arm from car as outlined above.

2. Support arm and remove bushing, using components of tool J 21474 as shown in Fig. 4-7.

3. Replace, using components of tool J 21474 as shown in Fig. 4-8.

4. Replace control arm as outlined above and tighten pivot bolts to 110 lb. ft. torque.

REAR BUSHING (IN AXLE HOUSING BRACKET, PONTIAC ONLY)

REPLACEMENT

1. Remove pivot bolt at rear end of lower control arm (below axle housing) and swing down control arm.

2. Remove bushing from axle housing bracket by arranging tools as shown in Fig. 4-9 and press out bushing.

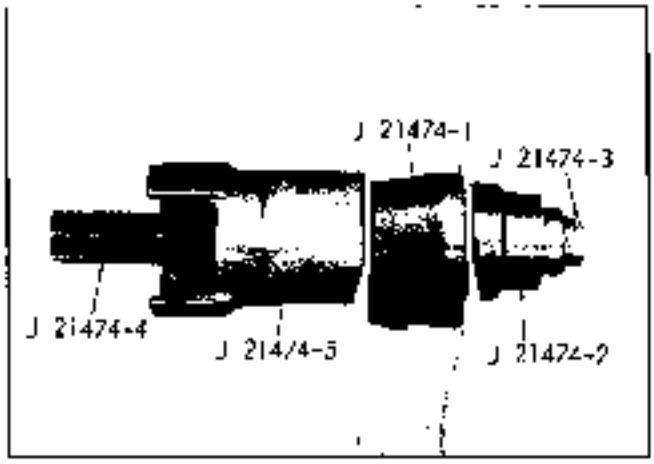


Fig. 4-8 Installing Rear Control Arm Bushings - Pontiac and Tempest

Fig. 4-9 Removing Lower Control Arm Rear Bushing - Pontiac

3. Install bushing in axle housing bracket by arranging tools as shown in Fig. 4-10 and press bushing into place. Use care to keep bushing properly aligned. Lightly lubricate bushing to increase ease of installation.

4. Position control arm in place and install pivot bolt. While holding nut, tighten pivot bolt to 105 lb. ft. torque or while holding pivot bolt, tighten nut to 80 lb. ft. torque.

SUPERLIFT SHOCK ABSORBER PONTIAC AND TEMPEST

REMOVAL

1. Remove vacuum lines from both shocks and seal port openings.

2. Remove nuts, bolts and lock washers at upper end of shock absorbers.

3. Remove self-locking nuts from lower end and remove shock absorbers.

INSTALLATION

1. Install shock absorbers by reversing above steps.

2. Tighten lower self-lock nut 65 lb. ft. torque and upper bolt 20 lb. ft. torque.

PRECAUTIONS

The precautions outlined below should be heeded to insure satisfactory function of the Superlift system:

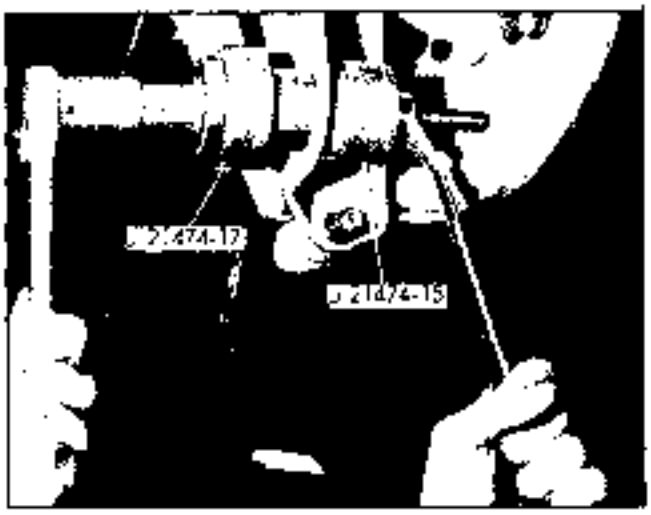


Fig. 4-10 Installing Lower Control Arm Rear Bushing - Pontiac

MINIMUM PRESSURE—10 PSI

For best ride characteristics with an empty car, a minimum pressure of 10 psi should be maintained.

MAXIMUM PRESSURE—90 PSI

The pressure may be varied to a maximum of 90 psi to level the car with loads.

NEOPRENE BOOT

Do not rotate free end of a Superlift unit after opposite end has been attached.

EXHAUST SYSTEM

The air lines cannot withstand exhaust system temperatures. At least 1.50" clearance should be maintained between the air lines and any portion of the exhaust system.

LINES AND FITTINGS (Fig. 4-11 and 4-12)

Flexible air lines are used throughout the system and are in 1/8" diameter tubing. Each fitting consists of a rubber seal, metal sleeve and nut (Fig. 4-13). These parts are intended specifically for the 1/8" diameter line and must be used to effect a reliable seal.

NOTE: While the lines are flexible for easy handling and installing, care should be taken not to kink them and to keep them from coming in contact with the exhaust system.

PONTIAC AUTOMATIC LEVEL CONTROL SERVICE PROCEDURES

REMOVAL AND INSTALLATION OF TUBING (Fig. 4-14)

Tubing may be removed by simply unscrewing the nut. Be sure system is deflated thru service valve before separating air lines. When installing tubing at any Automatic Level Control fitting, be careful not to kink line.

1. Preassemble metal sleeve and rubber seal.

2. Place nut on tubing.

3. Insert tube into metal sleeve and rubber seal until tube bottoms.

4. Holding tube in bottomed position, tighten the tube nut securely (70 lb. in.).

NOTE: Tubing may be reinstalled at its connections. If tubing is cracked at end, it will be necessary to cut flush and use a new metal sleeve and rubber seal to assemble as described above. Be careful not to remove too much or tubing may be kinked or broken at full suspension travel. Care should be taken that proper routing is followed in areas close to the exhaust system to prevent burning the tubing. Note particularly the areas at rear suspension crossmember.

REMOVAL OF COMPRESSOR, RESERVOIR AND REGULATOR VALVE ASSEMBLY (Fig. 4-15)

1. Deflate system through service valve.

2. Disconnect high pressure line at pressure regulator valve. Also disconnect vacuum line at compressor.

3. Remove three nuts securing the assembly to the brackets and remove assembly.

DISASSEMBLY OF COMPRESSOR

DISASSEMBLY OF COMPRESSOR INTO MAJOR COMPONENTS (Fig. 4-16)

The compressor is a precision-built mechanism that should be carefully handled and assembled. Care must be taken to prevent entrance of dirt or other foreign matter. This unit must not be lubricated as it is designed to operate dry.

1. Remove compressor as outlined above.

2. Remove two adapters and flexible mounts on compressor end of assembly.

3. Remove nuts from three reservoir retaining (long) bolts. The bolts enter from reservoir flange side of unit.

4. Remove nuts from three compressor retaining (short) bolts. These bolts enter from compressor side of unit.

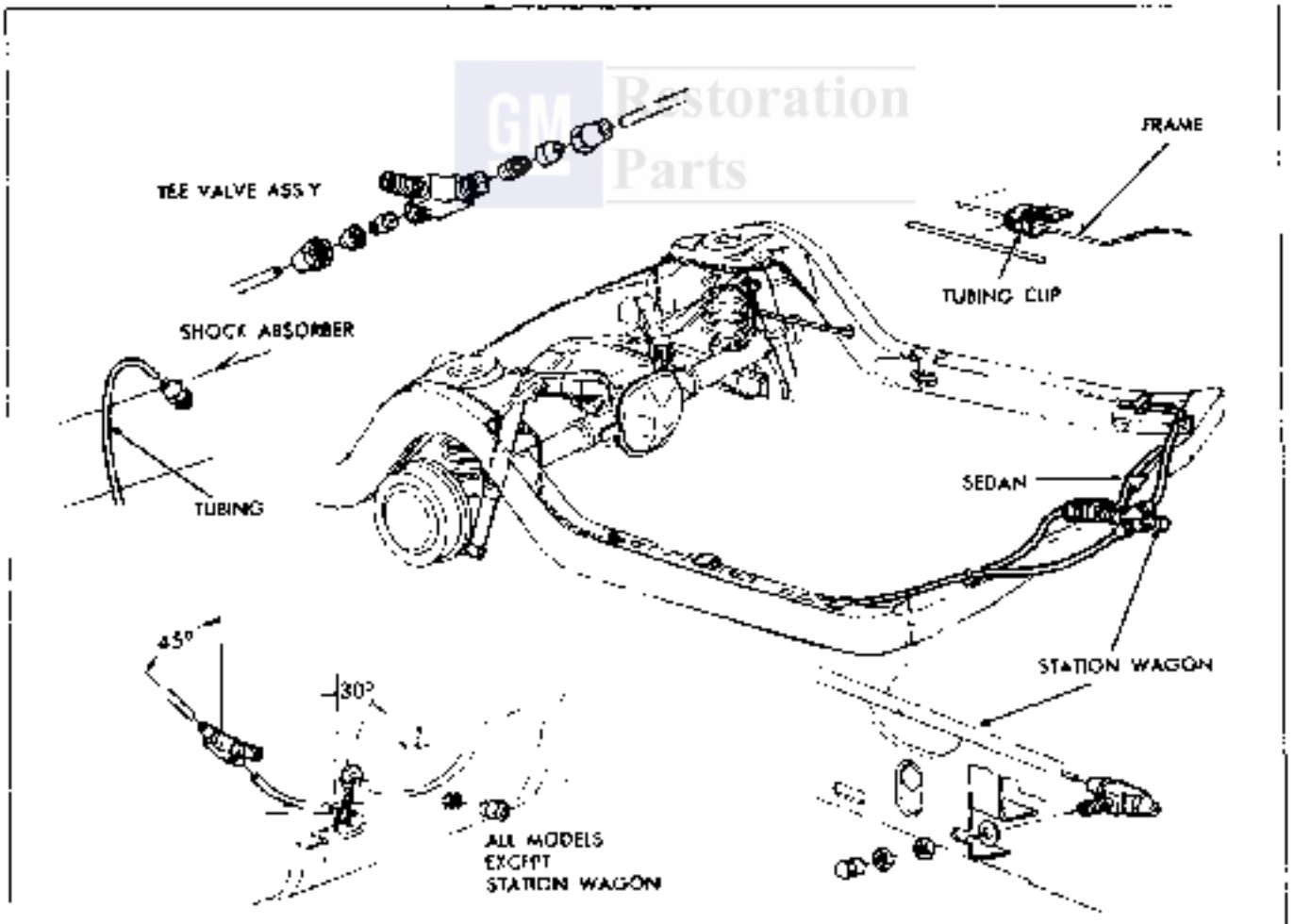


Fig. 4-11 Pontiac Superlift Shocks

CAUTION: DO NOT attempt to turn short bolts as they have a second nut hidden between reservoir flange and second stage housing. Always remove nuts from bolts while holding bolts stationary.

5. Separate compressor assembly and reservoir. Discard reservoir sealing O-ring.

6. Remove cover retaining screw. Remove cover and discard cover gasket.

7. Remove three compressor retaining (short) bolts that hold first and second stage housings together.

8. Separate first and second stage housings by sliding second stage housing straight off piston.

9. Remove two pressure regulator valve assembly retaining screws. Remove valve assembly from second stage housing and discard O-ring seal.

10. Disconnect distributor arm tensior spring from swivel arm.

11. Remove actuating arm retaining screw and arm.

12. Piston and diaphragm assembly can now be removed from first stage housing by carefully sliding the assembly straight out of housing.

DISASSEMBLY OF PISTON—DIAPHRAGM ASSEMBLY

1. Remove diaphragm retainer with diagonal pliers and discard retainer (Fig. 4-17).

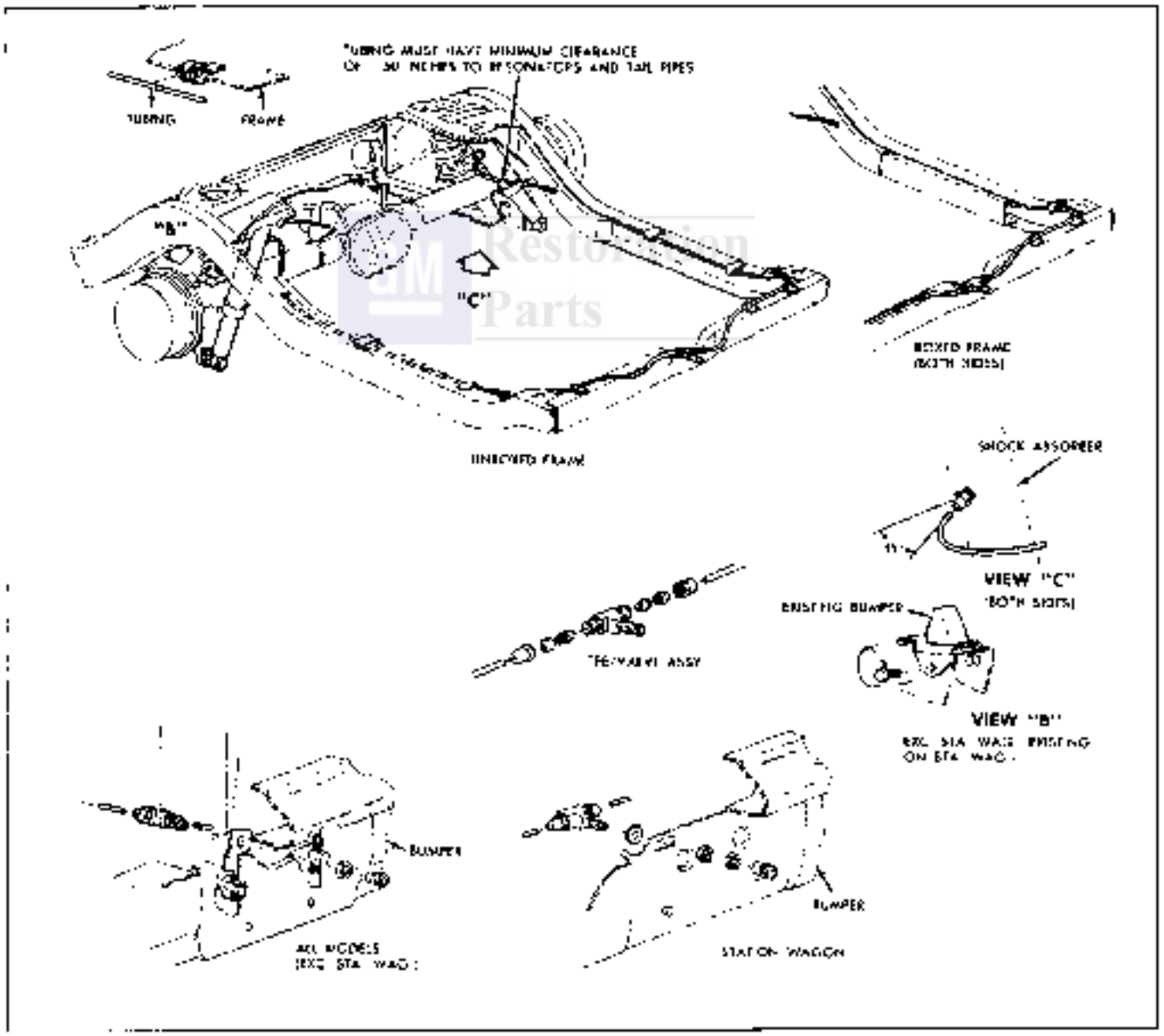


Fig. 4-19 Tempest Superlift Shocks

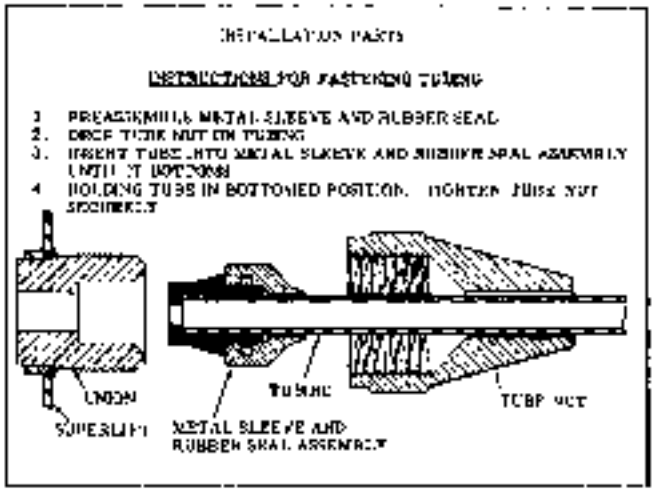


Fig. 4-13 Instructions for Fastening Tubing

2. Remove diaphragm plate, diaphragm, second diaphragm plate and neoprene washer can be discarded.

3. Remove and discard piston seals and O-rings from piston.

CAUTION: Be careful not to damage piston

1. Remove check valve in second stage end of piston by inserting a suitable punch or piece of 3/32" welding rod through air passage from first stage end and tapping.

DISASSEMBLY OF FIRST STAGE HOUSING AND VALVE MECHANISM

Actuate distributor valve with finger. Valve tension spring should press against distributor valve, holding it against either stop. If valve action is not free and positive, it will be necessary to rebuild using new parts in Distributor Valve and Arm Package. If action is free and positive and upon disassembly there are no damaged parts, parts may be re-used.

1. Remove screw, washer, distributor arm assembly, washer and distributor valve bushing (Fig. 4-18).

2. Remove two arm assembly stop bushing and two distributor valve stop bushings.

3. Remove distributor valve, being careful not to distort valve tension spring.

4. Carefully remove valve tension spring from boss. Do not distort spring.

NOTE: Tension spring has one short foot and one long foot. The short foot fits under the distributor valve and the long foot fits into a hole drilled at an angle in the boss (see Figs. 4-21 and 4-22).

5. Remove intake check valve retaining spring, intake check valve and washer, using a pocket knife.

6. If necessary, remove rocker and swivel arms. Grip pin with pliers and remove pin (Fig. 4-19).

DISASSEMBLY OF SECOND STAGE HOUSING

1. Remove check valve in second stage housing by inserting a suitable punch or piece of 3/32" welding rod through air passage and tapping.

CLEANING AND INSPECTION OF PARTS

All metal parts should be cleaned in clean solvent and blown dry with compressed air.

PISTON AND DIAPHRAGM ASSEMBLY

1. Inspect piston for scoring. Replace if necessary.

2. Inspect check valve seat. Seat should be smooth and clean.

3. Inspect diaphragm for holes, looseness or other defects. Replace if necessary.

FIRST STAGE HOUSING AND VALVE MECHANISM

1. Inspect housing for cracks or damage and replace if necessary.

2. Inspect piston bore. Replace housing, if scored.

3. Inspect check valve seat. Seat should be smooth and clean.

4. Inspect distributor valve parts for wear and replace if necessary.

5. Inspect distributor valve seat on housing for wear. Replace housing if necessary.

SECOND STAGE HOUSING

1. Inspect piston bore, replace housing if scored.

2. Inspect check valve seat. Seat should be smooth and clean.

3. Inspect housing for cracks or damage and replace if necessary.

ASSEMBLY OF COMPRESSOR ASSEMBLY

ASSEMBLY OF SECOND STAGE HOUSING

1. Install new check valve and spring.

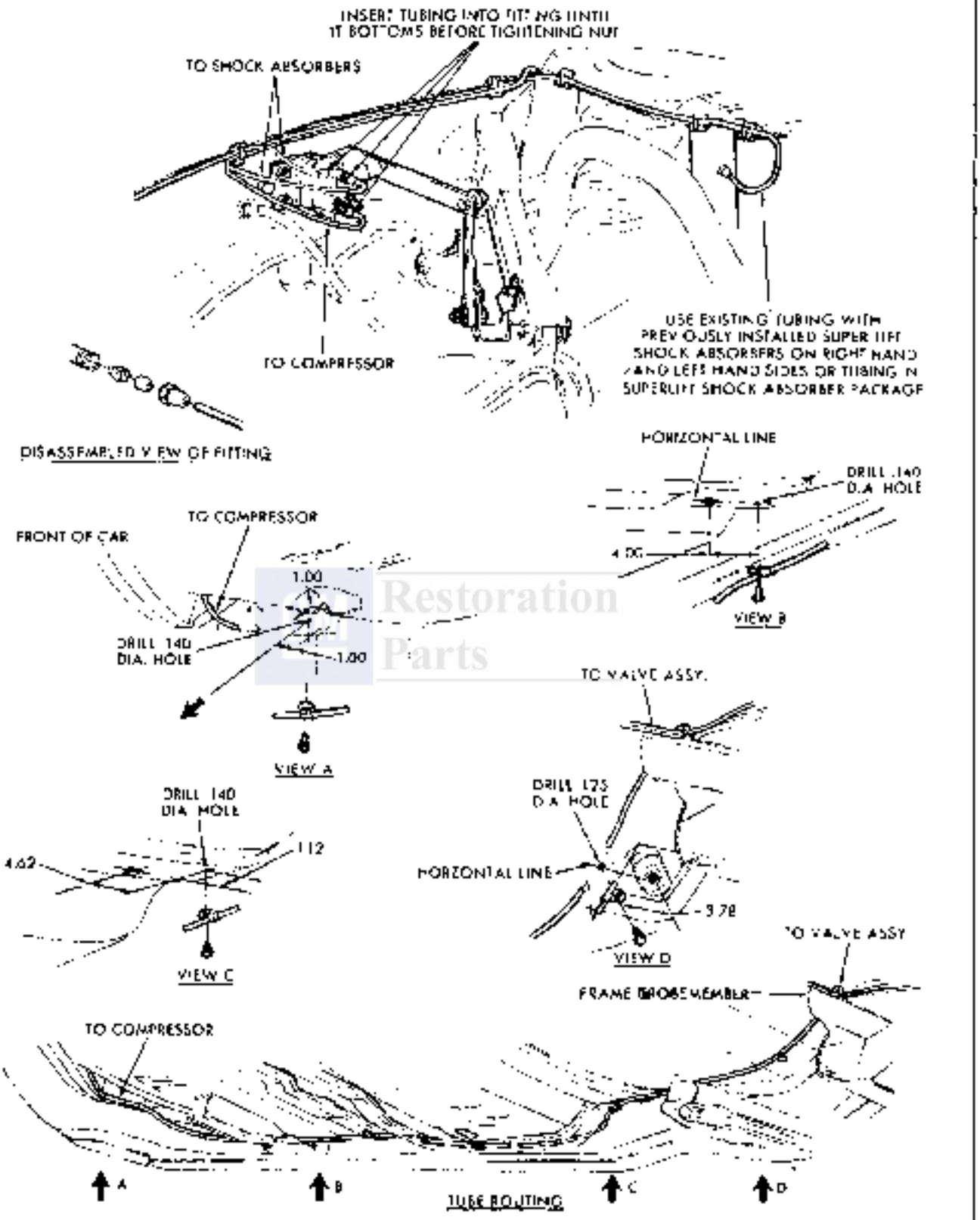


Fig. 4-14 Installation of Automatic Level Control

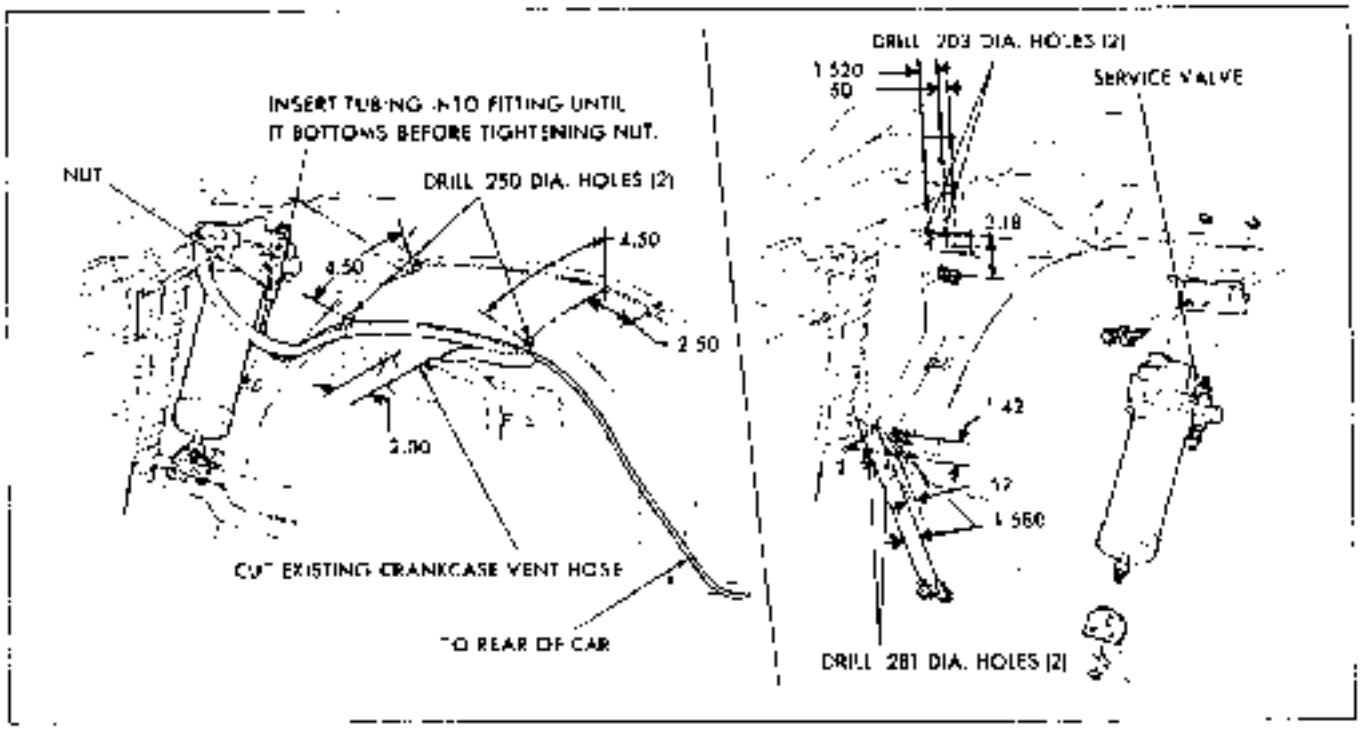


Fig. 4-15 Installation of Automatic Level Control Compressor, Reservoir, and Regulator Valve Assembly

2. Insert new expansion plug retainer and tap in until it bottoms (Fig. 4-20).

ASSEMBLY OF FIRST STAGE HOUSING AND VALVE MECHANISM

1. If removed, position bushings in first stage housing and install rocker arm and swivel arm. Align holes in rocker and swivel arms and install retaining pin, small end first.

NOTE: If distributor mechanism failed to operate properly or one or more parts were found defective, use new parts in Distributor Valve and Arm Package during remaining reassembly.

2. Install washer on intake valve and install in first stage housing with intake valve retaining spring.

3. Install longer foot of valve tension spring in boss on first stage housing, being careful not to distort spring (Fig. 4-21).

4. Position distributor valve so flat short foot of tension spring sits under valve and vertical leg is in slot (Fig. 4-22).

5. Install distributor valve bushing, washer, distributor arm assembly, washer and secure with screw (Fig. 4-23). Tighten screw to 12 lb. in.

6. Install two distributor valve stop bushings and two arm assembly stop bushings.

NOTE: Do not install actuating arm, arm tension spring or arm pivot screw at this time as rocker arm must be free to permit entrance of piston into first stage housing.

ASSEMBLY OF PISTON—DIAPHRAGM ASSEMBLY

1. Install new neoprene washer, old plate (unless damaged), new diaphragm (with outer lip toward second stage or piston) and second plate (Fig. 4-24).

2. Using a 13/16" deep socket as a retainer installer, press against the piston shoulder on the first stage housing side with wood blocks to seat retainer. The wood blocks used in the illustration are each 3/4" x 3/4" x 12".

NOTE: Be sure retainer is squarely seated in order to affect an air tight seal against the neoprene seal.

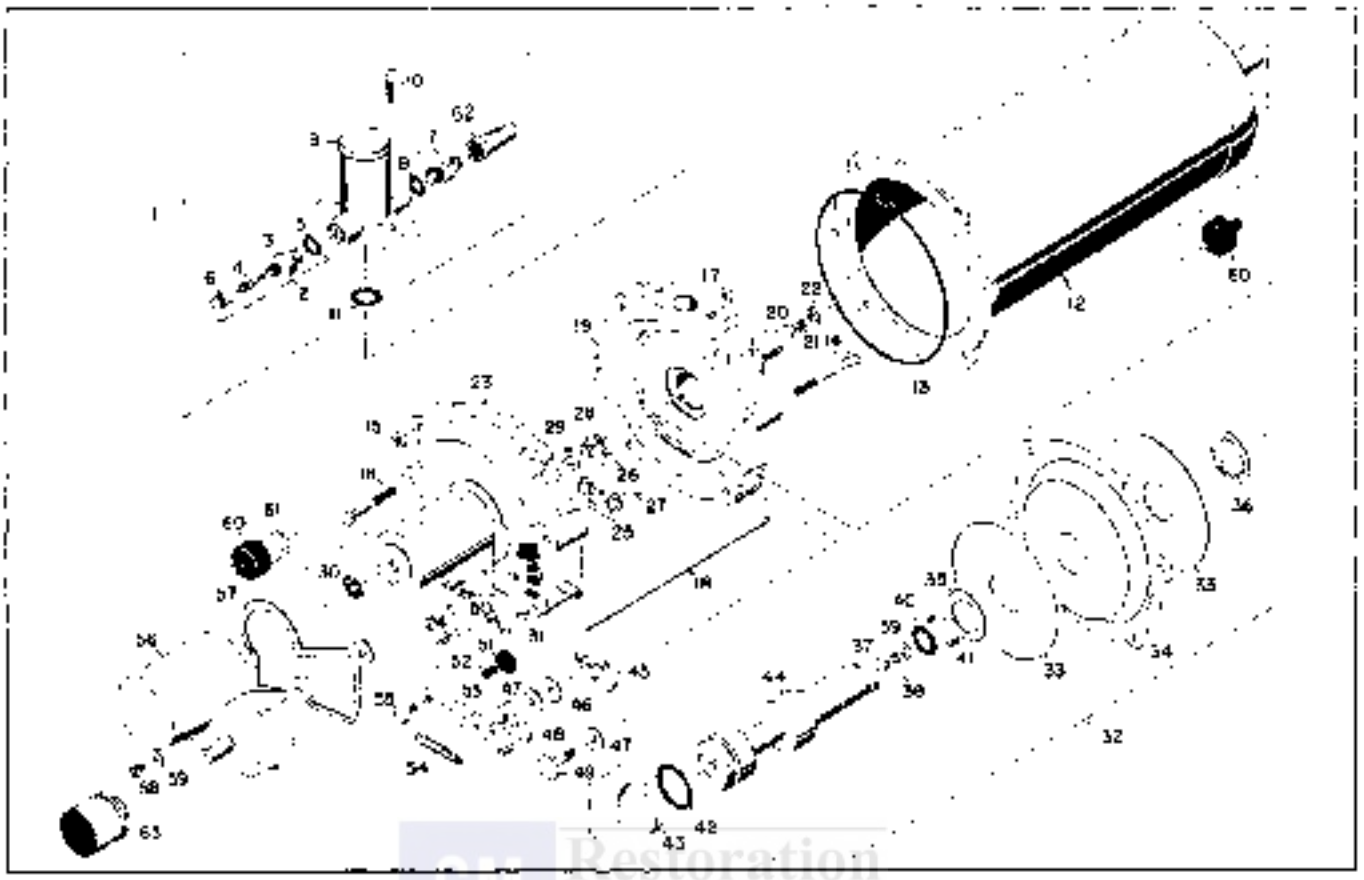
3. Install new O-rings by rolling into groove. Relieve any resulting twist.

4. Install new seals, using a piece of .020" shim stock (Fig. 4-25).

CAUTION: Make sure shim stock has no sharp edges that may cut seal. Do not stretch seal more than is necessary to install. Seals must be installed so they are not twisted.

ASSEMBLY OF MAJOR COMPONENTS

1. Slide piston assembly straight into first stage (large diameter) housing.



1. Regulator Assy.
2. Adapter Assy.
3. Adapter
4. Valve Core
5. O-Ring
6. Cap
7. Adapter Assy.
8. O-Ring
9. Boer
10. Screw, Regulator Retaining
11. O-Ring, Regulator to Compressor
12. Reservoir
13. O-Ring, Reservoir to Compressor
14. Thru Bolt, Reservoir Retaining
15. Nut, Thru Bolt Reservoir
16. Thru Bolt, Compressor Retaining
17. Nut, Thru Bolt Compressor
18. Compressor Assy.
19. Housing, 2nd Stage
20. Check Valve
21. Spring
22. Expansion Plug Retainer
23. Housing, 1st Stage
24. Arm, Swivel
25. Bushing
26. Arm, Rocker.
27. Pin, Rocker Arm Ret.
28. Intake Valve
29. Washer
30. Spring, Intake Valve Ret.
31. Pin, Bushing Retaining
32. Piston Assy.
33. Plate, Diaphragm
34. Diaphragm
35. Washer (.760-.765 I.D.)
36. Retainer, Diaphragm
37. Check Valve
38. Spring
39. Expansion Plug Retainer
40. O-Ring (.357-.367 I.D.)
41. Seal (.367-.371)
42. O-Ring (.732-.742 I.D.)
43. Seal (.940-.960)
44. Piston
45. Distributor Valve
46. Bushing, Distributor Valve
47. Washer (.760-.765 I.D.)
48. Arm Assy., Distributor
49. Screw
50. Spring, Valve Tension
51. Bushing, Distributor Valve Stem
52. Bushing, Arm Assy. Stop
53. Arm Actuating
54. Spring, Arm Tension
55. Screw, Arm Pivot
56. Cover
57. Gasket
58. Screw, Cover Retaining
59. Gasket, Cover
60. Mount, Flexible
61. Adapter
62. Tube Fitting
63. Filter

Fig. 4-16 Exploded View of Compressor

2. Install actuating arm and secure to first stage housing with arm pivot screw. Tighten to 12 lb. in.

3. Connect arm tension spring to swivel arm.

4. Rotate piston in first stage housing to align elongated hole in diaphragm with vent port in housing.

5. Install second stage housing by sliding straight onto second stage piston.

6. Install three compressor retaining (short) bolts from the first stage housing side, through the second stage housing hex shaped, recessed holes. The first and second stage housings will align one way only. Position three small nuts in hex recesses and tighten bolts to 28 lb. in.

7. Install new O-ring on second stage housing. Install reservoir on second stage housing with three large nuts. Tighten to 28 lb. in. Install the two reservoir retaining (long) bolts, from reservoir side, that do not go through cover. Tighten to 28 lb. in.

8. Install new gasket and cover and secure with retaining screw. Tighten screw to 35 lb. in. Install third reservoir retaining (long) bolt. Tighten to 28 lb. in.

9. Install new O-ring on pressure regulator and

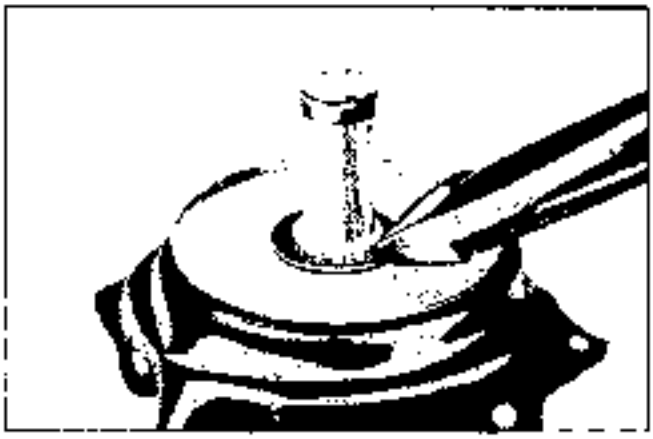


Fig. 4-17 Removing Diaphragm Retainer

secure with two retaining screws with high pressure fitting toward reservoir. Tighten to 35 lb. in.

10. Install two adapters and flexible mounts on the two reservoir (long) bolts that do not go through cover. Tighten to 28 lb. in.

11. Compressor should be output tested before installation on car. See Compressor Output Test on Car.

12. If compressor passes output test, install Compressor, Reservoir and Regulator Valve Assembly on car.

INSTALLATION OF COMPRESSOR, RESERVOIR AND REGULATOR VALVE ASSEMBLY

1. Install assembly in brackets and tighten nuts to 30 lb. in.

2. Connect high pressure line to regulator valve and tighten fitting nut to 70 lb. in. Install vacuum line to compressor.

3. Inflate system through service valve to maximum available pressure (Fig. 4-26).

NOTE: If available pressure is less than 140 psi, start engine to build up reservoir to this pressure.

Fig. 4-18 Removal of Distributor Valve

Fig. 4-19 Removing Rocker Arm Pin

TROUBLE DIAGNOSIS TESTS

QUICK CHECK OF AUTOMATIC LEVEL CONTROL SYSTEM

1. Record rear trim height of empty car (measure from center of rear bumper to ground).

2. Add weight equivalent to two passenger load to rear of car. Car should begin to level in 4-15 seconds. Final position should be with 1/2" of original measurement.

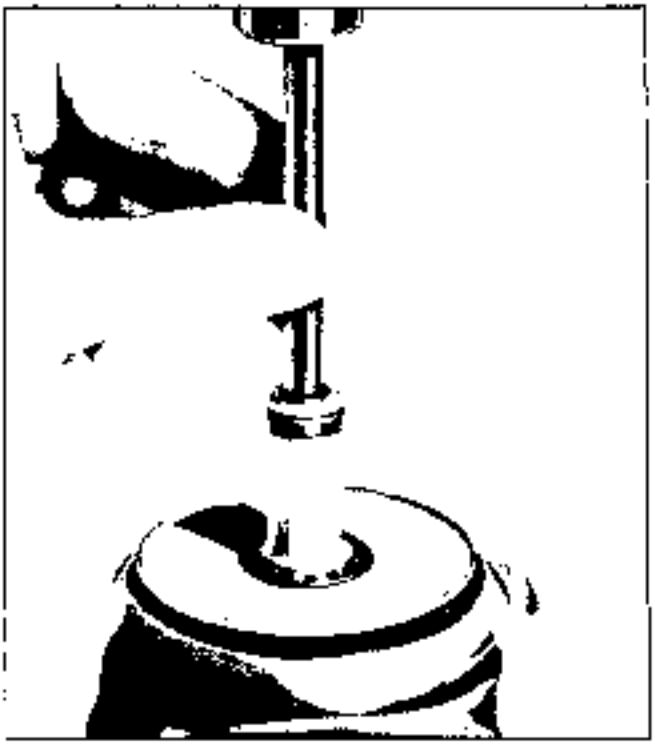


Fig. 4-20 Installing Check Valve

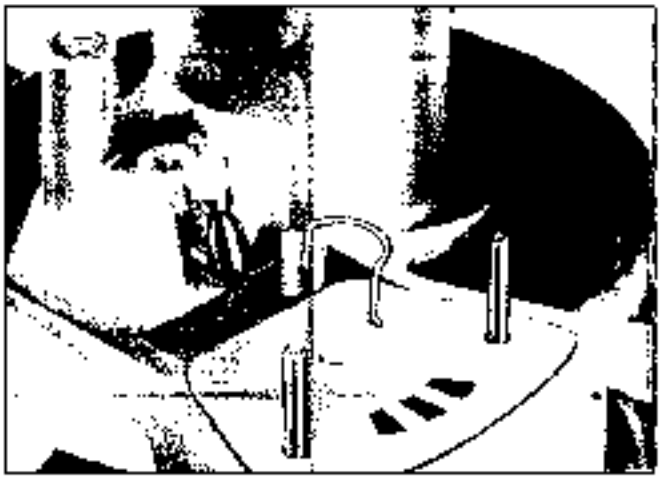


Fig. 4-21 Installing Valve Fender Spring to Boss

3. Remove weight. Car should begin to settle in 6-10 seconds. Final position should be within 1/2" of original measurement.

AUTOMATIC LEVEL CONTROL TEST GAGE

To properly service the Automatic Level Control, it will be necessary to obtain Test Gage J 5907 with adaptor package J 22495 or equivalent. A test gage can be made up by collecting and assembling the following parts.

PARTS REQUIRED

1. Fill valve.

2. A tee, which has three 1/8" female taper pipe threads.

3. One adapter, which has a 1/4" female taper pipe thread on one end and a 1/8" male taper pipe thread on the other end.

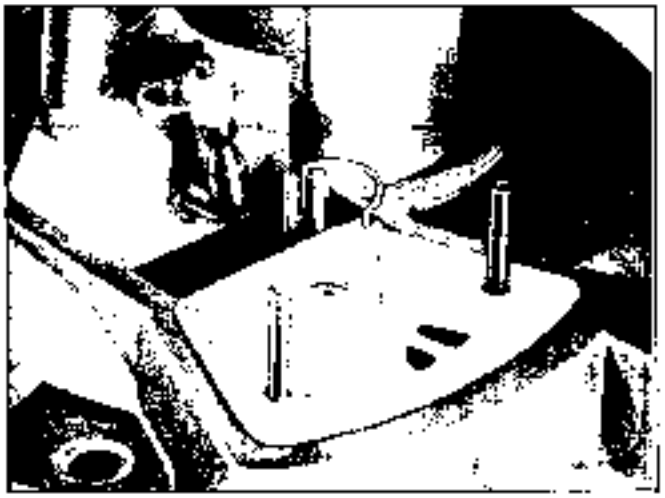


Fig. 4-22 Positioning Distributor Valve

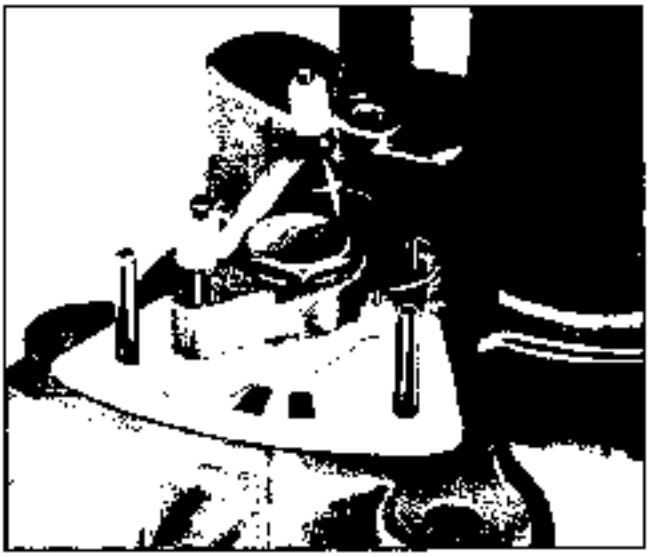


Fig. 4-23 Installing Distributor Arm

4. Air Pressure Gage J 5907.

5. One male connector, which has a 1/8" male taper pipe thread on one end and a 3/8"-24 straight thread male thread on the other end.

6. Two metal sleeves, rubber seals and tube nuts.

7. A length of 1/8" tubing.

ASSEMBLY

1. Install adapter in tee.

2. Install connector in one end of tee.

3. Install fill valve in other end of tee.

4. Install Pressure Gage J 5907 in adapter.

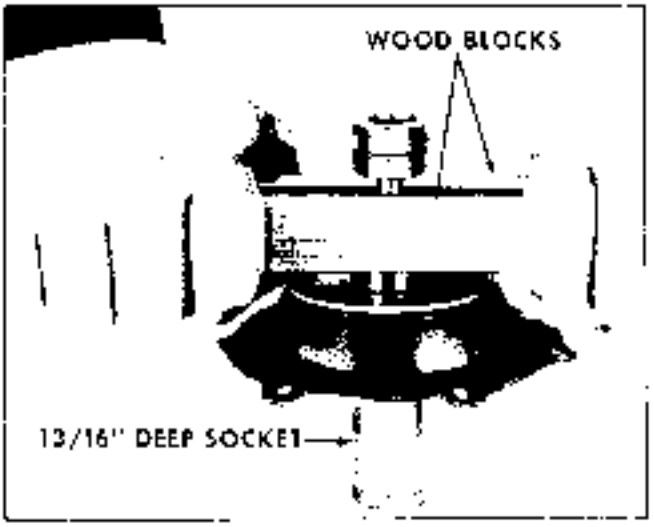


Fig. 4-24 Installing Diaphragm Retainer

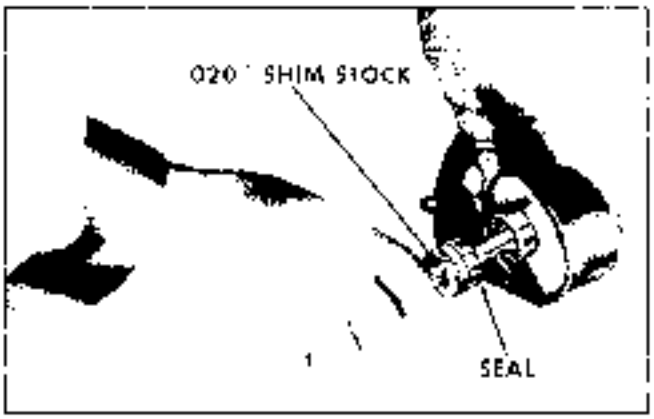


Fig. 4-25 Installing Piston Seal

5. Install fitting nut on tubing, then install metal sleeve and rubber seal over end of tubing until tubing bottoms in rubber seal. Tubing, nut and seal assembly can now be installed on connector opposite the fill valve. Tighten fitting nut to 70 in. lb.

NOTE: Make certain all fittings are air tight.

COMPRESSOR OUTPUT TEST—ON CAR

1. With all engine operated accessories turned off and ignition turned off, deflate system through service valve. Remove high pressure line at regulator and connect test gage (Fig. 4-26).

2. Inflate reservoir to 70 psi through service valve.

3. Observe test gage for evidence of compressor air leak.

4. If leaking, proceed to leak test the compressor, reservoir and regulator as outlined below. If not leaking, continue with this test.

5. With engine running at slow idle, observe reservoir build-up for five minutes. Reservoir pressure should build up to a minimum of 90 psi.

6. If compressor fails to cycle, make sure the vacuum line and filter is open and unobstructed before removing compressor for repair.

7. If build-up is too slow, proceed to repair compressor as outlined in Service Procedures.

8. Satisfactory build-up indicates system problem to be in the control section. However, again observe the test gage for evidence of an air leak and proceed accordingly.

PRESSURE REGULATOR TEST

Performance test the regulator with a known good compressor on the car.

1. Deflate system through service valve and disconnect line at pressure regulator valve. Install test gage on regulator valve high pressure fitting (Fig. 4-27).

2. Inflate system through service valve to maximum available pressure (Fig. 4-26).

NOTE: If available pressure is less than 140 psi, start engine to build-up reservoir to this pressure.

3. Regulated pressure should build-up to and hold steady at 100-130 psi on test gage.

4. Check regulated pressure by momentarily (not more than one second) depressing valve core on test gage and observe gage reading.

5. If regulated pressure now reads less than 100 psi, replace regulator assembly.

6. If regulated pressure exceeds 130 psi, replace regulator assembly.

HEIGHT CONTROL VALVE TEST—ON CAR

EXHAUST (SUPERLIFTS INFLATED)

1. Disconnect overtravel lever from link.

2. Hold lever down in exhaust position until Superlifts deflate or for a minimum of 15 seconds.

3. If Superlifts deflate, perform Intake Check.

4. If Superlifts do not deflate, remove exhaust adapter from control valve and hold lever down as in Step 2. Replace adapter, O-ring and filter if this deflates Superlifts.

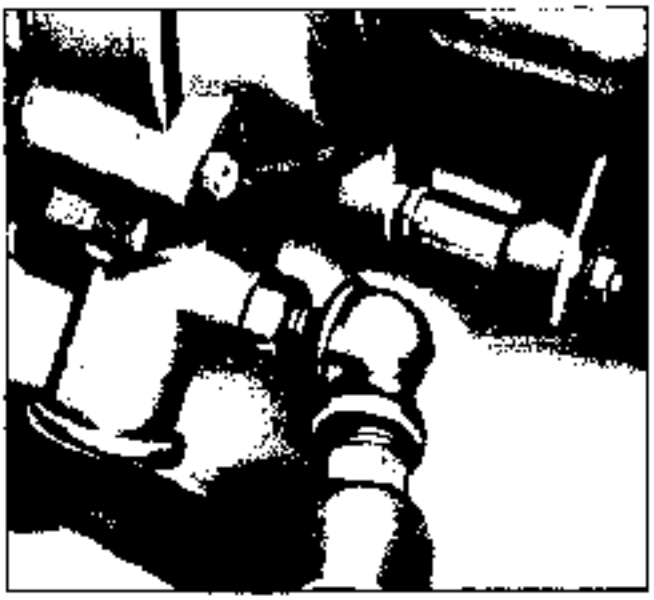


Fig. 4-26 Filling System through Service Valve

5. Replace control valve if none of the above steps corrects problem.

INTAKE (RESERVOIR PRESSURE 125 PSI MINIMUM)

1. Disconnect overtravel lever from link.

2. Hold lever up in intake position until Superlifts inflate or for a minimum of 15 seconds.

3. If Superlifts inflate and hold, proceed to Time Delay Check.

4. If Superlifts inflate and then leak down, perform leak test on lines and fittings and then on Superlifts. Also check and, if necessary, replace HCV intake and exhaust screens and O-rings. If superlifts still do not inflate, perform leak test on valve. Repair as indicated and proceed to Time Delay Check.

TIME DELAY CHECK

1. Disconnect overtravel lever from link.

2. Disconnect hose at Superlift and intake port.

3. Connect test gage to intake valve port and open air pressure (95 psi). Move overtravel lever approximately one inch down from neutral position, as measured from end of lever.

4. Quickly move overtravel lever upward two inches; at the same time, begin timing number of seconds before air starts to escape from Superlift port. This delay should be from 6-18 second. Repeat check. This will check the air intake time delay. Proceed with check to determine air exhaust time delay.

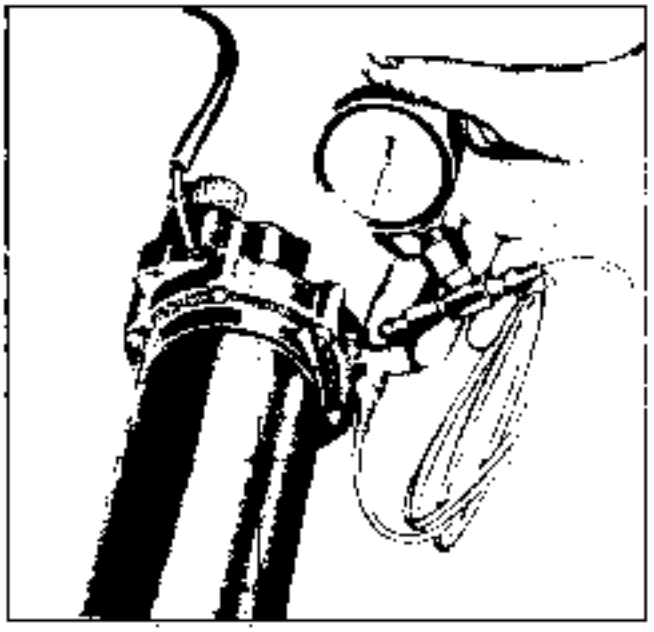


Fig. 4-27 Test Gauge Installed on Regulator Valve

5. Remove test gage and plug intake port with Fill Valve.

6. Connect test gage to Superlift port and open air pressure (95 psi). Move overtravel lever approximately one inch up from neutral position, as measured from end of lever.

7. Quickly move overtravel lever downward two inches; at the same time, begin timing number of seconds until air begins to escape from exhaust port. This delay should be 6-18 seconds. Repeat check.

If either delay is not within specification, there has either been a loss of silicone fluid or valve has lost its adjustment due to damage or wear. Valve must be replaced.

LEAK TEST

COMPRESSOR, RESERVOIR AND REGULATOR

1. Remove assembly intact.

2. Connect test gage to regulator. Inflate reservoir through service valve to 80-110 psi.

3. Route an 8" piece of rubber hose between vacuum and vent ports (Fig. 4-28).

4. While holding assembly in a vertical position with reservoir end down, immerse in water until diaphragm is just submerged. Do not submerge completely, as water can enter around the cover gasket. Observe for air leaks at:

Reservoir weld seam.

Reservoir to compressor O-ring. A stream of bubbles may appear in this area and then cease. The bubbles are caused by atmospheric air being purged from air pockets in the second stage housing. If the bubbles stop, there is no leak.

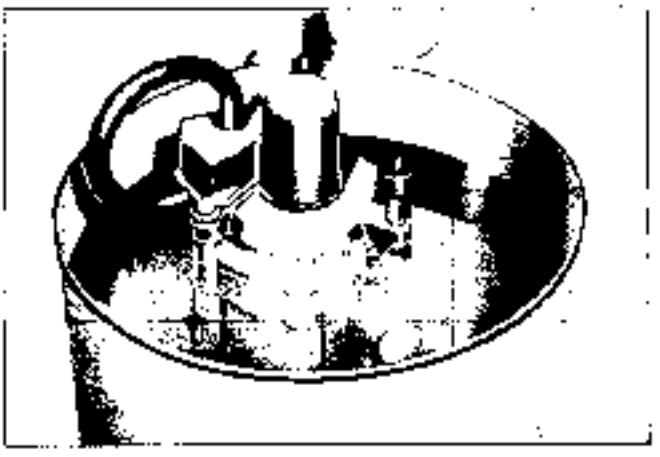


Fig. 4-28 Checking Compressor, Reservoir and Regulator for Leaks

Regulator to compress O-ring.

Regulator boot--defective internal O-ring.

Diaphragm between first and second stage housings--tightening through-bolts may correct the leak.

Service valve.

Test gage connections.

5. Remove hose from vacuum port and submerge disconnected end in water. Cover vacuum port with finger. Do not permit water to enter through vacuum port. If bubbles are evident, the probable cause is a defective second stage housing check valve.

6. Correct any leaks by either tightening screws or replacing parts.

7. If the cover gasket area is inadvertently submerged, remove cover and tilt unit so that water may drain through openings by distributor valve mechanism. Move distributor valve from side to side until all water is purged. Blow dry with compressed air, both the distributor valve mechanism and interior of the cover. Replace cover.

If the compressor passes this test, yet fails the output test, the compressor, reservoir and regulator needs to be overhauled.

HEIGHT CONTROL VALVE TEST—OFF CAR

1. Remove control valve from car.

2. Clean exterior of control valve thoroughly.

3. Connect test gage and air pressure source to intake adapter and open air pressure (80-110 psi).

4. Submerge unit in water. No air should escape if overtravel lever is in neutral position. If bubbles escape from Superlift port, replace control valve.

5. Shut off air pressure and detach test gage from air intake port. Plug intake port with fill valve from J-22695 adaptor package.

6. Connect test gage to Superlift port and open air pressure.

7. With overtravel lever in neutral position, no air should escape. If bubbles escape from exhaust port, replace control valve.

8. If air escapes around edge of cover plate, the gasket must be replaced.

9. Remove control valve from water. Actuate overtravel lever to expel any water from unit.

10. Shut off air pressure and remove line from Superlift port.

LINES AND FITTINGS LEAK TEST

1. Disconnect overtravel lever from link.

2. Hold lever up in intake position for maximum Superlift inflation and release.

3. Leak check all connections with a soap and water solution.

SUPERLIFTS LEAK TEST

1. Disconnect lines and remove Superlift from car.

2. Inflate individually to 50-60 psi utilizing Fill Valve from J-22695 package, submerge in water and observe for leaks.

3. Install Superlifts and connect lines.

ON CAR TRIM ADJUSTMENT

Trim adjustment should be performed with a full fuel tank (or the equivalent in load at the rate of six pounds per gallon of gasoline).

1. Fill compressor with available air line pressure.

2. Raise the car on twin post or drive-on hoist.

3. Disconnect the link from the upper control arm bracket.

4. Move the height control valve arm upward until air fills the Superlifts.

5. Move the height control valve arm downward until air stops escaping from the exhaust port on the height control valve. The Superlifts will now hold 9 to 15 psi. Let the arm go to the neutral position.

6. With link attached to the height control valve arm, determine which hole in the upper control arm bracket most closely aligns with the link hole.

7. Loosen valve control arm adjustment nut and move metal portion of arm until link and bracket holes line up and bolt link to bracket.

8. Tighten adjusting nut, being careful not to move lever and nylon arm while tightening.

TORQUE SPECIFICATIONS

	Lb. Ft.
Bolt, Upper or Lower Control Arm (Pontiac & Tempest)	110
Nut, Upper or Lower Control Arm (Pontiac & Tempest)	80
Nut, Shock to Lower Mount Pontiac & Tempest	85
Firebird	60
Nut, Shock to Upper Mount	20
Nut, Shock to Upper Mount (Firebird)	90 (In. Lb.)
Nut, Pinion Rubber Bumper	80 (In. Lb.)
Nut, Lower Shock Mount to Axle (Firebird)	60
Bolt, Upper Shock Mount to Frame (Firebird)	50
Nut, Front Spring Bushing to Bracket (Firebird)	100
Bolt, Front Spring Bracket to Frame (Firebird)	25
Nut, Rear Spring Bushing to Shackle (Firebird)	60
Nut, Compressor Fitting (Auto. Level Control)	70 (In. Lb.)
Nut, Height Control Valve (Auto. Level Control)	75 (In. Lb.)
Screw, Compressor Bracket to Fender Panel (Auto. Level Control)	40 (In. Lb.)
Nut, Upper & Lower Link (Auto Level Control)	75 (In. Lb.)

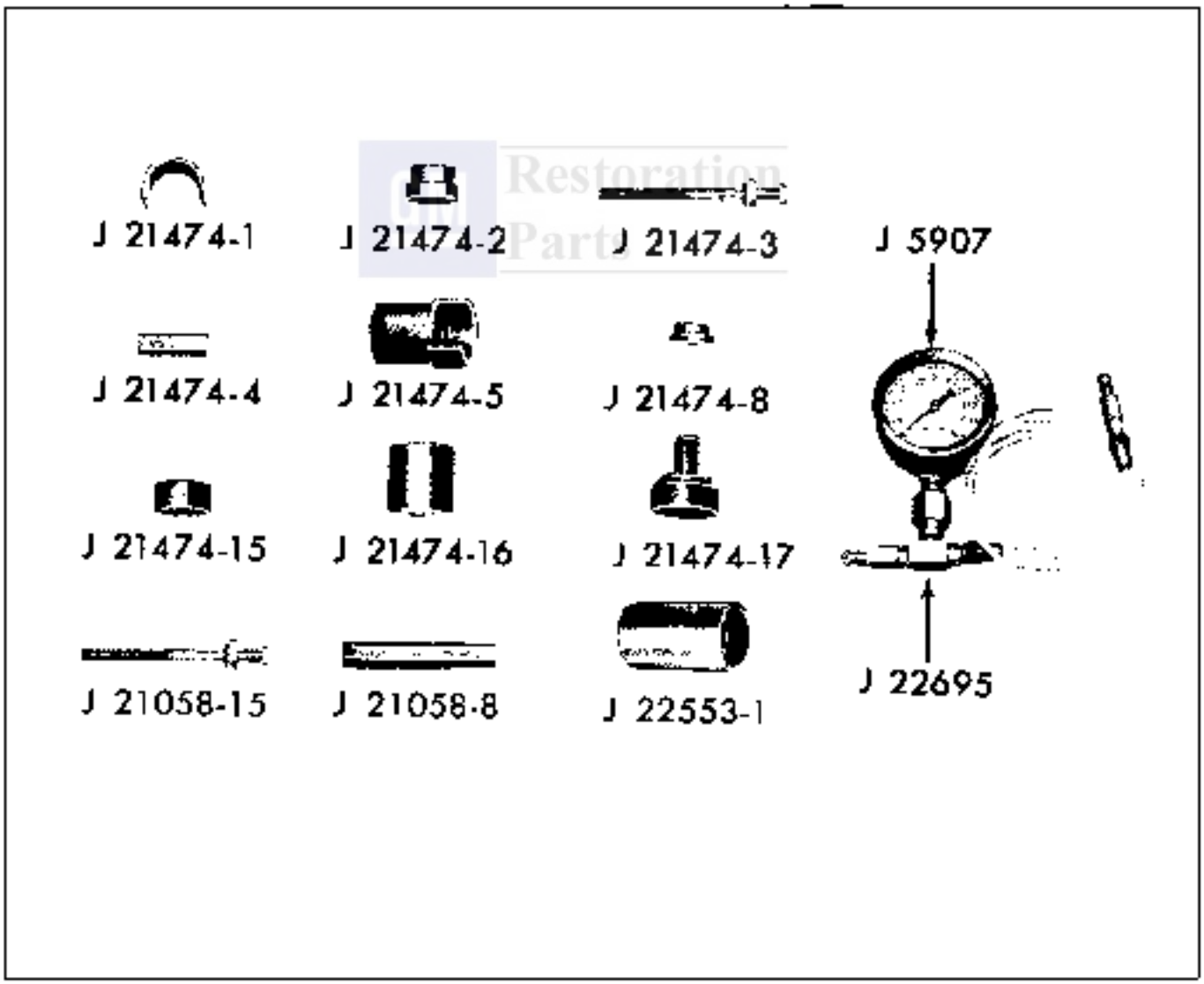


Fig. 4-29 Special Tools

STANDARD DIFFERENTIAL

CONTENTS OF THIS SECTION

AXLE RATIOS

PONTIAC (Fig. 4A-4A)

Eleven different axle ratios are available for the various car models. They can be identified by the code stamped on the rear of the L.H. axle tube adjacent to the carrier (Fig. 4A-1).

Three differential cases, which differ in ring gear mounting dimensions, are used: one for 2.29, 2.41 and 2.56 ratios, one for the 2.73, 2.90 and 3.08 ratios and one for the 3.23, 3.42, 3.55, 3.73 and 4.11 ratios. When changing axle ratios, be sure to use the proper differential case.

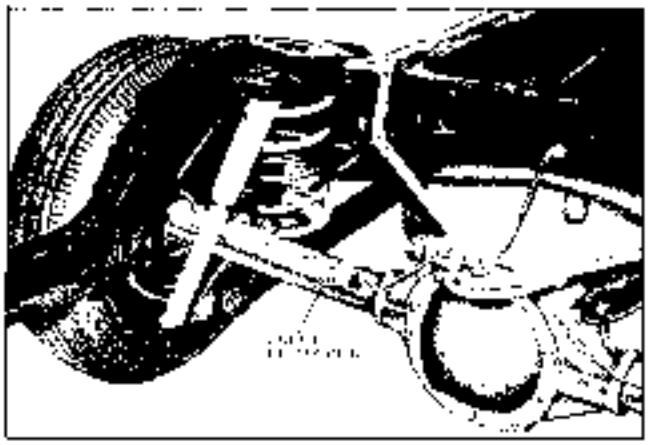


Fig. 4A-1 Rear Axle View - Pontiac and Tempest

TEMPEST—(Fig. 4A-4B) AND FIREBIRD—(Fig. 4A-4C)

Nine different axle ratios are available for the various car models. They can be identified by the code stamped on the rear of the L.H. axle tube adjacent to the carrier (Fig. 4A-1), or on the left rear brake drum surface. Three differential cases, which differ in ring gear mounting dimensions, are used: one for 2.56 and 2.78 ratios, one for 2.93, 3.08 and 3.23 ratios and one for 3.36, 3.55, 3.90 and 4.30 ratios. When changing axle ratios, be sure to use the proper differential case.

NEW CAR PRE-DELIVERY INSPECTION

TORQUE

Check torque specifications at rear axle.

1. Tighten all rear suspension control arm bolts to 110 lb. ft. torque and nuts to 80 lb. ft. torque (Pontiac and Tempest).

2. Tighten rear shock absorber to axle housing nut to 65 lb. ft. torque and shock absorber to frame bolt to 20 lb. ft. torque.

3. Tighten universal joint U-bolt nuts to 12 lb. ft. torque (with lock plates) or 17 lb. ft. torque (with lock washers).

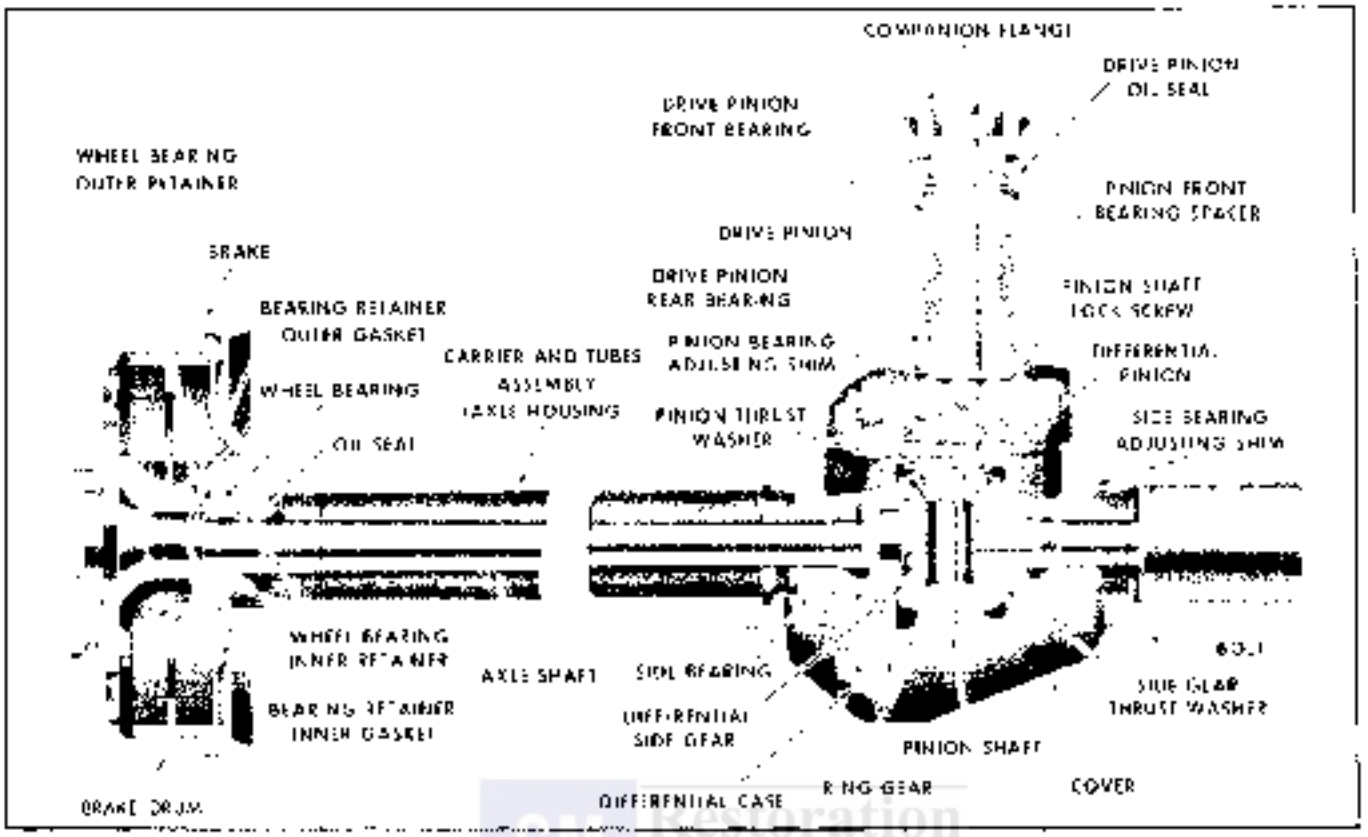


Fig. 4A-2 Cross Section of Typical Rear Axle and Differential

LUBRICATION

Check differential oil level and, if necessary, add sufficient amount of multi-purpose hypoid gear lubricant to bring level to bottom of filler plug hole.

PERIODIC SERVICE

LUBRICATION

Lubricant change in the differential is not recommended unless repair work is being done. The differential should be checked for leaks at each chassis lubrication. If there is evidence of leakage, the leak should be corrected and lubricant added if needed. Lubricant level should be even with bottom of filler plug hole. Rear axle capacity is 4 1/2 pints for Pontiac, 3 pints for Tempest and Firebird.

Use multi-purpose hypoid gear lubricant in the standard differential. Because of the importance of using factory recommended lubricant, a container of this lubricant is furnished with each service ring gear and pinion set or differential carrier assembly. This lubricant is also available through regular parts channels. See Section 4B for Safe-T-Track Lubricant Recommendations.

SHOCK ABSORBERS

Give visual inspection for leaks and jounce car at each lubrication period to see that shock absorbers are in an operative condition. If inoperative or if leaks are found, refer to suspension section of manual and thoroughly diagnose problem before replacing units.

MINOR SERVICE AND REPAIRS

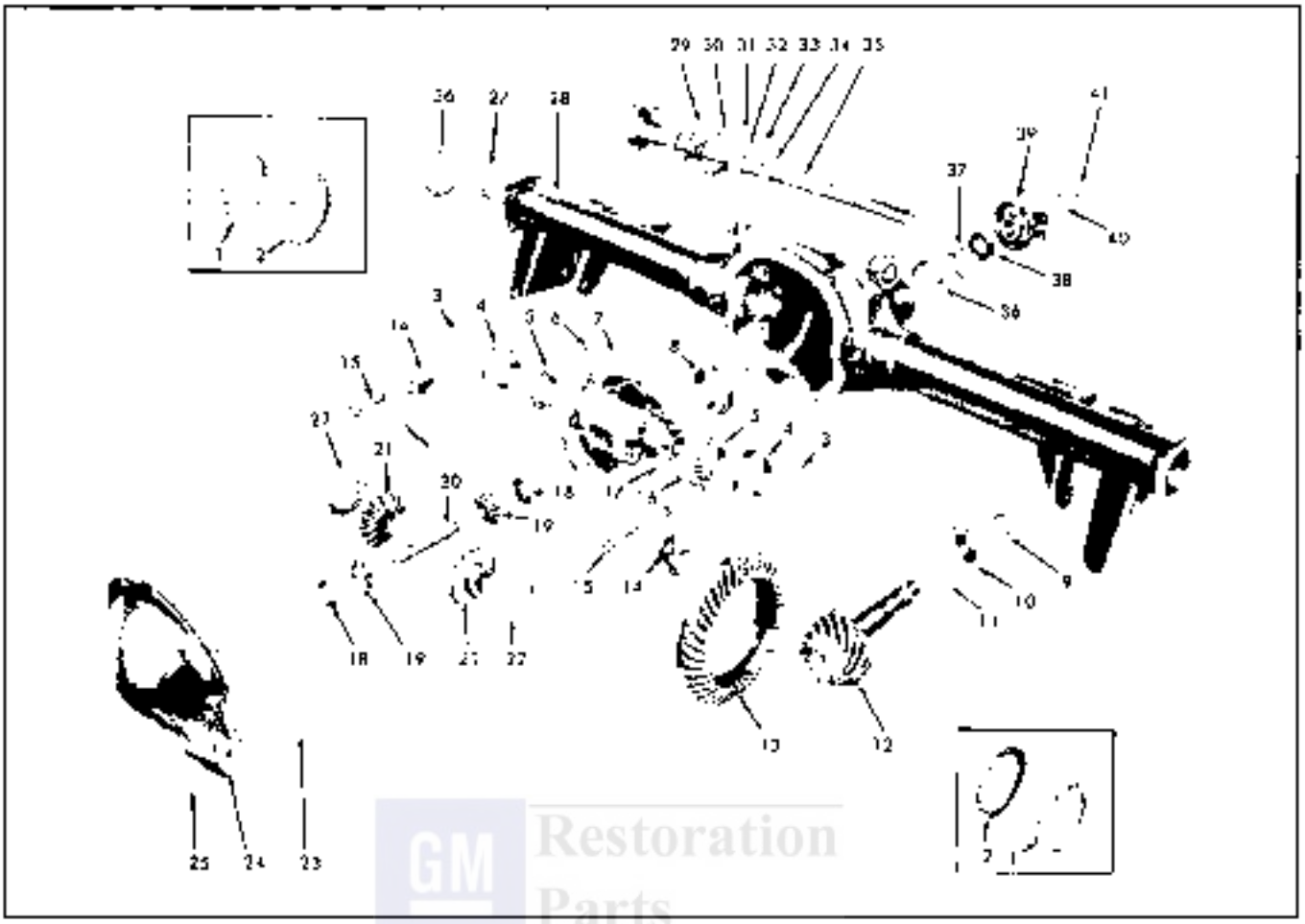
NOTE: Most rear axle service repairs can be made with the rear axle assembly in the car by raising the rear end, with the rear axle hanging on the shock absorbers. Rear axle lubricant may be drained by backing out all cover bolts and breaking cover loose at the bottom.

COMPANION FLANGE—REMOVE AND REPLACE

NOTE: When replacing companion flange, it is important that new flange be properly installed to provide correct pinion bearing preload. The following procedure must be used to ensure correct pinion bearing adjustment.

1. With rear wheels off floor, turn wheels and tap brake backing plates with a soft hammer to ensure that brakes are free.

2. Remove U-bolts which hold rear universal joint to companion flange. Use a heavy rubber band or tape to hold bearings onto journal to prevent loss of



1. Spacer
2. Differential Side Bearing Shim (Service)
3. Side Bearing Shim (Production)
4. Side Bearing Race
5. Differential Side Bearing
6. Ring Gear to Differential Case Bolt
7. Differential Case
8. Rear Pinion Bearing Outer Race
9. Bearing Spacer
10. Drive Pinion Bearing
11. Bearing Shim
12. Drive Pinion Gear
13. Ring Gear
14. Differential Side Bearing Cap
15. Cap Bolt
16. Pinion Shaft Lock Bolt
17. Washer
18. Pinion Gear Thrust Washer
19. Differential Pinion Gear
20. Differential Pinion Shaft
21. Differential Side Gear
22. Side Gear Thrust Washer
23. Cover Gasket
24. Cover
25. Cover Bolt
26. Inner Retainer Gasket
27. Axle Shaft Oil Seal
28. Carrier & Tubes Assy.
29. Outer Retainer
30. Outer Retainer Gasket
31. Nut
32. Axle Shaft Bearing
33. Brake Assy. to Housing Bolt
34. Inner Retainer
35. Axle Shaft
36. Front Pinion Bearing Outer Race
37. Front Pinion Bearing
38. Pinion Oil Seal
39. Companion Flange
40. Washer
41. Pinion Nut

Fig. 4A-3 Exploded View of Typical Differential Assembly

bearing rollers when joint is disconnected if tie wire has been removed (Fig. 4A-5).

3. Attach a 1/2" drive adapter and socket to a lb. in. torque wrench. Place socket over drive pinion nut and turn pinion two or three revolutions to ensure free movement. Then take a torque reading while rotating pinion to measure bearing preload (Fig. 4A-6). Record reading.

NOTE: Additional clearance to check preload can be obtained between differential and body by raising body a few inches by means of a jack or stand placed under frame at rear.

4. Hold companion flange with tool J 8614-1 (Fig. 4A-7) and remove drive pinion nut and washer using heavy duty socket.

5. Remove companion flange, using puller J 8614-2 and 3 (Fig. 4A-8).

6. Install new companion flange and washer and nut. Hold companion flange with tool J 8614-1 and tighten nut only a little at a time, stopping frequently to check preload (step 3). Tighten nut to reading noted in step 3; however, if reading obtained in step 3 was less than 12 lb. in., increase preload to 16 lb. in.

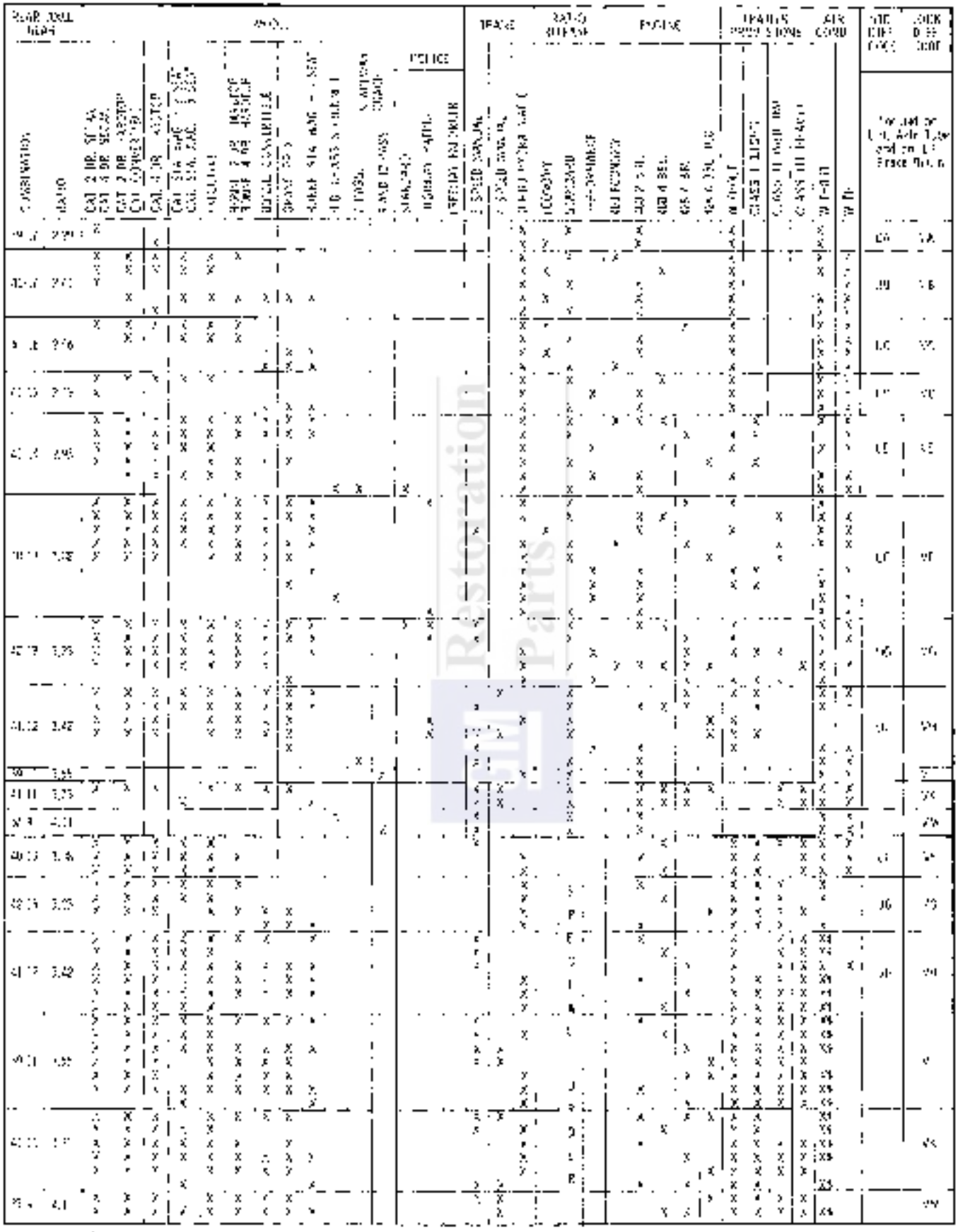


Fig. 4A-4A Pontiac - Rear Axle Usage and Identification

REAR AXLE GEAR: COMBINATION	RATIO	STD DIFF CODE*	LOCK DIFF CODE*: 2 PINION	LOCK DIFF CODE*: 4 PINION
41:16	2.56	WB	YB	
39:14	2.78	WC	YC	
41:14	2.93	WD	YD	
40:13	3.08	WE	YE	
42:13	3.23	WF	YF	
37:11	3.36	WG		ZG
39:11	3.55	WH		ZH
39:10	3.90	WK		ZK
39:9	4.33			ZL
40:13	3.08	WE	YE	
42:13	3.23	WF	YF	
37:11	3.36	WG		ZG
39:11	3.55	WH		ZH
39:10	3.90			ZK
39:9	4.33			ZL

(Column headings: REAR AXLE GEAR — COMBINATION, RATIO; MODEL — STD. 2 DR. COUPE, STD. 4 DR. SEDAN, CUSTOM 2 DR. COUPE / CUSTOM 2 DR. HARDTOP / CUSTOM CONVERTIBLE, CUSTOM 4 DR. SEDAN / CUSTOM 4 DR. HARDTOP, CUSTOM STATION WAGON / SAFARI STATION WAGON, LE MANS, GTO; TRANS. — STRAIGHT OPTION, 3 SPEED MANUAL, 4 SPEED MANUAL, 2 SPEED AUTOMATIC, TURBO HYDRA-MATIC; RATIO USAGE — ECONOMY, STANDARD, PERFORMANCE, SPECIAL ORDER; ENGINE — 6 CYL. 1 BBL., 6 CYL. 4 BBL., 350 2 BBL., 350 4 BBL. H.O., 400 2 BBL., 400 4 BBL., 400 4 BBL. H.O.; TRAIL. PROV. — WITHOUT, CLASS II TRAILER; AIR COND. — WITHOUT, WITH; STD. DIFF. CODE*; LOCK DIFF. CODE* — 2 PINION, 4 PINION)

- Special Radiator Required
& - Ram Air Engine Only
* - Stamped on L.H. Axle Tube & L.H. Brake Drum

Fig. 4A-48 Tempest - Rear Axle Usage and Identification

REAR AXLE GEAR COMBINATION	RATIO	MODEL: 2237, 2267, 2537, 2567	MODEL: 2437, 2467 WITH 350 ENGINE	MODEL: 2637, 2667 WITH 350 ENGINE	MODEL: 22M AUTOMATIC 226 WITH 400 ENGINE	TRANSMISSION: 3 SPEED MANUAL	TRANSMISSION: 4 SPEED MANUAL	TRANSMISSION: 2 SPEED AUTOMATIC	TRANSMISSION: TURBO HYDRA-MATIC	RATIO RELEASE: ECONOMY	RATIO RELEASE: STANDARD	RATIO RELEASE: PERFORMANCE	ENGINE: 6 CYL. - 1 BBL.	ENGINE: 8 CYL. - 4 BBL.	ENGINE: 350 - 2 BBL.	ENGINE: 350 - 4 BBL. H.O.	ENGINE: 400 - 4 BBL.	ENGINE: 400 - 4 BBL. H.O.	AIR COND.: 300 RAM AIR	AIR COND.: WITHOUT	AIR COND.: WITH	STD. OIL CODE*	LOCK OIL CODE* 2 PINION	LOCK OIL CODE* 4 PINION
41:16	2.56	X						X			X		X							X		XB	2S	
			X	X				X			X				X					X				
39:14	2.78	X						X		X				X								XC	2C	
			X	X				X			X				X	X				X				
					X				X		X						X	X			X			
41:14	2.93	X						X				X	X							X		XT	2D	
			X	X				X				X			X					X				
40:13	3.08	X				X	X				X		X							X		XF	2E	
			X	X		X	X			X					X					X				
					X				X		X							X			X			
42:13	3.23	X				X	X	X			X		X							X		XF	2Y	
		X						X			X									X				
			X	X		X	X				X				X					X				
					X				X		X							X			X			
97:11	3.36	X				X	X				X	X	X							X	X	XG		2M
			X	X		X	X				X				X					X				
					X	X	X				X							X		X				
		X				X	X				X		X							X				
		X						X			X		X											
94:11	3.55				X	X	X				X							X	X	X		X-		2N
					X				X		X								X	X				
			X	X		X	X			SPECIAL ORDER						X				X$			1	
					X		X		X		X							X	X	X				
90:13	3.90		X	X			X									X				X$				2P
					X				X	SPECIAL ORDER							X	X		X4				
94:9	4.33				X		X											X	X	X				2R

* - Special Retainer Required
* - Special Engine Fan Required
* - Located on L.H. Axle Tube and L.H. Brake Drum

Fig. 4A-4C Firebird – Rear Axle Usage and Identification

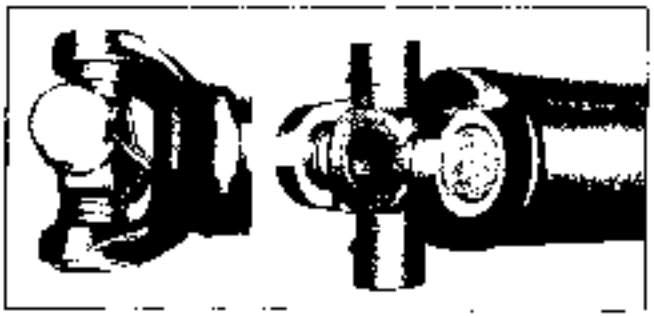


Fig. 4A-5 Bearings Held in Place by Tie Wire

7. Connect universal joints. Install lock plates and tighten U-joint to companion flange U-bolt nuts to 12 lb. ft. torque. If lockwashers are used, tighten U-bolts nuts to 17 lb. ft. torque.

PINION BEARING OIL SEAL— REMOVE AND REPLACE

NOTE: Check pinion bearing preload before removing companion flange. Proper preload can then be maintained if inspection of the flange after removal shows damage requiring replacement.

1. With rear wheels off floor, turn rear wheels and tap brake backing plates with a soft hammer to ensure that brakes are free.

2. Remove U-bolts which hold rear universal joint to companion flange. Use a heavy rubber band or tape to hold bearings onto journal to prevent loss of bearing rollers when joint is disconnected if tie wire has been removed (Fig. 4A-5).

3. Scribe a line on end of pinion stem, extending down along side of stem threads and onto companion flange nut.

4. Punch a small mark on the line at pinion stem end and at top of lock nut, close to pinion stem threads.

5. Using a lb. in. torque wrench with a 1/2" drive adapter and socket placed over drive pinion nut, turn two or three revolutions to ensure free movement. Then, take a torque reading while rotating

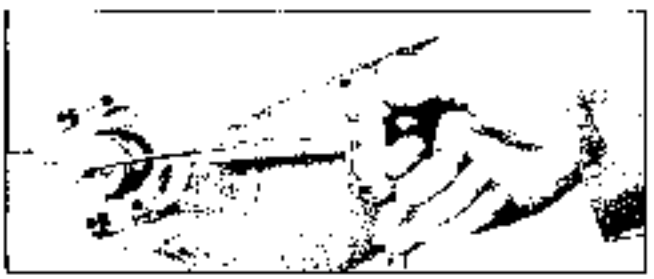


Fig. 4A-6 Checking Pinion Bearing Preload

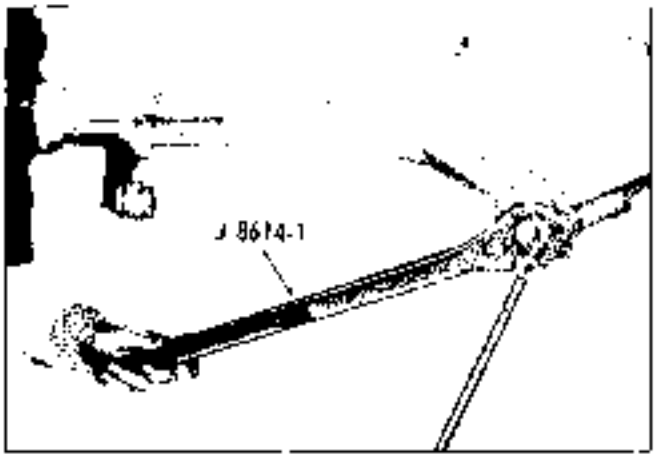


Fig. 4A-7 Removing Drive Pinion Nut

pinion to measure bearing preload (Fig. 4A-6). Record reading.

NOTE: Additional clearance to check preload can be obtained between differential and body by raising body a few inches by means of a jack or stand placed under frame at rear.

6. Count the number of exposed threads from top of pinion stem to lock nut. Remove lock nut with a heavy duty socket, while holding companion flange with J 8614-1 (Fig. 4A-7).

7. Remove companion flange, using puller J 8614-2 and 3 (Fig. 4A-8).

8. Remove oil seal by prying it out of carrier with a pointed tool, using care to keep tool away from the exposed front bearing. Discard seal.

CAUTION: Use care to keep dirt and other foreign matter out of exposed front pinion bearing.

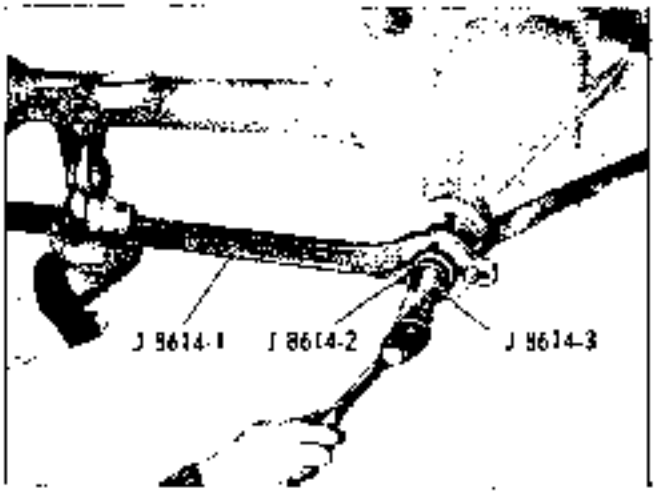


Fig. 4A-8 Removing Companion Flange

9. Lubricate lip of new seal with clean gear lube. Coat outer diameter of seal case with suitable sealer. Install seal by tapping into place, using J 21285-01 (Fig. 4A-9).

10. Before installing companion flange, inspect for nicks, scratches or burred surfaces that may damage the seal. If any such damage is evident, hone carefully or install new flange.

a. If a new companion flange is installed, refer to step 6 under COMPANION FLANGE - REMOVE AND REPLACE.

b. If inspection shows the original companion flange to be satisfactory, replace by holding companion flange with J 8614-1 and install nut to exactly the same position as before. Make sure punched holes and scribe line are in alignment. Tighten lock nut an additional 1/32" beyond this alignment.

CAUTION: DO NOT exceed the additional tightening of the nut by a distance of more than 1/32" from its original position, as tightening the nut in excess of this amount will disturb the pinion and ring gear tooth contact pattern.

11. Connect rear universal joint. Install lock plates and tighten U-joint to companion flange U-bolt nut to 12 lb. ft. torque. If lockwashers are used, tighten U-bolt nuts to 17 lb. ft. torque.

AXLE SHAFT, AXLE SHAFT BEARING, BEARING OIL SEAL AND/OR WHEEL BOLT—REMOVE AND REPLACE

REMOVE AXLE SHAFT ASSEMBLIES

Design allows for axle shaft end play up to .032". This end play can be checked with the wheel and brake drum removed by measuring the difference between the end of the housing and the axle shaft flange while moving the axle shaft in and out by hand.

End play over .032" is excessive. Inserting a shim inboard of the bearing to compensate for the end play is not recommended. This ignores end play of the bearing itself and may result in improper seating of the gasket or backing plate against the housing. If the end play is excessive, the axle shaft and bearing assembly should be removed and the cause of excessive end play determined and corrected.

1. Remove wheels. (Bolt right and left wheels have right hand threads.)

2. Remove brake drums.

3. Remove nuts holding retainer plates and brake backing plates. Pull retainers clear of bolts and reinstall two lower nuts finger tight to hold brake backing plate in position.

4. Pull out axle shaft assemblies, using puller J 21579 and adapter J 2619-4 with slide hammer J 2619.

CAUTION: While pulling axle shaft out through oil seal, support the shaft carefully in center of seal to avoid cutting the seal lip.

REMOVE AND REPLACE AXLE SHAFT BEARING

1. Press axle shaft bearing and inner retainer off, using plate J 6407-P, J 8916-1-T or F and remover J 21858 (Pontiac only). (Fig. 4A-10)

2. Press new axle shaft bearing against shoulder on axle shaft, using plate J 6407-1 and 2 with installer J 6783-P, J 21062-T or F. (Fig. 4A-11)

NOTE: DO NOT press bearing and inner retainer on in one operation.

CAUTION: The outer retainer plate, which retains bearing in housing, must be on axle shaft before bearing is installed. A new outer retainer gasket can be installed after bearing. Use care not to wedge outer retainer between bearing and shoulder of shaft.

3. Press new inner retainer ring against bearing, using installer J 6783-P, J 21062-T or F. (Fig. 4A-12)

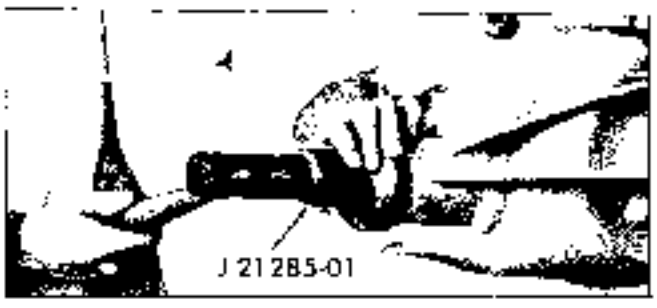


Fig. 4A-9 Installing Pinion Oil Seal

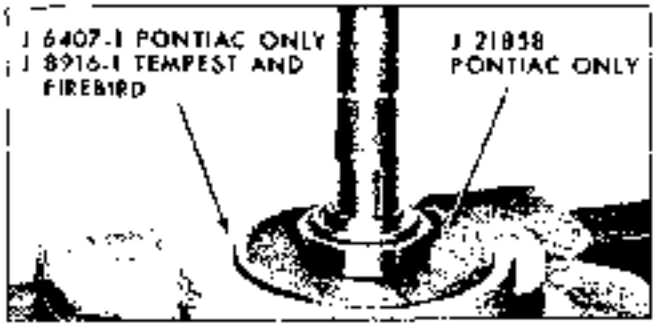


Fig. 4A-10 Removing Axle Shaft Bearing (Typical)

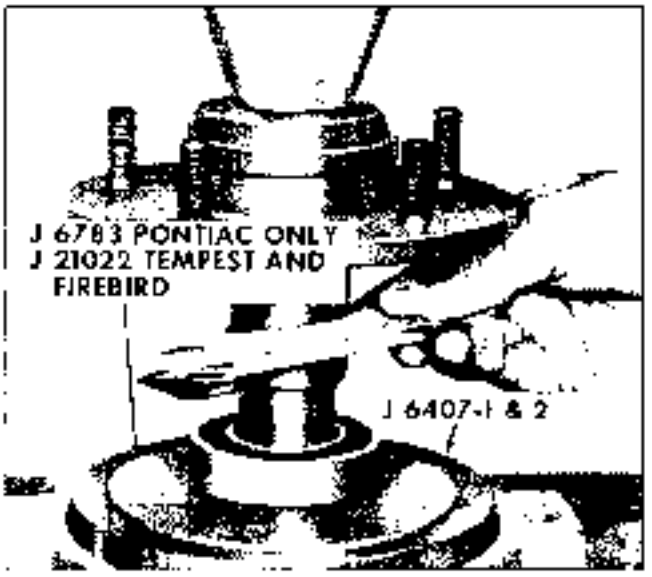


Fig. 4A-11 Installing Axle Shaft Bearing (Typical)

REMOVE AND REPLACE REAR WHEEL BOLT

1. To remove and install a rear wheel bolt, axle shaft assembly must be out of car. Remove rear wheel bolt by pressing from axle flange.

2. Install new rear wheel bolt by pressing through axle flange. Check new bolt for looseness; if bolt is loose, axle shaft must be replaced.

REMOVE AND REPLACE AXLE SHAFT SEAL

1. Insert tongs J 943 (Fig. 4A-13) behind seal and pull straight out to remove seal. Discard seal.

2. Apply sealer to O.D. of new seal.

3. Position seal over installer J 21736-P, J 21129-T or F and drive straight into axle housing

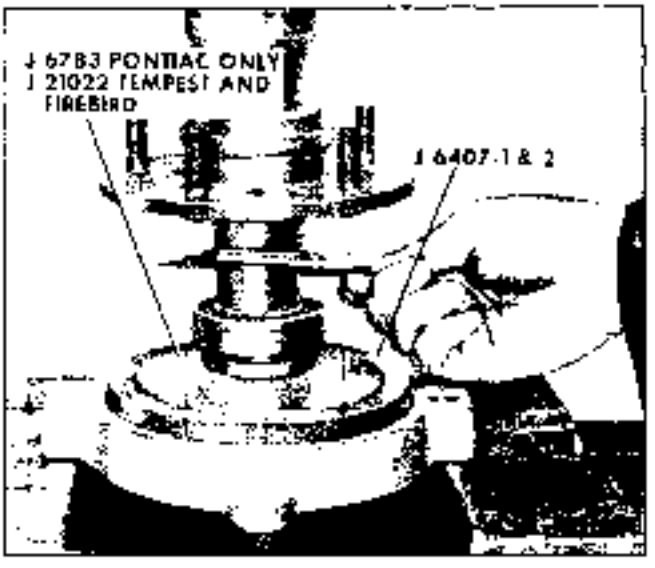


Fig. 4A-12 Installing Inner Retainer (Typical)

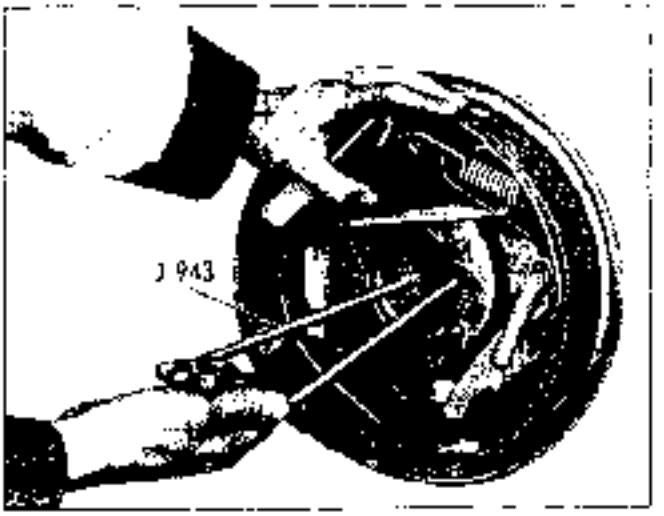


Fig. 4A-13 Removing Axle Shaft Seal

until tool bottoms on bearing shoulder in housing (Fig. 4A-14).

INSTALL AXLE SHAFT ASSEMBLIES

1. Apply a coat of wheel bearing grease in bearing recess of housing. Lightly lubricate axle shaft with axle lubricant, from sealing surface to approximately six inches inboard. This will help prevent damage to lip of wheel bearing seal when installing axle shaft and ensure lubricant on the seal lip during the first few miles of operation.

IMPORTANT: Install new axle housing to brake backing plate gasket.

2. Install brake assembly to axle housing bolts and place brake backing plate in proper position.

3. With a new outer retainer gasket in proper position, carefully insert axle shaft assembly into housing until splines engage differential.

CAUTION: Do not let shaft drag on oil seal.

Fig. 4A-14 Installing Axle Shaft Seal (Typical)

4. Drive axle shaft assembly into position with soft faced hammer.

5. Place the new outer retainer gasket (Fig. 4A-3) and retainer over studs and install nuts. Tighten nuts to 35 lb. ft. torque.

6. Install brake drums over wheel bolts.

7. Install wheels and tighten wheel nuts to 60 lb. ft. torque (Pontiac) or 65 lb. ft. torque (Tempest and Firebird).

MAJOR REPAIRS

REMOVAL AND INSTALLATION OF REAR AXLE ASSEMBLY

It is not necessary to remove the rear axle assembly for any normal repairs. However, if the housing is damaged, the rear axle assembly may be removed and installed using the following procedure:

REMOVE REAR AXLE ASSEMBLY

1. Raise rear of car high enough to permit working underneath. Place a floor jack under center of axle housing and just starts to raise rear axle assembly. Place car stands solidly under frame members on both sides.

2. Disconnect rear universal joint from companion flange by removing two U-bolts. Use a heavy rubber band or tape to hold bearings onto journal, to prevent loss of bearing rollers when joint is disconnected if tie wire has been removed (Fig. 4A-5). Support propeller shaft out of the way.

3. Remove both axle shafts.

4. Support both brake backing plates out of the way.

5. Disconnect rear brake hose bracket by removing top cover bolt. Remove brake line from housing by bending back tabs.

6. Loosen remaining cover bolts, break loose cover about 1/8" and allow lubricant to drain.

7. Disconnect shock absorbers at axle housing.

8. Pontiac and Tempest - Lower jack under axle housing until rear springs can be removed.

Firebird - Disconnect rear spring from its shackles and brackets and remove rear axle assembly from under car.

9. Pontiac and Tempest - Disconnect upper control arms at axle housing.

10. Pontiac and Tempest - Disconnect lower control arms at axle housing and remove rear axle assembly from under car.

INSTALL REAR AXLE ASSEMBLY

1. Rest car solidly on stands placed under frame side members, with rear end of car high enough to permit working underneath. Position axle assembly under car.

2. Pontiac and Tempest - Connect lower control arms to axle housing but do not torque.

Firebird - Connect leaf spring front eyes to their frame brackets but do not torque.

3. Pontiac and Tempest - Connect upper control arms to axle housing but do not torque.

Firebird - Connect leaf spring rear eyes to their shackles but do not torque.

4. Pontiac and Tempest - Place rear springs in position and jack axle housing upward until shock absorbers will reach.

Firebird - Jack axle housing upward until shock absorbers will reach.

5. Connect shock absorbers and tighten nuts to 65 lb. ft.

6. Pontiac and Tempest - Tighten upper and lower control arm bolts to 110 lb. ft. or nuts to 80 lb. ft.

Firebird - Tighten bracket bolt nuts to 100 lb. ft. and shackle pin nuts to 50 lb. ft.

NOTE: Upper and lower control arms (Pontiac and Tempest), leaf springs (Firebird) and lower shock absorber nuts must be torqued at curb position.

7. Install new axle housing to brake backing plate and outer retainer gaskets, then place backing plates in proper position and install axle shafts and wheels.

8. Connect rear universal joint to companion flange. Install lock plates and nuts. Tighten nuts evenly to 12 lb. ft. torque. If lockwashers are used, tighten U-bolt nuts to 17 lb. ft. torque.

CAUTION: U-bolt nuts must be torqued as specified, as over-tightening will distort bearings and cause early failure.

9. Connect rear brake hose to top of housing and bend tabs over brake lines on housing.

10. Fill rear axle with specified gear lubricant.

11. Bleed rear brakes as outlined in Section 5.

REMOVE DIFFERENTIAL

1. With rear wheels off floor, rotate rear wheels and tap brake backing plates with a soft hammer to ensure that brakes are free.

2. Remove both axle shafts.

3. Remove U-bolts which hold rear universal joint to companion flange. Use a heavy rubber band or tape to hold bearings onto journal to prevent loss of bearing rollers when joint is disconnected if tie wire has been removed (Fig. 4A-5).

4. Thoroughly clean differential housing cover and surrounding area of axle housing to avoid dirt entering housing or falling on the gears.

5. Drain oil by loosening all cover attaching bolts and then break loose cover about 1/8".

6. Allow oil to drain thoroughly, then remove attaching bolts and cover from housing.

PRE-REPAIR INVESTIGATION

A close examination of the differential prior to disassembly will often reveal valuable information as to the extent and type of repairs or adjustments necessary. The information thus gained, coupled with the report of malfunctioning, will provide a basis for determining the degree of disassembly required. Since the frequent causes of axle noise are improper backlash or side bearing preload, or both, a few simple adjustments may be all that is necessary to correct a problem.

Therefore, before removing the differential from the housing, the following checks should be made, with the results recorded and analyzed:

A. Backlash (See Page 4A-22).

B. Pinion Bearing Preload (See Page 4A-20).

C. Red Lead Test (See Page 4A-11).

Use care at all times to keep dirt and other foreign matter, such as grinder dust, soot or sand away from differential to prevent possibility of subsequent failure.

GEAR TOOTH NOMENCLATURE

The side of the ring gear teeth which curves outward, or is convex, is referred to as the drive side. The concave side is the coast side. The end of the tooth nearest center of ring gear is referred to as the toe end. The end of the tooth farthest away from center is the heel end. The end of tooth is smaller than heel end. It is very important that tooth contact be tested before the differential carrier assembly is disassembled and before it is installed. Allowable variations in the carrier or pinion rear bearing may cause the pinion to be too far away from, or close to, the ring gear. Thus, the tooth contact must be tested and corrected, if necessary, or the gears may be noisy.

RED LEAD TEST

1. Mix a small amount of powdered red lead (available from paint manufacturers and suppliers) with a drop of engine oil and apply this mixture sparingly to all ring gear teeth, using a medium stiff brush. When properly used, the area of pinion tooth contact will be visible when hand load is applied.

2. Tighten bearing cap bolts to 70 lb. ft. torque, tapping heads of bolt intermittently while tightening, to ensure proper seating of caps and sufficient tightness.

3. Insert crank (Fig. 4A-15) in companion flange and, while turning, apply pressure to back side of ring gear by hand (a leather glove can be used). A test made without loading the gears will not give a satisfactory pattern. Turn companion flange with crank so that ring gear rotates one full revolution, then reverse rotation so that ring gear rotates one revolution in opposite direction. Excessive turning of ring gear may indicate good tooth pattern because one or two teeth are making proper contact.

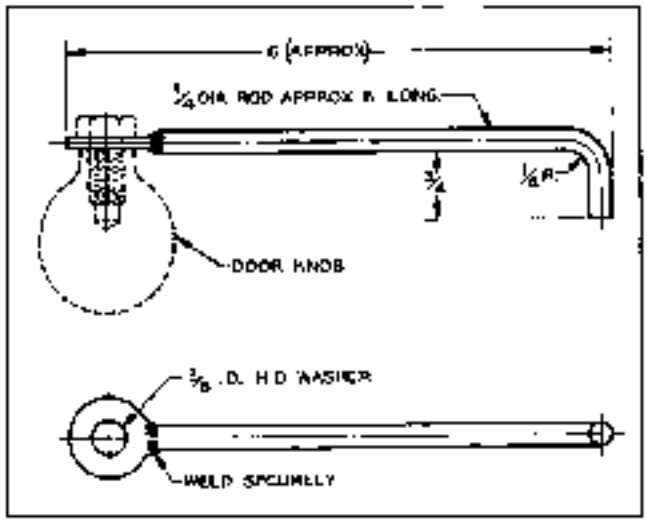


Fig. 4A-15 Differential Cranking Tool

NOTE: The crank in Fig. 4A-15 may be easily made as follows:

a. Weld a 3/8" heavy duty flat washer to a piece of 1/4" diameter rod, approximately 6" long, and form as shown.

b. Tap drive knob for 3/8" bolt and attach knob to crank as shown. Leave bolt loose enough to permit knob to turn.

4. Closely inspect tooth pattern on ring gear to determine whether pressure lines are apparent.

NOTE: If observation reveals pressure lines are present (dark narrow band at edge of pattern), examine for pressure line position on drive and coast sides of ring gear. If lines on drive side are too deep and those on coast side are too high (near heel and toe respectively), additional shims to bring pinion gear out (providing a more centrally located tooth pattern on ring gear) will result in a noisy tooth contact. This occurs because the pressure line has been moved deeper into the tooth on the drive side and farther out on the coast side. It does not follow that the ring gear and pinion are not good or should be destroyed. It only means they will not operate quietly in the carrier in which they are presently installed. These same parts may operate quietly in another carrier when tooth pattern is checked.

Removing backlash moves ring gear into pinion gear, driving the pinion deeper into the ring gear. Whenever pressure lines are noted, as explained above, install another ring gear and pinion set.

5. Observe pattern on ring gear teeth and compare with Fig. 4A-16.

EFFECTS OF INCREASING LOAD ON TOOTH CONTACT PATTERN

When "load" on ring and pinion gear is increased, such as when car is accelerated from standstill or from normal drive, the tooth contact will tend to spread out and under very heavy load will extend from near toe to near heel. The entire contact also

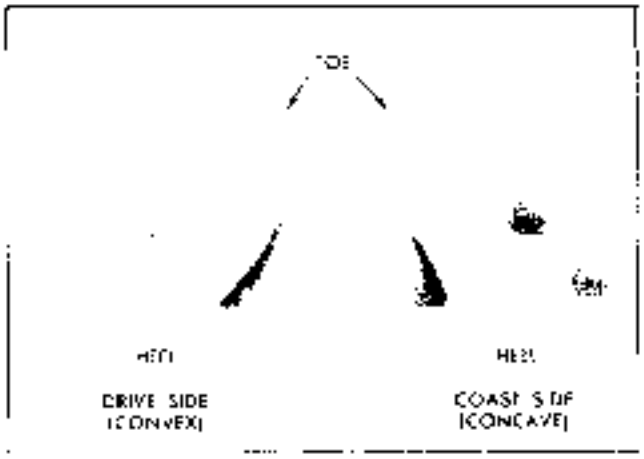


Fig. 4A-17 Tooth Pattern – Excessive Backlash

tends to shift toward heel under increasingly heavier loads and will become somewhat broader with respect to tops and bottoms of teeth. The patterns obtained by red lead tests, dependent upon degree of "loading", approximate a normal light load. For this reason, they will extend only about halfway (Fig. 4A-16). The important thing to note is that the contact pattern is centrally located up and down on the face of the ring gear.

ADJUSTMENTS EFFECTING TOOTH CONTACT

Two adjustments can be made which will effect tooth contact pattern; backlash and position of drive pinion in carrier. The effects of bearing preloads are not readily apparent on (hand loaded) red lead tests; however, these adjustments should be within specifications before proceeding with backlash and drive pinion adjustments.

Backlash is adjusted by means of the side bearing adjusting shims which move the entire case and ring gear assembly closer to, or farther from, the drive pinion. (The adjusting shims are also used to set side bearing preload.)

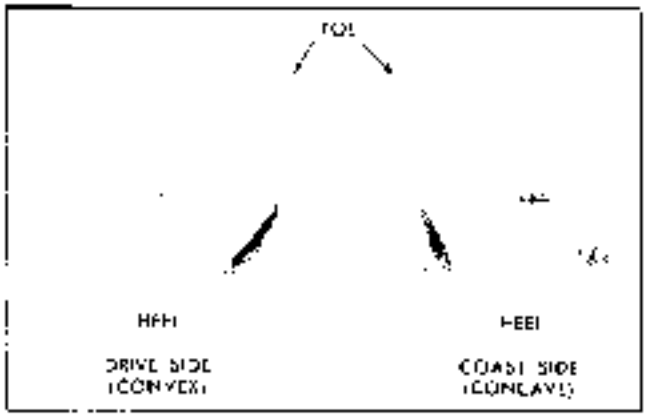


Fig. 4A-16 Desired Tooth Contact Under Light Load

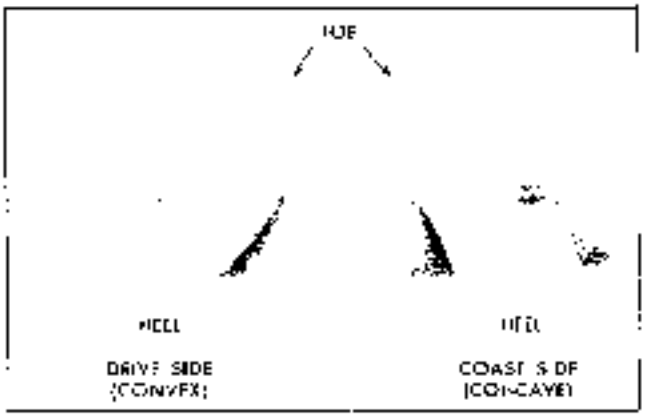


Fig. 4A-18 Tooth Pattern – Insufficient Backlash

The position of the drive pinion is adjusted by increasing or decreasing the shim pack between the pinion head and inner race of rear bearing. The shim pack is used in the differential to compensate for manufacturing tolerances. Increasing shim pack thickness will move the pinion closer to centerline of the ring gear; decreasing shim pack thickness will move pinion farther away from centerline of the ring gear.

EFFECTS OF BACKLASH ON TOOTH PATTERN

The terms "excessive" and "insufficient" refer to settings which are greater than .009" or less than .005" as specified. With respect to tooth contact patterns, "excessive" refers to backlash which, although less than .009", is more than necessary to provide the desire pattern. Similarly, "insufficient" refers to backlash which, although .005" or more, is less than necessary to provide the desired pattern.

Provided the pinion is properly positioned, excess backlash will give a high heel pattern on both drive and coast sides (Fig. 4A-17). Decreasing backlash by moving the case and ring gear assembly closer to the pinion will raise the pattern to move toward the toe end and down toward center of the tooth on both drive and coast sides.

Insufficient backlash, provided the pinion is properly positioned, will give a low toe pattern on both drive and coast sides (Fig. 4A-18). Increasing backlash will cause the pattern to move toward the heel end and up toward top of the tooth on both drive and coast sides.

EFFECTS OF PINION POSITION ON TOOTH PATTERN

When the drive pinion is too far away from centerline of the ring gear, the pattern will be a high heel contact on drive side and a high toe contact on coast side (Fig. 4A-19), provided backlash is within specifications of .005" to .009". Moving the pinion closer to centerline of the ring gear by increasing shim pack thickness will cause the high heel contact on drive side to lower and move toward the toe; the high toe contact on coast side will lower and move toward the heel (Fig. 4A-20).

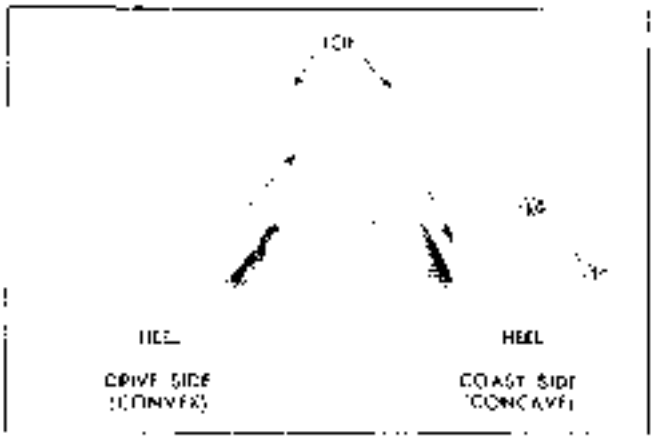


Fig. 4A-20 Effect on Pattern - As Shim Thickness is Increased

When the pinion is too close to the ring gear, the pattern will be a low toe contact on drive side and a low heel contact on coast (Fig. 4A-21), provided backlash is within specifications of .005" to .009". Moving the pinion farther away from the ring gear by decreasing shim pack thickness will cause low toe contact on drive side to raise and move toward the heel; low heel contact on coast will raise and move toward the toe (Fig. 4A-22).

OVERHAUL DIFFERENTIAL

REMOVE DIFFERENTIAL CASE

NOTE: Before removing case from housing, be sure the checks under pre-repair investigation have been completed.

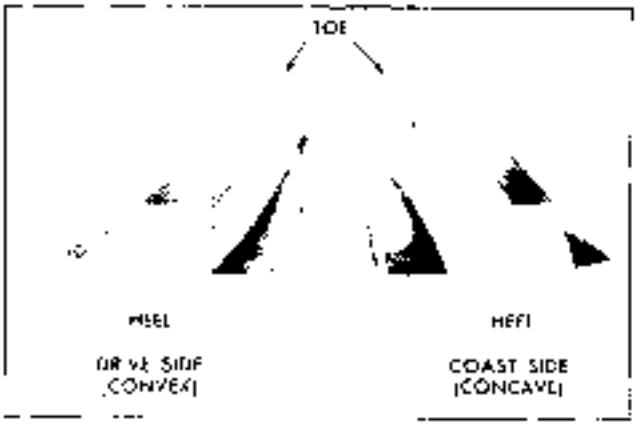


Fig. 4A-19 Tooth Pattern - Pinion Too Far Away From Ring Gear (Shim Thickness Insufficient)

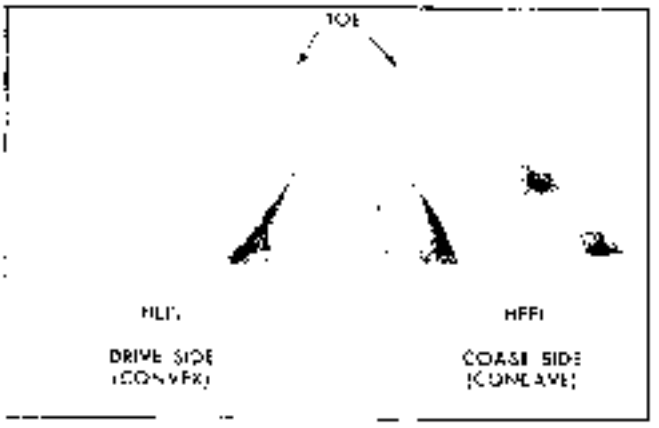


Fig. 4A-21 Tooth Pattern - Pinion Too Close to Ring Gear (Shim Thickness Excessive)

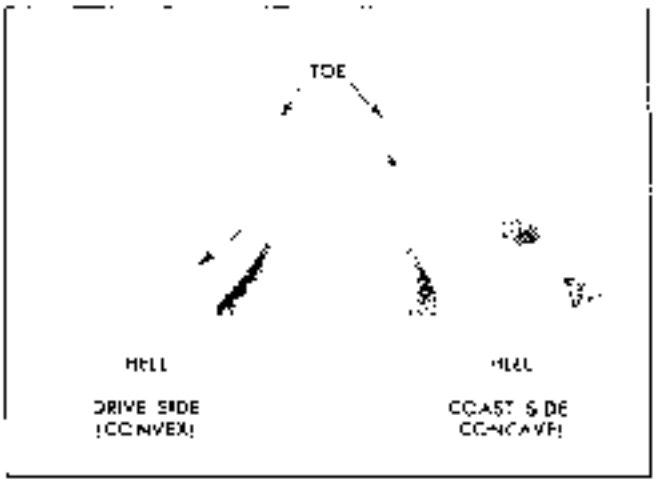


Fig. 4A-22 Effect on Pattern - As Shim Decreases

1. Remove the four bearing cap bolts and reinstall bearing caps, using four (7/16"-14 x 1 1/2") bolts finger tight as a safety precaution.

NOTE: Bearing caps are not marked for identification. Use lead of paint to identify, as the caps are not interchangeable.

2. Pontiac—Remove two ring gear to case assembly bolts. Install ring gear and case remover J 21322, left hand bolt and sleeve set J 22042 and slide hammer J 2619 (Fig. 4A-23).

NOTE: Ring gear to case bolts have left hand threads.

Tempest and Firebird—Remove two ring gear to case bolts. Install ring gear and case remover J 21322 and slide hammer J 2619 (Fig. 4A-23).

NOTE: Attach remover J 21322 to case and ring gear by using two 3/8"-24 x 1 3/4" bolts.

2. Loosen case from housing with slide hammer until it falls free. Safety bolts installed in step 1 will retain assembly.

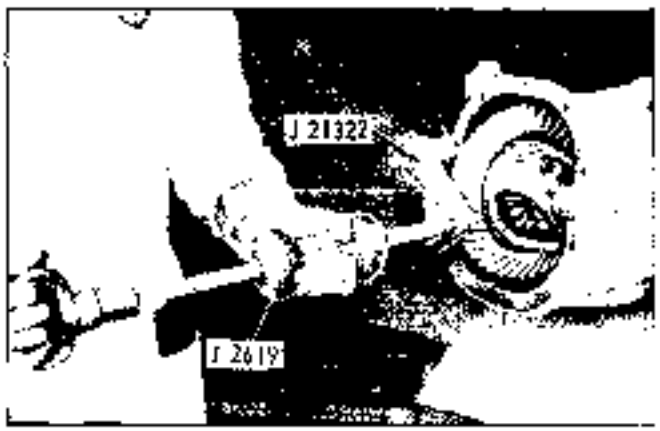


Fig. 4A-23 Removing Differential Case

4. Support case assembly in one hand and remove safety bolts. CAREFULLY remove case so as not to let bearing races or shims fall from housing.

NOTE: Place right and left bearing outer races and shims in sets with marked bearing caps. Measure thickness of each shim and record.

DISASSEMBLE DIFFERENTIAL CASE

1. Before disassembling differential case, inspect differential side bearings for visible damage of rollers and outer races.

2. Place one outer race into its matching inner cone and roller assembly and turn slowly, applying hand load.

3. If bearing outer race turns smoothly and no visible damage is found, bearing can probably be reused.

4. Repeat above operation with other outer race and matching bearing.

NOTE: Both side bearings and their outer races are matched sets. If either bearing is to be replaced, its mating outer race must also be replaced.

5. Inspect fit of inner races on case hubs by prying against shoulders at puller recesses. Bearing inner races must be tight on case hubs.

NOTE: If either bearing is loose on case, the entire case must be replaced.

6. If bearing inspection indicates that bearings should be replaced, insert differential case in vise and remove side bearing, using side bearing puller J 8107 and adapter J 8107-1-P, J 8107-2-T or F or a suitable puller (Fig. 4A-24).

CAUTION: Make certain ends of puller arms are firmly seated in recesses at sides of hubs and fully against inner race of bearing.

7. Turn differential case in vise and remove other side bearing in same manner.

8. Remove pinion shaft locking bolt and washer.

9. Drive pinion shaft out of case, using brass drift (Fig. 4A-25).

10. Remove differential pinion gears, thrust washers and side gears. Place them in sets so they may be reinstalled in their original position.

11. If ring gear is to be removed, clamp case in vise so jaws are 90° to pinion shaft holes. Remove twelve ring gear retaining bolts for Pontiac; ten retainer bolts for Tempest or Firebird.

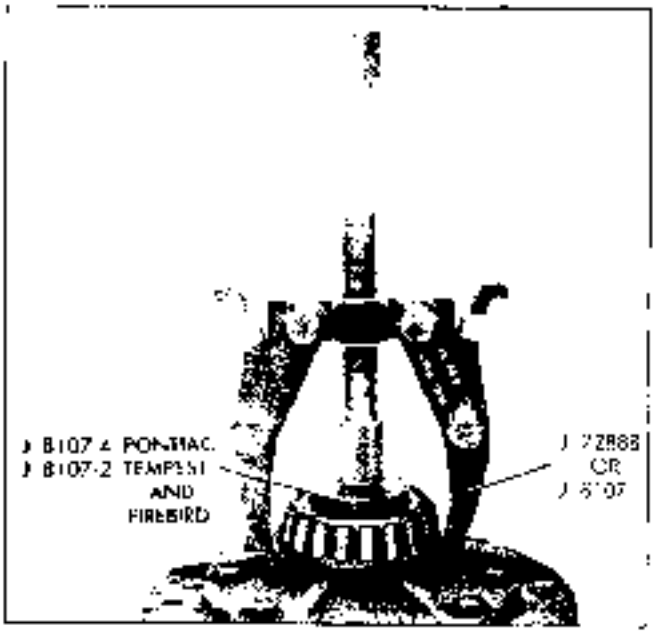


Fig. 4A-24 Removing Differential Side Bearing

NOTE: Ring gear to case bolt have left hand threads. Pontiac only.

12. Partially re-install two bolts on opposite sides of ring gear.

13. Remove ring gear from case by alternately tapping on bolts.

CAUTION: Do not pry between case and ring gear.

CLEANING AND INSPECTION

1. Thoroughly clean differential case and inspect, paying particular attention to ring gear mounting flange, ring gear pilot, side bearing hubs, thrust washer surfaces, pinion shaft bore and side gear hub bores.

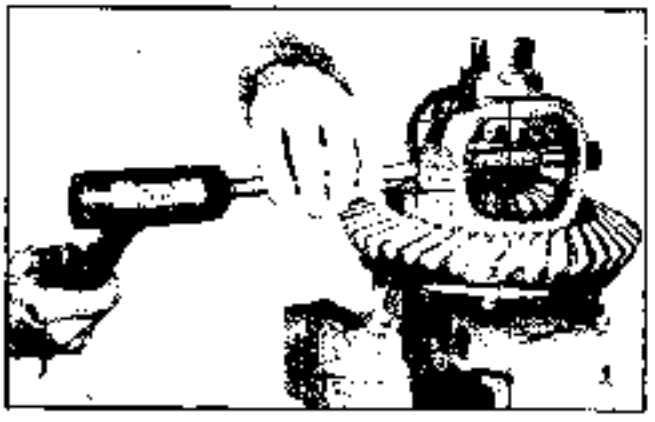


Fig. 4A-25 Removing Pinion Shaft

2. Remove nicks and burrs with mill file.

NOTE: When using a new case, thoroughly clean new case in suitable solvent, making certain all holes and bores are clean of steel filings and foreign material.

3. Clean side gears, pinion gears, pinion shaft and thrust washers with suitable solvent. Inspect for excessive wear.

4. Thoroughly clean ring gear and inspect back side for any adhering material which may cause runout.

5. Position ring gear on case and check fit of gear on flange and pilot. It should be from .002" tight to .001" loose. If ring gear easily falls into position, it must be replaced.

NOTE: If ring gear is replaced, pinion gear must also be replaced as they are only serviced in matched sets.

6. Replace parts as necessary and coat with clean gear lube before installing in case.

ASSEMBLE DIFFERENTIAL CASE

1. After making sure that mating surfaces are clean and free of burrs, position ring gear on case so holes are in line.

2. Lubricate attaching bolts with clean engine oil and install.

3. Pull ring gear onto case by alternately tightening bolts around case. When all bolts are snug, tighten bolts evenly and alternately across diameter to 90 lb. ft. torque for Pontiac; 60 lb. ft. torque for Tempest or Firebird.

CAUTION: Do not use hammer to force ring gear on case.

4. Place side gear thrust washers over side gear hubs and install side gears in case. Replace any re-used parts in original sides.

5. Position one pinion (without washer) between side gears and rotate gears until pinion is directly opposite from loading opening in case. Place other pinion between side gears so that pinion shaft holes are in line, then rotate gears to make sure holes in pinions will line up with holes in case.

6. When holes line up, rotate pinions back toward loading opening just enough to permit sliding in pinion thrust washers.

7. Install pinion shaft and pinion shaft locking bolt. Torque to 15 lb. ft. (Fig. 4A-26).

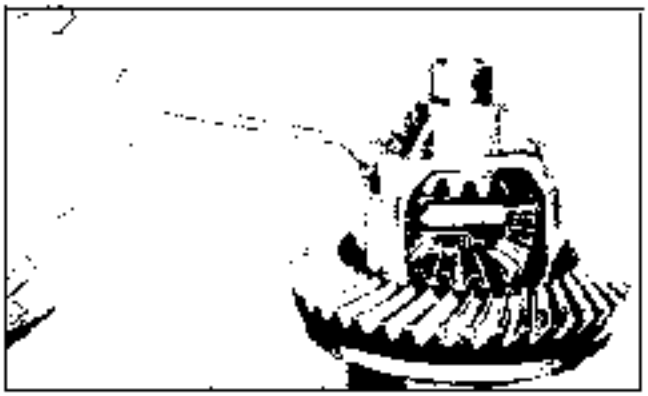


Fig. 4A-26 Installing Pinion Shaft Locking Bolt

8. Remove differential case from vise and lubricate other bearing surfaces.

9. Using installer J 5292-P, J 21028-T or F, press on right side bearing with arbor press. Support opposite bearing with J 8001-P, J 8980-T or F if already installed (Fig. 4A-27).

10. Reverse differential case, support previously installed side bearing with J 8901-P, J 8980-T or F, and press on other side bearing, using J 5292 for Pontiac, J 21028 for Tempest or Firebird (Fig. 4A-28).

REMOVE PINION ASSEMBLY

1. Check pinion bearing preload as described on page 4A-20. If there is no preload reading, check for

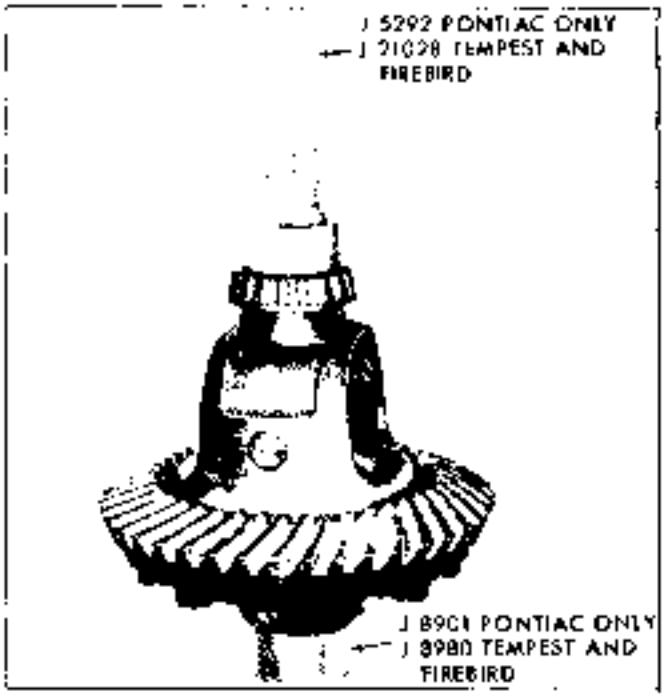


Fig. 4A-27 Installing Right Differential Side Bearing

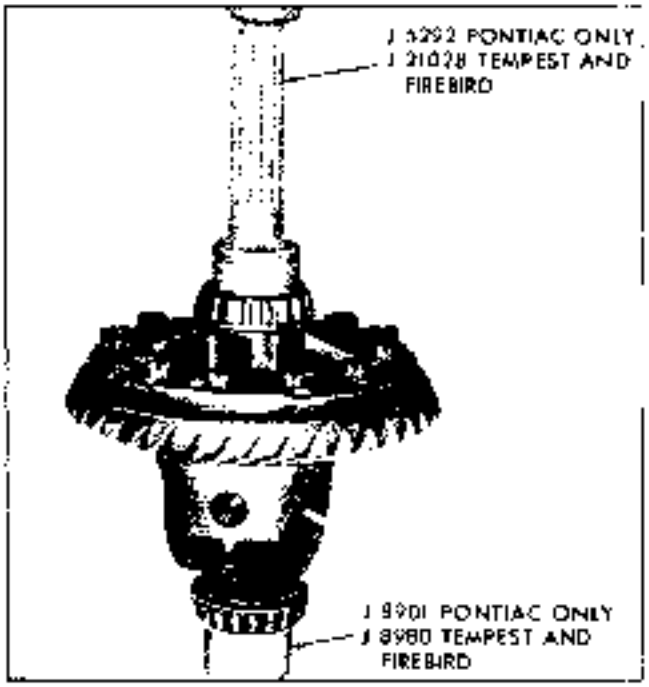


Fig. 4A-28 Installing Left Differential Side Bearing

looseness of pinion assembly by shaking. Looseness indicates need for bearing replacement. If assembly is run with loose bearings for any extended period, ring gear and pinion will also need to be replaced.

2. Install holder J 9614-1 on pinion flange by using two 5/16" bolts with flat washers. Remove pinion nut and washer (Fig. 4A-29).

3. Pull companion flange from pinion, using puller J 6014-2 and 3 in. holder J 9614-1. To install puller, back out puller screw, insert puller through holder and rotate 1/8 turn (Fig. 4A-30).

4. Remove pinion assembly. If necessary, tap pinion out with soft hammer, being careful to guide

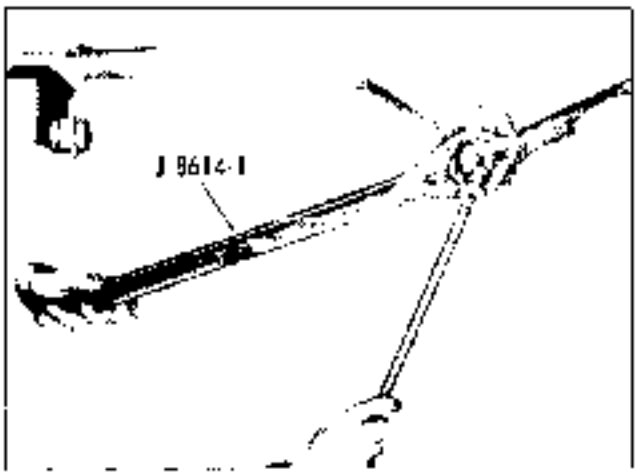


Fig. 4A-29 Removing Pinion Nut

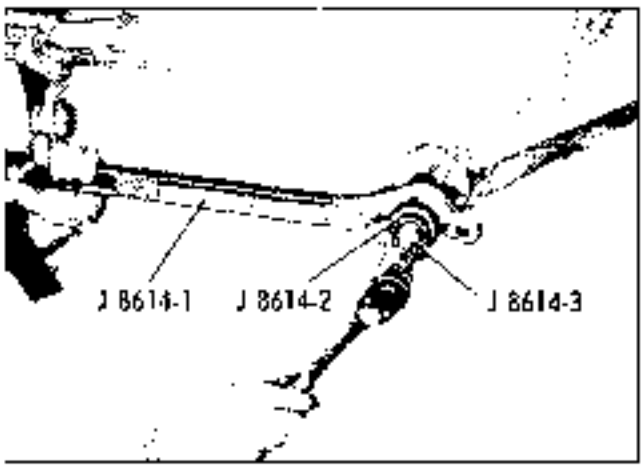


Fig. 4A-30 Removing Companion Flange

pinion with hand to avoid damage to bearing outer races.

DISASSEMBLE PINION ASSEMBLY

NOTE: Both front bearing and outer race, and rear bearing and outer race, are matched parts. If either bearing is to be replaced, its matching outer race must also be replaced.

1. If replacing rear pinion bearing or changing pinion depth setting, remove rear pinion bearing from pinion shaft, using remover J 9746-P, J 21498-T or F with holder J 6407-1 (Fig. 4A-31).

2. If replacing rear pinion bearing, drive outer race from carrier, using a drift.

3. Pry pinion oil seal from carrier and remove front pinion bearing. If replacing this bearing, drive its outer race from carrier, using a drift.

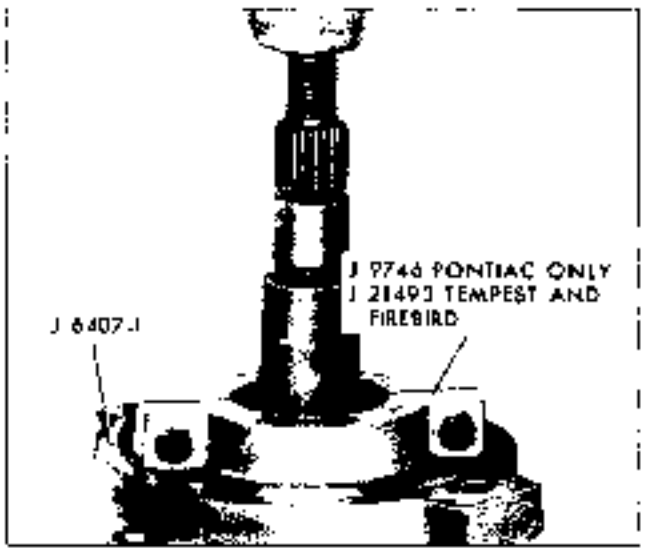


Fig. 4A-31 Removing Rear Pinion Bearing

CLEANING AND INSPECTION

1. Check drive pinion stem and gear for excessive wear.

NOTE: Ring gears and pinions are matched at the factory and are serviced only in sets. Never attempt to replace either a ring gear or pinion without its matching member.

2. Thoroughly clean and inspect carrier for cracks or other damage.

3. Be sure oil passage in carrier is clean and clear.

4. Inspect bearing cap and bolt threads in carrier. Clean out metal filings and chips.

5. Carefully inspect pinion bore and shoulders against which pinion bearing outer races seat. They must be free of burrs, nicks or material which would prevent proper seating of bearing outer races.

NOTE: If axle housing (carrier and tube assembly) is being replaced, thoroughly clean and inspect new housing, paying particular attention to machined surfaces in bearing caps and carrier. Be sure all metal filings and foreign material are removed from the bearing cap bolt holes in the carrier. Be sure bearing caps seat squarely on carrier. Use mill file lightly to remove nicks and burrs.

INSTALL PINION BEARING OUTER RACES

1. If replacing rear pinion bearing, install new outer race by using installer J 9745-P, J 8107-T or F with driver handle J 8092 (Fig. 4A-32).

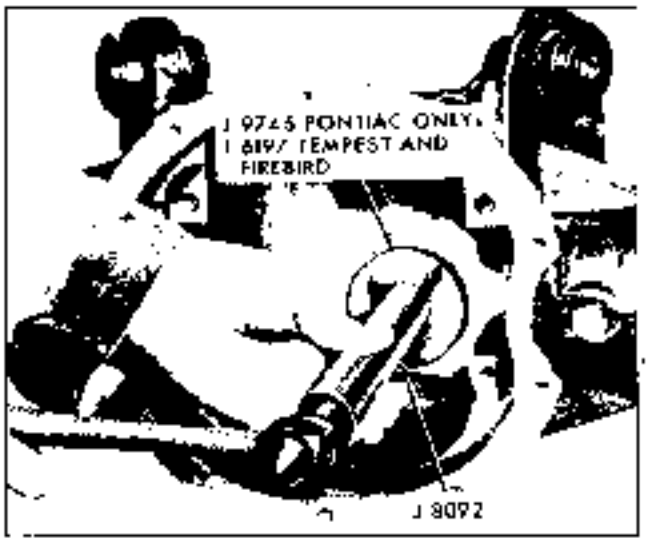


Fig. 4A-32 Installing Rear Pinion Bearing Outer Race

2. If replacing front pinion bearing, install new outer race by using installer J 8611-01-P, J 7817-T or F with driver handle J 8092 (Fig. 4A-33).

SETTING PINION DEPTH

The pinion bearing shim thickness (pinion depth) must be determined:

a. Whenever a new housing (carrier and front assembly) is to be used.

and/or b. new bearings and races are installed

or c. the pre-repair investigation indicates the drive pinion bearing shim should be changed.

Ring and pinion gear sets are matched in a special test machine. All production pinions are marked on face of pinion gear in thousandths of an inch if they vary from a "nominal" setting. When a pinion is marked "+" (plus), it means that the pinion is located too far away from the centerline of the ring gear. Shims must be added to move the pinion closer to the ring gear and position the pinion at the nominal setting. When a pinion is marked "-" (minus), it means the pinion shims must be removed to move the pinion away from the ring gear and position the pinion at the nominal setting. All pinions produced for service are "nominal" or "zero" pinions and are unmarked.

Pinion depth is set with pinion depth setting gauge J 21777 which consists of the following, one J 21777-1 cross shaft assembly, two J 21777-3 discs (Pontiac), one J 21777-2 "A" & "B" gauge plate, one J 8619-13 pilot, one J 21777-8 washer (Pontiac only) and one J 8619-13 bolt and nut. A J 8001 dial indicator must also be used with the cross shaft. The pinion depth setting gauge provides in effect a "nominal" or "zero" pinion as a gauging reference.

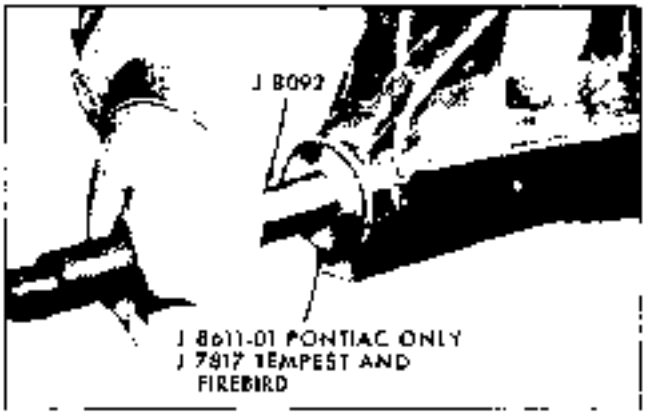


Fig. 4A-33 Installing Front Pinion Bearing Outer Race

1. Make certain all gauge parts are clean. Check particularly the discs, gauge pin ends, dial indicator tip and gauge plate surface.

2. Lubricate front and rear pinion bearings and position them in their respective races in carrier. Bearings used with gauge must be those to be installed in car, in order to ensure accurate reading.

3. Pontiac - Thread J 21777-8 washer onto J 8619-13 bolt to end of thread. Thread J 8619-13 bolt into J 21777-2 gauge plate, so plate rests against J 21777-8 washer. Insert assembled gauge plate and bolt through front and rear bearings with underside of plate against J 21777-8 washer (Fig. 4A-34). Slip J 8619-12 pilot over bolt end, with underside against front bearing. Tighten nut finger tight while rotating gauge plate to ensure proper seating. Check to be sure gauge plate is centered over bearing (Fig. 4A-35), then torque nut to obtain a bearing preload reading of 20 in. lbs. (obtained with gauge plate assembly rotating). It may be necessary to hold stud stationary with a wrench on plate at end of stud.

Tempest or Firebird - Thread nut on J 8619-13 bolt to end of thread. Thread J 8619-13 bolt into J 21777-2 gauge plate so plate rests against nut. Insert assembled gauge plate and bolt into carrier through front and rear bearings with underside of plate against rear bearing (Fig. 4A-34). Slip J 8619-12 pilot over bolt end with underside against front bearing. Tighten another nut fingertight while rotating gauge plate to ensure proper seating. Check to be sure gauge plate is centered over bearing (Fig. 4A-35), then torque nut to obtain a bearing preload reading of 20 in. lbs. (obtained with gauge plate assembly rotating). It may be necessary to hold stud stationary with a wrench on flats at end of stud.

4. Install a stem on the J 8001 dial indicator and mount loosely on cross shaft. Position stem of indicator on head of gauge pin so that stem is slightly depressed (causing a low indicator reading). Tighten thumb screw on indicator and set at zero.

5. Make certain bearing support bores are free of burrs and dirt. Place discs J 21777-3-P, J 8619-10-T or F on cross shaft assembly. Position assembly in the carrier with the discs resting on the bearing support bores and gauge pin facing in toward gauge plate. Rotate discs to insure firm seating.

6. Position gauge plate so that, as cross shaft is rotated (pressing firmly), the arc of the spherical end of gauge pin scribes across the "B"-P, "A"-T or F surface of the gauge plate (Fig. 4A-36).

7. Record maximum reading of dial indicator throughout arc. When indicator scale is less than .100", be sure to note if indicator completes more than one revolution.

8. Subtract recorded reading from .100". This figure will be used to select correct shim in step 10.

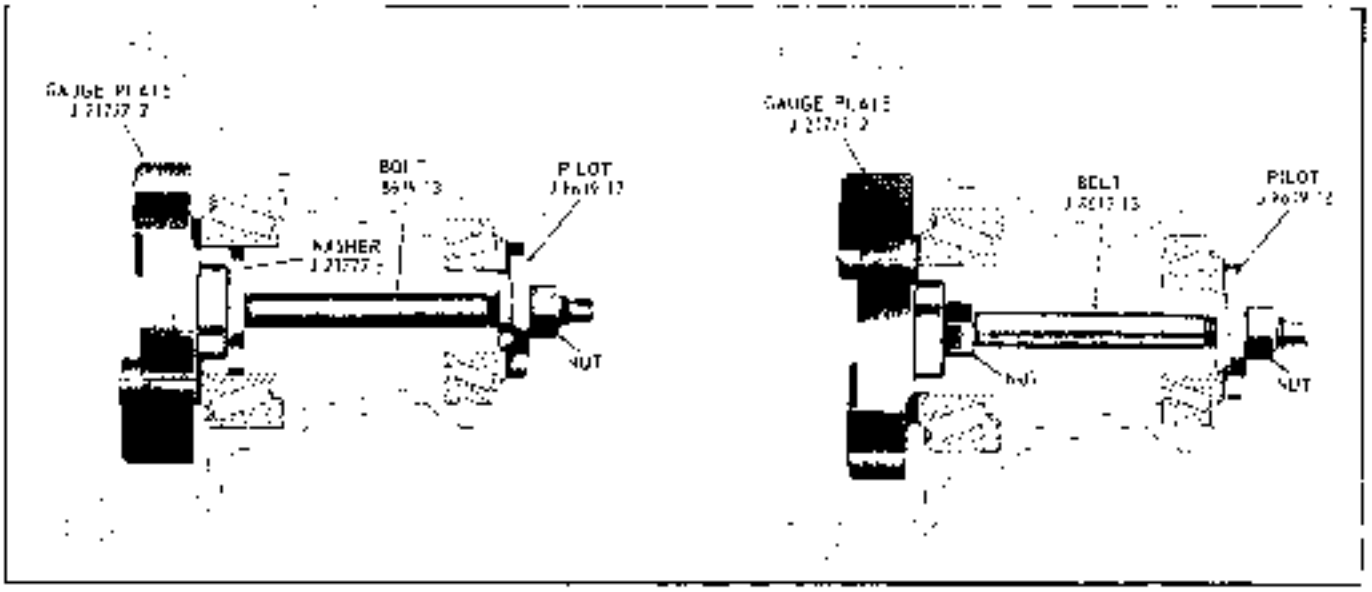


Fig. 4A-34 Securing Gauge Plate in Carrier

NOTE: The piston depth setting tool is designed so that a perfect dial indicator reading of .100" would require no shim. This is why the reading obtained must be subtracted from .100".

8. Examine ring gear and pinion for nicks, burrs or scoring. Any of these conditions will require replacement of gear set.

10. Select correct pinion shim to be used during pinion reassembly on the following basis:

NOTE: Pontiac - Fifteen (15) shims are available in increments of (.002") two thousandths from .020" to .050" (Fig. 4A-37)

Tempest or Firebird - Ten (10) shims are available in increments of (.002") two thousandths from .020" to .038" (Fig. 4A-37).

a. If reusing production pinion, and pinion is marked "+" (plus), correct shim will have a thickness equal to gauge reading found in step 7, plus the amount specified on pinion.

b. If production pinion is marked "-" (minus), correct shim will have a thickness equal to gauge reading found in step 7, less the amount specified on pinion.

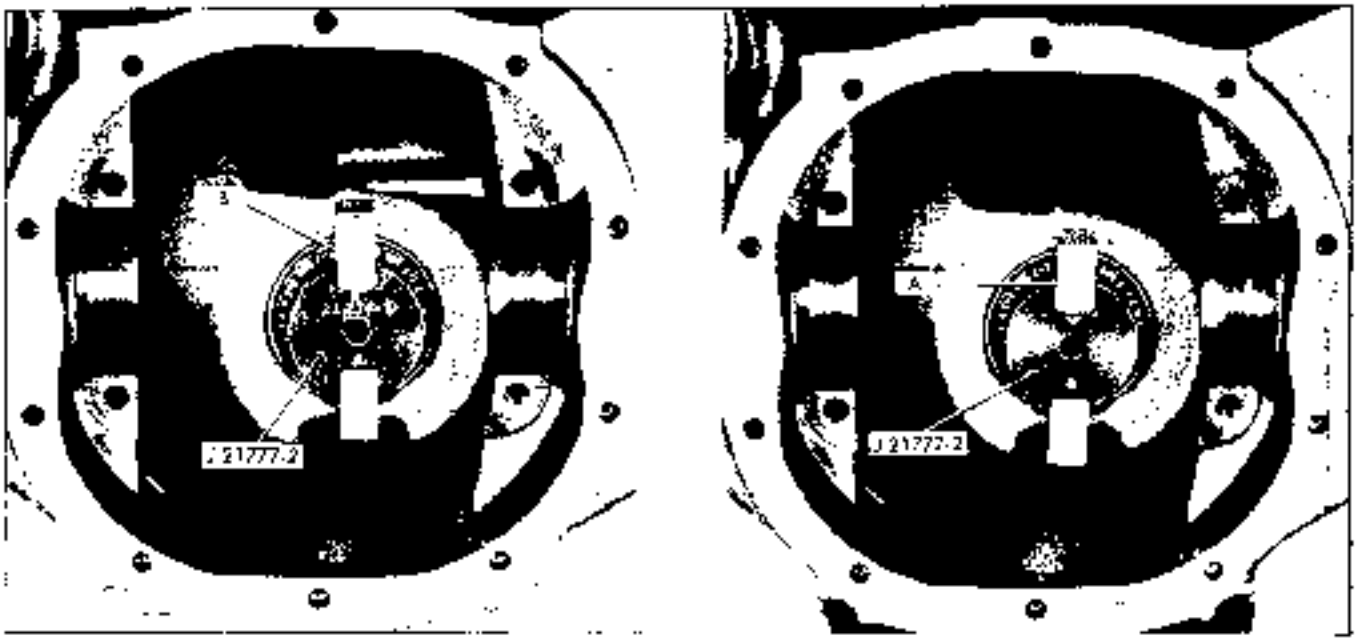


Fig. 4A-35 Gauge Plate Installed

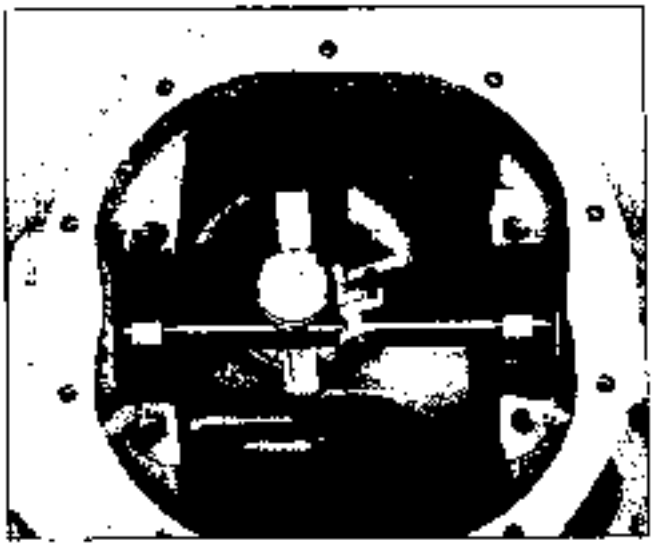


Fig. 4A-36 Checking Pinion Depth

c. If using production or service pinion which has no marking, the correct shim will have a thickness equal to the gauge reading found in step 8.

11. Loosen stud J 6619-13 and remove gauge plate J 21777-2, washer J 21777-5 (Pontiac only), pilot J 8619-12 and both bearings from case.

12. Slide pinion shim onto pinion shaft and install rear pinion bearing on pinion, using installer J 6547-P, J 21022-T or F and holder J 6407-1 and 2 in a press, as shown in Fig. 4A-38.

INSTALL PINION ASSEMBLY AND ADJUST PINION PRELOAD

1. Position pinion assembly in carrier and install new collapsible spacer.

NOTE: Tap rear of pinion assembly with soft hammer to assure seating of rear pinion bearing to its outer race in carrier.

2. Place front pinion bearing in position on pinion. Hold pinion fully forward and drive bearing over pinion until seated, using installer J 21295-01.

3. Coat O.D. of pinion oil seal with sealing compound and install in carrier, using installer J 21205-01 (Fig. 4A-9).

4. Coat lips of pinion oil seal and seal surface of companion flange with gear lube. Install companion flange on pinion, by tapping with a soft hammer until a few pinion threads project through flange.

5. Install pinion washer and nut. Hold companion flange with holder J 8614-1. While intermittently rotating pinion to seat bearings, tighten pinion nut until end play begins to be taken up.

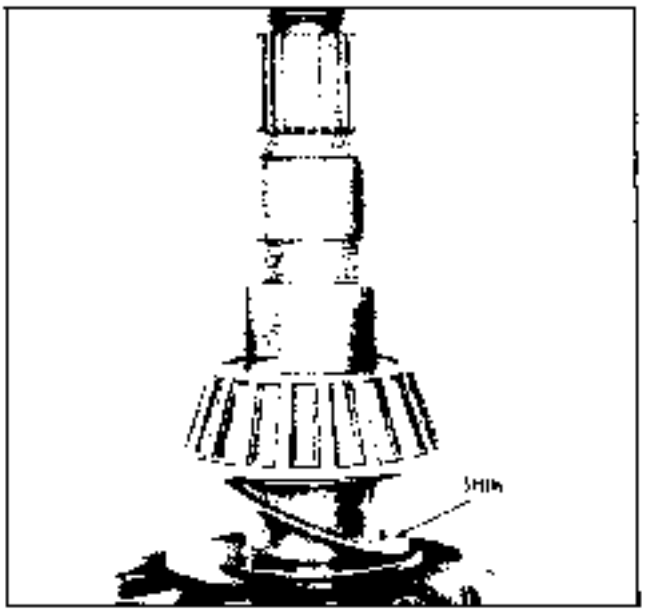


Fig. 4A-37 Pinion Shim

CAUTION: When no further end play can be determined, and holder J 8614-1 will no longer pivot freely as pinion is rotated, preload is being applied. Further tightening should be done only after preload has been checked.

6. Check preload by using a lb. in. torque wrench (Fig. 4A-39).

CAUTION: After preload has been checked, final tightening should be done very cautiously. Tighten the pinion nut further, only a little at a time, and check preload after each slight amount of tightening. Exceeding preload specifications will compress the collapsible spacer too far and require its replacement. Backing off nut to correct excessive preload will unload the front bearing and pinion nut allowing bearing to turn on shaft.

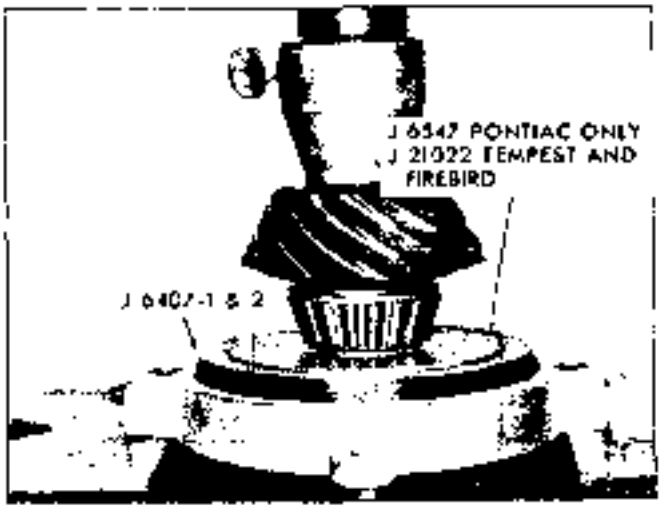


Fig. 4A-38 Installing Rear Pinion Bearing

Fig. 4A-39 Checking Pinion Bearing Preload

7. While observing the preceding caution, carefully set preload drag to 25 lb. in. on new bearings or 17 lb. in. on used bearings.

8. Rotate pinion several times to assure that bearings have been seated. Check preload again. If drag has been reduced by rotating pinion, re-set preload to specification.

INSTALL DIFFERENTIAL CASE AND ADJUST SIDE BEARING PRELOAD

Production shims are cast iron and vary in thickness from .210" to .272", in increments of .002".

NOTE: Whenever a case assembly is removed from the housing, measure the production shims for thickness and discard them (Fig. 4A-40).

This figure will be used to determine the approximate shim pack needed in step 4 (below). Use standard .170" service spacers and steel service shims available from .040" to .082", in increments of .002". For all service repairs

NOTE: Do not attempt to reinstall the production shims as they may break when tapped into place. If service shims were previously installed, they can be reused but (whether using new or old bearings) adhere to the following procedure in all cases:

Fig. 4A-40 Measuring Original Production Shim

To adjust differential side bearing preload, change the thickness of the right and left shims equally, thus leaving the original backlash undisturbed

1. Before installation of case assembly, make sure side bearing surfaces are clean and free of burrs. Lubricate side bearings with gear lube. If reusing original bearings, the original outer races must also be used.

2. Place differential case with bearing outer races in position in carrier.

3. Slip one .170" service spacer between each bearing race and carrier housing, with flat edge against housing (Fig. 4A-41).

NOTE: As a safety precaution, install the left bearing cap loosely so that the case may be moved while checking adjustments (one 7/16"-14 x 4 1/2" bolt can be added as an extra safety precaution in the lower right bearing cap hole). This will prevent the carrier from dropping while making shim adjustments.

4. Subtract .360" (total of two .170" service spacers plus .025" gauging space) from total shim pack removed on disassembly. Select two shims totaling this amount and position both between right bearing race and service spacer. Be sure left bearing race and spacer are against left housing of carrier (Fig. 4A-42).

5. Insert a feeler gauge of less than .100" between right shim and service spacer (Fig. 4A-43).

NOTE: It will be necessary to work the case in and out and to the left in order to insert the gauge. The gauge must be inserted in order to judge the drag. Be sure to locate the gauge at the centerline of the housing.

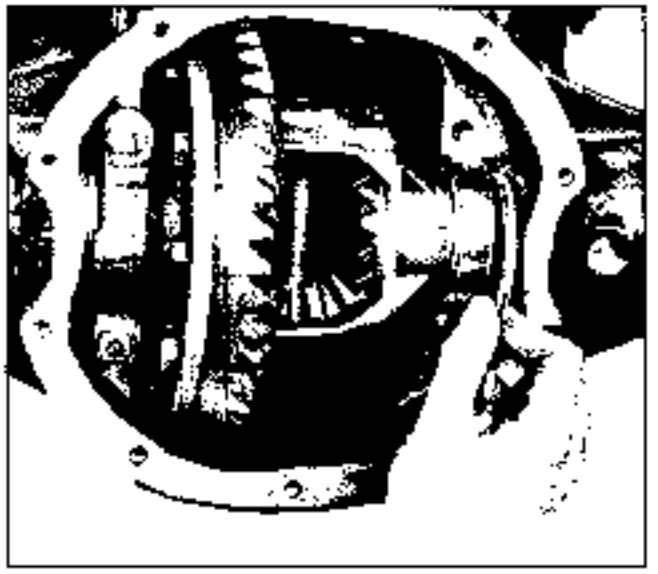


Fig. 4A-41 Installing Service Spacer

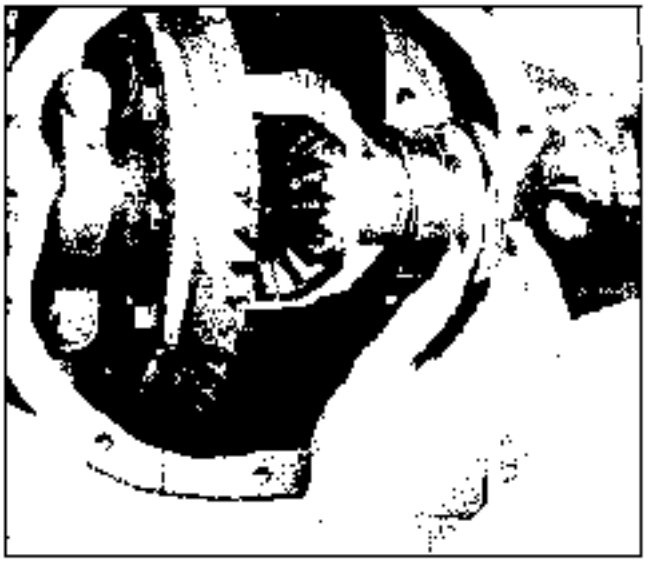


Fig. 4A-42 Installing Two Service Shims

Insert progressively larger sizes (.010", .012", .014", etc.) until there is a noticeably increased drag. The point just before additional drag begins is correct gauge thickness. Rotate case while using gauge to insure an even reading.

NOTE: The original light drag was caused by weight of the case against the carrier while additional drag is caused by side bearing preload. By starting with a thin feeler gauge, a sense of "feel" is obtained so that the beginning of preload can be recognized.

5. Remove left bearing cap and all shims from carrier. The total shim pack needed (with no preload on side bearings) is feeler gauge reading found in step 5 plus thickness of shims installed in step 4.

NOTE: The object of step 6 is to reach the equivalent of a "slip fit" of the case in the carrier. For convenience in setting backlash and tooth contact, the preload will not be added until the final step.

7. Select two shims of approximately equal size, whose total thickness is equal to the value obtained in step 6. Install one of these shims between each side bearing race and service spacer.

CAUTION: If insertion of second shim causes excessive pinion to ring gear contact (noticeable by difficulty in rotation of the case), select thinner left shim and add difference to the right side. Keep total shim thickness of a value equal to that obtained in step 6.

8. Check backlash and tooth pattern as described in the following section. The bearing caps must be installed and the bolts torqued to 70 lb. ft.

9. When backlash and tooth pattern operations are complete, remove shim pack installed in step 7. Select two shims each .004" thicker than those removed and install one on each side. This additional thickness will provide proper bearing preload. It will be necessary to tap the final shim into place with a soft hammer (Fig. 4A-44).

ADJUSTING DIFFERENTIAL BACKLASH

1. Rotate differential case several times to seat bearings, then mount dial indicator (Fig. 4A-45). Use a small button on indicator stem so that contact can be made near heel end of tooth. Set dial indicator so that stem is, as nearly as possible, in line with gear rotation and perpendicular to tooth angle for accurate backlash reading.

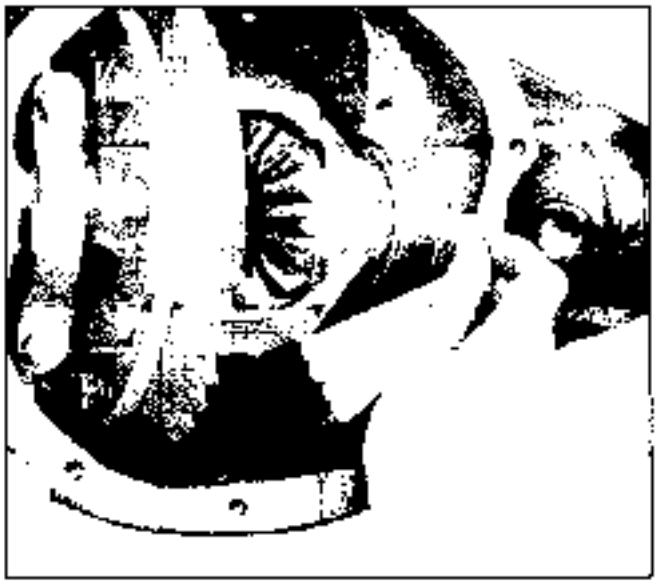


Fig. 4A-43 Inserting Feeler Gauge

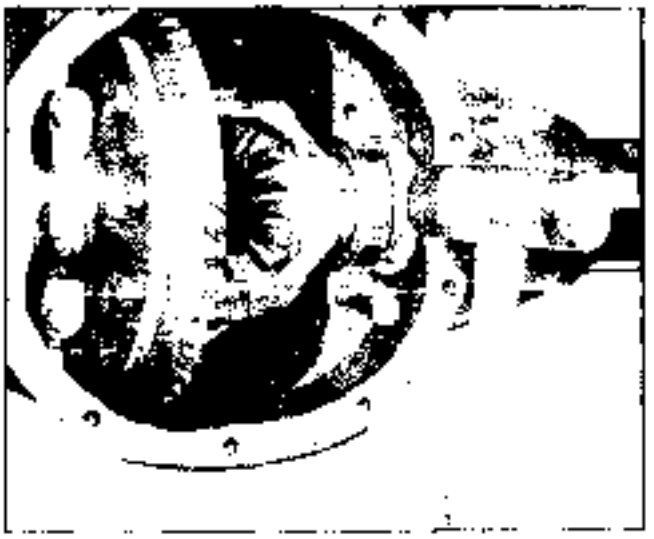


Fig. 4A-44 Tapping Final Shim Into Place

Fig. 4A-45 Checking Ring Gear to Pinion Backlash

2. With pinion locked to carrier, check gear lash at 3 or 4 points around ring gear. Lash must not vary over .002" around ring gear. If variation is over .002", check for burrs, uneven bolting conditions or distorted case flange and make corrections as necessary.

3. Gear lash, at the point of minimum lash, should be .005" to .009" for all new gears. If original gear set having a wear pattern is being reinstalled, original gear lash should be maintained with ± .001".

4. If gear backlash is not within specifications, correct by increasing thickness of one differential shim and decreasing thickness of other shim the same amount. In this way, correct differential bearing preload will be maintained. Shift .002" in shim thickness for each .001" change in backlash desired. If backlash is .001" too much, decrease thickness of right shim .003" and increase thickness of left shim .002". If backlash is .002" too little, increase thickness of right shim .004" and decrease thickness of left shim .004".

5. When backlash is adjusted to specifications, tighten bearing cap bolts to 70 lb. ft. torque.

6. Check tooth contact pattern with red lead test.

NOTE: It may be necessary to readjust the backlash to obtain the correct tooth contact pattern. On high mileage gear sets where a definite wear pattern has been established, it may be necessary to exceed .009" backlash to obtain the desired tooth contact. It is important, however, not to exceed .009" backlash on new gear sets.

If readjusting the backlash doesn't give the correct tooth contact pattern, the pinion depth must be readjusted.

7. When correct tooth contact pattern is obtained, install cover with new gasket on housing. DO NOT USE GREASE TO RETAIN GASKET. Insert two upper cover bolts carefully through cover and gasket. Be sure gasket is flat and not twisted between cover and housing. Be sure all cover bolts pass through gasket holes. Torque to 25 ft. lbs.

NOTE: See page 4A-8 for replacement of axle shaft assemblies.

OIL LEAKS

It is difficult to determine the source of some oil leaks. Even after the point of leakage has been determined, it is hard to tell whether the oil is leaking past the lip of the seal or past the O.D. of the seal. Therefore, it is a good idea to make sure the leak is stopped by using a nonhardening sealing compound around the O.D. of the new seal.

SPECIFICATIONS

REAR AXLE

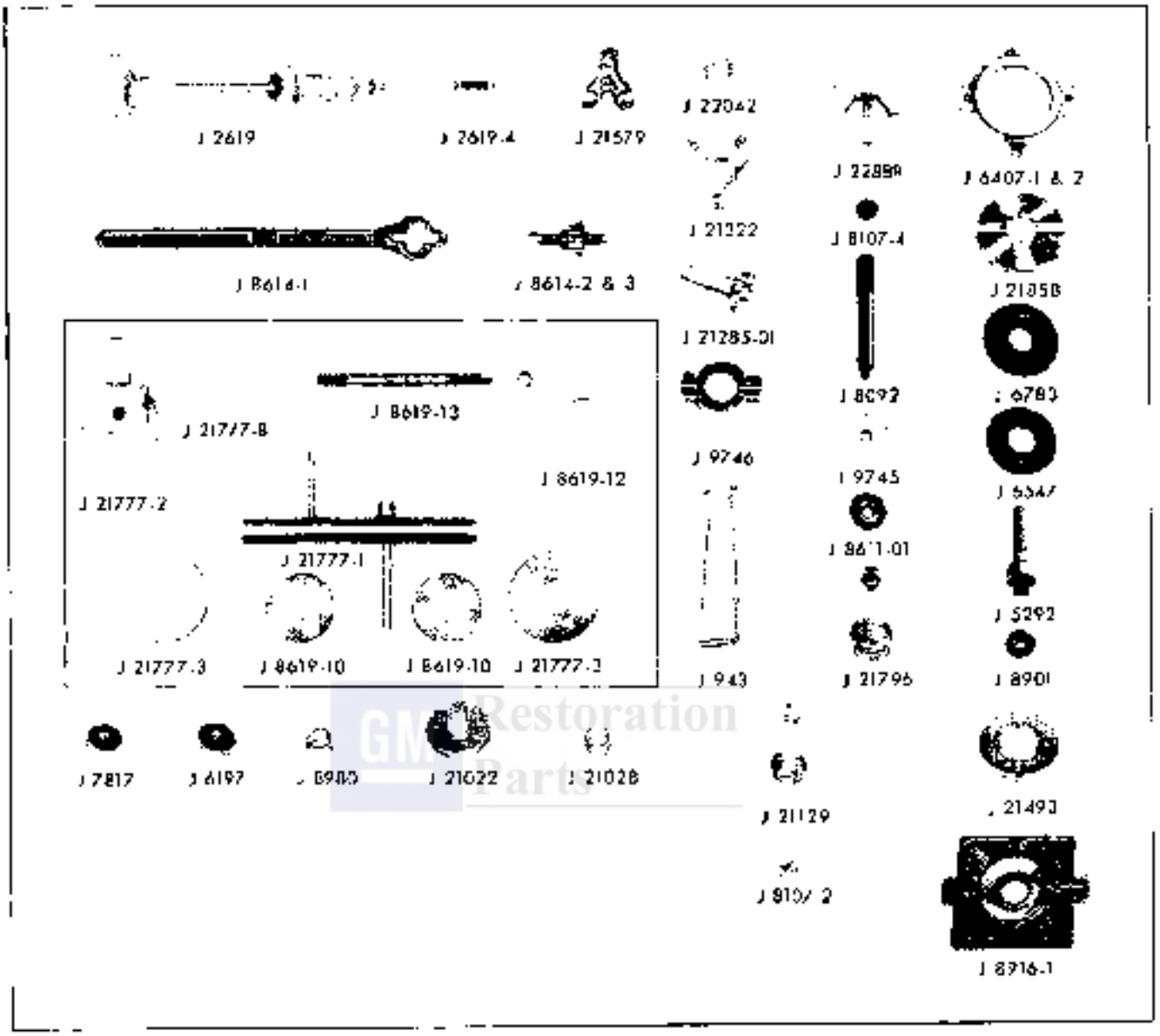
Type	Semi-Floating
Type of Drive	Multiple Splines
Drive – Final	Hypoid Gear
Lubricant Capacity	Pontiac–72 oz. or 4 1/2 pints Tempest or Firebird–48 oz. or 3 pints
Lubricant	Multi-purpose Hypoid Gear Lubricant
Lubricant Level	Bottom of Filler Plug Hole

RING AND PINION GEAR

Backlash	.005" - .009"
Ring gear run-out maximum	.002"
Ratios	See Fig. 4A-4A for Pontiac, See Fig. 4A-4B for Tempest, See Fig. 4A-4C for Firebird.
Pinion Bearing Preload (with Ring Gear)	
New Bearings (New Seal)	20 lb. in.
Old Bearings (New Seal)	17 lb. in.
Side Bearing Preload	Slip Fit Plus .005"

Torque	Lb. Ft.
Differential Cover to Carrier Bolts	25
Differential Bearing Caps to Carrier Bolts	70
Differential Ring Gear to Case Bolts-Pontiac	90
Differential Ring Gear to Case Bolts-Tempest or Firebird	60
Differential Pinion Shaft Lock Screw	15
Rear U-Joint Companion Flange Nut with Lock Plates	12
Rear U-Joint Companion Flange Nut with Lockwashers	17
Rear Axle Upper Control Arm Assy to Axle Housing Bolt-Pontiac or Tempest	110
Rear Axle Upper Control Arm Assy to Axle Housing Nut-Pontiac or Tempest	80
Rear Axle Lower Control Arm Assy to Axle Housing Bolt-Pontiac or Tempest	110
Rear Axle Lower Control Arm Assy to Axle Housing Nut-Pontiac or Tempest	80
Rear Axle Bumper Spacer to Axle Housing Bracket Bolt and Nut (Station Wagon) - Tempest	50
Rear Axle Upper Control Arm Assy to Frame Bolt-Pontiac or Tempest	110
Rear Axle Upper Control Arm Assy to Frame Nut-Pontiac or Tempest	80

Torque	Lb. Ft.
Rear Axle Lower Control Arm Assy to Frame Bolt-Pontiac or Tempest	110
Rear Axle Lower Control Arm Assy to Frame Nut-Pontiac or Tempest	80
Leaf Spring Front Eye to Frame Brackets Nuts-Firebird	100
Leaf Spring Rear Eye to Shackle Nuts-Firebird	50
Rear Shock Absorber to Axle Housing Bracket Nut	65
Shock Absorber to Frame Bolt-Pontiac or Tempest	20
Shock Absorber to Frame Bolt-Firebird	8
Rear Wheel and Drum to Axle Shaft Nut-Pontiac	80
Rear Wheel and Drum to Axle Shaft Nut-Tempest or Firebird	65
Rear Brake Assy to Axle Housing Bolt and Nut	35
Pinion Nose Bumper-Pontiac or Tempest	8
Differential Case Bolts (Safe-T-Track) - Tempest or Firebird	30



J 8107-4	Adapter
J 8611-01	Front Pinion Bearing Outer Race Installer
J 8614-1	Companion Flange Holding Tool
J 8614-2 & 3	U-Joint Companion Flange Puller
J 8619-10	Pinion Depth Gauge Discs
J 8619-12	Pilot
J 8619-13	Pinion Depth Gauge Bolt & Nut
J 8901	Side Bearing Support
J 943	Oil Seal Remover
J 2619	Slide Hammer
J 2619-4	Adapter
J 5292	Side Bearing Installer
J 6197	Rear Pinion Bearing Outer Race Installer
J 6407-1 & 2	Press Plate Holder & Insert
J 6547	Rear Pinion Bearing Installer
J 6783	Axle Shaft Bearing Installer
J 7817	Front Pinion Bearing Outer Race Installer
J 8092	Drive Handle
J 8107	Side Bearing Puller (Not Shown)
J 8916-1	Split Plate
J 8980	Differential Side Bearing Installer
J 9745	Rear Pinion Bearing Outer Race Installer
J 9746	Rear Pinion Bearing Remover
J 21022	Axle Shaft Bearing Installer
J 21028	Differential Side Bearing Installer
J 21129	Axle Shaft Oil Seal Installer
J 21285-01	Pinion Oil Seal Installer
J 21372	Case Remover
J 21493	Rear Pinion Bearing Remover
J 21579	Axle Shaft Remover
J 21777	Pinion Depth Gauge
J 21777-1	Cross Shaft Assy.
J 21777-2	Gauge Plate
J 21777-3	Discs
J 21777-8	Washer
J 21796	Axle Shaft Oil Seal Installer
J 21858	Axle Bearing Remover
J 22042	Left Hand Bolt and Sleeve Set
J 22899	Side Bearing Puller (Four Pinion Differential)

Fig. 4A-46 Special Tools

SAFE-T-TRACK DIFFERENTIAL

CONTENTS OF THIS SECTION

GENERAL DESCRIPTION

The Safe-T-Track differential can be identified by a tag attached to the lower right section of axle cover. It is designed to direct the major driving force to the wheel with greater traction, thereby reducing the possibility of the car becoming stuck while driving under adverse conditions.

PONTIAC—

The Safe-T-Track differential (Fig. 4B-1) is similar to, and interchangeable with, the standard differential case assembly (the ring gear and side bearings are identical).

TEMPEST AND FIREBIRD—

All rear axle parts of cars equipped with the Safe-T-Track two pinion differential (Fig. 4B-2) or the Safe-T-Track four pinion differential (Fig. 4B-3) are interchangeable with those equipped with the conventional differential, except for the case assembly. It is similar in all respects to the conventional case assembly, with the addition of cone clutches behind each side gear.

LUBRICATION

The differential should be checked for leaks and level every 6000 miles. Maintain level to bottom of the filler plug opening. No periodic lubricant change is recommended. However, if necessary to add lubricant, use only specially formulated lubricant for Safe-T-Track differentials.

IMPORTANT. Never use any other lubricant in a Safe-T-Track differential or a severe chatter may result, especially when turning corners. If the wrong lubricant is added, remove it from housing and flush with special lubricant. Then add the proper amount of lubricant. It may be necessary to drive the car several miles to allow the lubricant to work through the clutches and eliminate the chatter. If chatter persists, drain and refill again to eliminate contamination. It may require 2 or 3 flushings to correct. An alternate procedure is disassembly and cleaning with solvent. Capacity is 1 1/2 pints of lubricant for Pontiac; capacity for Tempest and Firebird is 3 pints of lubricant.

SERVICE PROCEDURES

All rear axles service procedures are the same for the Safe-T-Track as for the conventional differential, except for servicing the case assembly.

NOTE: Two precautions must be observed when working on cars with Safe-T-Track differentials:

1. NEVER raise one wheel and run the engine with the transmission in gear. The driving force to the wheel on the floor will cause the car to move.

2. Do not use "on the car" type wheel balancers on the rear wheels, unless BOTH wheels are off the floor.

TESTING FOR CORRECT OPERATION

If there is any doubt as to the proper functioning of the Safe-T-Track differential, the following simple test should be performed:

1. Place the car on a hoist with engine off and the transmission selector lever in park if automatic, or in low gear if manual.

2. Attempt to turn either wheel.

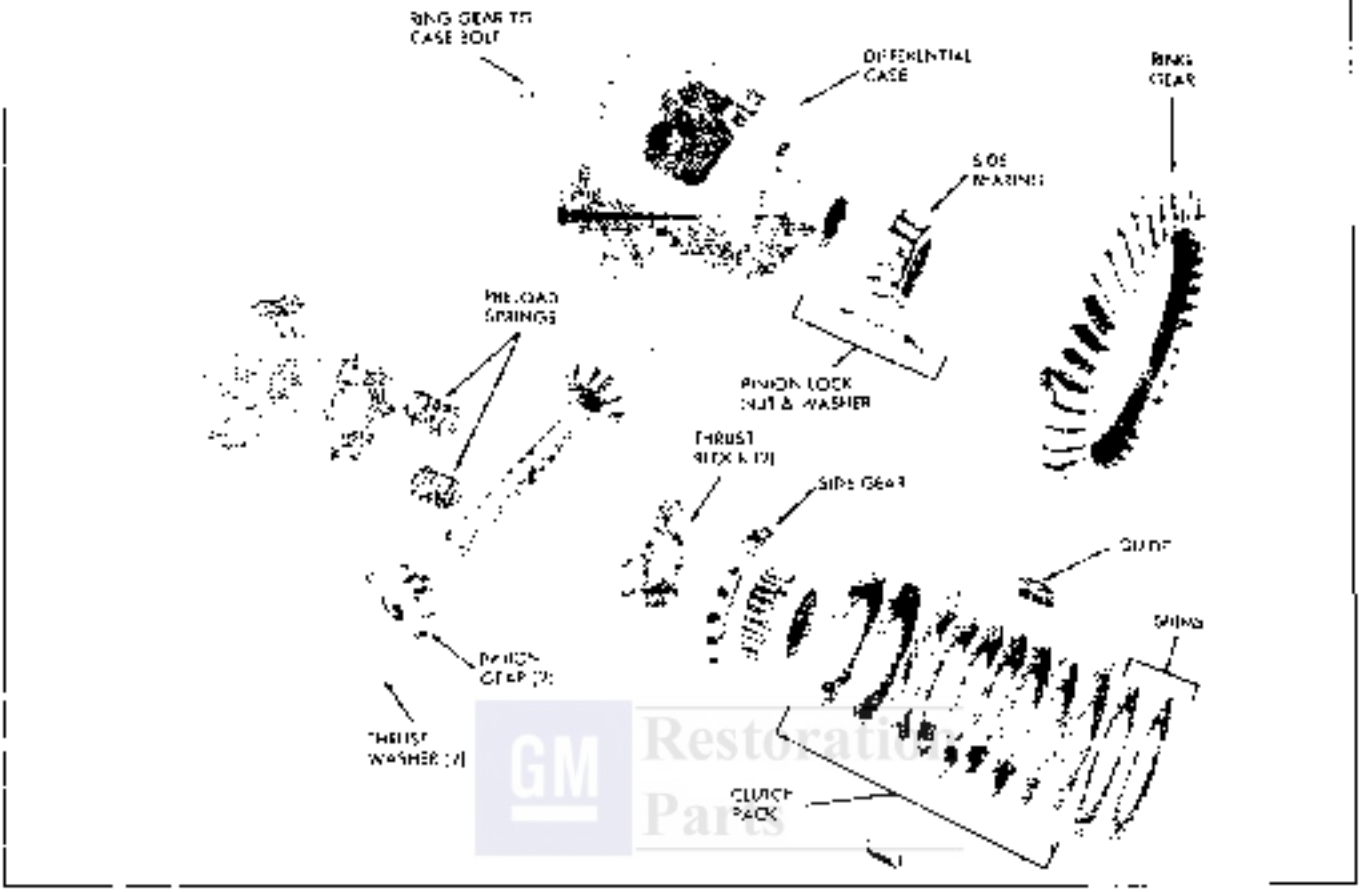


Fig. 4B-1 Exploded View of Pontiac Safe-T-Track

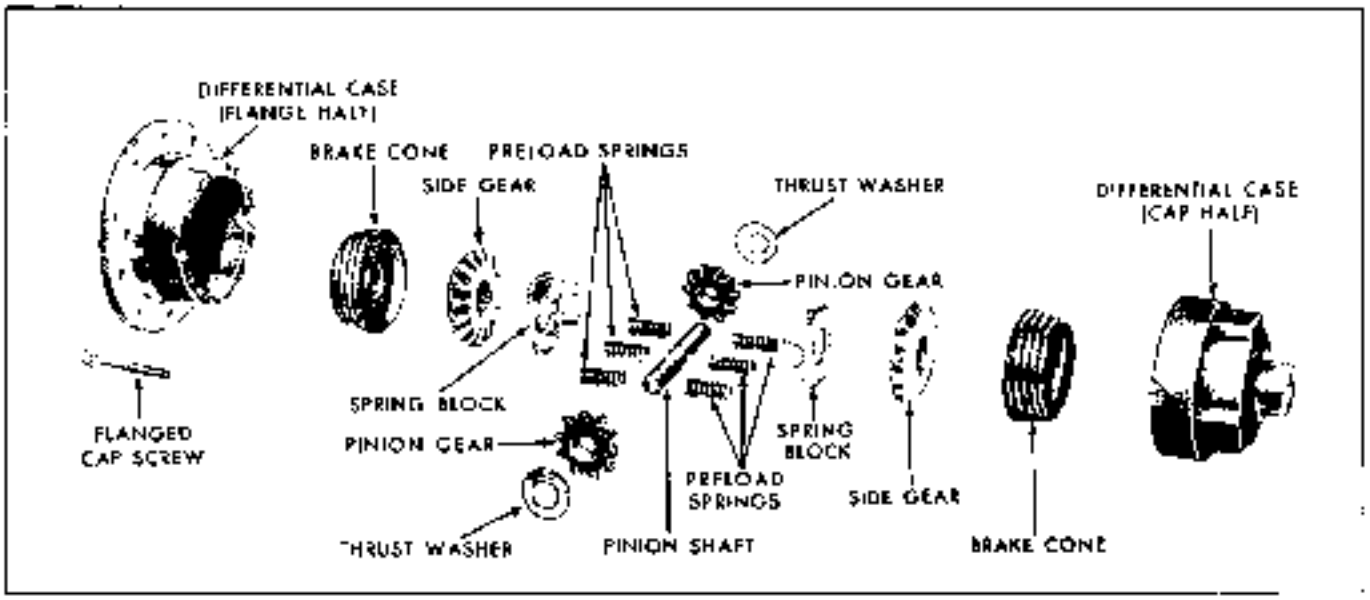


Fig. 4B-2 Exploded View of Tempest and Firebird 2 Pinion Safe-T-Track

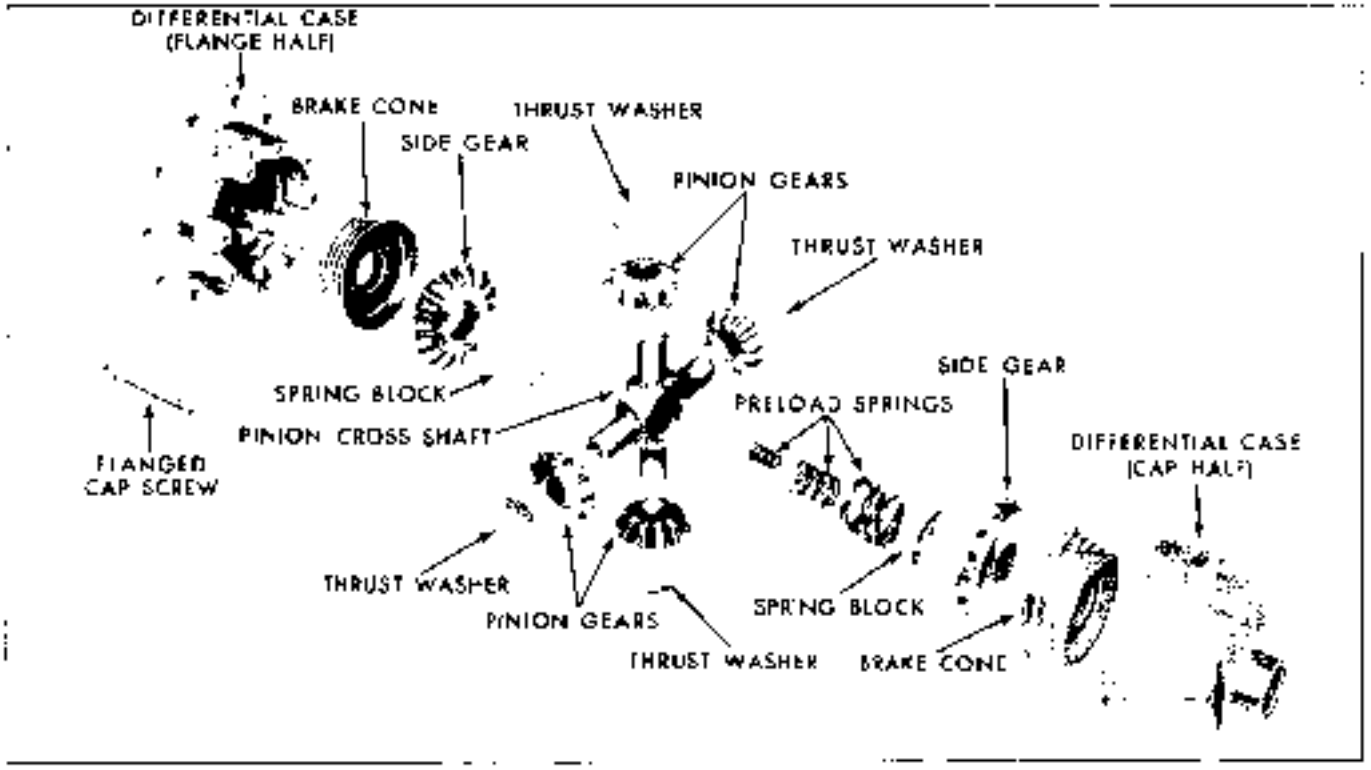


Fig. 4B-3 Exploded View of Tempest and Firebird 4 Pinion Safe-T-Track

3. The average man will find it extremely difficult, if not impossible, to manually turn either wheel. This is because one wheel will provide approximately 400 lbs. draw bar pull, with zero traction at the opposite wheel.

MAJOR REPAIRS

DIFFERENTIAL CASE—DISASSEMBLE

PONTIAC—

NOTE: Keep side bearing outer races with side bearings, so these matched parts can be correctly replaced during build-up.

1. Before disassembling differential case, inspect differential side bearings for visible damage of rollers and outer races.

2. Place one outer race onto its matched inner race and roller assembly and turn slowly, applying some load.

3. If bearing outer race turns smoothly and no visible damage is found, bearing can probably be reused.

4. Repeat above operations with other outer race and matched bearing, and check for smoothness.

NOTE: Both side bearings and their races are matching parts. If either bearing is to be replaced, its matching outer race must also be replaced.

5. Inspect fit of inner races on case hubs by prying against shoulders at puller recesses. Bearing inner races must be tight on case hubs.

NOTE: If either is loose on case, the entire case must be replaced.

6. If bearing inspection indicates that bearings should be replaced, insert differential case in vise and, using side bearing puller J 8107 and adapter J 8107-4, remove side bearing. (Fig. 4B-4)

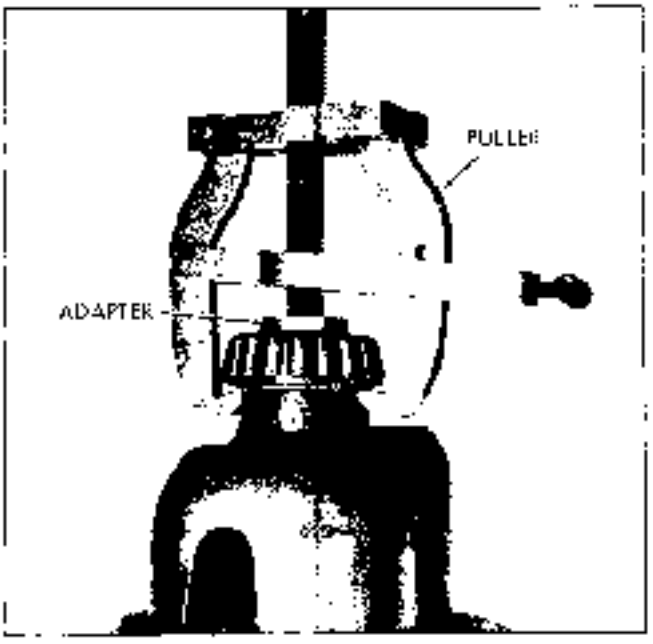


Fig. 4B-4 Removing Differential Side Bearing

CAUTION: Make certain ends of puller arms are firmly seated in recesses in sides of hubs and fully against inner race of bearing.

7. Turn differential case in vise and remove other side bearing in same manner.

8. If removing ring gear, clamp case in vise so jaws are 90° to pinion shaft holes and remove ring gear retaining bolts.

NOTE: Ring gear to case bolts have left hand threads.

9. Partially install two bolts on opposite sides of ring gear.

10. Remove ring gear from case by alternately tapping on bolts.

CAUTION: Do not pry between case and ring gear.

11. Remove pinion shaft lock screw and washer and tap out pinion shaft from case.

12. Remove preload spring, retainer and springs from case (Fig. 4B-5).

13. Rotate side gears until pinions are in open area of case. Remove pinions and thrust washers.

14. Remove a side gear, clutch pack and shims from case. Note location in case to aid in reassembly. Remove side gear clutch pack and shims from opposite side.

NOTE: If a side gear or clutch pack cannot be readily removed from case, drive out with brass drift (Fig. 4B-6).

15. Remove clutch plate guides and separate shims and clutch plates from side gears.

NOTE: Keep clutch plates in their original location in clutch pack.

TEMPEST AND FIREBIRD (2 pinion or 4 pinion)

1. Before disassembling differential case, inspect differential side bearings for visible damage of rollers and outer races.

2. Place one outer race onto its matched inner race and roller assembly and turn slowly, applying hand load.

3. If bearing outer race turns smoothly and no visible damage is found, bearings can be reused.

4. Repeat above operation with other race and matched bearing and check for smoothness.

NOTE: Both side bearings and their outer races are matched parts. If either bearing is to be replaced, its matching outer race must also be replaced.

Fig. 4B-5 Removing Preload Springs and Retainer - Pontiac

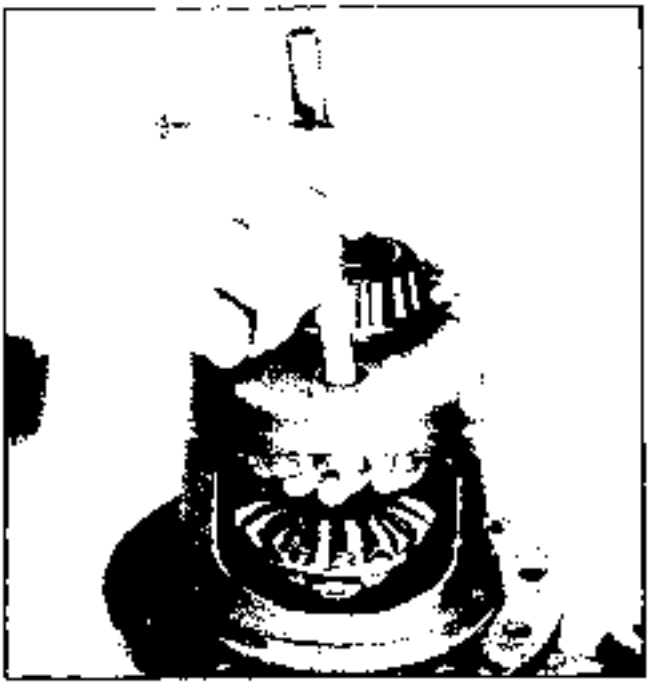


Fig. 4B-6 Driving Out Clutch Pack - Pontiac

5. Inspect fit of inner races on case hubs by prying against shoulders at puller recesses. Bearing inner races must be tight on case hubs.

NOTE: If either bearing is loose on case, entire case must be replaced.

6. If bearing inspection indicates that bearings should be replaced, remove side bearings by using side bearing puller J 8107 (two prong) or J 22999 (four prong) and adapter J 8107-2 (Fig. 4B-11).

CAUTION: Make certain that ends of puller arms are fully against inner race of bearing.

7. Turn differential case in vise and remove other side bearing in same manner.

8. If removing ring gear, clamp case in vise so jaws are 90° to pinion shaft holes and remove ten ring gear retaining bolts.

9. Partially install two bolts on opposite sides of ring gear.

10. Remove ring gear from case by alternately tapping on bolts.

CAUTION: Do not pry between case and ring gear.

11. Scribe mark or paint differential case halves (Fig. 4B-7) to aid in alignment of case when assembling.

12. Remove differential case half attaching bolts.

13. Lift cap half of case from flange half. Remove clutch cone, side gear, spring block, preload springs and shims, if provided.

NOTE: Shims are used in some units between the side gear and cone to maintain proper backlash.

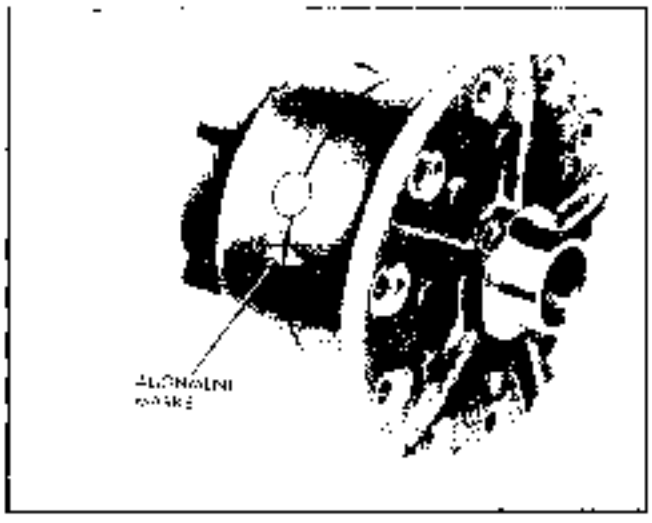


Fig. 4B-7 Alignment Marks – Tempest and Firebird

between pinion gears and side gears. Keep these parts with cap half of case assembly.

14. Remove corresponding parts from flange half of case and keep them with flange half of case assembly.

CLEANING AND INSPECTION OF CASE

PONTIAC—

1. Thoroughly clean differential case and inspect, paying particular attention to ring gear mounting flange, ring gear pilot and side bearing hubs.

2. Remove nicks and burrs with mill file.

NOTE: If using new case, thoroughly clean case in stoddard solvent, making certain bolt holes and bolts are clean of steel filing and foreign material.

3. Clean side gears, pinion gears and thrust washers with suitable solvent and inspect for excessive wear.

4. Clean side bearings thoroughly in clean solvent (do not use a brush). Examine bearings visually and by feel. Bearings should feel smooth when oiled and rotated, while applying as much hand pressure as possible.

NOTE: Minute scratches and pits that appear on rollers and races of low mileage are due to the initial preload. Bearings having these marks should not be rejected.

5. Thoroughly clean ring gear and inspect back side for any adhering material which may cause runout.

6. Examine ring gear and drive pinion teeth for nicks, burrs or scoring. Any of these conditions will require replacement of gear set.

7. Position ring gear on case and check fit of gear on flange and pilot. It should be .002" tight to .001" loose. If ring gear easily falls into position, it must be replaced.

NOTE: If ring gear is replaced, pinion gear must also be replaced as they are only serviced in matched sets.

8. Check press fit of side bearing inner race on differential case. Side bearings must be a tight press fit on hub.

9. Inspect clutch plates for scored, worn, cracked or a distorted condition. If any of these conditions exist, new clutch plates must be installed.

10. Replace parts as necessary and coat with clean engine oil before installing in case.

TEMPEST AND FIREBIRD (2 pinion or 4 pinion)

1. Make certain all parts are absolutely clean and dry.

2. Inspect pinion shaft, pinion and side gears, brake cone surfaces and corresponding axle seats in case. The bore seats in case should be smooth and free of any excessive scoring. Slight grooves or scratches, indicating passage of foreign material, are permissible and normal. The land surface on the heavy spirals of axle bores will duplicate case surface condition. Replace any parts which are excessively scored, pitted or worn. Both halves of case must be replaced if one half is damaged or worn.

DIFFERENTIAL CASE— ASSEMBLE

PONTIAC—

1. After making sure that matching surfaces are clean and free of burrs, position ring gear on case so holes are in line.

2. Lubricate attaching bolts with clean engine oil and install.

3. Pull ring gear onto case by alternately tightening bolts around case. When all bolts are snug, tighten bolts evenly and alternately across diameter to 90 lb. ft. torque.

CAUTION: Do not use hammer to force ring gear on case.

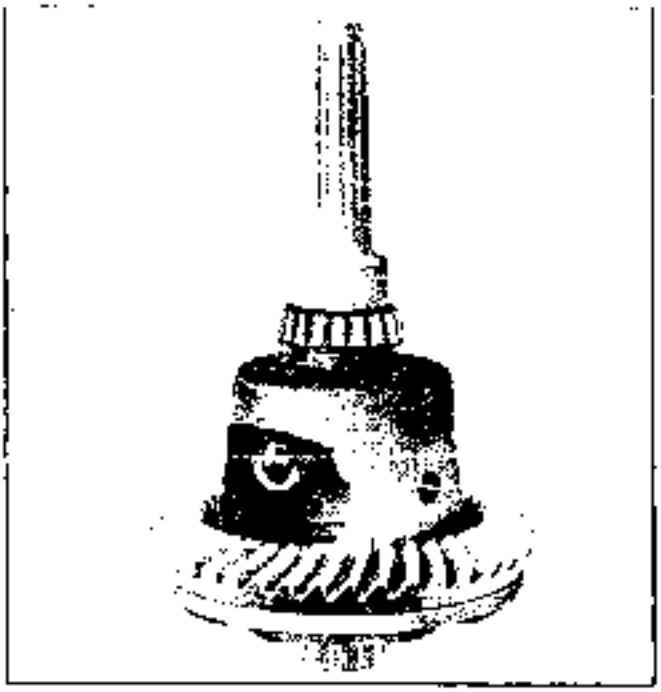


Fig. 4B-8 Installing Differential Side Bearing

4. If side bearings were removed, lubricate the bearings and install on case hubs, as shown in Fig. 4B-8, using tool J 5293.

5. Apply special lubricant to the clutch plates.

6. Assemble the clutch packs as follows:

a. Alternately position nine clutch plates on the side gear, starting and ending with a clutch plate having external lugs.

b. Install the two clutch guides over the clutch plate lugs.

c. Install the same shims which were removed, or an equal amount, on the clutch plate.

d. Repeat steps a, b, and c on the other clutch pack.

7. Check the pinion to side gear clearance as follows:

a. Install one side gear with clutch pack and shims in the case.

b. Position the two pinion gears and thrust washers on the side gear and install the pinion shaft.

c. Compress the clutch pack by inserting a screwdriver or wedge between the side gear and the pinion shaft.

d. Install dial indicator with the contact button against the pinion gear (Fig. 4B-9).

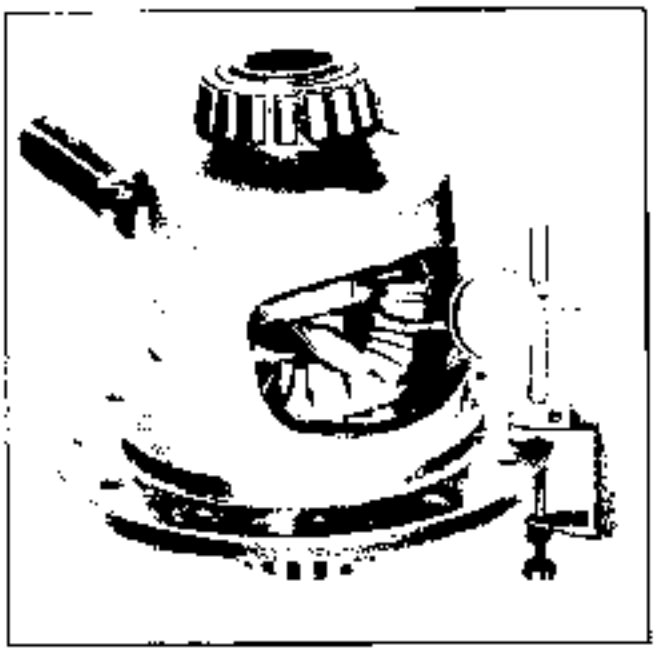


Fig. 4B-9 Checking Pinion Gear to Side Gear Clearance — Pontiac

e. Rotate pinion gear. Clearance should be .001" to .006". Add or subtract necessary shims to reach this figure.

f. Remove side gear and repeat procedure with opposite clutch pack on the side of case.

8. Remove pinion shaft, pinions and thrust washers.

9. Install remaining side gear and clutch pack with correct shims in case.

10. Place pinion gears on side gears and rotate into correct position.

11. Compress the preload springs with a 2" C clamp, as shown in Fig. 4B-10, and drive the preload retainer and springs between side gears.

12. Insert thrust washers behind pinion gears.

13. Install pinion shaft and retain with lock screw. Tighten lock screw to 25 lb. ft.

14. Check side gear splined hole to be certain it is in line with hole in the preload spring retainer. The spring retainer can be moved slightly to correct misalignment.

TEMPEST AND FIREBIRD—

The following procedure is to be used in assembling both the two pinion differential and the four pinion differential. Slight differences are noted in steps 4 and 5.

CAUTION: When assembling unit, use axle shafts as aligning tools to assure proper gear and cone spline alignment. Do not ignore this procedure or it will be impossible to install shafts at final assembly. Attempting to force shafts into position may result in damage to spring thrust blocks.

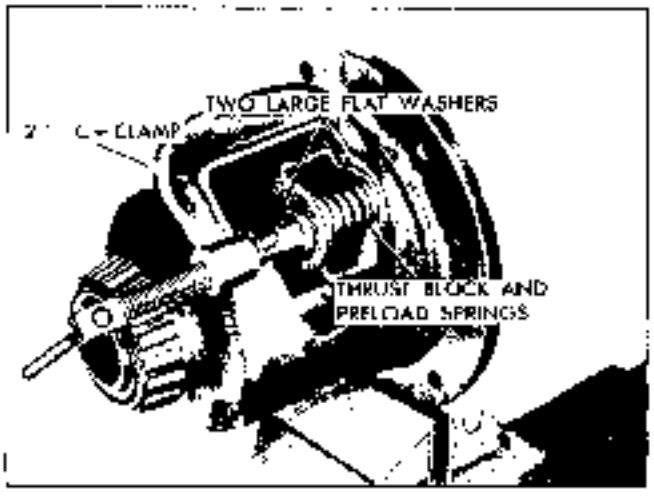


Fig. 4B-10 Compressing Preload Springs - Pontiac

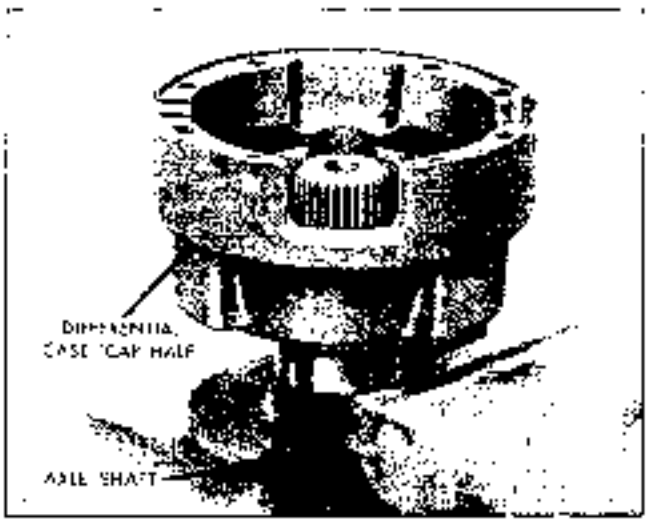


Fig. 4B-11 Axle Shaft and Cap Half of Case - Two and Four Pinion Tempest and Firebird

1. Clamp one axle shaft in vise, allowing three inches to extend above vise jaws. Then place cap half of differential case over extended axle shaft, with interior of case facing up (Fig. 4B-11).

2. Install proper cone over axle shaft splines, seating it into position in cap half of case.

NOTE: Be certain that each cone is installed in proper case half, since bores and surfaces become matched and their positions should not be changed.

3. If unit was originally assembled with shims located between side gears and cones for backlash adjustment, reinstall side gear with shim so that gear may seat on shim. If unit was originally assembled without shims, reassemble same way.

4. (2 pinion) Place one spring block in position over gear face, in alignment with pinion gear shaft grooves. Install pinion shaft, pinion gears and thrust

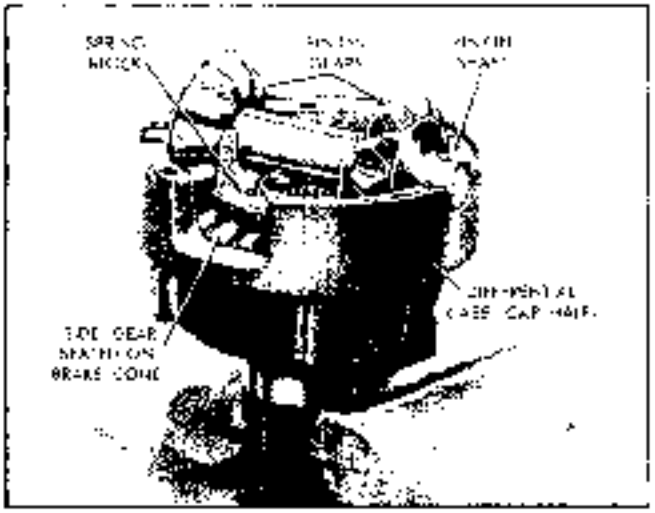


Fig. 4B-12 Installing Parts in Cap Half - Two Pinion Tempest and Firebird

washers into cap half of differential case in such a manner that pinion shaft retaining dowel can be inserted through pinion gear shaft into differential case. This prevents pinion shaft from sliding out and causing damage to carrier (Fig. 4B-12)

(4 pinion) Place one spring block in central position over gear face. Assemble the four pinions and four thrust washers onto the pinion cross shaft and place in position in the cap half of the differential case (Fig. 4B-13).

(6 12 pinion) Insert six springs into spring block that is already installed into case, then place second spring block over springs. Note offset construction of spring block tabs (Fig. 4B-14)

(4 pinion) Insert three springs through center of pinion cross shaft onto spring block that is already installed into case, then place second spring block on top of springs (Fig. 4B-15).

6. Install second side gear, face down on spring block so that side gear will mesh with pinion gears.

7. Place shim, if provided, and remaining cone over side gear.

8. Install flange half of differential case over cone, in proper position to match alignment marks; insert two case half bolts finger tight, 180° apart (Fig. 4B-16).

9. Install other axle shaft through flange half of differential case, rotating axle to enter cone splines and then side gear splines. Leaving the axle shaft in this position, insert remaining bolts and tighten to 30 lb. ft. (Fig. 4B-17).

10. Remove axle shafts (A slight tapping on the shafts with a soft hammer may be necessary to align the splines during assembly. The shafts can

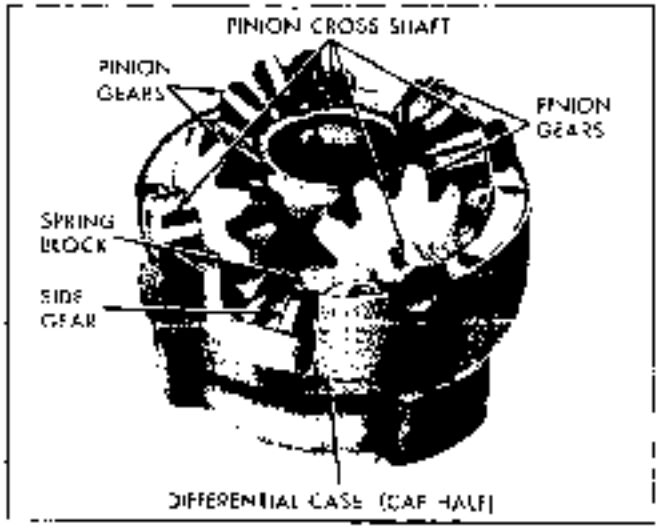


Fig. 4B-12 Installing Parts in Case Half - Four Pinion Tempest and Firebird

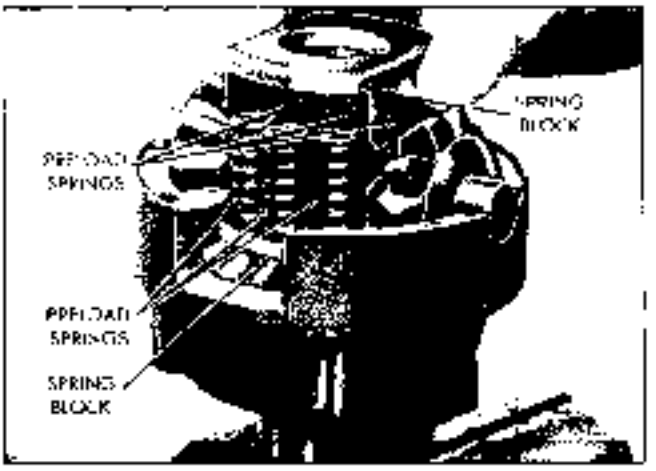


Fig. 4B-14 Installing Second Spring Block - Two Pinion Tempest and Firebird

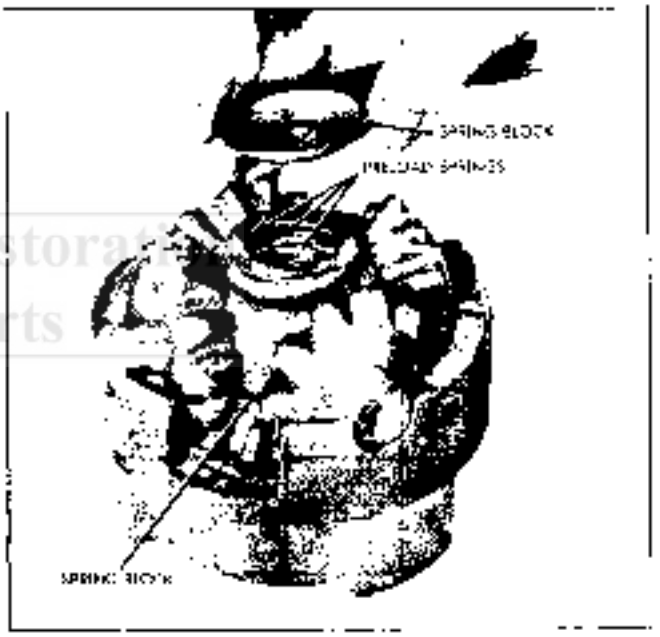


Fig. 4B-15 Installing Second Spring Block - Four Pinion Tempest and Firebird

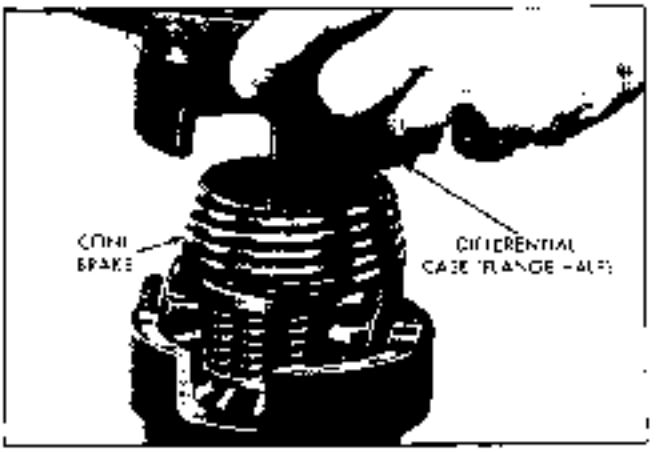


Fig. 4B-16 Installing Flange Half of Differential Case - Two or Four Pinion Tempest and Firebird

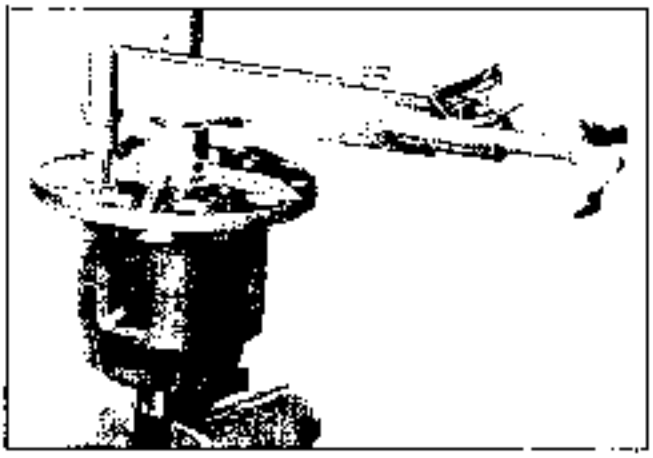


Fig. 4B-17 Torquing Case Half Bolts - Two or Four Pinion Tempest and Firebird

liners be readily reinstalled without spline interference during final assembly).

11. If side bearings were removed, lubricate outer bearing surfaces and press on bearings as described in (standard) Assemble Differential Case.

12. After making sure that matching surfaces are clean and free of burrs, position ring gear on case so holes are in line.

13. Lubricate attaching bolts with clean engine oil and install.

14. Pull ring gear onto case by alternately tightening bolts around case. When all bolts are snug, tighten bolts evenly and alternately across diameter to 60 lb. ft. torque.

CAUTION: Do not use hammer to force ring gear on case.

15. Install unit into axle carrier following instructions given for Standard Differential.

TROUBLE DIAGNOSIS

OIL LEAKS

It is difficult to determine the source of some oil leaks. Even after the point of leakage has been determined, it is hard to tell whether the oil is leaking past the lip of the seal or past the O.D. of the seal. Therefore, it is a good idea to make sure the leak is stopped by using a nonhardening sealing compound around the O.D. of the new seal.

SPECIFICATIONS

REAR AXLE

Type	Semi-Floating
Type of Drive	Modified Hotchkiss
Drive - Final	Hypoid Gear
Lubricant Capacity	Pontiac-32 oz. or 4 1/2 pints Tempest & Firebird-48 oz. or 3 pints
Lubricant	Multi-purpose Hypoid Gear Lubricant
Lubricant Level	Bottom of Filler Plug Hole

RING AND PINION GEAR

Backlash	.005" - .009"
Ring gear run-out maximum	.002"
Ratios	See Fig. 4A-4A for Pontiac. See Fig. 4A-4B for Tempest See Fig. 4A-4C for Firebird
Pinion Bearing Preload (with Ring Gear)	
New Bearings (New Seal)	35 lb. in.
Old Bearings (New Seal)	17 lb. in.
Side Bearing Preload	Slip Fit Plus .008"

TORQUE

	Lb. Ft.
Differential Cover to Carrier Bolts	25
Differential Bearing Caps to Carrier Bolts	70
Differential Ring Gear to Case Bolts-Pontiac	60
Differential Ring Gear to Case Bolts-Tempest or Firebird	60
Differential Pinion Shaft Lock Screw	15
Rear U-Joint Companion Flange Nut with Lock Plates	12
Rear U-Joint Companion Flange Nut with Lockwashers	17
Rear Axle Upper Control Arm Assy to Axle Housing Bolt-Pontiac or Tempest	110
Rear Axle Upper Control Arm Assy to Axle Housing Nut-Pontiac or Tempest	80
Rear Axle Lower Control Arm Assy to Axle Housing Bolt-Pontiac or Tempest	110
Rear Axle Lower Control Arm Assy to Axle Housing Nut-Pontiac or Tempest	80
Rear Axle Bumper Spacer to Axle Housing Bracket Bolt and Nut (Station Wagon) Tempest	50
Rear Spring Lower Clamp to Axle Housing Seat Bolt & Nut-Tempest	35
Rear Axle Upper Control Arm Assy to Frame Bolt-Pontiac or Tempest	110
Rear Axle Upper Control Arm Assy to Frame Nut-Pontiac or Tempest	80
Rear Axle Lower Control Arm Assy to Frame Bolt-Pontiac or Tempest	110
Rear Axle Lower Control Arm Assy to Frame Nut-Pontiac or Tempest	80
Rear Shock Absorber to Axle Housing Bracket Nut	65
Shock Absorber to Frame Bolt-Pontiac or Tempest	20
Rear Wheel and Drum to Axle Shaft Nut-Pontiac	80
Rear Wheel and Drum to Axle Shaft Nut-Tempest or Firebird	65
Rear Brake Assy to Axle Housing Bolt and Nut	35
Pinion Nose Bumper-Pontiac or Tempest	8
Differential Case Bolts (Safe-T-Track)-Tempest or Firebird	80
Leaf Spring Front Eye to Frame Bracket Nuts-Firebird	100
Leaf Spring Rear Eye to Frame Bracket Nuts-Firebird	50
Shock Absorber to Frame Bolt-Firebird	8

SPECIAL TOOLS

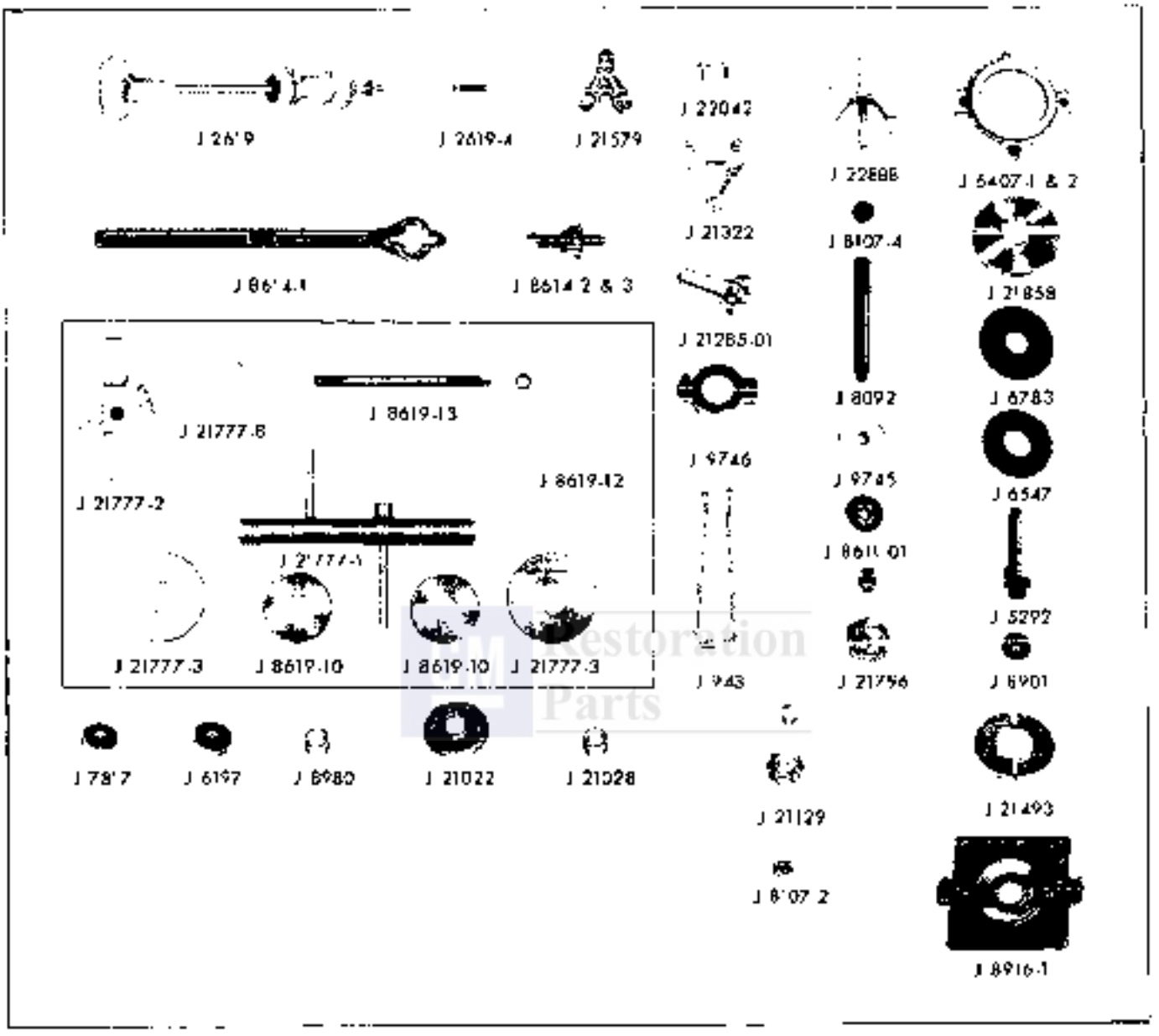


Fig 9B-10 Special Tools

J 943	Oil Seal Remover	J 8916-1	Split Plate
J 2619	Slide Hammer	J 8980	Differential Side Bearing Installer
J 2619-4	Adapter	J 9745	Rear Pinion Bearing Outer Race Installer
J 5292	Side Bearing Installer	J 9746	Rear Pinion Bearing Remover
J 6197	Rear Pinion Bearing Outer Race Installer	J 21022	Axle Shaft Bearing Installer
J 6407-1 & 2	Press Plate Holder & Inserts	J 21028	Differential Side Bearing Installer
J 6547	Rear Pinion Bearing Installer	J 21129	Axle Shaft Oil Seal Installer
J 6783	Axle Shaft Bearing Installer	J 21285-01	Pinion Oil Seal Installer
J 7817	Front Pinion Bearing Outer Race Installer	J 21322	Case Remover
J 8092	Drive Handle	J 21493	Rear Pinion Bearing Remover
J 8107	Side Bearing Puller (Two Required)—Not Shown	J 21579	Axle Shafts Remover
J 8107-2	Adapter	J 21777	Pinion Depth Gauge
J 8107-4	Adapter	J 21777-1	Cross Shaft Assy.
J 8611-01	Front Pinion Bearing Outer Race Installer	J 21777-2	Gauge Plate
J 8614-1	Companion Flange Holding Tool	J 21777-3	Discs
J 8614-2 & 3	U-Joint Companion Flange Puller	J 21777-5	Washer
J 8619-10	Pinion Depth Gauge Discs	J 21795	Axle Shaft Oil Seal Installer
J 8619-12	Pilot	J 21858	Axle Bearing Remover
J 8619-13	Pinion Depth Gauge Bolt & Nut	J 22042	Left Hand Bolt and Sleeve Set
J 8901	Side Bearing Support	J 22888	Side Bearing Puller (Rear Pinion)

PROPELLER SHAFT

CONTENTS OF THIS SECTION

INSPECTION

No periodic inspection of propeller shaft assembly is required. Since propeller shaft assembly is a balanced unit, it should be kept free of undercoating and other foreign material which could upset shaft balance. It is essential that bearing caps or companion flange be in alignment with mark on propeller shaft yoke for optimum balance.

MINOR SERVICES AND REPAIRS

ALIGNMENT OF ENGINE AND PROPELLER SHAFT

All necessary differential pinion angle requirements are designed and built into rear upper and lower control arm geometry. Slots in the engine support rear crossmember provide for fore and aft movement of engine-transmission assembly to provide for variation in positioning.

MAJOR REPAIRS

REMOVE PROPELLER SHAFT

1. Mark propeller shaft rear yoke and differential companion flange to insure their correct alignment on re-assembly.

2. Remove U-bolt nuts, lockplates (or lockwashers) and U-bolts from rear axle drive pinion companion flange.

3. If bearing tie wire has been removed, use suitable rubber band or tape to hold bearings onto journal, thus preventing loss of bearing rollers while rear universal joint is being disconnected (Fig. 4C-1).

4. Remove complete propeller shaft assembly by sliding it rearward and downward to disengage splined yoke from splines on transmission output shaft.

DISASSEMBLE UNIVERSAL JOINTS

NOTE: On Firebird and Tempest—When removing bearings from universal joint yokes, use extreme care so as not to lose needle rollers from bearings.

On Pontiac - Because of elastic properties of nylon retainers used on Pontiac universal joint bearings they must be pressed out which shears nylon retainers in half, rendering bearings and journal unsuitable for re-use. Therefore, upon re-assembly, new bearing and journal assemblies employing conventional steel ring retainers must be used. Consult parts book for repair kit part number.

A. Differential End

1. Firebird and Tempest – Remove two snap ring retainers from propeller shaft rear yoke bearing shells by using screwdrivers or similar tool.

2. Support journal on a press bed in manner that will allow propeller shaft yoke to be moved downward. Support front of propeller shaft on stand so that propeller shaft is horizontal (Fig. 4C-2).

3. Using piece of pipe or similar tool with diameter sufficiently large (slightly larger than 1 1/8") to encircle the bearing shell, apply force on yoke (Fig. 4C-3) until downward movement of yoke and stationary position of journal forces the bearing assembly almost out top of yoke (Force applied on yoke will shear nylon retainers which hold bearings in place - Pontiac only).

4. Rotate propeller shaft 180° and repeat preceding step to partially remove opposite bearing.

Fig. 4C-1 Bearings Held In Place by Tie Wire

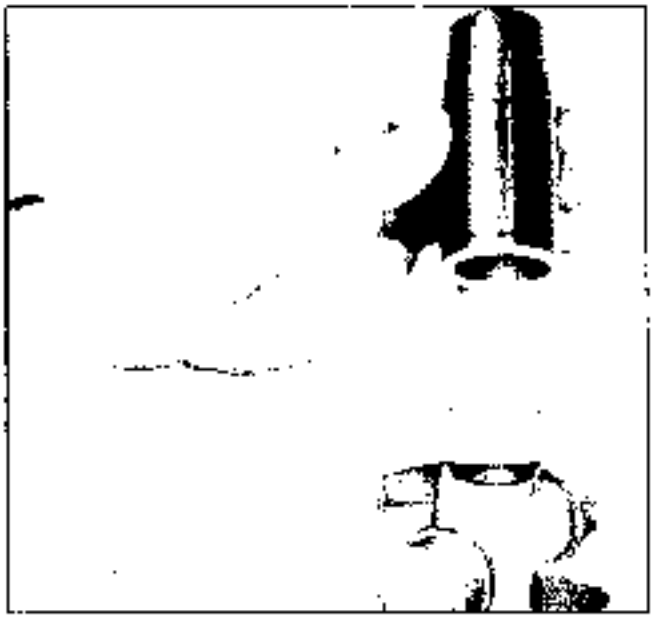


Fig. 4c-2 Removing Bearing from Yoke with 1-1/8" Dia. Rod

5. Complete removal of these bearings by tapping around circumference of exposed portion of bearing with small hammer (Fig. 4C-4).

6. Remove journal from propeller shaft rear yoke.

7. Firebird and Tempest - Remove bearing tie wire, retaining bearings to journal, by using pliers or similar tool and carefully remove bearings from journal.

B. Transmission End

1. Firebird and Tempest - Remove the four snap

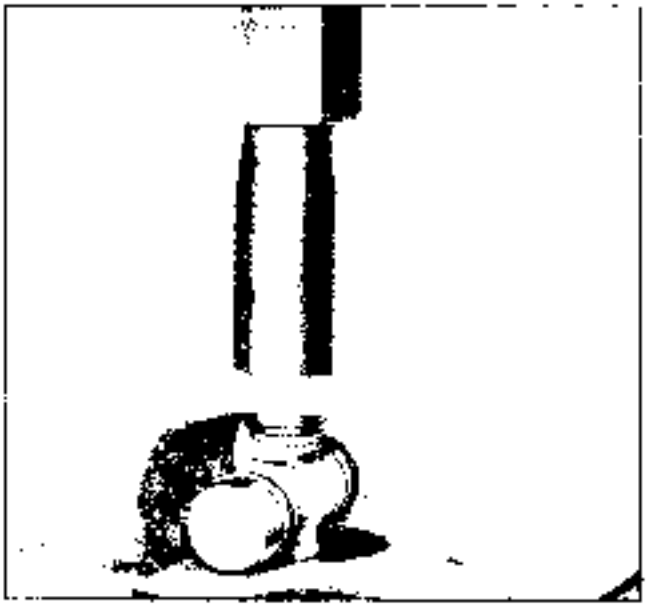


Fig. 4c-3 Pressing Out Bearing

Fig. 4c-4 Tapping Out Bearing

ring retainers. Two from bearing shells in splined yoke and two from bearing shells in front fixed yoke of propeller shaft, by using screwdriver or similar tool.

2. Support splined yoke on a press bed in manner that will allow propeller shaft fixed yoke to be moved downward (Fig. 4C-5). Support rear of propeller shaft on a stand so that propeller shaft is horizontal. Be sure weight is evenly distributed on each side of splined yoke.

3. Using piece of pipe or similar tool with diameter sufficiently large (slightly larger than 1 1/8") to encircle the bearing shell, apply force on propeller shaft fixed yoke until downward movement of propeller shaft fixed yoke and stationary position of journal forces the bearing assembly almost completely out top of yoke (Force applied on fixed yoke will shear nylon retainers which hold bearings in place - Pontiac only).

4. Rotate propeller shaft 180° and repeat preceding step to partially remove opposite bearing.

5. Complete removal of these bearings by tapping around circumference of exposed portion of bearing with small hammer (Fig. 4C-4).

6. Remove splined yoke and journal from propeller shaft front fixed yoke.

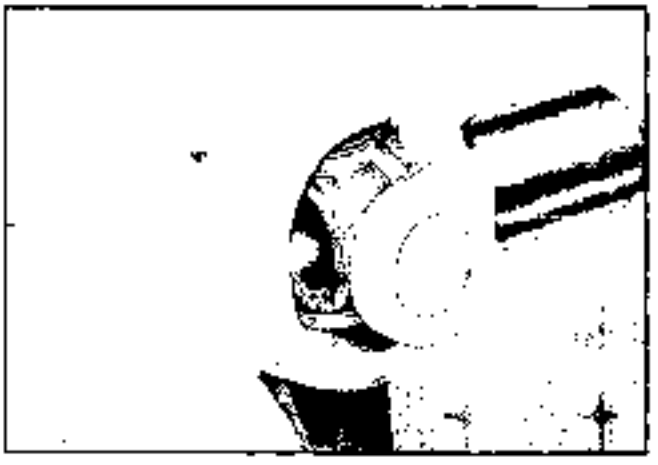


Fig. 4c-5 Supporting Splined Yoke

7. Remove bearings and journal from splined yoke in a similar manner.

CLEANING AND INSPECTION

1. Firebird and Tempest - Wash all parts thoroughly in cleaning fluid. Probe holes in journals to remove any hardened grease.

2. Firebird and Tempest - Inspect roller bearing surfaces of journals, inner bearing surfaces of outer races and inspect rollers for wear, scuring, flat spots or other damage.

3. Firebird and Tempest - Inspect packings (Cork washers) and journal dust shields for wear and injury. Replace if necessary. Packing should be flexible, but replace with new packing if brittle or hard.

4. Clean and inspect outer surface of propeller shaft splined yoke to ensure that it is not burred, since burrs will damage transmission seal. Also, inspect splines of yoke for freedom from dirt.

ASSEMBLE UNIVERSAL JOINTS

NOTE: If universal joints from Pontiac model are disassembled, new bearing and journal assemblies must be used as necessary. Consult parts book for repair kit part number.

A. Transmission End

1. Firebird and Tempest - Repack roller bearings and fill holes in ends of journal with high melting point wheel bearing lubricant.

2. Firebird and Tempest - Press cork washers into position in recess of bearings.

Fig. 4C-6 - Installing Journal in Yoke

3. Install one bearing one-quarter way in one side of splined yoke, using soft-faced hammer. Check for proper alignment.

4. Insert journal into splined yoke (with dust shields installed - Firebird and Tempest), so that arm of journal seats in bearing and complete installation of bearing (Fig. 4C-6).

5. Install opposite bearing, ensuring that bearing rollers do not jam on journal. Check for free movement of journal in bearings.

6. Install snap ring retainer in each journal with gaps toward splined yoke (Fig. 4C-7).

7. Install bearings and splined yoke to front fixed yoke of propeller shaft in a similar manner and install two snap ring retainers with gaps toward fixed yoke.

B. Differential End

1. Firebird and Tempest - Repack roller bearings and fill holes in ends of journal with high melting point wheel bearing lubricant.

2. Firebird and Tempest - Press cork washers into position in recess of bearings.

3. Install one bearing one-quarter way in one side of propeller shaft rear yoke, using soft-faced hammer. Check for proper alignment.

4. Insert journal into rear yoke (with dust shields installed - Firebird and Tempest), so that arm of journal seats in bearing and complete installation of bearing (Fig. 4C-6).

5. Install opposite bearing, ensuring that roller bearings do not jam on journal. Check for free movement of journal in bearings.

Fig. 4C-7 - Installing Snap Ring Retainer

6. Install snap ring retainer on each journal with gaps toward rear fixed yoke (Fig. 4C-7).

7. Install two remaining trunnion bearings onto journal arms, using suitable rubber band or tape to hold bearings to journals.

INSTALL PROPELLER SHAFT ASSEMBLY

1. Inspect outer diameter of splined yoke to ensure that it is not burred, as this will damage transmission seal.

2. Apply engine oil to inside spline and outside diameter of yoke and slide propeller shaft splined yoke onto transmission output shaft.

3. Position rear universal joint to rear axle companion flange, making sure trunnion bearings are properly aligned in companion flange yoke.

NOTE: Be sure to align mark on companion flange with mark on propeller shaft rear yoke.

4. Install U-bolts, lockplates (or lockwashers), nuts and tighten U-bolt nuts to 12 lb. ft. torque (If lockwashers are used, tighten nuts to 14 lb. ft. torque).

TORQUE SPECIFICATIONS

	Lb. Ft.
U-Bolt Nuts	12 (with lockplates) 14 (with lockwashers)

Usage	Transmission	Color Code	Wheelbase (Inches)	Length (Inches)	Diameter (Inches)	Type Insulator
Firebird	3 and 4 Speed Manual	2 Blue Bands	108.1	49.96	2.75	SOLID
	2 Speed Automatic	2 Pink Band		49.96		
	Turbo Hydra-Matic	2 Red, 1 Pink Band		49.30		
2 Door Tempest Models	3 and 4 Speed Manual	1 Green, 1 Yellow 1 White Band	112	56.00	3.00	
	3 Speed H.D. Manual	1 Brown, 1 Green Band		56.00		
	2 Speed Automatic	1 Green, 1 Pink Band		56.00		
	Turbo Hydra-Matic	1 Red, 2 White Bands		55.34		
4 Door Tempest Models	3 and 4 Speed Manual	1 Brown 1 Gold Band	116	60.00	3.25	
	3 Speed H.D. Manual	1 Red, 1 Yellow Band		60.00		
	2 Speed Automatic	1 Purple, 1 Yellow Band		60.00		
	Turbo Hydra-Matic	1 White Band		59.34		
Cat., G.P. and Sta. Wag.	3 Speed Manual	1 Black, 1 Yellow Band	121	56.40	3.00	
	4 Speed Manual	2 Red Bands			3.00	
	Turbo Hydra-Matic	① 2 White Bands			3.00	
	Turbo Hydra-Matic	② 2 Pink Bands			3.38	
Exec. & Bonne. Except Sta. Wag.	3 Speed Manual	1 Brown, 1 Pink Band	124	59.30	3.25	
	4 Speed Manual	1 Black, 1 White Band			3.25	
	Turbo Hydra-Matic	1 Black, 1 Green Band			3.38	

①Use with 2.29 and 2.41 axle ratio only.
②Use with all axle ratios except 2.29 and 2.41.

Fig. 4C-8 Propeller Shaft Comparison and Usage Information

STANDARD BRAKES

CONTENTS OF THIS SECTION

SERVICE OPERATIONS

The brake system should be checked visually each time the car is lubricated. With the car raised on a lift for inspection, brake lines, hoses, and cables should be inspected for signs of chafing, deterioration, or other damage. A careful check for leaks should be made. Repairs as necessary should be performed as outlined in this section.

Each time the car is serviced for any reason there is an opportunity and obligation to check the operation of the brake system. If the brake pedal can be depressed to within less than 2 in. of floor mat when brakes are applied, or if pulls, grabs, or other irregularities are noted, a need for brake service exists. No car should leave the Service Department with brakes that are not safe. Corrections should be made as outlined in this section.

BRAKE PEDAL

BRAKE PEDAL REMOVAL

NOTE: Refer to Section 1A for removal of air conditioning components if necessary.

1. Disconnect clutch pedal return spring (manual transmission models only).

2. Disconnect clutch push rod at pedal (manual transmission models only).

3. Remove stoplight switch.

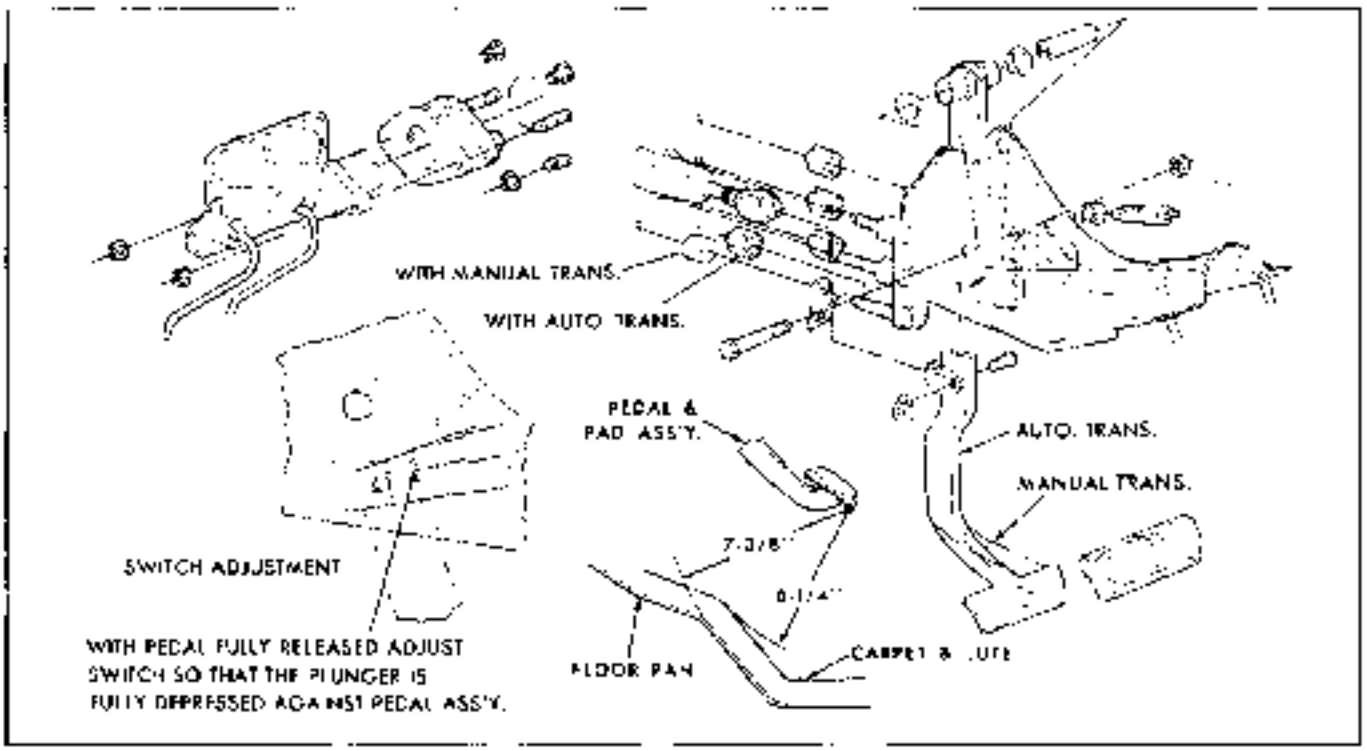


Fig. 5-1 Position, Manual Brake System

4. Firebird – Disconnect brake pedal return spring.

5. Pontiac and Tempest – Remove brake pedal clevis pin retainer and pin.

Firebird – Remove brake pedal clevis pin retainer.

6. Pontiac and Tempest – Remove nut from brake pedal pivot bolt.

Firebird – Remove retainer from right side of pedal pivot shaft.

7. Pontiac and Tempest – Slide pedal pivot shaft bolt to left enough to clear brake pedal.

Firebird – Slide clutch pedal assembly to the left and remove from support brace.

8. Firebird models, remove clevis pin. All models, withdraw brake pedal, spacer and nylon bushings.

BRAKE PEDAL INSTALLATION

1. Lubricate and install nylon bushings on pedal pivot shaft, right side of support brace cutout, and through both ends of brake pedal bore.

2. Pontiac and Tempest – Install brake pedal in support brace.

Firebird – Place pedal assembly in support brace and install clevis pin.

3. Pontiac and Tempest – Slide pedal pivot shaft bolt through support brace and pedal bore.

Firebird – Slide pedal pivot shaft through support brace and brake pedal bore.

4. Pontiac and Tempest – Install nut to pedal pivot shaft bolt.

Firebird – Install retainer to right side of pedal pivot shaft.

5. Install clevis pin retainer.

6. Firebird – Install brake pedal return spring.

7. On manual transmission models, connect clutch pedal push rod to pedal bracket and install retainer. Install clutch pedal return spring.

8. Install stoplight switch.

PEDAL HEIGHT AND STOP LIGHT SWITCH

PEDAL HEIGHT

Before any attempt is made to change brake pedal height, the following areas should be checked to make certain the brake system is functioning correctly.

1. Check adjustment of brakes for proper clearance.

2. Check to make sure hydraulic system is properly bled and bleed if necessary, including master cylinder.

If brakes are properly adjusted and system is void

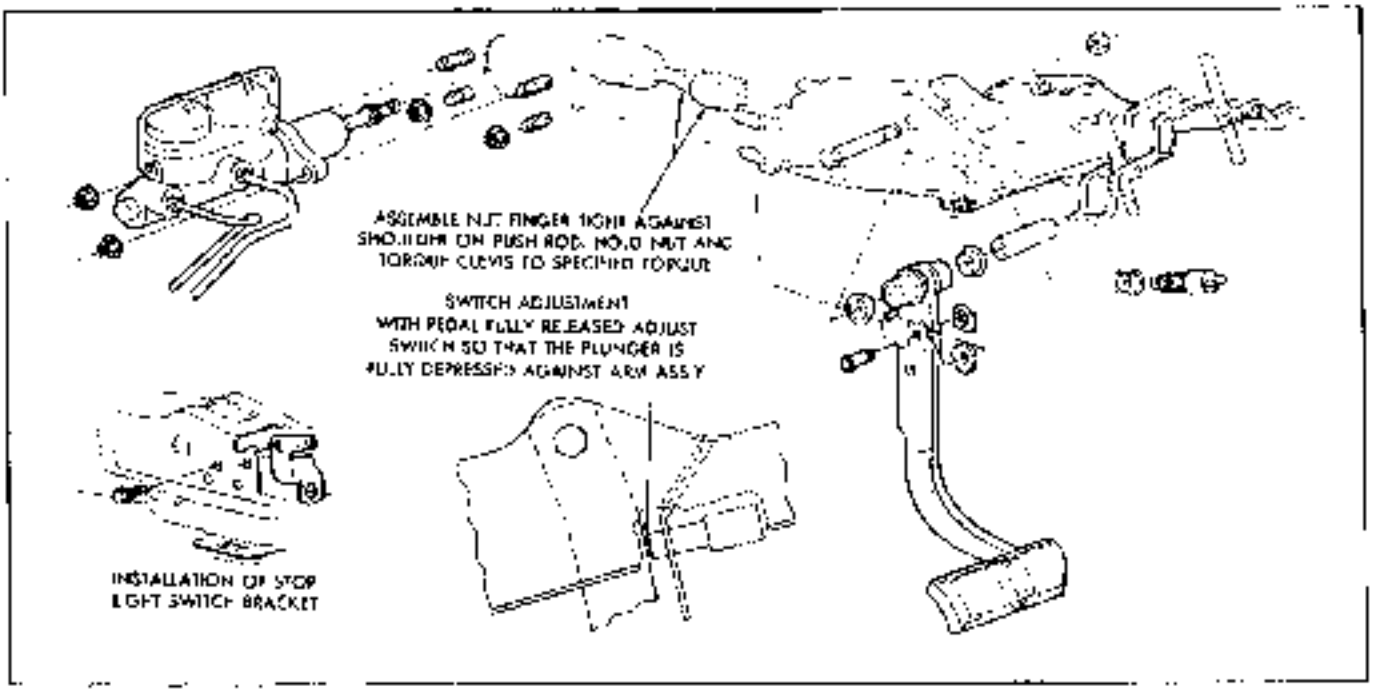


Fig. 5-2 Tempest Manual Brake System

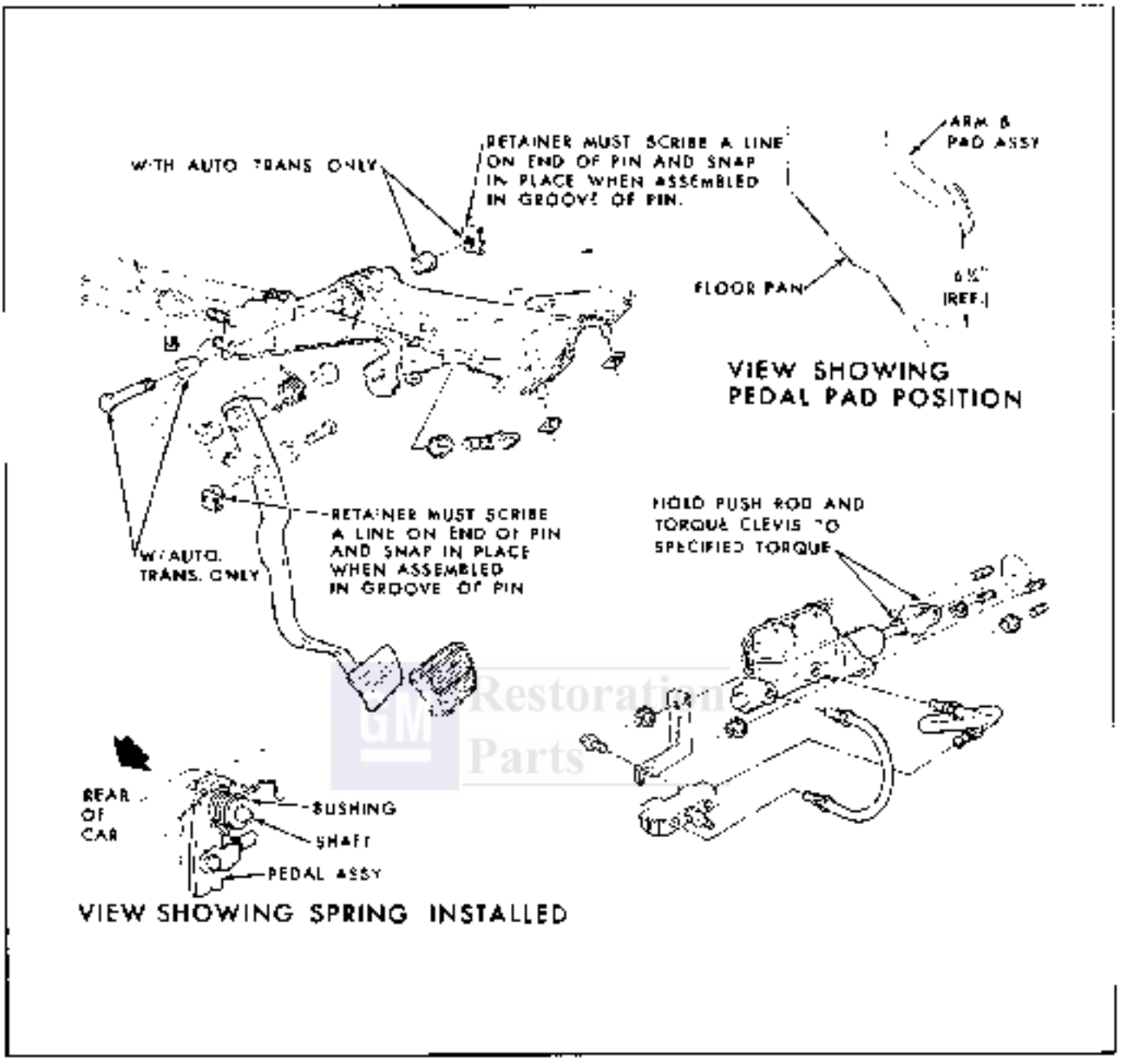


Fig. 5-3 Firesid Manual Brake System

of air and a pedal height adjustment appears necessary, the following procedure should be used.

1. Remove clevis pin retainer.

2. Remove clevis pin.

3. Loosen lock nut.

4. Adjust clevis to obtain proper pedal height.

5. Retighten lock nut against clevis to 90 lb. in. torque.

6. Reinstall clevis pin and secure with retainer.

NOTE: Pontiac power brake and all standard brake equipped vehicles are not adjustable and no adjustment attempt should be made.

Normal adjustment for all units is to bottom lock nut finger tight on push rod. Hold nut and torque clevis to 90 lb. in.

CAUTION: Do not lower pedal more than absolutely necessary as insufficient brake pedal travel may result when used at high speeds with worn linings.

After changing pedal height or stop light switch, sparingly lubricate end of switch plunger and with

pedal fully released (up) adjust switch by pushing body through mounting sleeve so that plunger is fully depressed against pedal arm.

CAUTION: If pedal pressure prevents full return of brake pedal and master cylinder push rod, the master cylinder pistons may be prevented from returning to their stops. This can block off the compensating ports which prevents brake shoes from returning fully when the pedal is released. A further complication which follows a blocked compensating port is lining drag and complete brake burnup on the first prolonged drive. It is necessary that the primary cups be entirely clear of the compensating ports to provide a safety factor against normal rubber swell and expansion and deflection of body parts and pedal linkage.

STOP LIGHT SWITCH

REMOVE

1. Disconnect wires from switch.

2. Remove switch by pulling out of bracket.

REPLACE

1. Position stop light switch in bracket and push in to maximum distance.

2. Connect wires to switch.

3. Brake pedal arm moves switch to correct distance on rebound. Check if pedal is in full return position by lifting slightly by hand. Electrical contact should be made when the brake pedal is depressed 3/8" to 5/8" from fully released position.

BRAKE WARNING LIGHT CHECKING PROCEDURE

1. Determine if bulb is functioning by depressing parking brake.

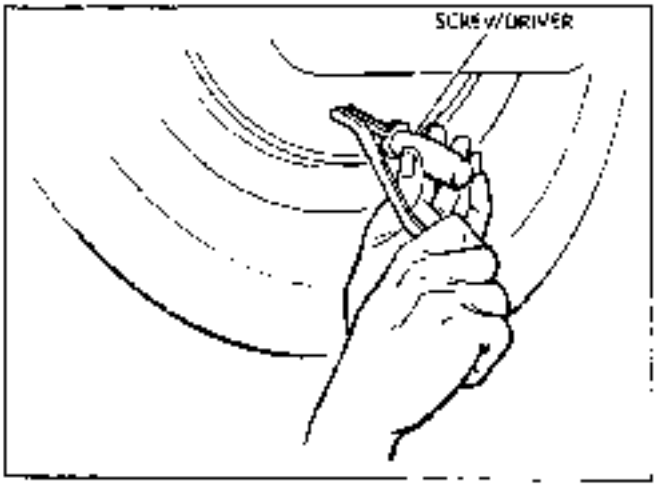


Fig. 5-4 Prepring to Sock Off Adjusting Screw

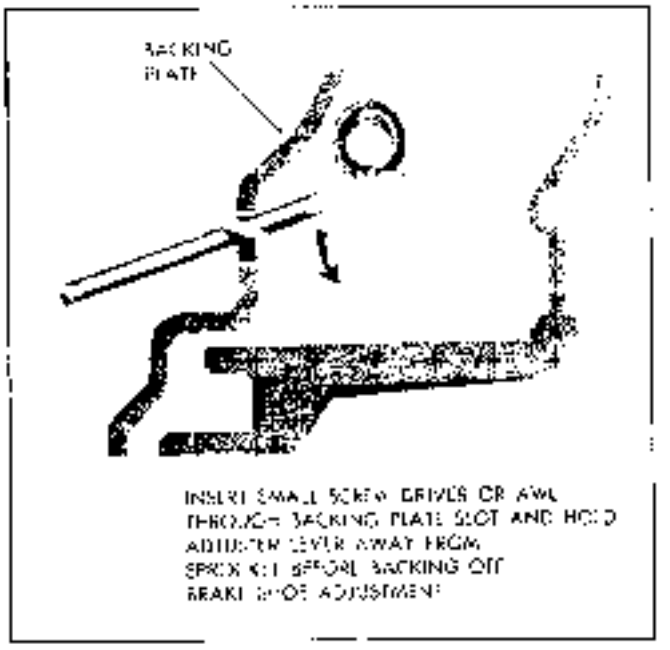


Fig. 5-5 Backing Off Adjusting Screw

2. Check to make sure both master cylinder reservoirs are full.

3. Open one wheel cylinder bleed screw in rear brake system. (Do not remove one from each system.)

4. Depress brake pedal. Do not release pedal. The light should come on due to pressure difference between front and rear systems. Approximately 150-200 psi differential is needed to operate brake light.

5. Close bleed screw. Release brake pedal. Refill rear reservoir, if needed.

NOTE: Caution should be taken to prevent air from entering hydraulic system during checks on switch.

The recommended checking interval should be 24 months or 24,000 miles, any time major brake work is done or any time a customer complains of excessive pedal travel.

BRAKE MECHANISM AND DRUMS

ADJUSTMENT

All four brake assemblies incorporate a self adjusting mechanism to automatically adjust the brake shoes when the car is operated in reverse. A manual adjustment is required only when brake shoes are replaced or the length of the star wheel adjuster has been changed during some other service operation.

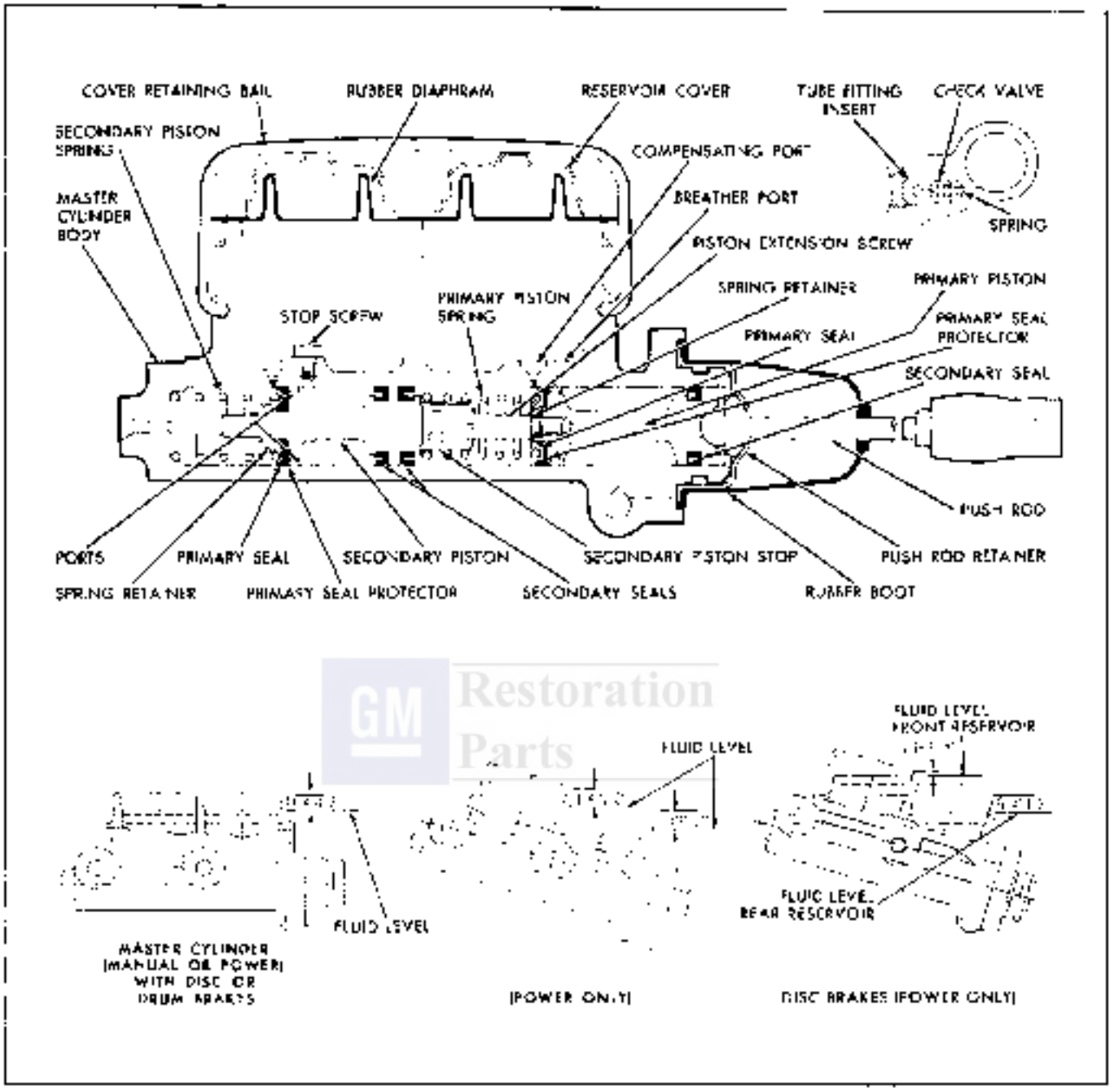


Fig. 5-6 Fluid Levels and Master Cylinder Details

1. Check fluid level in master cylinder. The level should be within 1/2 inch from top of reservoir, Fig. 5-6.

2. Check for correct wheel bearing adjustment (see section 3).

3. Check to make certain parking brake mechanism and linkage are properly adjusted.

4. With wheels removed, remove adjusting hole cover from backing plate and lengthen adjusting screw using J 4735 (Pontiac) or J 8915 (Tempest and Firebird) until a heavy drag is felt on the outer diameter of the drum (approximately a 27 lb. drag).

5. Hold automatic adjuster actuator arm away from adjusting screw with screw driver or probe and back-off one turn (Pontiac - 30 notches, Tempest and Firebird, 20 notches of adjusting screw star wheel). (Fig. 5-4 and 5-5).

This will provide proper drum to lining clearance between secondary lining and drum while primary lining is against drum.

a. At completion of adjustment, drum must rotate without any drag.

b. Replace any parts that prevent free rotation.

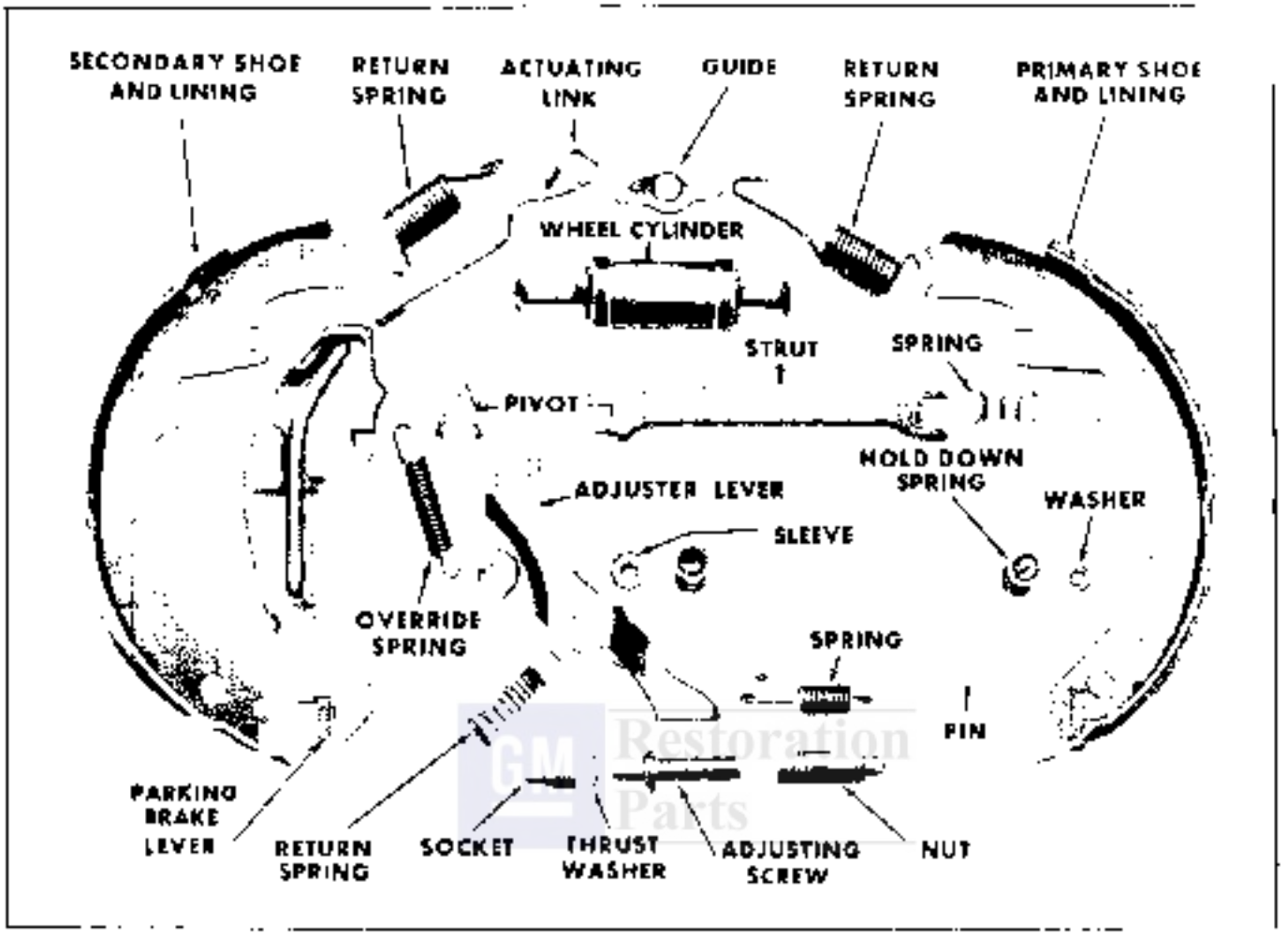


Fig. 5-7 Typical Self Adjusting Brake Assembly — Exploded View — Right Hand Side Rear

NOTE: Mark front and rear brake mechanisms incorporate fixed anchors which must be replaced if they cause improper clearances.

8. Install adjuster plug to adjuster slot in backing plate.

7. Install wheels and tighten nuts to 75 lb. ft. torque (Pontiac), 70 lb. ft. torque (Tempest and Firebird).

8. Drive car alternately forward and backward, moderately applying brakes in each direction to check for proper operation.

DISASSEMBLY

1. Raise all four wheels off ground.

2. Remove front wheels, front hub and drum assemblies, rear wheels and rear drums.

NOTE. It may be necessary to back off the brake shoe adjustment before the brake drums can be removed. To back off shoe adjustment insert a small rod or screwdriver through the adjusting screw slot in the backing plate and hold automatic adjuster lever away from adjusting screw star wheel and rotate adjusting screw upward (Figs. 5-4 and 5-5).

3. Remove the primary and secondary shoe return springs.

4. Remove the actuating link (Fig. 5-7).

5. On rear brakes spread shoes slightly and remove the parking brake lever strut and spring, then disconnect the parking brake cable from the operating lever.

6. Remove the brake shoe hold-down springs, pins and washers, and the adjuster lever and return spring (Fig. 5-7).

7. Spread shoes to clear wheel cylinder links, then remove the primary and secondary shoes as an assembly.

CAUTION: Extreme care must be taken to prevent oil, grease or brake fluid from getting on linings. Even oily fingerprints on linings may affect the operation of brakes.

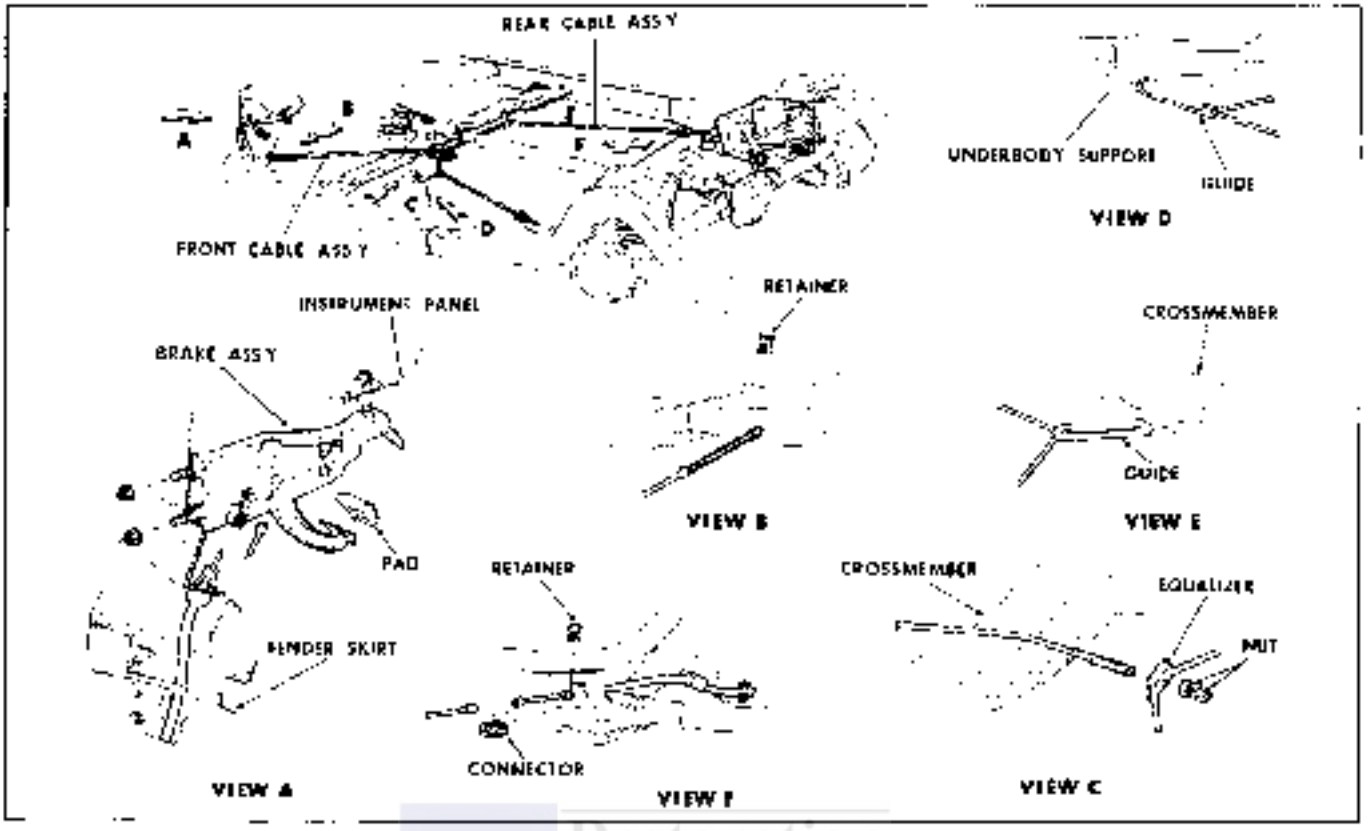


Fig. 5-8 Pontiac Parking Brake System

8. Remove the primary to secondary shoe spring and the adjusting screw.

9. On rear brakes, remove the parking brake lever from the secondary shoe.

INSPECTION AND CLEANING

1. Inspect brake drums for scoring. Road dirt frequently cuts grooves in drums which do not impair operation of brakes unless grooving is extremely severe. When drums are badly scored, inspect brake shoe linings carefully for imbedded foreign material. Replace or recondition only if drums are badly scored.

CAUTION: Removing material from brake drum reduces the strength of the drum and also its ability to transfer heat. Never remove more than is absolutely necessary and in no case remove more than 0.090" (increasing diameter by 0.060"). After a drum is turned, be sure it is free of all metal particles. Whenever a drum is turned, the drum on the opposite side should also be turned. If the drum diameter is less than 0.030" oversize (11.030") after refinishing, standard linings may be installed. If drum diameter is 11.036-11.060", oversize linings must be installed.

NOTE: If new linings are installed on one wheel, they must also be installed on the opposite side of the car.

2. Inspect front wheel bearings and oil seals and replace as necessary.

3. Inspect linings for wear or cracks. Clean brake shoes, drums and backing plates, removing any foreign particles that may have become imbedded in lining surface. Examine shoes for loose rivets which must be replaced. Install new shoes or reline if linings are badly burned or worn nearly flush with rivets or if linings show evidence of oil, grease or brake fluid on the surface.

4. Carefully pull wheel cylinder links out of the boots. Excessive fluid at this point indicates leakage past piston cups.

NOTE: A slight amount of fluid is nearly always present and acts as lubricant for the piston.

5. If an excessive amount of fluid is present, overhaul wheel cylinder. See Hydraulic System.

6. Clean inner surfaces of brake backing plates and all shoe contacting points. Apply a small amount of petroleum base lubricant to pads where brake shoes contact backing plates.

7. Clean exposed portions of parking brake cables.

8. Disassemble the adjusting screw assembly and inspect as follows:

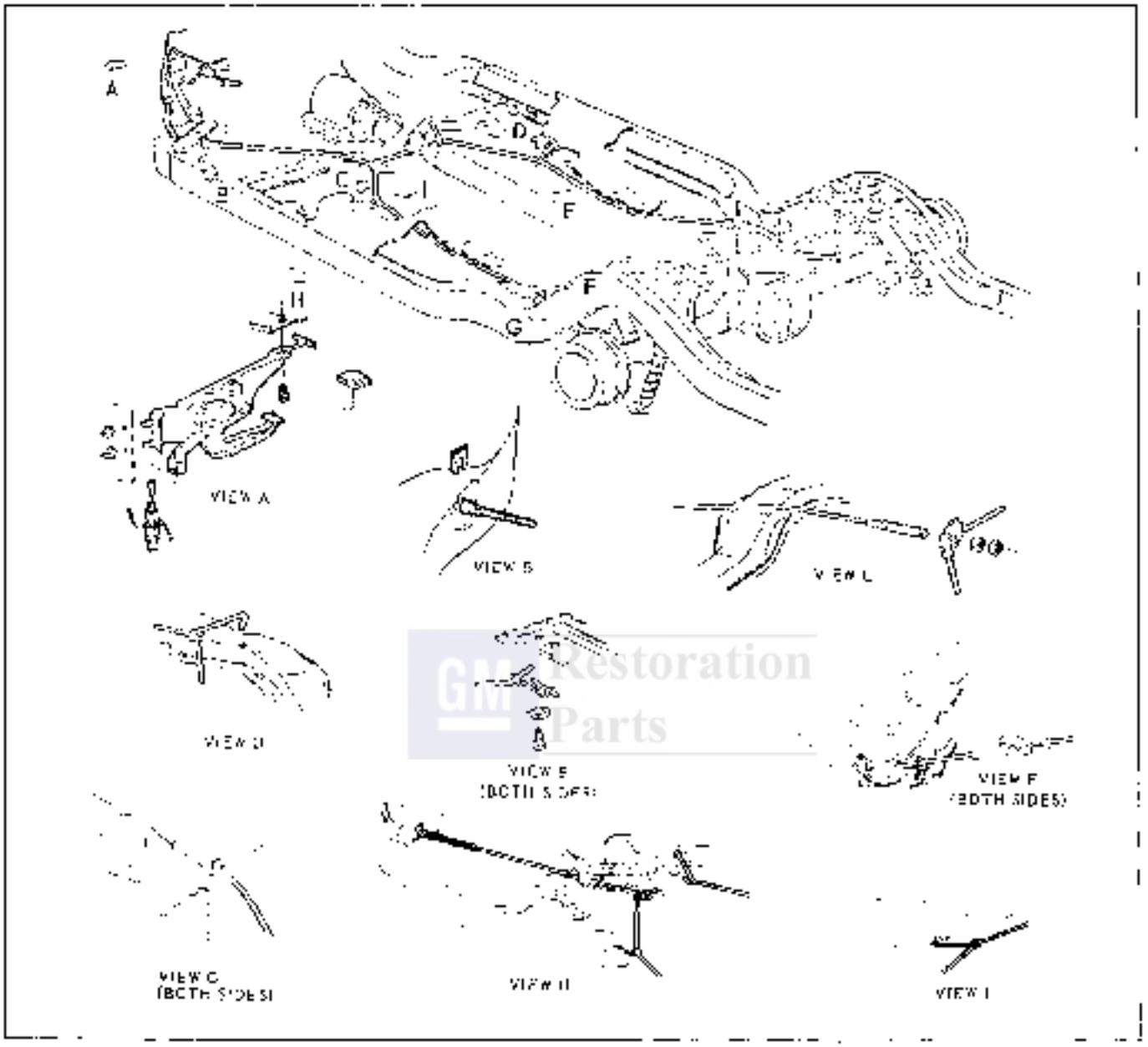


Fig. 5-9 Ten-post Parking Brake System

a. Inspect teeth on star wheel for wear.

b. Remove all foreign material from adjusting screw and nut. Nut must rotate freely on threads.

9. Check adjuster lever to be certain it is not bent or distorted, and that foot is not worn excessively. Replace if necessary.

10. Check the overrode pivot for wear or deformed parts.

11. Check brake drum for build-up of rust and dirt at outer circumference. Remove build-up so that drums can be installed over pre-adjusted linings.

12. Inspect hoses and hydraulic lines for wear, kinks, or damage and replace as necessary.

13. Check to make sure all bolts and nuts securing backing plate to suspension are tightened to 100 lb. ft. torque at upper plate to knuckle bolt, 80 lb. ft. torque at lower bolt and 35 lb. ft. torque on all rear plate to axle flange bolts.

ASSEMBLY

1. Lubricate the adjusting screw threads, backing plate ledges and all other contacting surfaces with a small amount of brake lubricant or wheel bearing lubricant. Do not lubricate teeth of star wheel.

2. Pull parking brake cable forward and rearward through conduit and examine for broken strands. Lubricate freely with light grease or chassis lubricant and return cable to normal position. Remove any excess lubricant.

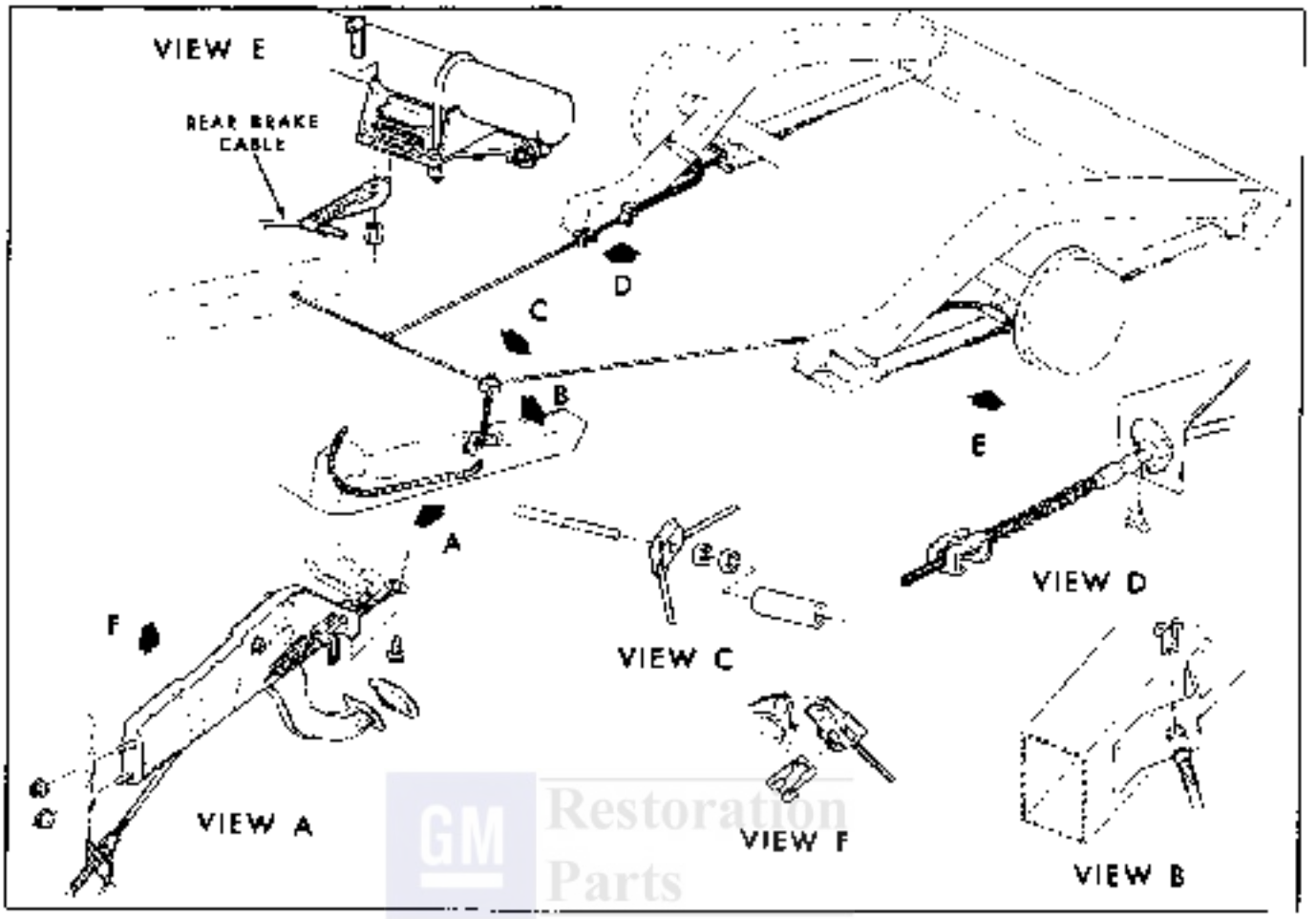


Fig. 5-10 Firebird Parking Brake System

3. On rear brake assemblies, install the parking brake lever to the secondary shoe.

4. Assemble the adjusting screw.

5. Attach the primary to secondary shoe spring to the shoes and install the adjusting screw. The primary to secondary shoe spring must not contact the adjusting screw star wheel.

NOTE: The right front and right rear adjusting screws have left hand threads and can be identified as follows:

PONTIAC

Right front - 5 wide grooves.
Right rear - 1 wide groove.
Left front - 3 V grooves.
Left rear - 1 V groove.

TEMPEST AND FIREBIRD

Right front and rear - 2 wide grooves.
Left front and rear - 2 V grooves.

All adjusting screws must be installed with the star wheel end of the screw toward the rear of the car.

6. Position shoe assembly on the backing plate. Be sure wheel cylinder links are properly positioned in the shoe notches.

NOTE: When replacing shoes, always be certain to assemble secondary shoes to the rear and primary shoes to the front. Note that linings of primary shoes are usually shorter than secondary linings.

7. On rear brakes, connect parking brake lever to secondary shoe and install strut and spring between lever and primary shoe.

8. Position the upper end of actuating link over anchor pin.

9. Engage the adjuster lever with the override pivot, then position the adjuster lever and return spring on the secondary shoe. Fasten with the hold down spring assembly (Fig. 5-7).

NOTE: THE FRONT BRAKE SPRING RETAINING PINS ARE IDENTIFIED WITH THE NUMERAL 6

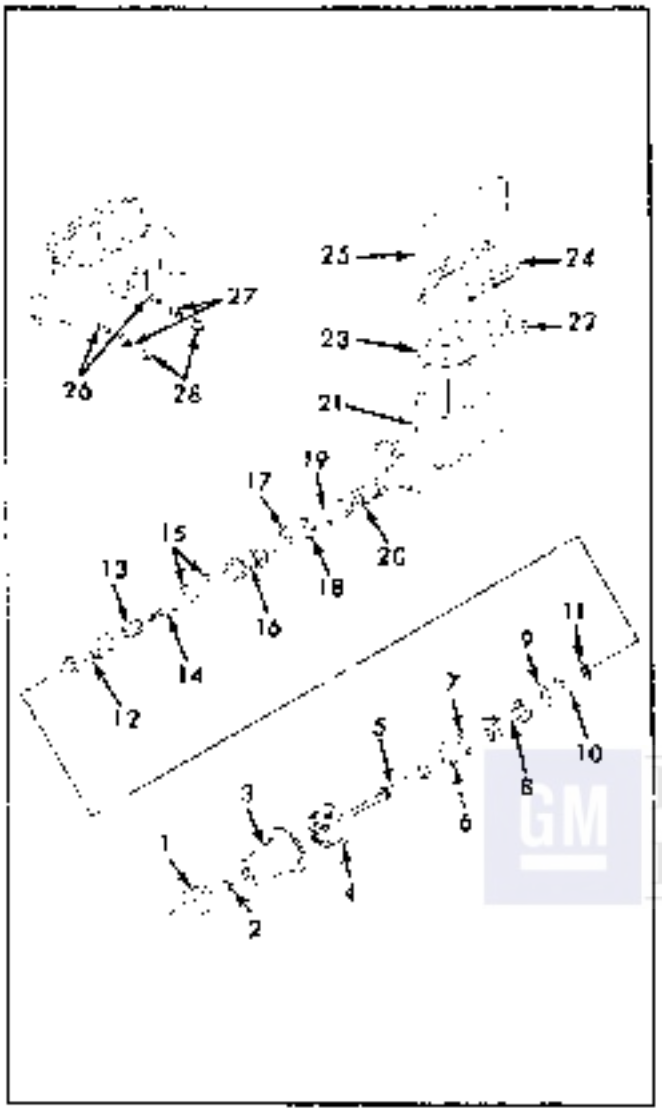


Fig. 5-11 Master Cylinder—Exploded View

1. Chevy
2. Chevy Nut
3. Boot
4. Push Rod Retainer
5. Push Rod
6. Snap Ring
7. Secondary Seal
8. Primary Piston (Rear)
9. Plastic Washer
10. Primary Cup
11. Spring Retainer
12. Primary Piston Spring
13. Secondary Piston Stop
14. Piston Extension Screw
15. Secondary Seal
16. Secondary Piston (Front)
17. Primary Seal Protector
18. Primary Seal
19. Spring Retainer
20. Secondary Piston Spring
21. Master Cylinder Casting
22. Stop Bolt
23. Reservoir Diaphragm
24. Reservoir Cover
25. Reservoir Retaining Bail
26. Check Valves Springs
27. Check Valves
28. Tube Seat Inserts

PONTIAC OR 4 (TEMPEST AND FIREBIRD) STAMPED ON THE OUTER FACE. THE REAR BRAKE RETAINING PINS ARE IDENTIFIED WITH THE NUMERAL 8 (PONTIAC) OR 2 (TEMPEST AND FIREBIRD) STAMPED ON THE OUTER FACE. INSTALL THE PRIMARY HOLD-DOWN SPRING.

10. On rear brakes, install the parking brake cable on the parking brake lever.

11. Install the primary and secondary brake shoe return springs.

NOTE: New brake shoe return springs should be installed if old springs have been overheated or strength is doubted. Overheated springs may be indicated by burned paint, end coils opened up, or failure of shoes to return to anchor pin.

12. Sand linings lightly to remove any trace of dirt.

13. When new shoes or linings have been installed, shorten adjusting screw until drum can slide freely over shoes. Check to see that adjuster lever can turn adjusting screw star wheel with minimum of effort.

14. Install drums, observing instructions for front wheel bearing adjustment as outlined in section 3 of this manual.

15. If wheel cylinder has been replaced or repaired, or hydraulic line has been replaced, bleed brakes as described in this section on BLEEDING BRAKES.

16. Connect parking brake front cable and adjust as outlined under PARKING BRAKE-ADJUSTMENT.

17. Check fluid level in master cylinder as shown in Fig. 5-6.

18. Adjust brake shoes as described in this section on ADJUSTMENT.

19. Install wheels. Tighten nuts (Pontiac) 75 lb. ft., (Tempest and Firebird) 70 lb. ft. torque.

20. Check brake pedal travel to be sure it is within specifications, then road test car for proper operation of the brake system.

CAUTION: New linings must be protected from severe usage for several hundred miles. They should be conveyed to owner, along with instructions to follow proper burnishing procedure as outlined in Owner's Manual.

HYDRAULIC SYSTEM

BLEEDING BRAKES

Depressing the pedal with a low fluid level in master cylinder reservoir or disconnecting any part of the hydraulic system permits air to enter the system.

Air may also enter the system occasionally when brake shoes are replaced. This air must be removed by bleeding.

Bleeding may either be done by hand pumping the brake pedal using bleeder tube as outlined below or by using pressure bleeding equipment.

CAUTION: Always clean away any dirt around master cylinder reservoir cover before removing cover for any reason. Never depress pedal while brake drums are removed unless bleeder valve is open.

When using pressure bleeding equipment follow instructions of the equipment manufacturer and always use bleeder tube attached to wheel cylinder to prevent brake fluid from running inside the brake assembly and ultimately on the brake linings.

When bleeding by operating pedal proceed as outlined below:

1. Fill master cylinder reservoir with recommended brake fluid.

CAUTION: Never use an inferior or reclaimed brake fluid as this will positively result in brake trouble. Even though reclaimed fluid may look clear, tests have shown such fluid to be corrosive. If there is doubt as to the grade of fluid in the system, flush out system and fill with recommended brake fluid complying with SAE 70-R-1 specifications such as Delco Supreme 11.

2. On models equipped with master cylinder bleeder screws (Tempest and Firebird Power Brake units), bleed master cylinder by following procedure. Attach bleeder tube to valve and allow tube to hang submerged in brake fluid in a clean quart glass jar. Using brake bleeder wrench or equivalent, unscrew bleeder valve three quarters of a turn. Depress pedal full stroke and allow it to return slowly making sure end of bleeder tube is under surface of liquid in container. Continue operating pedal, refilling reservoir after each five strokes (unless an automatic filling device is used), until liquid containing no air bubbles emerges from bleeder tube.

3. Close bleeder valve assembly and bleed other master cylinder bleeder valve.

NOTE: If a power brake unit has been installed on a Tempest or Firebird and the original manual master cylinder (without bleeder valves) is used, these units may be bled by unscrewing the master cylinder brake line three-quarters of a turn, depressing brake pedal, tightening brake line, then releasing brake pedal.

4. After master cylinder has been bled wheel cylinders may be bled in the following order using the above procedure: left front, right front, left rear and right rear.

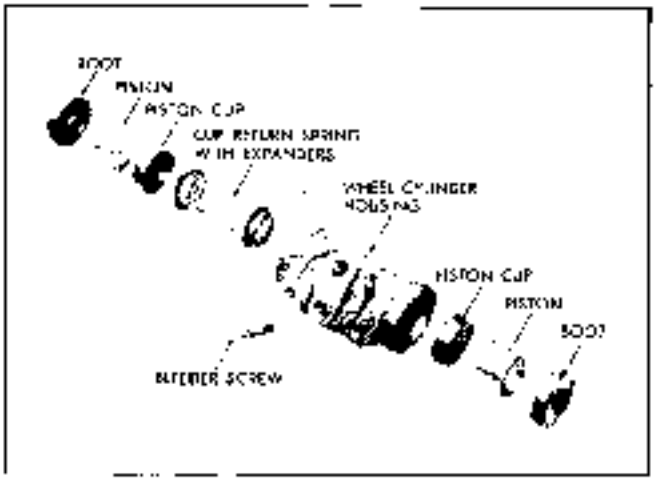


Fig. 5-12 Wheel Cylinder—Exploded View

CAUTION: Bleeder tube should always be used when bleeding brakes, and end of tube must be below level of brake fluid in glass jar when bleeding other than by pressure.

5. When bleeding operation is completed, refill reservoir as shown in Fig. 5-6, then replace reservoir cover.

FLUSH HYDRAULIC SYSTEM

It may sometimes become necessary to flush out the brake hydraulic system due to the presence of mineral oil, kerosene, gasoline, carbon tetrachloride, etc., which will cause swelling and/or deterioration of rubber piston cups and valves so they become inoperative.

NOTE: If it becomes necessary to replace brake fluid lines, use only steel lines with double-flared ends.

To flush hydraulic system proceed as follows:

1. Attach bleeder tube and open bleeder valve at left front wheel.

2. Flush out system thoroughly with clean denatured alcohol, pumping the fluid from master cylinder reservoir and out of wheel cylinder bleeder valve.

3. Repeat steps 1 and 2 at remaining wheel cylinders. To ensure thorough flushing, approximately 1/2 pint of alcohol should be bled through each wheel cylinder.

4. Replace all rubber parts in master and wheel cylinders. Thoroughly clean cylinders and pistons in alcohol before installing new parts.

5. After installing parts, fill system with recommended brake fluid and follow steps 2 through 4 under BLEEDING BRAKES to flush system of cleaning

solution and to bleed brakes. In doing this, pump brake fluid from wheel cylinder bleeder valves until clear fluid flows from bleeder tube and then continue until no air bubbles emerge from bleeder tube.

The dual master cylinder is designed and built to satisfy individual brake system displacement requirements (Fig. 5-6). Therefore, it is necessary that the following basic rules be used when replacing either a complete master cylinder or parts.

1. The two-letter identification stamp on the end of master cylinder indicates displacement capabilities of a particular cylinder. Master cylinder should only be replaced with another cylinder bearing the same two-letter identification.

2. The lengths of component pistons in a master cylinder are critical factors in displacement capabilities of a master cylinder. Pistons are coded, using rings or grooves in shank of piston. When pistons are replaced, replacement piston must contain same identification marks and same contour at push rod end as piston which was removed.

3. The dual master cylinder, used with standard brakes contains a rubber check valve and check valve spring in each outlet boss. No check valve is required for disc brakes and, therefore, the outlet boss to the front brakes will not contain a check valve and spring.

MASTER CYLINDER

REMOVE

1. Disconnect brake lines from two outlets on master cylinder and tape end of lines to prevent entrance of dirt.

2. Disconnect master cylinder push rod from brake pedal.

3. Remove master cylinder from dash.

DISASSEMBLE

1. Remove master cylinder reservoir cover and drain fluid. Pump fluid from master cylinder by depressing push rod.

NOTE: A new type of retained push rod is used on all standard brake applications.

2. Pull boot from master cylinder, to uncover push rod retainer.

3. The retainer has a small, depressed tab in the side and may be pried up to release retainer. Tab serves to hold retainer and push rod on master cylinder while it is being shipped. It is not necessary to bend tab down at reassembly as retainer is held in place between master cylinder and dash when master cylinder is bolted to car.

MASTER CYLINDER USAGE CHART

USAGE	Master Cyl. Ident. Stamp.	Bore* Size	Primary* Piston Ident.	Secondary Piston Ident.
Delco Moraine				
Pontiac Std. - Power Drum & Manual Drum	HJ	1"		No Rings or Grooves
Tempest - Power Drum & Manual Drum	CT	1"		1 Ring or 1 Groove
Firebird - Power Drum & Manual Drum	CT	1"		1 Ring or 1 Groove
Firebird - Disc (Power & Manual)	FR	1-1/8"		3 Rings or 3 Grooves
Tempest - Manual Disc	GD	1-1/4"		7 Rings or 7 Grooves
Tempest - Power Disc	DW	1-1/2"		6 Rings or 6 Grooves
Bendix				
Pontiac - Drum	HC	1"	716	
Pontiac - Disc	YM	1-1/8"	704	
Pontiac - Heavy Duty	PP	1"	6213	

*Number stamped on side of piston.

4. Remove small secondary piston stop bolt from bottom of front fluid reservoir of master cylinder.

5. Place master cylinder in soft jaws of vise. Remove lock ring from small groove in inside diameter of bore. Remove primary piston (rear). Remove secondary (front) piston, piston spring and retainer by applying air pressure through front stop bolt hole. Do not attempt to disassemble front piston since complete new assembly is provided in repair kit.

NOTE: If air is not available, a piece of wire may be used. Bend one fourth inch of one end of wire into right angle and hook end under edge of floating piston to remove.

6. For your convenience, in the event they are needed, repair kits contain replacement check valves and springs. Following are the conditions under which the check valves should be replaced:

a. Whenever fluid in brake system is contaminated.

b. Whenever foreign material or sediment is found inside reservoir.

c. If vehicle is 5 years old, or has 10,000 miles or more on it.

d. If hydraulic brake master cylinder was subjected to excessive heat such as fire due to accident, etc.

NOTE: In most cases, it will not be necessary to install new check valves unless conditions above exist; therefore, unless they do exist, it is not recommended that the check valves be replaced. If check valves do require replacement, carefully follow the service procedure outlined below.

7. With master cylinder in vise (outlet holes up), drill out the tube fitting insert with a 13/64" drill and then tap the hole, using a 1/4" x 20 tap. Place a 1/2" to 3/4" long, 1/4" x 20 bolt through a thick washer and then thread the bolt into the insert. Tighten the bolt against the washer until the insert is removed.

8. Remove check valves and springs from cavities beneath tube seats.

9. Remove master cylinder from vise and inspect bore for corrosion, pits and foreign matter. Make sure outlet ports are clean and free of brass cuttings from tube-seat removal operation. Inspect fluid reservoirs for foreign matter. Check bypass and compensating ports to master cylinder bore to insure they are not restricted. Do not use wire to check ports.

10. Remove primary seal, primary seal protector and secondary seals from front piston.

Cleaning

Use a reputable cleaner or clean brake fluid to clean all metal brake parts thoroughly. Immerse parts in cleaning fluid using a bristle brush to remove foreign matter. Blow out all passages, orifices and valve holes. Air dry and place cleaned parts on clean paper or lintfree cloth.

NOTE: Dirt is the major cause of trouble and wear in service. Be sure to keep parts clean until reassembly. Recheck at reassembly if there is any occasion to doubt cleanliness.

ASSEMBLE

1. Place master cylinder in vise, with outlet holes up. Place check valve springs in outlet holes, so they will seat in depression in bottom of holes. Place new rubber check valves over springs, being careful not to displace springs from their seat.

2. Place new brass tube seat in outlet holes in position to be pressed into outlet hole. Be sure that it is not cocked, as this would cause burrs to be turned up when the tube seat is pressed in. Recommended method of inserting tube seat is to thread a spare brake line tube nut into outlet hole and turn nut down until tube seat bottoms. Remove tube nut and check outlet hole for loose burrs, which might have been turned up when the tube seat was pressed down.

3. Put new secondary seals in the two grooves in the end of front piston. Seal which is nearest the end of the piston will have its lips facing toward that end. The second groove seal should have its lips facing toward the portion of front piston which contains small compensating holes.

4. Assemble a new primary seal and protector over end of front piston with flat side of seal seating against seal protector and protector against flange of piston which contains the small compensating holes (Fig. 5-6).

5. All master cylinder overhaul kits contain assembled primary piston, making it unnecessary to assemble any primary piston component parts.

6. Coat bore of master cylinder, primary and secondary seals on front piston with clean brake fluid. Insert secondary piston spring retainer into secondary piston spring. Place retainer and spring down over end of front piston locating retainer inside lips of primary cup.

7. Holding master cylinder with open end of bore down, push front piston into bore, seating spring against closed end of bore.

8. Place master cylinder in vise with open end of bore up. Coat primary and secondary seal on rear piston with clean brake fluid. Push rear piston as-

sembly, spring end first, into bore of master cylinder. Hold piston down and snap lock ring into position in small groove in I.D. of bore.

9. Continue to hold rear piston down, which will move front piston forward far enough to clear stop screw hole located in bottom of front fluid reservoir. Position stop screw in its hole and tighten to a torque of 30 pound inches.

10. Install a new reservoir diaphragm in reservoir cover, if needed. Install cover on master cylinder. Bonded side forms casting to insure positive sealing. Push bail wires into position to hold reservoir cover.

11. Assemble push rod through push rod retainer, if disassembled.

12. Push retainer over end of master cylinder. Assemble new boot over push rod and press it down over push rod retainer.

REPLACE

1. Mount and secure master cylinder to dash, tighten bolt to 25 ft.lb. torque. The flange on the push rod retainer and flange on boot will be held between the dash and master cylinder.

2. Connect push rod to brake pedal and attach brake lines to appropriate boss on master cylinder. Outlet boss thread sizes and brake line fittings for front and rear are different, to assure that correct connections are made, providing original brake lines have not been changed.

3. Bleed master cylinder as though it were two separate units. See section on bleeding brakes. After bleeding, fill reservoirs with brake fluid to within 1/2" of top of reservoir.

WHEEL CYLINDER

REMOVE

1. Raise wheels of vehicle and remove wheel and drum assembly.

2. On Tempests, remove brake pipe.

3. Disconnect hose from wheel cylinder on Firebird and Pontiac.

4. Remove brake shoes to protect them from dripping fluid.

5. Remove wheel cylinder.

The internal wheel cylinder boots should be removed from cylinder body only when they are visibly damaged or leaking fluid.

Wheel cylinders having torn, cut or heat-cracked boots should be completely overhauled.

Inspection for leakage may be accomplished at the boot center hole after removal of the link pin. Fluid coatings on the piston within the cylinder and on the end of the link pin removed from the boot are normal, as the cylinder contains a porous piston which is impregnated with a corrosion-inhibiting fluid. Fluid spilling from the boot center hole, after the link pin is removed, indicates cup leakage and the necessity for completely overhauling the cylinder.

DISASSEMBLE (Fig. 5-12)

1. Pull boots from cylinder ends with pliers and discard boots.

2. Extract and discard pistons and cups.

3. Inspect cylinder bore. Check for staining or corrosion. It is best to discard a corroded cylinder.

NOTE: Staining is not to be confused with corrosion. Corrosion can be identified as pits or excessive bore roughness.

4. Polish any discolored or stained area with crocus cloth by revolving the cylinder on the cloth supported by a finger. Do not slide the cloth in a lengthwise manner under pressure. Do not use any other form of abrasive or abrasive cloth.

5. Rinse the cylinder in brake fluid.

6. Shake excess rinsing fluid from the cylinder. Do not use a rag to dry the cylinder, as lint from the rag cannot be kept from the cylinder bore surfaces.

7. Lubricate the cylinder bore and counterbore with brake fluid and insert spring-expander assembly.

8. Install new cups making sure cups are lint and dirt free. Do not lubricate cups prior to assembly.

9. Install new pistons in the as received condition to insure proper corrosion inhibiting properties. Do not lubricate pistons with brake fluid.

10. Press new boots into cylinder counterbores by hand. Do not lubricate boots prior to assembly.

REPLACE

1. Install wheel cylinder on backing plate with screws and lock washers. Tighten screws to 14 1/2 lb. ft. torque (Pontiac 9 lb. ft. torque (Tempest and Firebird).

2. Replace wheel cylinder connecting links.

3. Install brake shoes and springs.

4. Connect hose or pipe to wheel cylinder. (Use new gasket with hose.)

5. Install brake drums. Adjust front wheel bearings (as described in Section 3, SUSPENSION).

6. Bleed all brake lines as described under BLEEDING BRAKES in this section.

7. Adjust and test brakes as previously described in this section.

PARKING BRAKE

The rear brake assemblies serve a dual purpose in that they are utilized both as a hydraulically operated brake and a mechanically operated parking brake. In view of this dual purpose, the hydraulic brake must be properly adjusted as a base for parking brake adjustment.

NOTE: Automatic brake adjusters normally keep the parking brake adjusted correctly, however, there may be a condition where the parking brake system will require additional adjustment even though the service brakes are perfectly satisfactory.

INSPECTION, CLEANING AND LUBRICATION

If complete release of the parking brake pedal is not obtained unless the pedal is forcibly returned to its released position, or if the application effort is high, check parking brake pedal assembly for free operation. If operation is sticky or a bind is experienced, correct as follows.

1. Clean and lubricate cables (within conduits) and cable contact areas with lithium soap grease or equivalent.

2. Inspect brake pedal assembly for straightness and alignment.

3. Clean and lubricate parking brake pedal assembly with chassis grease.

4. Check routing of cables for kinks, binds and broken strands.

ADJUSTMENT

CAUTION: It is very important that parking brake cables are not adjusted too tightly causing brake drag. With automatic brake adjusters, a tight cable causes brake drag and also positions the secondary brake shoe, lower the adjuster lever, so that it continues to adjust to compensate for wear caused by the drag. The result is a cycle of wear and adjustment that can wear out linings very rapidly.

1. Jack up both rear wheels.

2. Push parking brake pedal five to seven notches from fully released position (Pontiac and Tempest). Two notches on Firebird models.

3. Loosen the equalizer rear lock nut. Adjust the forward nut until a light to moderate drag is felt when rear wheels are rotated.

4. Tighten lock nut.

5. Fully release parking brake and rotate rear wheels; no drag should be present.

PARKING BRAKE PEDAL REMOVAL

NOTE: Remove positive cable from battery to eliminate the possibility of creating short circuits under dash

1. Place parking brake pedal in released position.

2. Remove equalizer check nut and separate cable stud from equalizer.

3. Remove two attaching nuts from mounting studs located in engine compartment.

4. Remove front cable ball end from pedal swivel.

5. Remove pedal to dash brace attaching screw.

6. Remove brake pedal switch wire.

7. Remove pedal assembly by lowering rear slightly to avoid scratching dash, and pulling it out of the firewall.

BRAKE PEDAL INSTALLATION

1. Place pedal in position with the two mounting studs protruding through the holes provided in the firewall.

2. Position front cable ball end into pedal swivel.

3. Install and tighten pedal to dash brace attaching screw.

4. Install parking brake switch wire.

5. Install and tighten two attaching nuts on mounting studs located in engine compartment.

6. Place equalizer in position on center cable and insert front cable stud through equalizer and secure with check nut.

7. Adjust parking brake as outlined under Parking Brake Adjustment.

8. Connect positive battery cable.

FRONT CABLE REMOVAL

NOTE: Remove positive cable from battery to eliminate the possibility of creating short circuits under dash.

1. Place parking brake pedal in release position.

2. Remove equalizer check nut and separate cable stud from equalizer.

3. Remove retainer from cable at inner side of frame rail.

4. Remove ball end of cable from pedal swivel by removing clip.

5. Pontiac and Tempest - Position left fender and inner fender panel to allow access to cable.

6. Compress expanded conduit locking fingers at toe pan and withdraw cable from under car.

FRONT CABLE INSTALLATION

1. Position cable ball and conduit tip through cut out in firewall. Make sure conduit locking fingers are fully expanded and secured in cutout, then position cable ball into pedal swivel.

2. Feed stud end of cable through frame rail and secure with retainer on inner side of frame.

3. Replace inner fender panel and left fender.

4. Place one check nut on cable stud and insert stud through equalizer (make sure center cable is in position), then place check nut on stud.

5. Adjust parking brake as outlined under Parking Brake Adjustment.

6. Connect positive battery cable.

CENTER CABLE REMOVAL AND INSTALLATION

1. Place parking brake pedal in released position.

2. Remove equalizer check nut and remove equalizer from cable.

3. Remove cable from cable guides.

4. Disconnect center cable from rear cables at connectors.

5. To install, reverse above procedures and adjust as outlined under Parking Brake Adjustment.

REAR CABLES REMOVAL AND INSTALLATION

1. Place parking brake pedal in released position.

2. Remove equalizer check nut and remove equalizer from cable.

3. Remove rear cable from connector.

4. Remove retainer from rear cable at frame bracket. Pull cable out of bracket.

5. Remove rear brake drums.

6. Remove rear brake shoes.

7. Remove cable end from parking brake actuating lever.

8. Tempest and Firebird - Compress expanded conduit locking fingers at flange plate entry hole and withdraw cable.

Pontiac - Remove cable anchor at backing plate and remove cable.

9. To install, reverse above procedure and adjust as outlined under Parking Brake Adjustment.

PONTIAC SPECIFICATIONS

NEW DRUMS

Inside diameter—Front ..... 11"
—Rear ..... 11"

Out-of-round including taper for full width (max.)—Front ..... .005"
—Rear ..... .005"

Indicator shall not change more than .0025" in any inch of circumference.

FLUID ..... Fluid which complies with heavy duty standards of SAE 70-R-3 specifications.

LINING

Width—Front ..... 2 3/4"
—Rear ..... 2"

Thickness (front and rear) ..... .220" Min. .260" Sec.

Effective braking surface area ... 187.0 sq. in.

MASTER CYLINDER BORE

Standard system ..... 1"
Disc Brake system ..... 1.125"

PEDAL HEIGHT (underside of standard pedal pad to floor pan) ..... 7 3/8"

WHEEL CYLINDER BORE —Front ..... 1 1/16"
—Rear ..... 15/16"

TORQUE SPECIFICATIONS
Torque in lb. ft. unless otherwise specified

APPLICATION	TORQUE
Bolt-Wheel Cylinder to Backing Plate	14 1/2
Bolt and Nut—Front Brake to Stg. Knuckle Lower	75
Bolt—Front Brake to Stg. Knuckle Upper ..	100
Bolt and Nut—Rear Brake to Axle Housing ..	35
Screw—Wheel Cylinder Bleeder	75 in. lb.
Bolt and Nut—Brake and Clutch Pedal Shaft	30
Nut—Brake and Clutch Pedal Mtg. Brkt. to Dash	28
Bolt—Parking Brake Lever to Instrument Panel	8
Nut—Parking Brake Lever to Dash	8
Nut—Brake Master Cylinder to Dash	28
Bolt—Parking Brake Rear Cable Anchor to Brake	25
Screw—Front Brake Hose Bracket to Frame	8
Screw—Rear Brake Hose Brkt. to Axle Housing	8
Screw—Master Cylinder Brake Pipe Conn. to Frame	9
Nut—Brake Pipe Connector	9

TEMPEST AND FIREBIRD SPECIFICATIONS

NEW DRUMS

Inside diameter—Front and Rear ..... 9 1/2"

Out of Round Maximum
—Front ..... .005"
—Rear ..... .006"

Indicator reading shall not vary more than .0005" per inch of circumference.

LINING

Width—Front ..... 2 1/2"
—Rear ..... 2"
Thickness (Front and Rear)—Primary ... 0.196"
—Secondary .. 0.265"
Effective braking surface area ... 149.4 sq. in.

MASTER CYLINDER BORE

Standard system ..... 1"
Disc brake system ..... 1.125"

FLUID

Fluid that complies with heavy-duty standards of SAE 70-R-3 Specifications.

PEDAL HEIGHT

Underside of Pedal Pad
to Floor Pan - Tempest ..... 7 1/8"
- Firebird ..... 6 1/8"

WHEEL CYLINDER BORE

—Front ..... 1 1/8"
—Rear ..... 7/8"

TORQUE SPECIFICATIONS
Torque in lb. ft. unless otherwise specified

APPLICATION	TORQUE
Front brake to steering knuckle—lower bolt and nut	75
Front brake to steering knuckle—upper bolt (bolt lubrication)	100
Rear brake to axle housing bolt and nut	35
Brake master cylinder to dash nut	24
Wheel cylinder to backing plate bolt	8
Wheel brake cylinder bleeder screw	75 in. lbs.
Parking brake lever to dash nut	8
Parking brake front cable to equalizer nut	6
Parking brake lever to instrument panel bolt	8

SPECIAL TOOLS

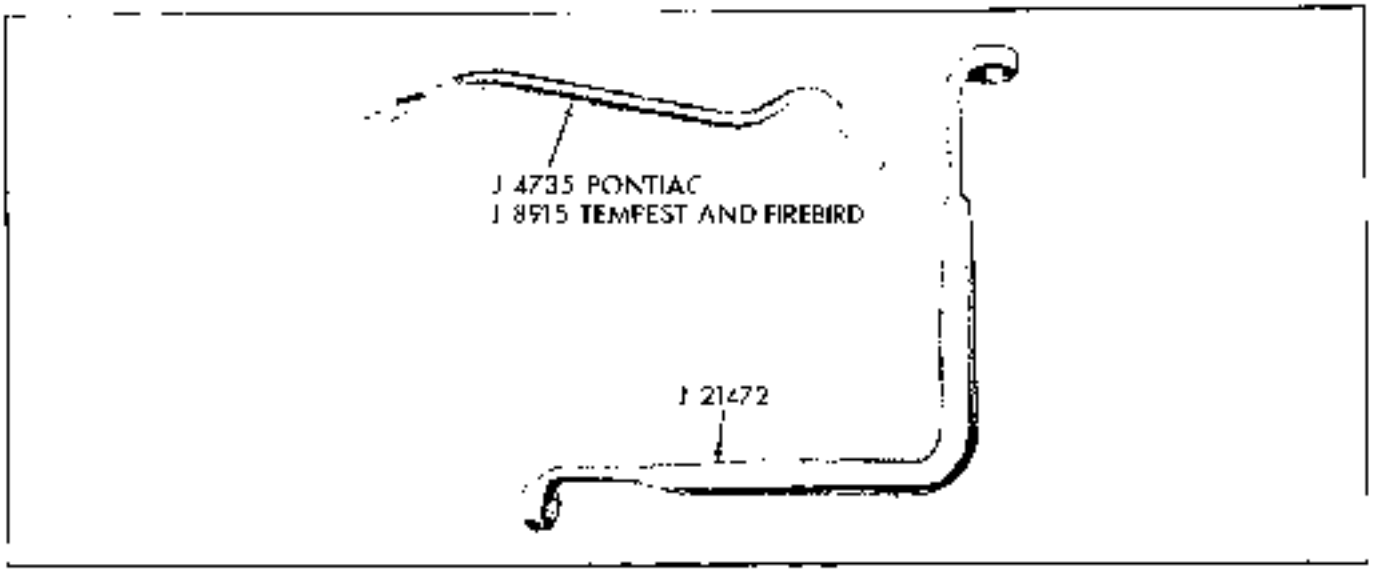


Fig. 5-13 Special Tools

J 4735 - Pontiac Brake Adjusting Tool
J 8915 - Tempest and Firebird Brake Adjusting Tool
J 21472 - Brake Bleeder Wrench

DELCO-MORAINE POWER BRAKE

CONTENTS OF THIS SECTION

CHECKS AND ADJUSTMENTS ON CAR

1. Check for free operation of brake pedal. If binding exists, check pivot points for binding and lubricate as required.

2. Check stop light switch for proper setting and operation.

3. Check fluid level in hydraulic cylinder reservoir. Fluid level should be as shown in Section 6.

4. Check vacuum line and connections between carburetor and vacuum power cylinder for possible vacuum leaks.

5. Check engine for good stall-free idle. Correct as required.

MINOR REPAIRS

BLEEDING BRAKES

Brakes should be bled in the same manner as standard brakes, unless a balance valve is incorporated in the system.

STOP LAMP SWITCH

The stop lamp switch has a slip fit in the mounting sleeve which permits positive adjustment by pulling the brake pedal up firmly against the stop. The pedal arm forces the switch body to slip in the mounting sleeve bushing to properly position switch.

REMOVE

1. Disconnect switch wires by removing plug at stop light switch.

2. Remove switch by turning out of bracket.

REPLACE

1. Position stop light switch in bracket and push an maximum distance.

2. Connect switch wires by inserting plug on switch.

3. Brake pedal arm moves switch to correct distance on rebound. Check if pedal is in full return position by lifting slightly by hand.

OVERHAUL DELCO-MORAINE POWER BRAKE

MASTER CYLINDER ONLY—REMOVE

Certain repair operations, such as replacement of master cylinder internal parts, permits the master cylinder to be removed by itself, leaving the power cylinder pedal and brackets in the car.

1. Remove hydraulic connections from master cylinder, pump fluid from cylinder into a container and dispose of fluid. Cover cylinder openings and pipe ends to exclude dust, dirt, etc.

2. Remove master cylinder attaching nuts and remove master cylinder from vacuum power section.

POWER BRAKE AND MASTER CYLINDER ASSEMBLY—REMOVE

1. Disconnect vacuum hose at vacuum check valve. Plug hose and cover valve opening to exclude dust, dirt, etc. (Fig. 5A-1, 5A-2, 5A-3).

2. Disconnect pipes from master cylinder hydraulic ports and cover openings and pipe ends to exclude dust, dirt, etc.

3. Remove retainer and clevis pin from brake pedal inside car.

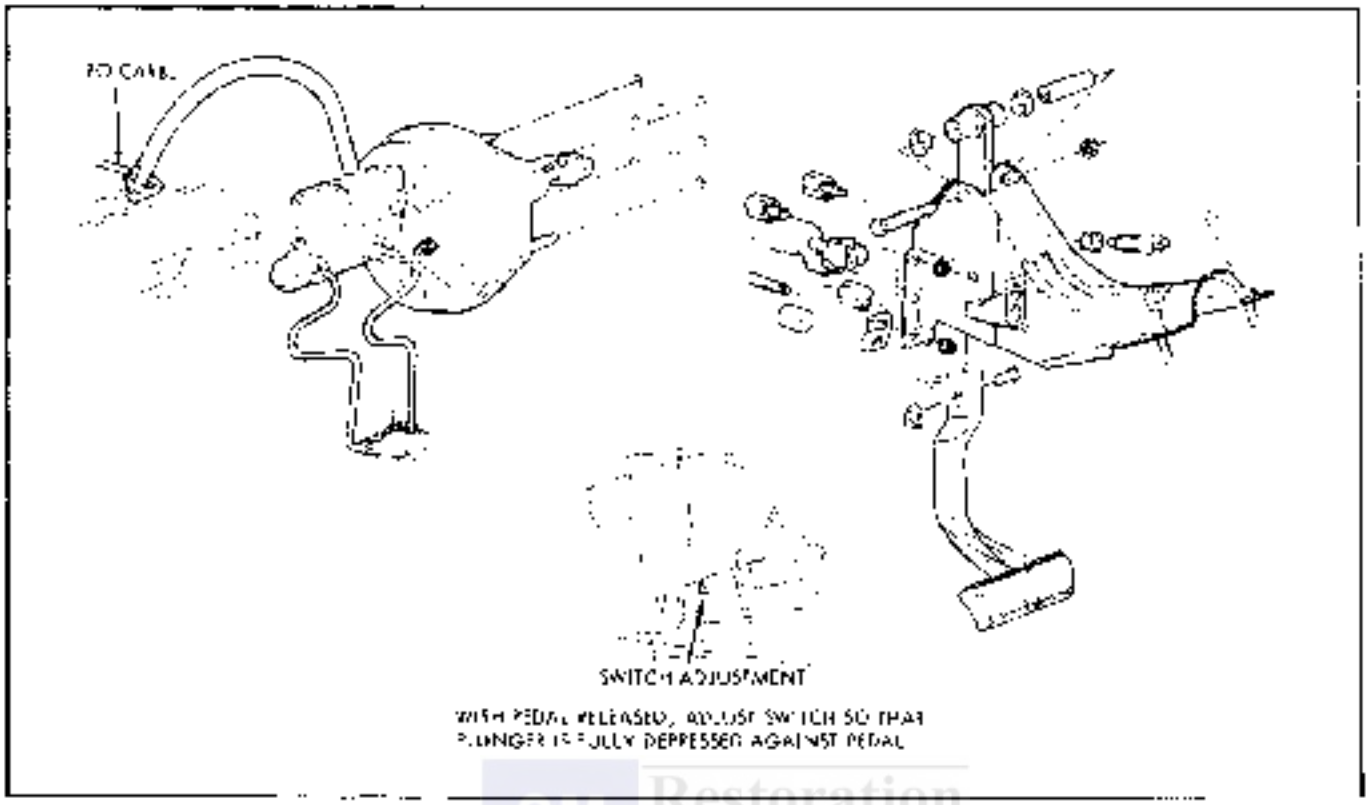


Fig. 5A-1 Pontiac Power Brake System

4 Remove nuts and lock washers from rear half housing and remove power cylinder assembly.

5 Clean exterior of power brake assembly and drain reservoir of hydraulic fluid.

OVER-ALL BRAKE UNIT—DISASSEMBLE

1. Using an old master cylinder or tool J22809-01, put power brake unit in a vise, push rod up, clamping on sides of master cylinder reservoir (Fig. 5A-4).

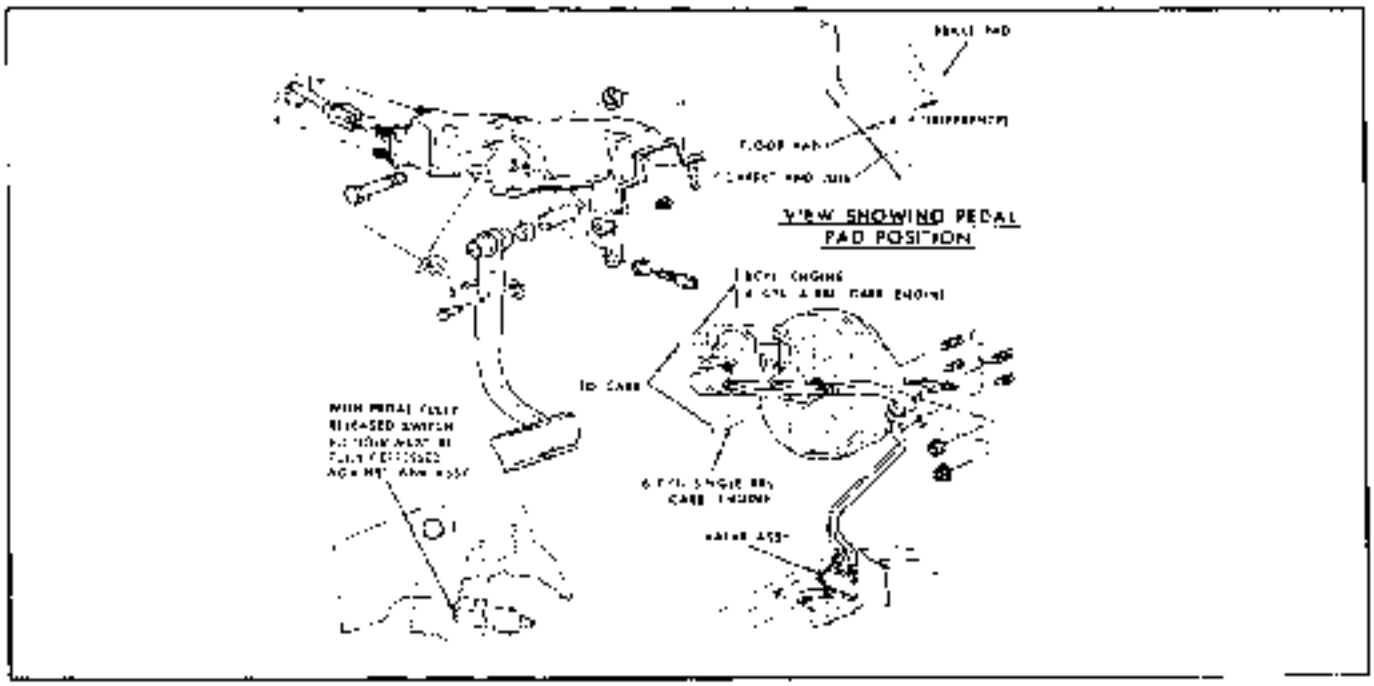


Fig. 5A-2 Tempest Power Brake System

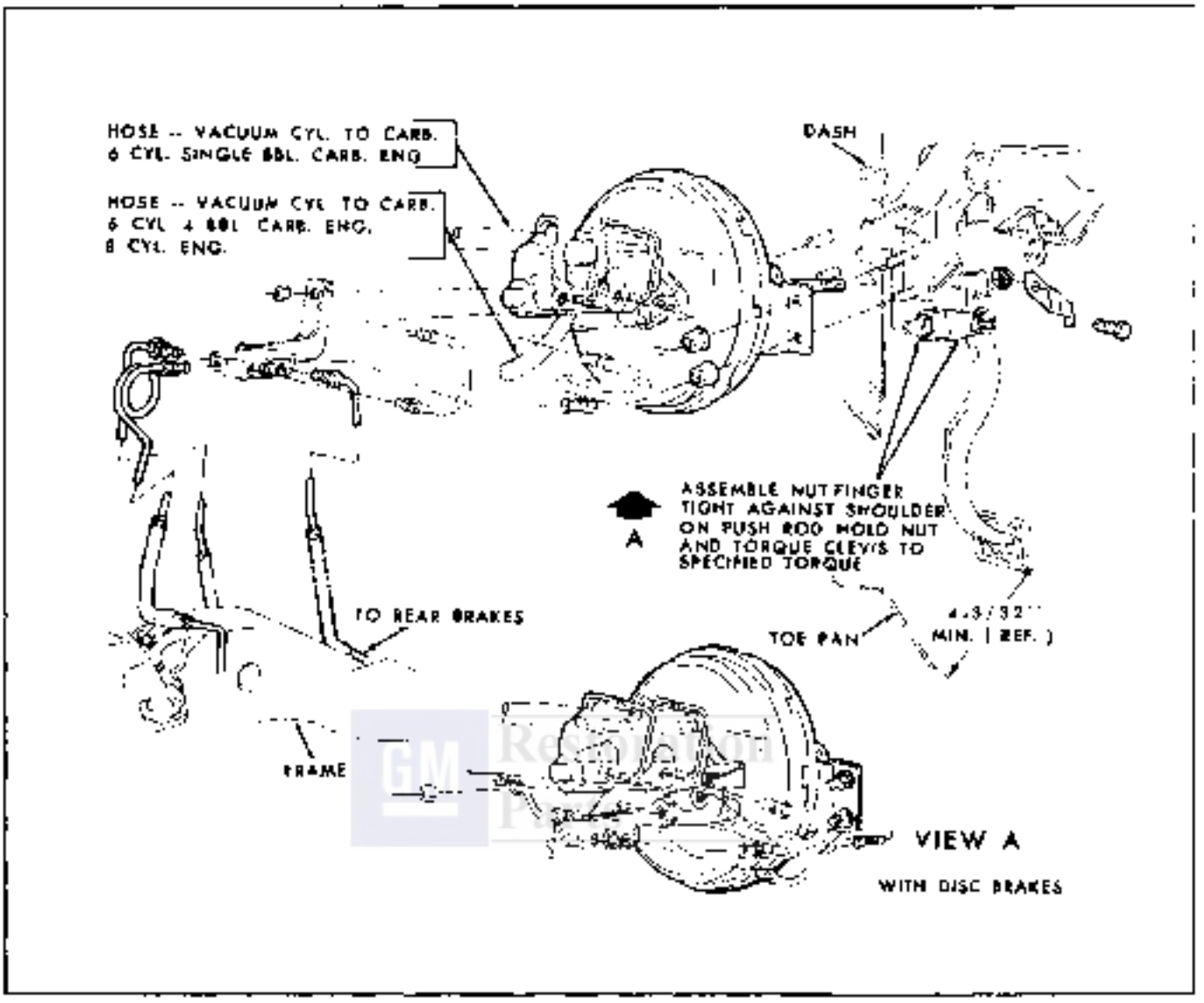


Fig. 5A-3 Firesure Power Brake System

2. Scribe a line across the front and rear housings to facilitate reassembly.

3. Remove clevis from the valve operating rod.

4. Remove boot and silencer.

5. Using tool J 9504, rotate rear half housing counterclockwise to unlock rear half from front housing. Disassembly of Tempest and Firebird units may be facilitated by using tool J 22893-01.

NOTE. Rotate slowly as housing is under spring load.

6. Remove rear housing and power piston assembly by lifting straight up slowly and lay it aside on a clean smooth surface (Fig. 5A-5).

7. Remove power piston assembly from rear housing.

8. Remove power piston return spring.

9. Scribe a line across front housing and master cylinder assembly and remove nuts and lock washers from master cylinder studs. Remove master cylinder assembly from front housing.

10. Remove front housing seal, vacuum check valve and grommet from front housing (Fig. 5A-6 and 5A-7).

POWER PISTON—DISASSEMBLE (Fig. 5A-8)

CAUTION: Care must be taken in handling diaphragm of power piston group. Diaphragm should be guarded against grease, oil and foreign matter and must be protected from nicks or cuts that might be caused by rough surfaces, damaged tools or dropping the piston.

1. Remove lock ring from power piston by prying from under locking lugs. (Fig. 5A-9)

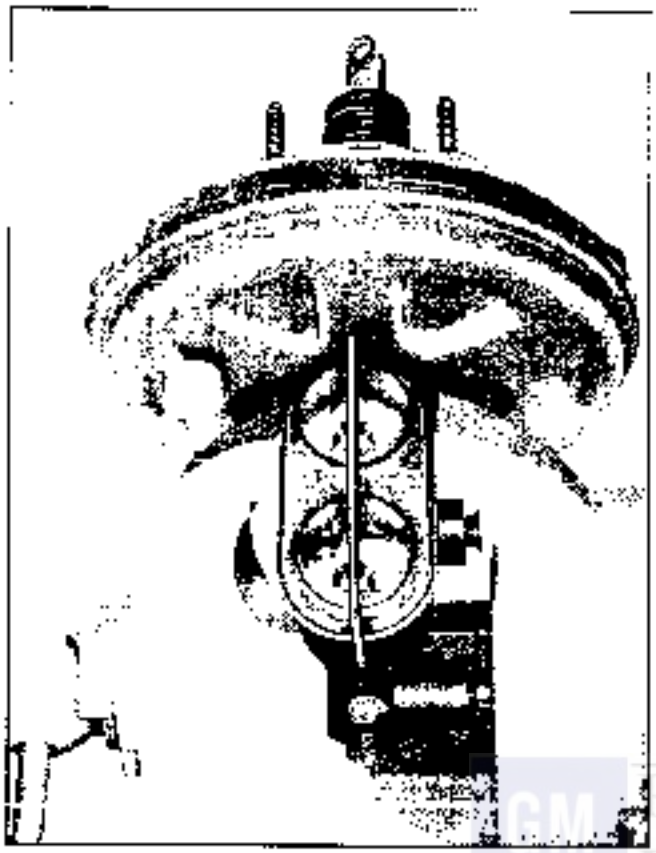


Fig. 5A-4 Brake Unit Mounted In Vise

2. Remove reaction retainer, vacuum cylinder push rod, reaction plate, three reaction levers and air valve spring. (Fig. 5A-10)

3. Remove small reaction bumper and air valve spring retainer from air valve.

4. Place square end of tool J 21524 in vise holding support plate and power piston with tube end of piston facing up.

5. Pull diaphragm edges away from support plate and position on tool J 21524 so that three lugs on tool fit into three notches in power piston. (Fig. 5A-11)

6. Press down on support plate and rotate counter-clockwise until support plate separates from power piston (Fig. 5A-12).

7. Remove diaphragm from support plate.

8. Remove silencer from neck of power piston tube.

9. Position power piston in vise padded with shop towels with tube end down.

CAUTION. Do not clamp on tube as outside surface of tube acts as bearing surface.

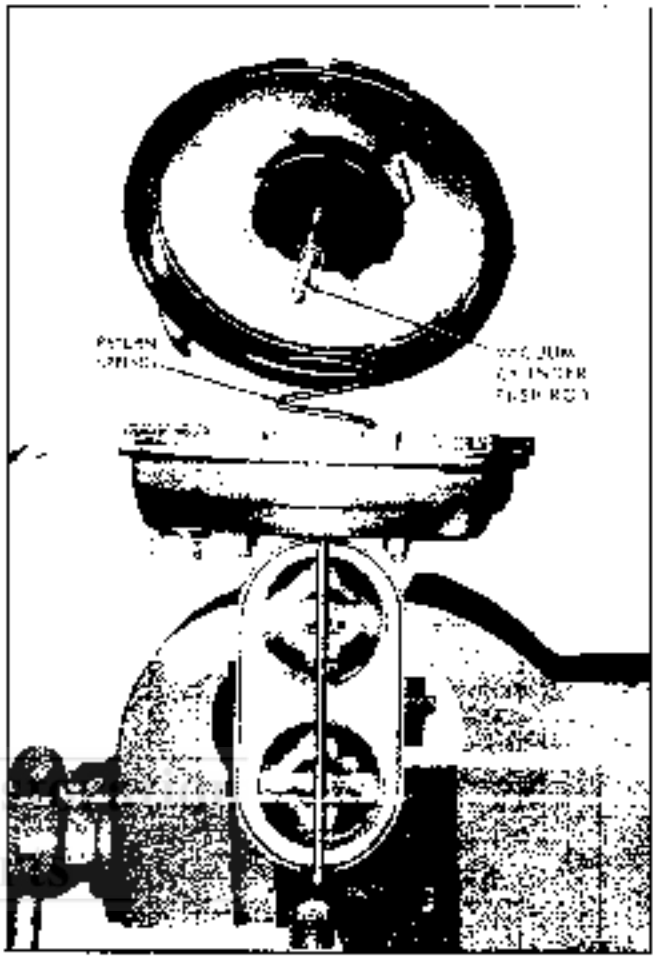


Fig. 5A-5 Removing Rear Housing

10. Remove snap ring on air valve using Truarc Pliers and place power piston with tube end down in arbor press.

11. Press air valve from power piston using rod not exceeding 1/2" diameter. Removal of valve releases floating control valve, floating valve retainer, push rod limiter washer and air filters (Fig. 5A-13).

NOTE: The floating control valve cannot be removed from push rod. It will be necessary to service complete push rod air valve assembly.

12. Remove O-ring seal from the air valve in second groove from air valve operating rod end.

13. Remove vacuum cylinder push rod from center of reaction retainer and O-ring seal from groove on the rod.

MASTER CYLINDER—DISASSEMBLE (Fig. 5A-14)

Refer to Section 5 - Standard Brakes for disassembly procedures.

INSPECTION AND CLEANING

Thoroughly wash all parts in alcohol and air dry. Blow dust and cleaning fluid out of all internal pass-

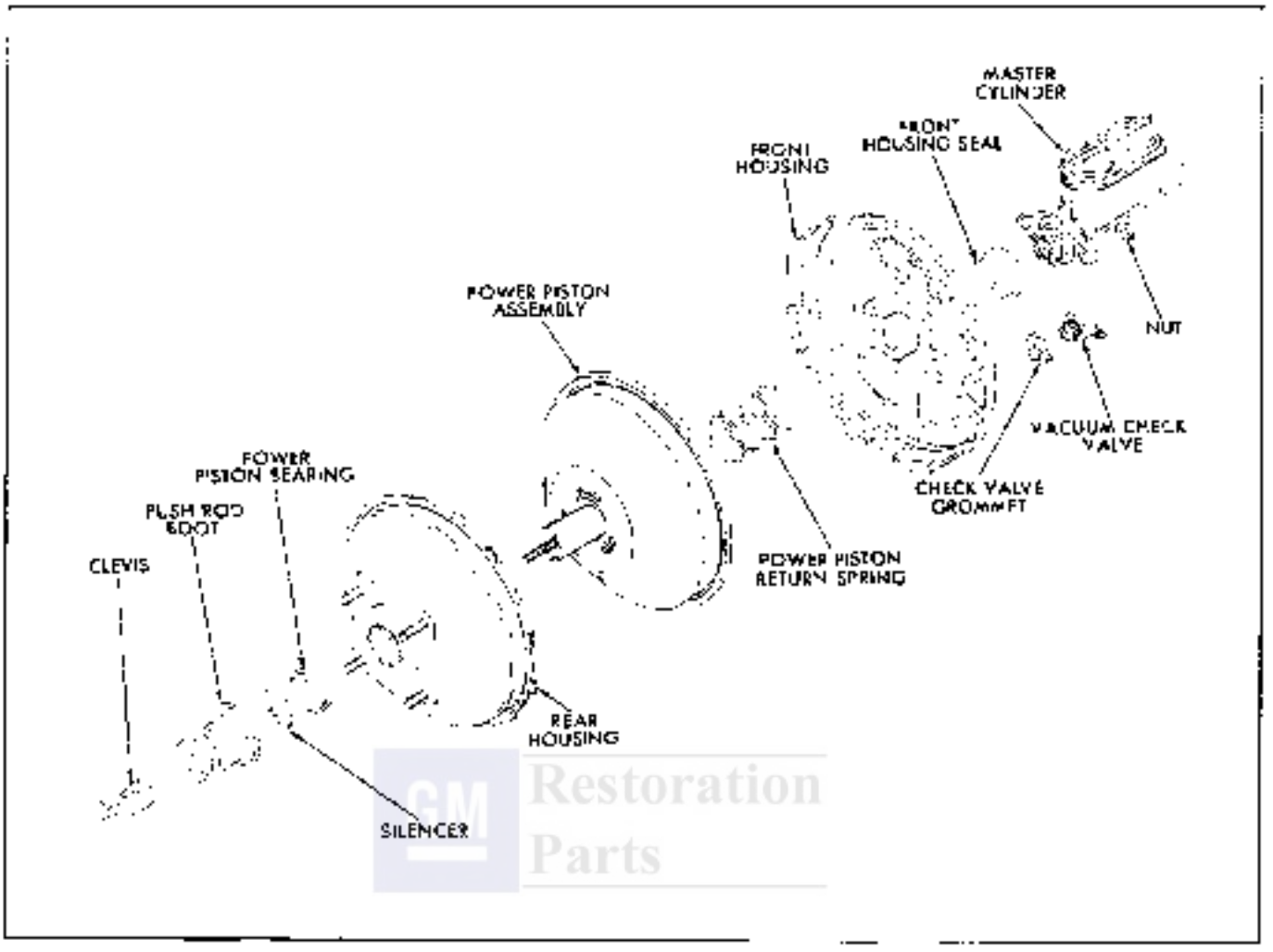


Fig. 5A-6 Exploded View of Pontiac Power Brake Unit

ages. If inside of front housing is slightly scored or scratched, clean with crocus cloth or fine emery cloth. If scratches in front housing cannot be removed, replace housing.

CAUTION. It is important that all parts be placed on a clean paper after being cleaned to prevent the possibility of dirt being assembled into seal or grease contacting any rubber parts.

POWER BRAKE

Inspect all parts for scoring, pitting, dents or nicks. Small imperfections can be smoothed out with fine emery cloth. Replace if badly nicked, scored or otherwise damaged

MASTER CYLINDER

Inspect bore from the open end. The bore should be free from scores, deep scratches and corrosion. If it appears that corrosive brake fluid has damaged the bore, replace damaged parts and flush out entire brake system including wheel cylinders.

The seating surfaces should be clean and smooth. Check for cracks and damaged threads. Be sure that the by pass and compensating ports to the master cylinder are not restricted.

Check for distortion of all springs and deterioration of all rubber parts. Any evidence of soft or swollen rubber parts indicates contaminated brake fluid requiring flushing of the entire brake system and replacement of wheel cylinder cups, as well as all rubber parts in master cylinder.

AIR FILTER

Replace air filter element if dirty. Do not clean.

ASSEMBLE BRAKE UNIT

MASTER CYLINDER—ASSEMBLE

Refer to Section 5 - Standard Brakes for assembly procedures.

POWER PISTON—ASSEMBLE

1. Place a new O-ring seal in groove on vacuum

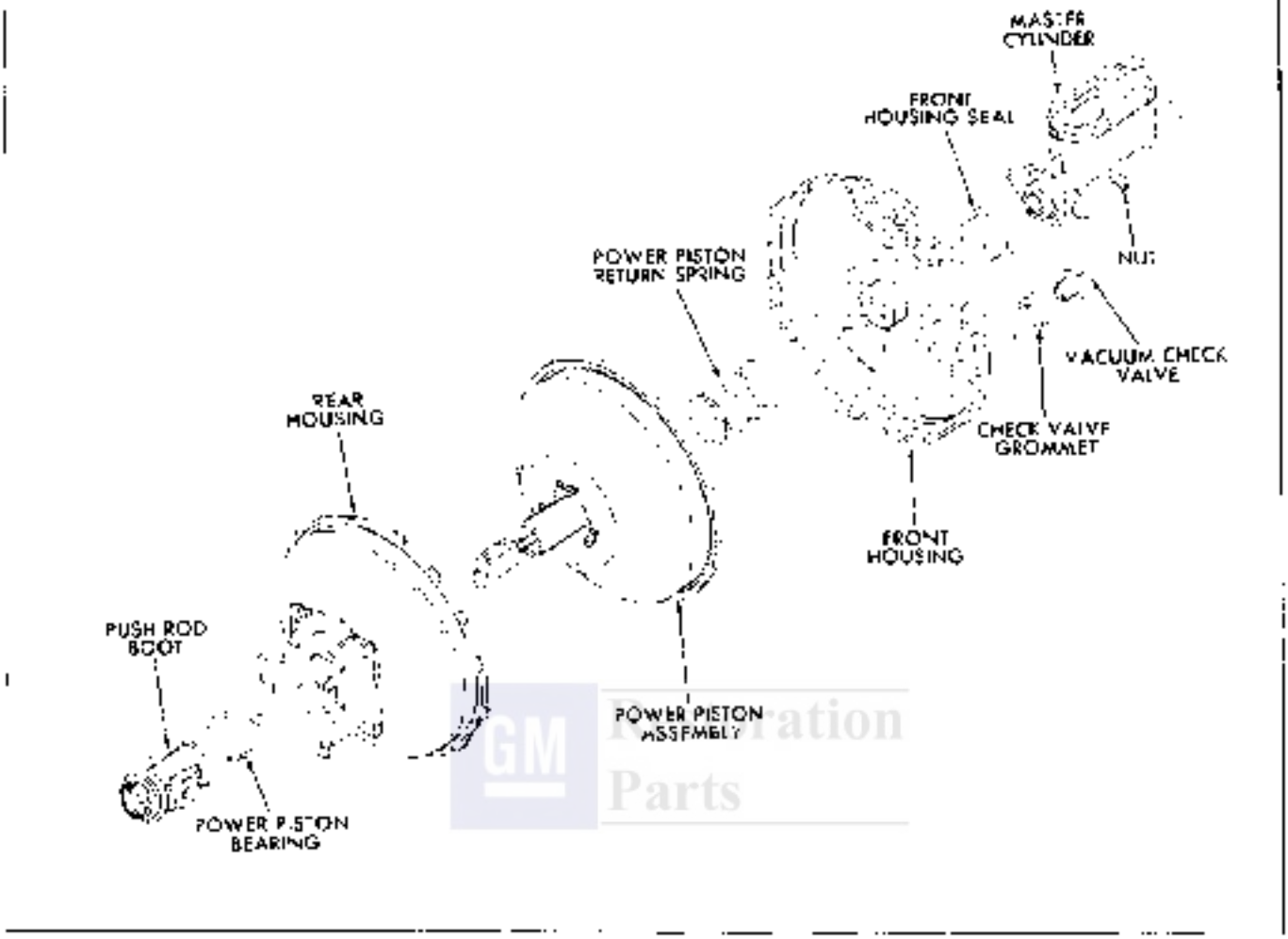


Fig. 5A-7 Exploded View of Firebird and Tempest Power Brake Unit

cylinder push rod. Wipe thin coat of power brake lubricant on O ring.

2. Insert vacuum cylinder push rod through reaction retainer so that round end of rod protrudes from end of tube of reaction retainer.

3. Place power piston installer, J 21524, in vise and position power piston with three lugs fitting into notches in piston.

4. Install new O-ring seal on air valve in second groove from valve operating rod end.

NOTE: A new air valve assembly must be installed since floating control valve is a component part of this assembly and cannot be disassembled.

5. Wipe thin film of power brake lube on large O.D. of floating control valve and on O-ring of air valve.

6. Press air valve - push rod floating control valve assembly, air valve first, to the seat in tube of power piston.

7. Place floating control valve retainer over push rod so that flat side seats on floating control valve.

8. Start floating control valve and its retainer into power piston tube. Use tool J 21601 to press floating valve to seat in tube by placing tool on top of retainer and pressing down.

9. Position push rod limiter washer over push rod to floating control valve and install two air filter elements over end of push rod and into power piston tube.

10. Assemble power piston diaphragm to support plate from side of plate opposite locking tangs and press raised flange of diaphragm through hole in center of plate.

NOTE: Be sure that edge of center hole fits into groove in flange of diaphragm.

11. Pull diaphragm away from O.D. of support plate so that the plate can be gripped with hands. Wipe power brake lubricant on all surfaces of small bead of diaphragm which contacts power piston.

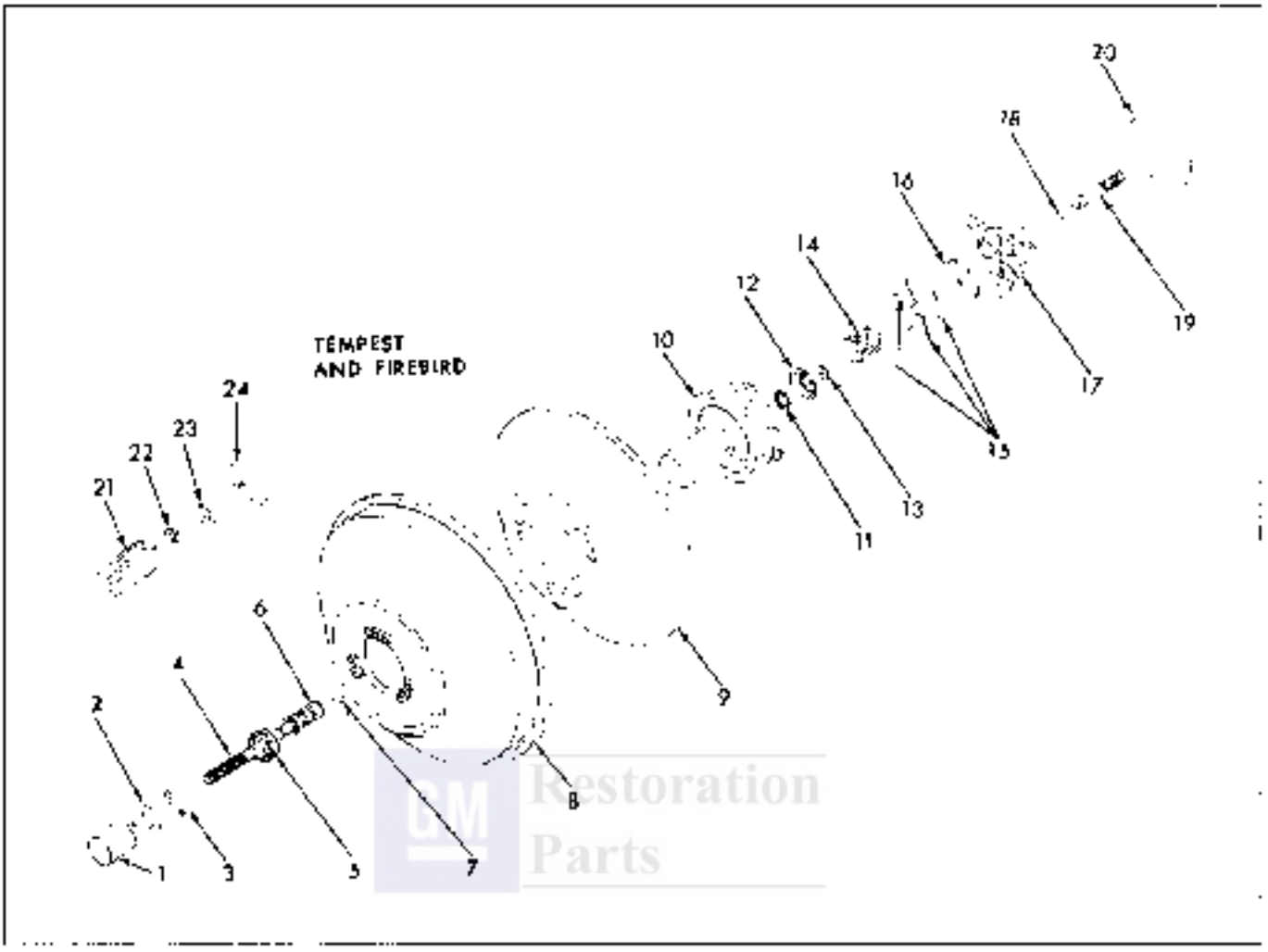


Fig. 5A-8 Exploded View of Power Piston

1. Filter
2. Push Rod Limiter Washer
3. Floating Valve Retainer
4. Valve Operating Rod
5. Floating Control Valve
6. Air Valve
7. O-Ring Seal
8. Diaphragm
9. Support Plate
10. Power Piston
11. Retaining Ring
12. Reaction Spring Seat
13. Reaction Bumper
14. Reaction Spring
15. Reaction Levers
16. Reaction Plate
17. Reaction Retainer
18. O Ring Seal
19. Vacuum Cylinder Push Rod
20. Lock Ring
21. Clevis
22. Clevis Nut
23. Retaining Ring
24. Strainer

12. Holding support plate on bare metal, with locking tangs down, place support plate and diaphragm assembly down over tube of power piston. Flange of diaphragm will fit into groove on power piston.

13. Press down and rotate support plate clockwise until lugs on power piston come against stops on support plate.

14. Invert assembly and place on padded vise with power piston tube end down and insert snap ring on air valve using Truarc Pliers.

15. Place air valve spring retainer to seat on snap ring and assemble reaction bumper into groove in end of air valve.

16. Position reaction spring, large end down, on spring retainer.

17. Position three reaction levers on slots on power piston. Narrow ends will rest on reaction spring.

18. Position reaction plate, with numbered side up, on top of reaction levers and press down on plate until large ends of reaction levers pop up and plate rests flat on levers. Be sure that reaction plate is centered.

19. Place small end of piston rod in hole in center of reaction plate and line up ears on reaction retainer with notches in power piston and push reaction retainer down until ears seat in notches.

Fig. 5A-9 Removing Locking Ring From Power Piston

20. Maintain pressure on reaction retainer and position large lock ring down over master cylinder push rod so that one end of lock ring goes under lug on power piston raised divider.

NOTE: Lock ring is positioned around power piston so that it goes alternately over one of reaction retainer and under lug of power piston until end of ring is seated under lug with raised divider.

CAUTION: Make sure that both ends of lock ring are securely under large lug.

21. Place new front housing seal in center of front housing so that flat surface of cup lies against bottom of depression in housing.

22. Install vacuum check valve using new grommet if old one is cracked or damaged.

23. Place new power piston bearing in center of rear housing so that flange on center hole of housing fits into groove of power piston bearing. Large flange on power piston bearing will be on seal side of housing.

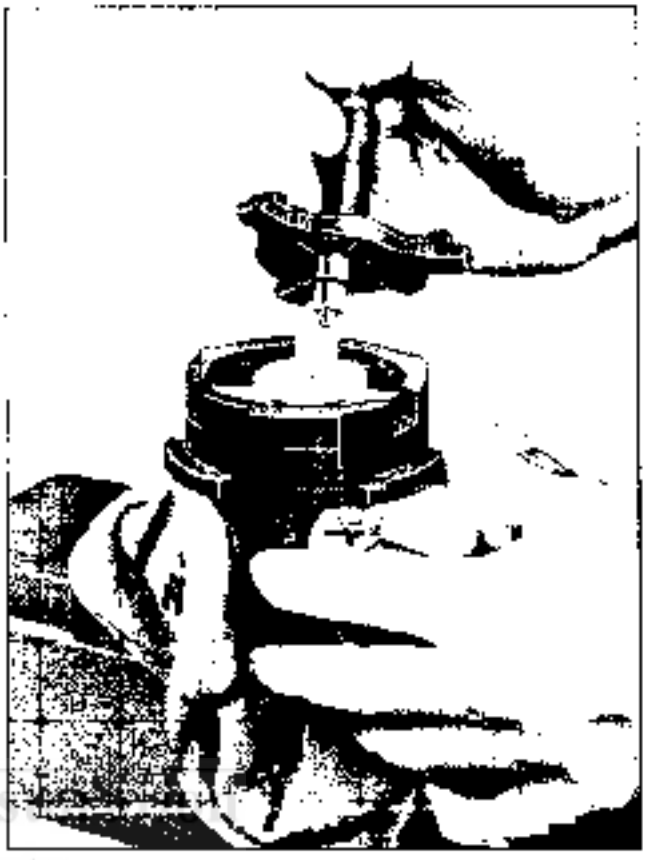


Fig. 5A-10 Removing Reaction Retainer

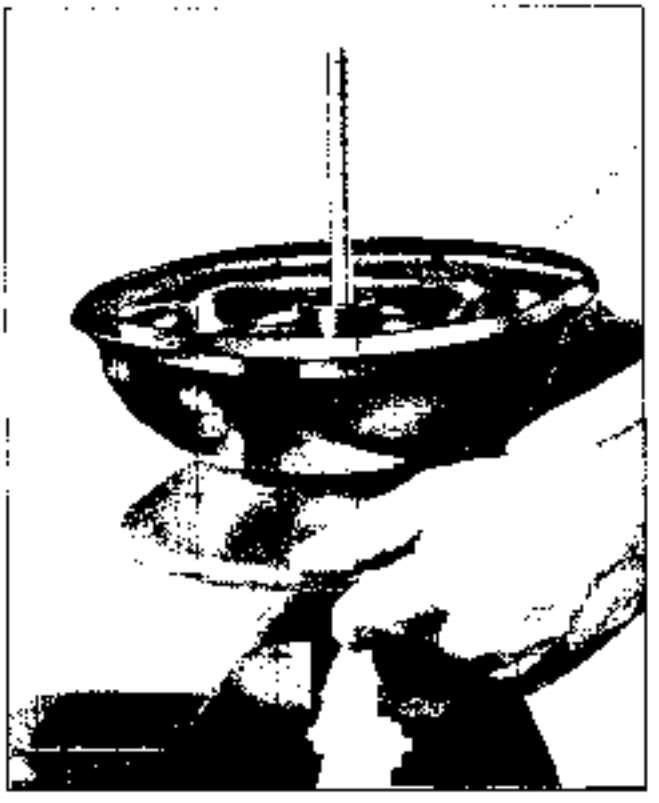


Fig. 5A-11 Positioning Power Piston or Support Plate Remover

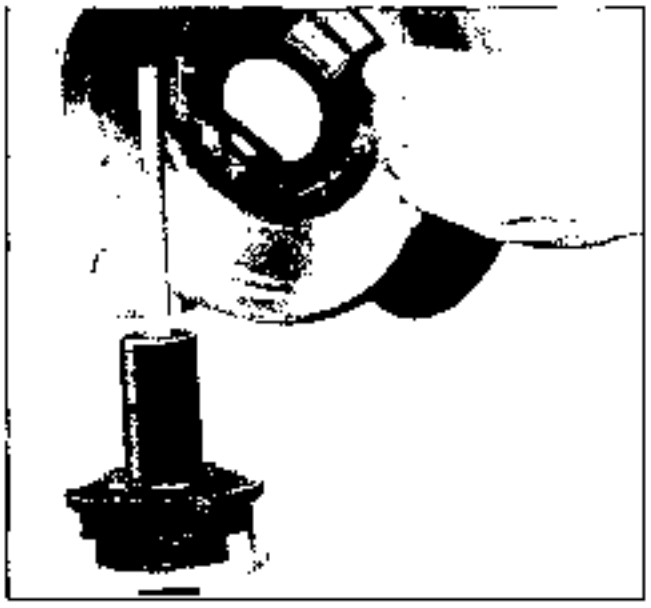


Fig. 5A-12 Removing Support Plate

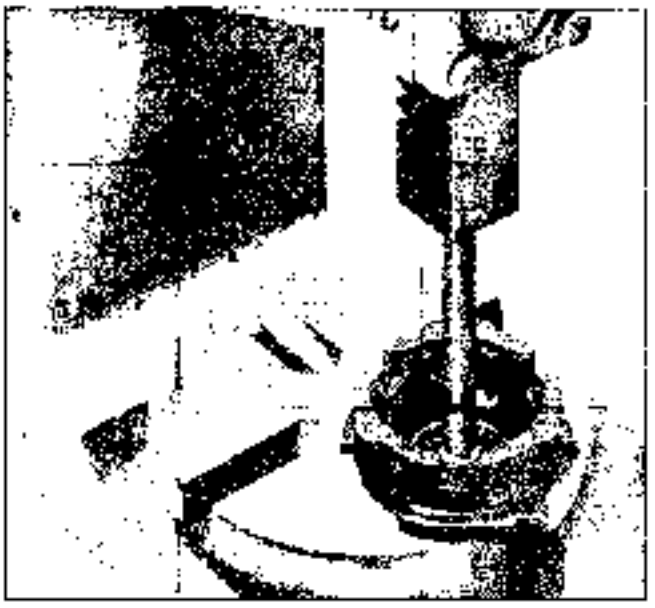


Fig. 5A-13 Removing Air Valve

24. Coat inside of power piston bearing with power brake lube.

25. Place air silencer over tube of power piston and wipe tube with power brake lube.

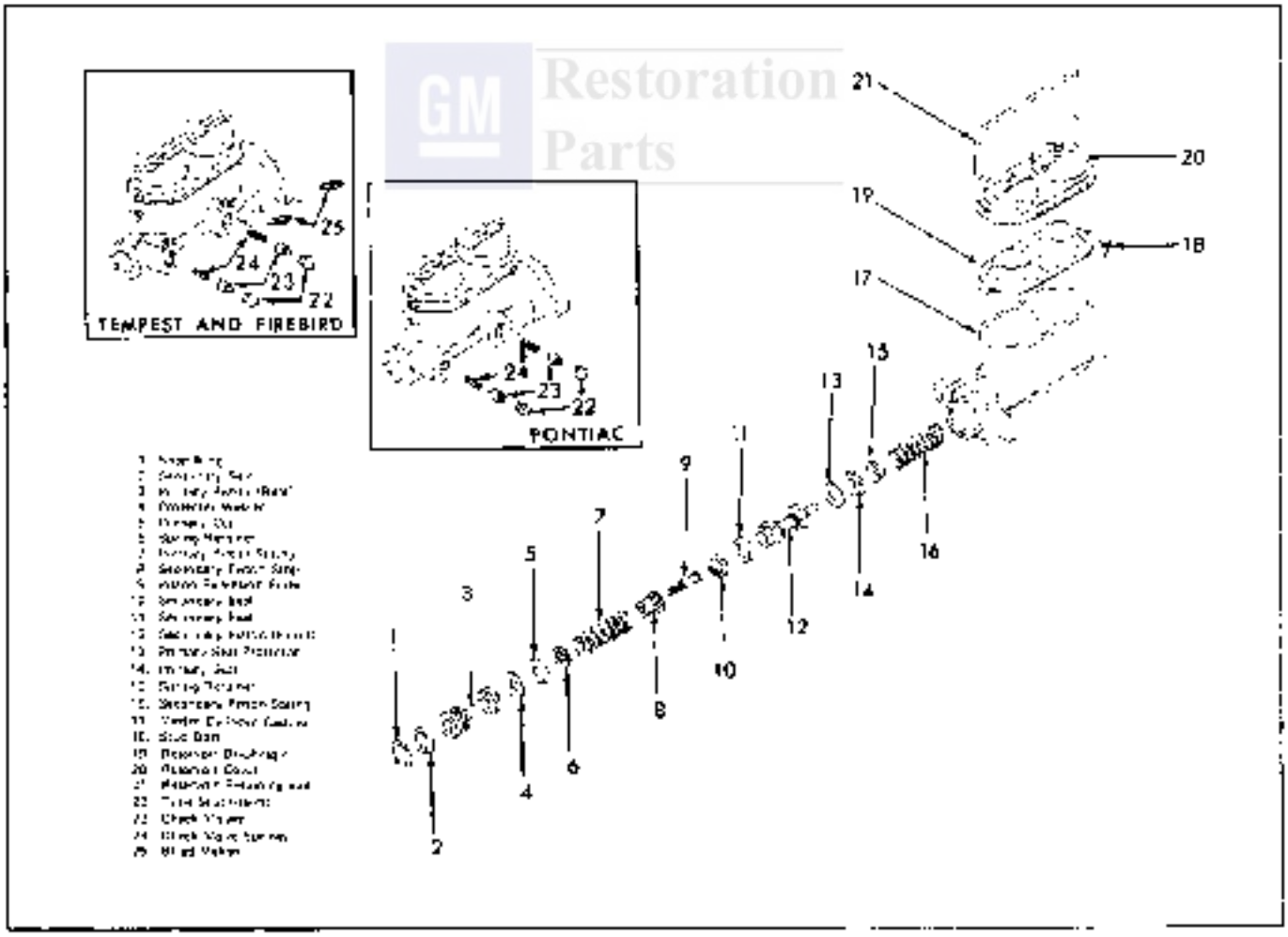


Fig. 5A-14 Exploded View of Master Cylinder

26. Assemble power piston to rear housing by pushing tube of power piston through rear housing from side opposite studs.

27. Wipe tube of reaction retainer with power brake lube and lay assembly aside.

28. Place front housing in vise with master cylinder down. Lubricate I.D. of support plate seal with power brake lube. Position power piston return spring over inset in front housing.

29. Lubricate beaded edge of diaphragm lightly with talcum powder. Slide rear housing and power piston assembly over front housing with master cylinder push rod down and position rear housing so that scribe marks on housings will be in line when it is rotated into locked position.

30 Pontiac - Place tool J 9504 in position on rear housing.

Tempest and Firebird - Place a rod on rear housing (reverse step 5, Brake Unit--Disassemble) or use tools J 22893-01 and J 9504. Press down to check that bead of diaphragm is positioned between edges of housings. If this is satisfactory, apply additional pressure on rear housing and, at the same time, rotate housing clockwise into locked position. If housings are not easily locked, hold housing together and apply vacuum to check valve in front housing. This will draw housings together and will ease locking procedure.

CAUTION: Do not put pressure on power piston tube when locking housings and take care not to break or bend studs in rear housing.

31. Pontiac - Place felt silencer in end of boot. Stretch boot over valve operating rod and rear housing flange. Clevis can now be re-assembled on the valve operating rod.

Tempest and Firebird - Push felt silencer over valve operating rod to seat against end of power piston tube and place snap ring retainer in groove on rod to hold silencer against power piston tube.

32. Tempest and Firebird - Seat plastic boot against rear housing. Raised bumps on side of boot will locate in large holes in center of brackets. Install jam nut and clevis on the valve operating rod.

GAUGING PROCEDURE (Fig. 5A-15)

1. Place power brake assembly in vise so that master cylinder is up. Remove master cylinder from front housing. Master cylinder push rod is now exposed.

NOTE: GAUGING IS TO BE PERFORMED WITHOUT VACUUM.

2. Place the gauge J 22647 over the piston rod in a position which will allow the gauge to be slipped

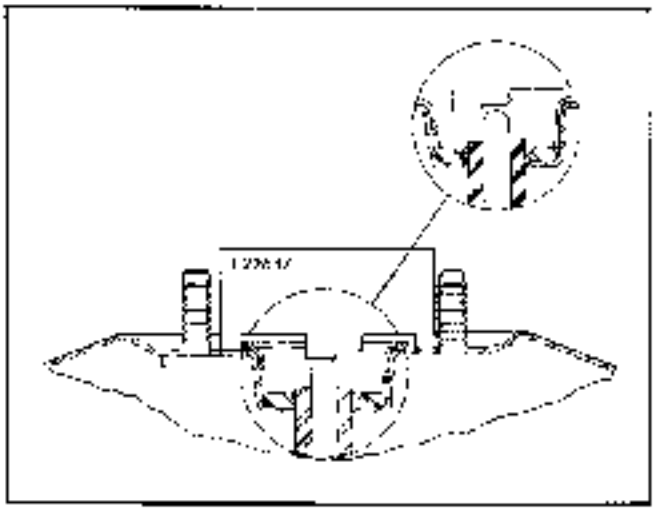


Fig. 5A-15 Push Rod Adjustment

to the left or right without contacting the studs. (Fig. 5A-15)

The center section of the gauge has two levels. The piston rod end should always touch the longer section of the gauge which extends into the front housing. The piston rod end should never touch the shorter section of the gauge.

NOTE: Any variation beyond these limits must be compensated for by obtaining service adjustable piston rod and adjusting screw to end to match height of gauge. Variation beyond these limits can cause the primary cup to overlap the compensating port of the master cylinder which will trap fluid in the hydraulic system causing brake drag.

3. Replace master cylinder on front housing studs. Install attaching nuts on studs. Torque to 25 lb. ft.

POWER BRAKE ASSEMBLY—INSTALL

1. Place power brake into position and install four rear housing to dash attaching lock washers and nuts from inside of car. Tighten nuts 24 lb. ft. torque.

2. Attach clevis to brake pedal. Install pin and retainer.

3. Check stop light switch adjustment.

4. Attach vacuum hose to vacuum check valve.

5. Attach hydraulic lines.

6. Bleed brakes as necessary and fill fluid reservoir to level shown in Section 5.

TORQUE SPECIFICATIONS

	LB. FT.
Power Cylinder Housing-to-Master Cylinder Nuts	25
Rear Housing to Pedal Bracket Nuts	24
Push Rod Clevis (Tempest and Firebird)	12 1/2

SPECIAL TOOLS

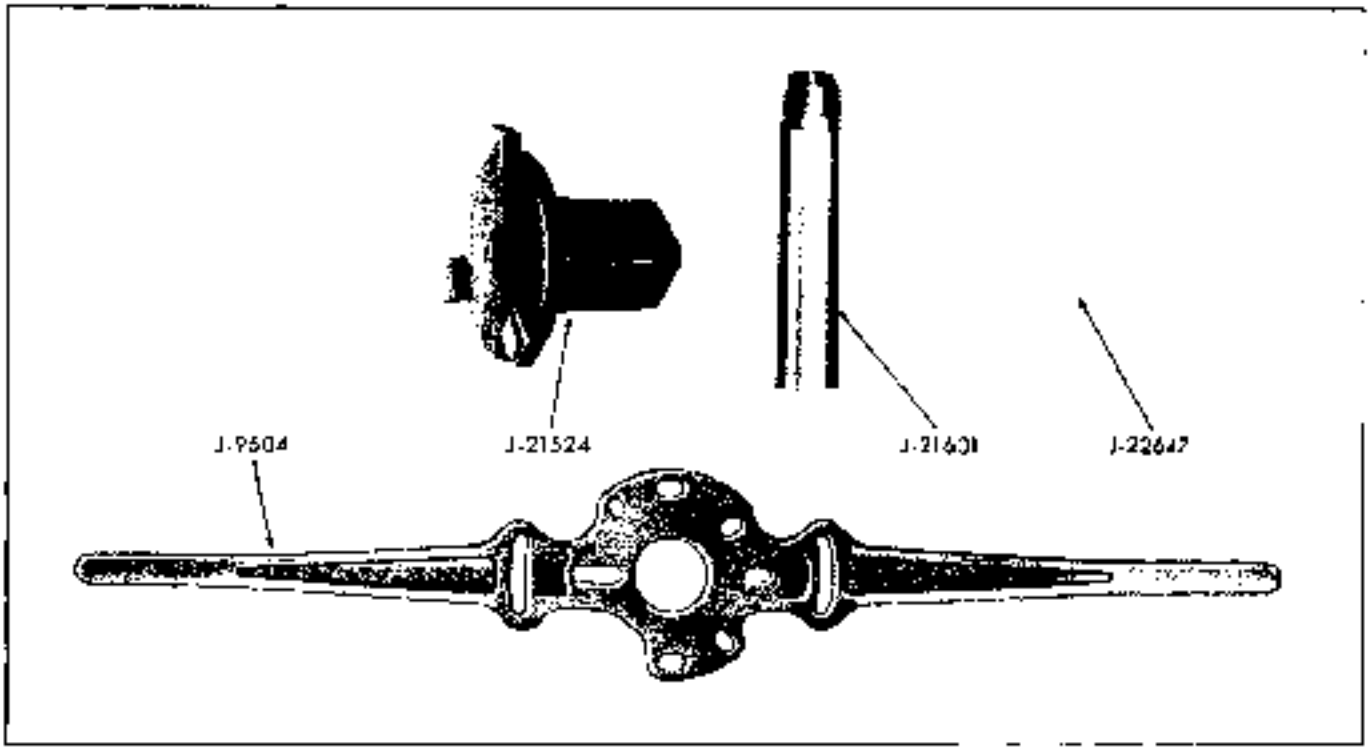


Fig. 5A-14 Special Tools

J 9504 Power Cylinder Spanner Wrench
J 21524 Power Piston Remover and Installer
J 21601 Power Brake Air Valve Installer
J 22647 Height Gauge

BENDIX POWER BRAKE

CONTENTS OF THIS SECTION

CHECKS AND ADJUSTMENTS ON CAR

1. Check for free operation of brake pedal. If binding exists, check all pivot points for binding and lubricate as required.

2. Check stop light switch for proper setting and operation.

3. Check fluid level in hydraulic cylinder reservoirs. Fluid level should be as shown in Fig. 5 B.

4. Check vacuum line and connections at carburetor and vacuum check valve for possible vacuum leaks.

5. Check engine for good stall-free idle, and correct as required.

MINOR REPAIRS

BLEEDING BRAKES

Brakes should be bled in the same manner as standard brakes, but, if bleeding manually, do not run engine.

STOP LAMP SWITCH

See Section 5 for service.

OVERHAUL BENDIX POWER BRAKE

MASTER CYLINDER ONLY—REMOVE

Certain repair operations, such as replacement of master cylinder internal parts, permit the master cylinder to be removed by itself, leaving the power cylinder on the car.

1. Disconnect hydraulic lines at master cylinder. Cover openings in master cylinder and end of both pipes to prevent entry of dust, dirt, etc.

2. Remove two nuts and lock washers from vacuum cylinder studs extending through master cylinder assembly.

3. Remove master cylinder from power unit.

POWER BRAKE AND MASTER CYLINDER ASSEMBLY—REMOVE

1. Disconnect vacuum hose from vacuum cylinder assembly. Cover openings to prevent entry of dust, dirt, etc.

2. Disconnect pipes from master cylinder hydraulic ports and cover openings in master cylinder and end of both pipes to prevent entry of dust, dirt, etc.

3. Remove retainer and clevis pin from brake pedal inside the car.

4. Remove nuts and lock washers from vacuum cylinder studs under dash and remove power brake assembly.

5. Clean exterior of power brake assembly and drain reservoirs of hydraulic fluid.

POWER UNIT—DISASSEMBLE (Fig. 5B-2)

1. Using old master cylinder assembly or Tool J-22605-01, mount power brake assembly in vise, clamping on unit so that valve operating rod is up.

2. Scribe a line across the front and rear housings to facilitate reassembly.

3. Remove clevis from valve operating rod.

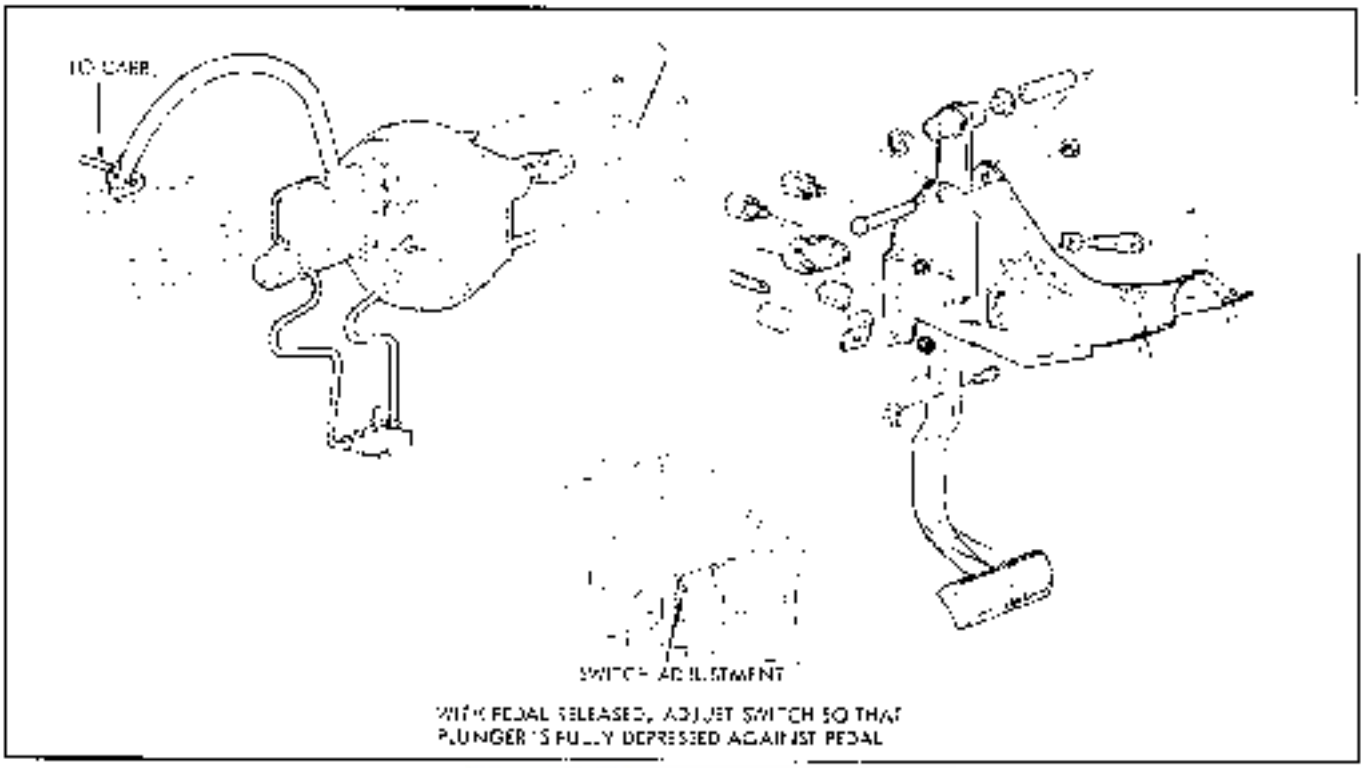


Fig. 5B-1 Power Brake System

4. Using tool J 6504, press down firmly and rotate tool and housing clockwise so that cut-outs in rear housing line up with indentation of front housing.

NOTE: Remove rear housing carefully as it is spring-loaded and will tend to fly away from the front housing.

5. Remove tool, housing, hydraulic push rod from diaphragm plate (power piston) and return spring from front housing.

6. If check valve needs replacing, push it and the grommet out of the front of the housing.

7. Remove assembly from vise and remove master cylinder assembly or Tool J-22805-01 from front housing.

8. Remove front vacuum seal with a blunt tool.

POWER PISTON—DISASSEMBLE (Fig. 5B-4)

CAUTION: Exercise extreme care in handling power piston, rubber surfaces and metal parts in this assembly. They should be guarded against grease, oil and foreign matter and must be protected from nicks or cuts that might be caused by rough surfaces or damaged tools.

1. Remove boot and felt filter from power unit.

2. Remove the two felt air silencers and the one foam type filter. Be careful not to chip plastic housing.

3. Remove diaphragm plate (power piston) from rear housing.

4. Carefully remove rubber diaphragm from diaphragm plate.

5. Tilt diaphragm plate and depress valve operating rod slightly to remove valve assembly retainer (valve plunger stop key). See Fig. 5B-3.

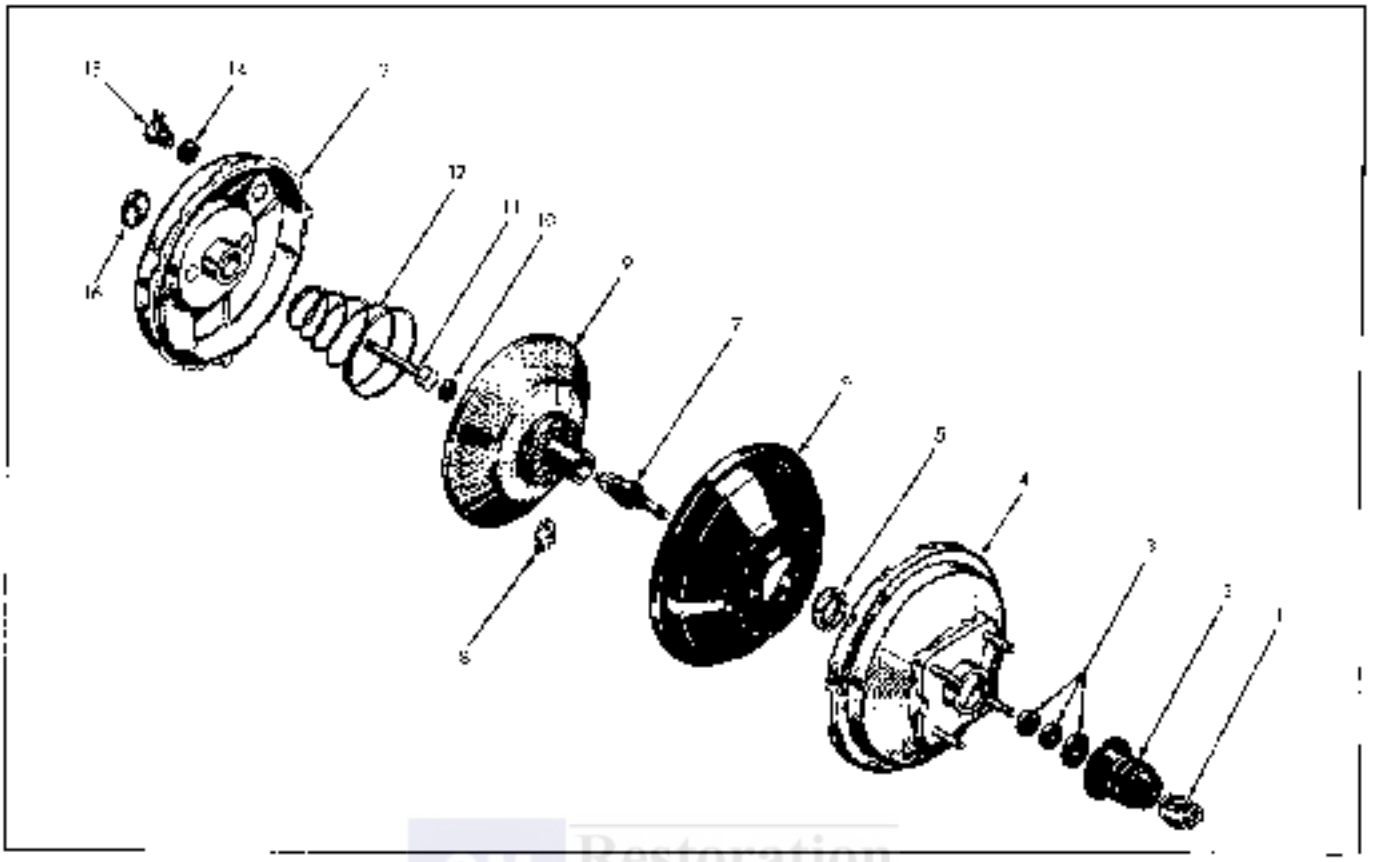
6. Pull control valve assembly straight out from diaphragm plate and with a blunt tool, push reaction disc out front of plate. Do not disassemble control valve assembly.

7. Inspect rear vacuum seal. Remove only if necessary to replace by driving out with a screwdriver or punch.

MASTER CYLINDER—DISASSEMBLE (Fig. 5B-5)

1. Pry splash seal and retainer out of shallow cavity around master cylinder hub.

2. Press in against rear piston with round-end rod to relieve spring load on piston stop screw under master cylinder bore. Use 3/8" wrench to remove stop screw and O-ring seal. Maintain pressure on



1. Clevis
2. Dust Guard (Boot)
3. Air Silencers and Filter
4. Rear Housing
5. Rear Vacuum Seal
6. Diaphragm
7. Control Valve (Valve Rod and Plunger)
8. Valve Plunger Stop Key
9. Diaphragm Plate (Power Piston)
10. Reaction Disc
11. Hydraulic Push Rod
12. Diaphragm Return Spring
13. Front Housing
14. Grommet
15. Vacuum Check Valve
16. Front Vacuum Seal

Fig. 5B-2 Power Brake—Exploded View

rear piston and use Tru-Arc pliers to remove snap ring from groove in master cylinder bore.

5. Remove rear piston and spring assembly and discard. Do not attempt to disassemble it since complete new assembly is provided in repair kit.

4. Remove front piston assembly, front return spring and retainer. Slide primary cup and protector off nose of front piston. Use dull scribe to lift both secondary seals from the grooves at rear end of front piston. Discard all old rubber parts.

NOTE: Check valves should not be replaced unless one or more of conditions exist as outlined in Section 6 under Master Cylinder Disassemble.

5. Install spare tube nut in outlet ports. Place thin washer on self tapping screw and install screw in tube seat with washer bottomed against tube nut. (Fig. 5B-5) Hold screw with screwdriver and use wrench to remove tube nut, screw, washer and tube seat. Remove rubber check valve and spring from both output ports and discard.

INSPECTION—CLEANING

Thoroughly wash all parts in alcohol and air dry. Blow dust and cleaning fluid out of all internal passages. If inside of front housing is slightly scored or scratched, clean with crocus cloth or fine emery cloth. If scratches cannot be removed, replace housing.

All rubber parts should be replaced, regardless of condition, and those parts which come in contact with brake fluid should be rewashed in clean alcohol before reassembly.

CAUTION: It is important that all parts be placed on a clean paper or cloth after being cleaned to prevent the possibility of dirt being assembled into unit or grease contacting any rubber parts.

INSPECT POWER BRAKE ASSEMBLY

Inspect all parts for scoring, pitting, dents or nicks. Small imperfections can be smoothed out with fine emery cloth or parts replaced if badly worn, scored, or otherwise damaged.

INSPECT HYDRAULIC MASTER CYLINDER ASSEMBLY

Inspect bore from the open end. The bore should

Fig. 5B-3 Valve Plunger Stop Key—Remove and Install

be trace of scoring, rust, pitting or etching. If any of these are apparent, master cylinder must be replaced. If it appears that contaminants have damaged the bore, replace damaged parts and flush out entire brake system including wheel cylinders.

The sealing surfaces should be clean and smooth. Check for cracks and damaged threads. Be sure that the by-pass and recuperating ports to the master cylinder reservoirs are not restricted.

Check for distortion of all springs and deterioration of all rubber parts. Any evidence of soft or swollen rubber parts indicates contaminated brake fluid requiring flushing of the entire brake system and replacement of wheel cylinder cups as well as all rubber parts in master cylinder.

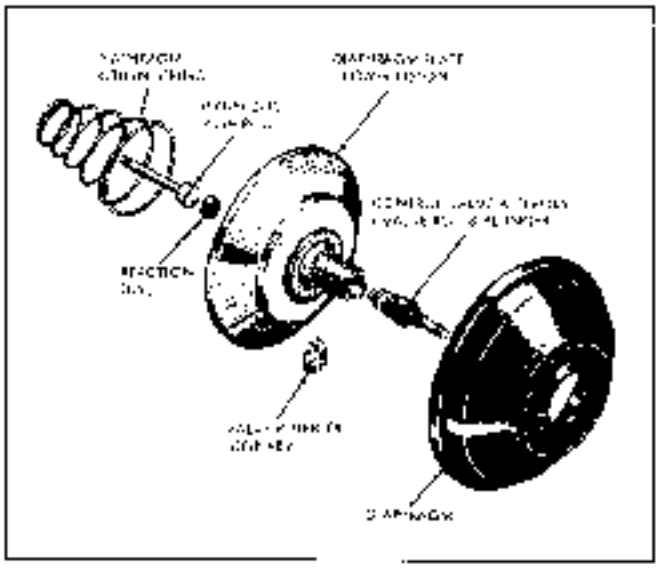


Fig. 5B-4 Power Piston—Exploded View

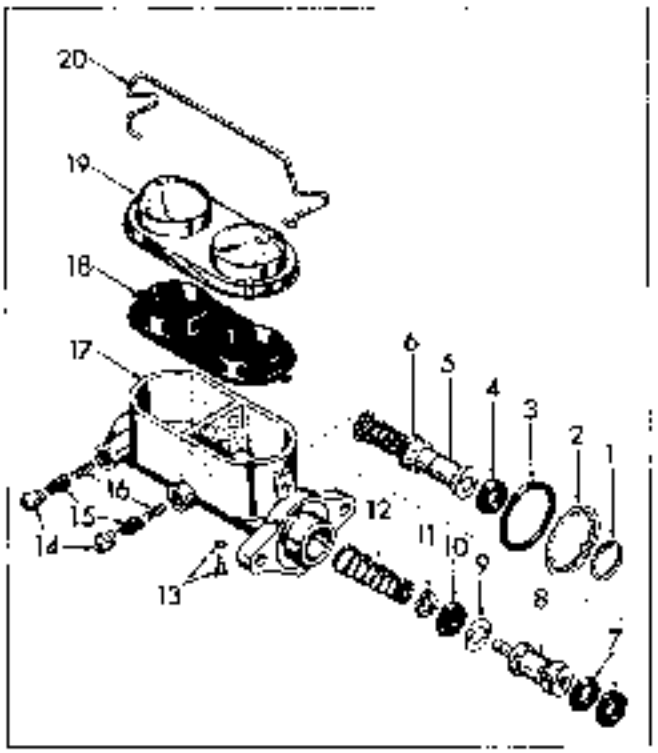


Fig. 5B-5 Master Cylinder—Exploded View

1. Snap Ring
2. Splash Shield Retainer
3. Splash Seal
4. Secondary Seal
5. Rear Piston and Spring Assembly
6. Primary Cup
7. Secondary Seals
8. Front (Floating) Piston
9. Protector
10. Primary Cup
11. Retainer
12. Front Piston Return Spring
13. Piston Stop Screw and Seal
14. Tube Seats
15. Check Valves
16. Springs
17. Master Cylinder Casting
18. Hermetic Diaphragm
19. Reservoir Cover
20. Bale-Type Retainer

INSPECT AIR FILTERS

Replace felt air filters if dirty. Do not clean.

POWER UNIT AND MASTER CYLINDER—ASSEMBLE

MASTER CYLINDER—ASSEMBLE (Fig. 5B-5)

1. Clamp master cylinder in vise with front end slightly below horizontal.

2. Install new secondary seals, back to back, in grooves on rear end of front piston. Dip seals in brake fluid and lift them carefully into grooves with dull scribe. Slide protector and primary cup onto nose of front piston.

3. Stack front piston return spring and retainer on nose of front piston and dip assembly in brake

fluid. Slide assembly to bottom of master cylinder bore. Press and twist piston to ease cups past snap ring groove into bore.

4. Dip new rear piston and spring assembly into bore. Press and twist piston to ease cups past snap ring groove into bore.

5. Press in against rear piston with round-end rod to compress return springs. Do NOT use screw driver or other sharp-edged tool since this will damage the push rod seat inside the piston. Maintain pressure on piston and use Tru Arc pliers to install snap ring in groove inside bore. Make certain that snap ring is securely seated in groove.

6. Install piston stop screw and new O-ring seal in port underneath bore. Torque screw with 3/8" wrench to 40 in. lbs.

7. Install new spring and check valve in both outlet ports. Press new tube seat into port using spare tube nut. Torque tube nut to 40 in. lbs. to be sure tube seat is bottomed in port.

8. Remove master cylinder assembly from vise.

POWER PISTON—ASSEMBLE (Fig. 5B-4)

1. If rear vacuum seal was removed, place rear housing on bench with studs down and press new seal carefully into cavity in housing, plastic side first, using tool J 22677. (Fig. 5B-6) Use hands to press seal about 7/16" below inner housing surface or until metal shoulder bottoms. DO NOT CRACK PLASTIC.

2. Lubricate outside diameter of diaphragm plate hub, bearing surfaces of the valve plunger, and outer edge of valve poppet with power brake lubricant.

3. Insert control valve assembly into diaphragm plate hub. Push on valve enough to insert the valve plunger stop key. (Fig. 5B-3)

4. Assemble diaphragm on diaphragm plate, making sure the inner bead of the diaphragm is seated in the groove in plate.

5. Install silencers over valve operating rod. Be careful not to chip the plastic.

6. Apply power brake lubricant to seal in rear housing and around hub of diaphragm plate. Install rear housing over hub of diaphragm plate.

7. Install large felt air filter and boot. Press boot onto housing until it bottoms.

8. Install clevis on the valve operating rod.

9. Coat all surfaces of reaction disc with power brake lubricant and install disc, button side first, in hub cavity of diaphragm plate.

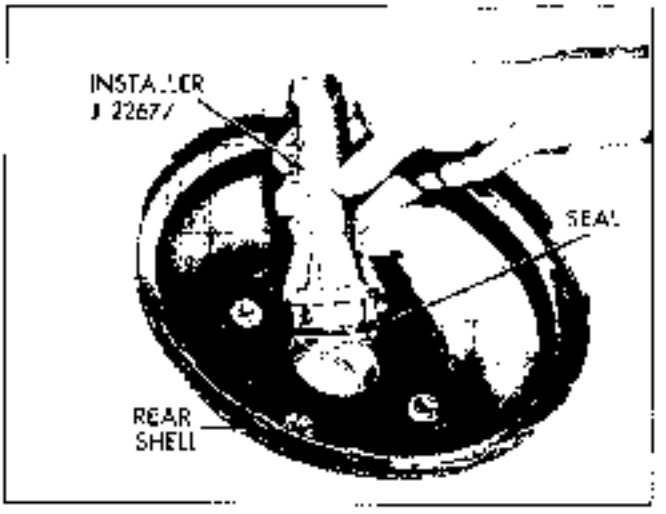


Fig. 5B-6 Installing Rear Vacuum Seal

10. Apply power brake lubricant to piston end and shaft of hydraulic push rod and install firmly against reaction disc in diaphragm plate. DO NOT LUBRICATE ADJUSTING NUT END OF PUSH ROD.

POWER UNIT—ASSEMBLE (Fig. 5B-2)

1. Coat front vacuum seal with power brake lubricant and install, in cavity of front housing, rubber side toward master cylinder. Make certain rubber portion does not separate from metal plate.

2. Install old master cylinder assembly or Tool J-22605-01, on front housing. Torque bolts to 25 lb ft.

3. Install check valve and grommet in front housing if they were removed. Lubricate with alcohol for easier assembly.

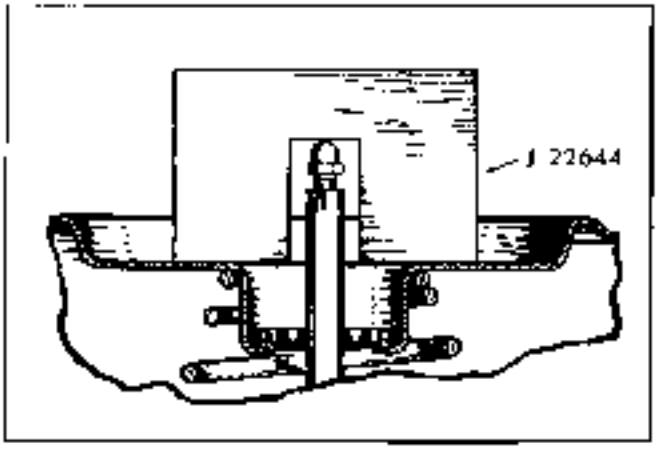


Fig. 5B-7 Gauging Push Rod Length

4. Place master cylinder or Tool J-22805-01 in vise with front housing up.

5. Place diaphragm return spring in front housing, small end down.

6. Apply silicone grease or talcum powder to all surfaces of outer bead of diaphragm that bear against front and rear housings.

7. Place rear housing assembly over diaphragm return spring and, using tool J 9504 press down firmly on rear housing, guiding push rod into front housing seal making certain scribe marks will align when housings are locked together. Rotate tool counter-clockwise to lock the two housings. Vacuum may be applied to the check valve to help draw the housings together.

CAUTION: Do not release pressure on rear housing until the housings are fully locked.

NOTE: Be sure diaphragm is not pinched during assembly.

ASSEMBLE MASTER CYLINDER TO POWER UNIT

Remove master cylinder and power brake assembly from vise and remove old master cylinder assembly or Tool J-22805-01.

NOTE: Before reassembling master cylinder to power section, the distance from the outer end of the push rod to the master cylinder must be measured as explained under PUSH ROD ADJUSTMENT below.

PUSH ROD ADJUSTMENT

The push rod is designed with a self-locking adjustment screw to provide the correct relationship between the vacuum power piston and master cylinder piston. The adjustment screw is set to the correct height at the time of original assembly of the power unit. Under normal service conditions the adjustment screw does not require any further attention providing the push rod assembly remains in the original unit.

Whether a new push rod is used or the push rod assembly is transferred to a unit other than the original one, the distance from the end of the adjustment screw to the mounting face of the power cylinder should be rechecked either with a micrometer depth gauge to a dimension of 1.225 to 1.210" or with height gauge J 22644. Place gauge over the push rod on the front housing. Cutout portion of the gauge should never be lower than the adjustment screw end of the push rod and the gap between the cutout and edge of the push rod end should never exceed .010". (Fig. 5B-7)

To adjust push rod, grip splined area of push rod with pliers, being careful not to scratch machined shaft. (DO NOT REMOVE PUSH ROD FROM POWER CYLINDER SINCE REACTION DISC MIGHT BE PULLED OUT OF DIAPHRAGM PLATE AND FALL INTO FRONT VACUUM CHAMBER.) Use a 5/16" wrench to turn adjusting nut in to shorten or out to lengthen push rod.

When push rod adjustment is correct, assemble master cylinder assembly to the power unit vacuum cylinder at two studs. Secure with two nuts and lock washers tightening to 25 lb. ft. torque.

After assembly of the master cylinder to the power unit, the primary cups of the master cylinder must clear the compensating hole when the unit is in the released position. This can be checked by partially filling the reservoir, and then stroking the power unit. If air bubbles appear or fluid spurts, the compensating ports are clear. If the primary cups overlap the compensating ports, there will be no flow of air or fluid through the compensating port when stroked. If this condition exists, the adjusting screw should be turned into the push rod a slight amount, or until the compensating port is open. Failure to clear the compensating port in the released position traps fluid in the hydraulic lines and wheel cylinders and causes brake drag when the fluid warms up.

If compensating port is blocked, fluid from pressure bleeder will flow thru bypass main metering port behind primary cup and then thru holes in piston, around lip of primary cup to wheel cylinders.

TORQUE SPECIFICATIONS

Piston Stop Screw	40 lb. in.
Power cylinder housing to master cylinder nuts	25 lb. ft.
Rear housing to dash nuts	25 lb. ft.

SPECIAL TOOLS

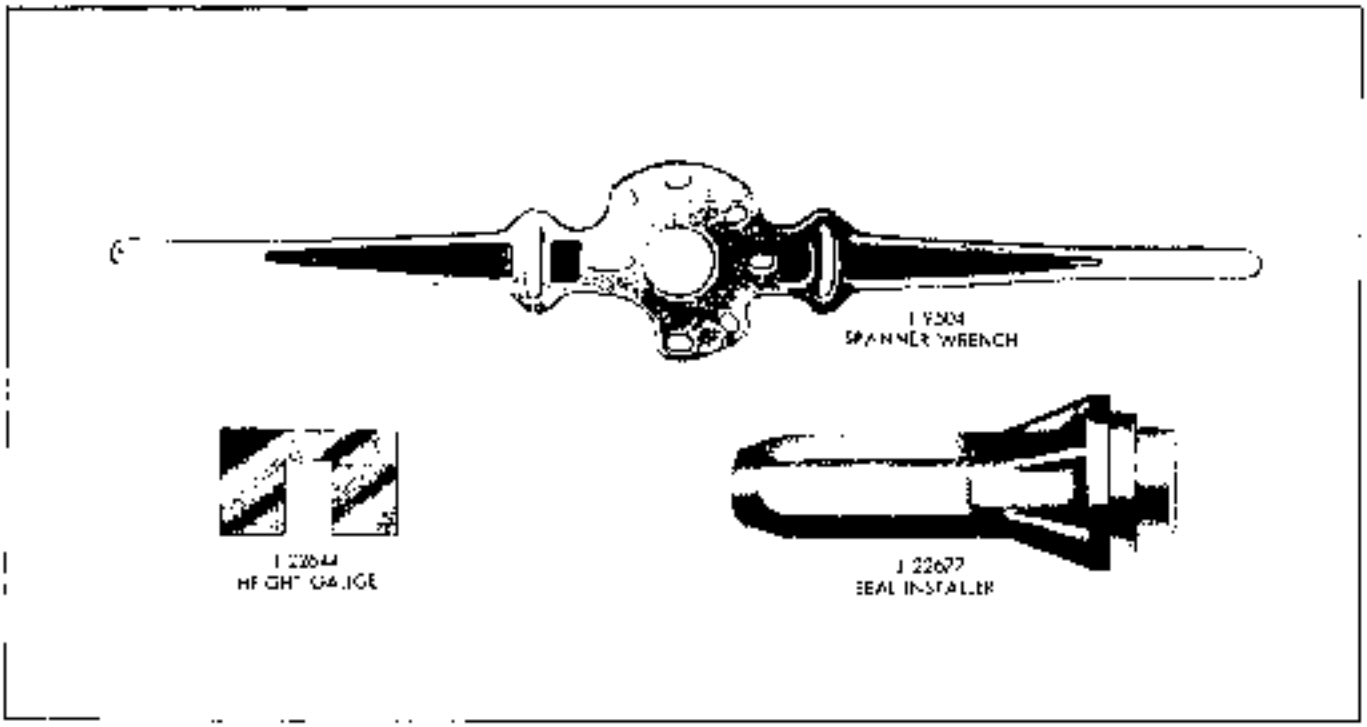


Fig. 5B-8 Special Tools

HEAVY DUTY POWER BRAKES

BENDIX TANDEM DIAPHRAGM TYPE

CONTENTS OF THIS SECTION

CHECKS AND ADJUSTMENTS ON CAR

1. Check for free operation of brake pedal. If binding exists, check all pivot points for binding and lubricate as required.

2. Check stop light switch for proper setting and operation.

3. Check fluid level in hydraulic cylinder reservoir. Fluid level should be as shown in Section 5.

4. Check vacuum line and connections at carburetor and vacuum check valve for possible vacuum leaks.

5. Check engine for good stall-free idle and correct as required.

MINOR REPAIRS

BLEEDING BRAKES

Brakes should be bled in the same manner as standard brakes.

STOP LAMP SWITCH

See Section 5 for service.

MAJOR REPAIRS

POWER BRAKE AND MASTER CYLINDER—REMOVE

1. Disconnect vacuum hose from vacuum cylinder assembly. Cover openings to prevent entry of dust, dirt, etc.

2. Disconnect pipe from master cylinder hydraulic port and cover opening in master cylinder and end of pipe to prevent entry of dust, dirt, etc.

3. Remove clevis pin from brake pedal inside the car.

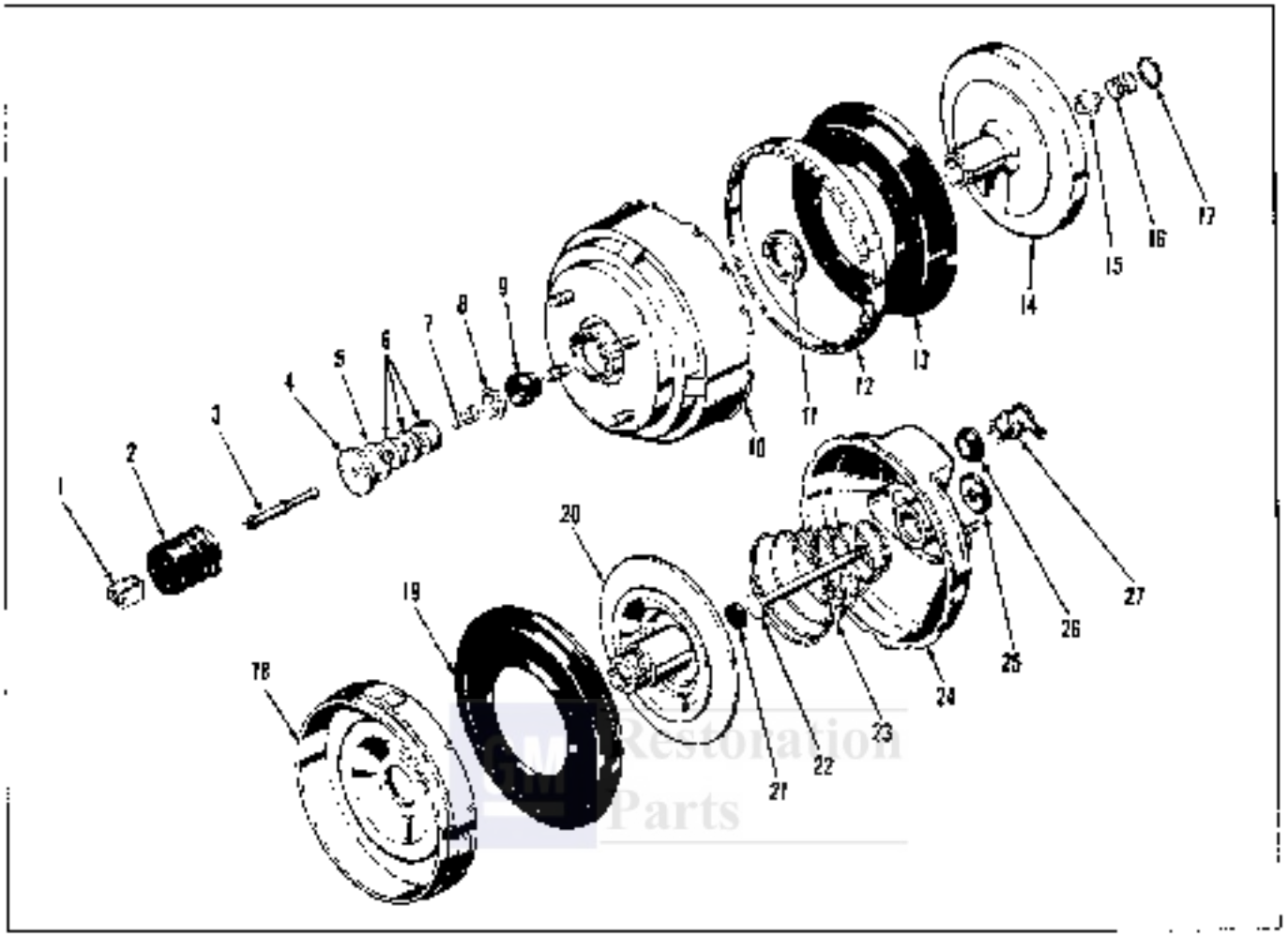
4. Remove nuts and lock washers from power cylinder studs and remove power cylinder.

5. Clean exterior of power brake assembly and drain reservoir of hydraulic fluid.

DISASSEMBLY

MASTER CYLINDER AND EXTERNAL PARTS—REMOVE

Scribe across master cylinder flange and front shell of power section. Remove the two master cylinder attaching nuts and lockwashers and lift off master cylinder. Remove clevis from valve rod. Wet



1. Clevis
2. Dust Guard
3. Valve Rod
4. Silencer
5. Retainer
6. Air Filters
7. Valve Return Spring
8. Poppet Retainer
9. Poppet
10. Rear Shell
11. Rear Seal
12. Rear Diaphragm Spring Retainer
13. Rear Diaphragm
14. Rear Plate
15. Valve Plunger
16. Valve Plunger Spring
17. Square Ring Seal
18. Center Plate
19. Front Diaphragm
20. Front Plate
21. Reaction Disc
22. Hydraulic Push Rod
23. Power Diaphragm Return Spring
24. Front Shell
25. Front Vacuum Seal
26. Rubber Grommet
27. Vacuum Check Valve

Fig. 5C-1 Power Unit—Exploded View

hex and threaded end of valve rod and small diameter of dust guard with alcohol and then carefully remove dust guard and silencer from valve rod and scalloped hub of rear shell. Remove hydraulic push rod by pulling it straight out of front shell. Slide front seal off adjustment nut end of push rod.

VALVE ROD, RETAINERS, FILTERS AND POPPET PARTS—REMOVE (Fig. 5C-2)

Remove air filters from valve hub with ice pick. USE CARE TO AVOID DAMAGING PLASTIC HOUSING. With valve rod in vertical position, squirt alcohol down rod to wet rubber grommet in valve plunger on ball end of valve rod. Install 3/8-24" nut on threaded end of valve rod and clamp nut securely in vise (see Fig. 5C-2 inset). Leave just enough space between steel retainer on plastic valve hub and side of vise jaw to insert two medium-sized open end wrenches. Use wrench nearest vise as a pry to force the valve plunger grommet (and power section) off the ball end of the valve rod.

CAUTION: When separating valve rod from plunger, hold power unit to prevent it from falling to floor. Use care when prying with wrenches to avoid damaging plastic valve housing.

Remove valve rod from vise. Carefully pry retainer off end of valve housing and remove valve return spring, poppet retainer and poppet.

POWER SECTION DISASSEMBLY (Fig. 5C-4)

1. Assemble special tool combination as shown in Fig. 5C-3.

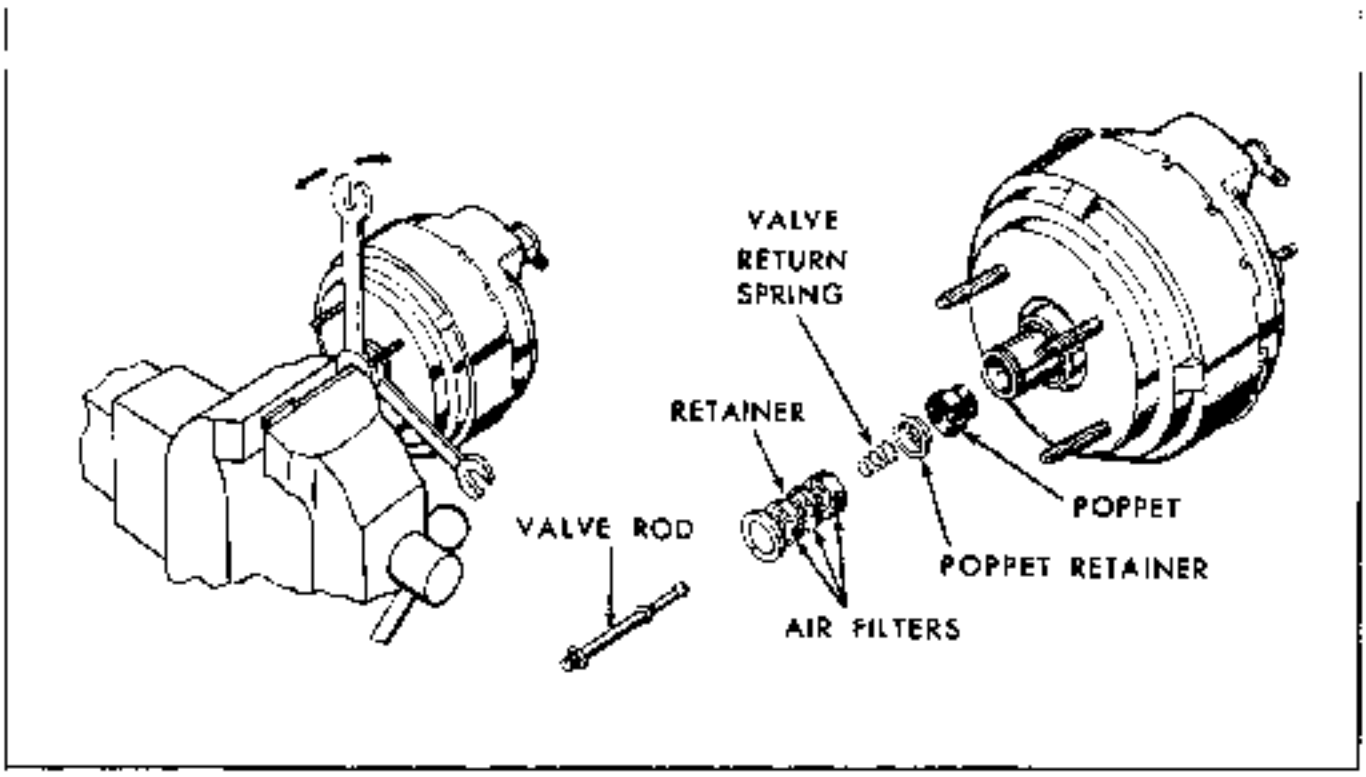


Fig. 5C-2 Valve Rod, Retainer, Filters and Poppet

2. Place assembly in arbor press (Fig. 5C-3A) with rear shell and spanner wrenches up. Secure tool J-8433 to press to prevent tilting of front shell.

3. Compress assembly sufficiently enough to allow rotation of tools J-9504.

CAUTION: Do not compress assembly to the point of damaging power unit.

4. Scribe a mark across front and rear shell to facilitate assembly.

5. Rotate spanner wrenches (J-9504) counterclockwise to release position (to point where cutouts in front shell are in line with lances in rear shell).

6. Slowly release pressure on assembly.

CAUTION: Diaphragm return spring is under pressure. Use care in separating shells to avoid the spring flying out.

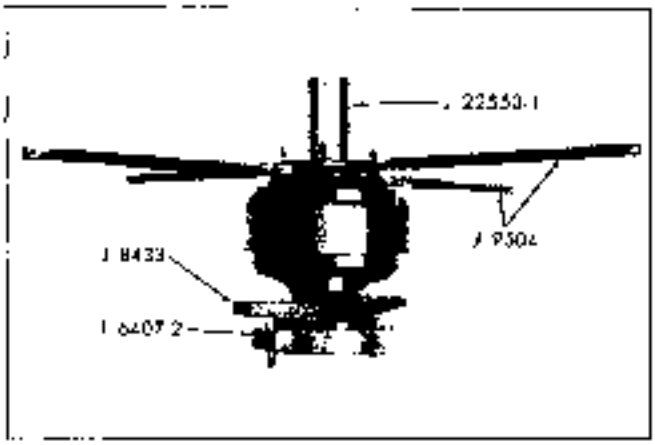


Fig. 5C-3 Power Unit Special Tool Combination

REMOVAL OF REAR SHELL VACUUM SEAL (Fig. 5C-1)

Place rear shell on bench with studs up and drive out seal with punch or screwdriver.

NOTE: Do NOT remove rear seal unless seal is defective.

DIAPHRAGMS, PLATES, RETAINER AND PLUNGER—REMOVE (Fig. 5C-4)

Wet rear diaphragm spring retainer with alcohol and remove, using fingers only. Remove rear diaphragm from rear plate. Set 1-1/16" hex bar stock about 2" long or tool J-22839 in bench vise. Set Diaphragm and Plate assembly on hex stock with hex opening in center of front plate on bar. Twist rear plate counterclockwise, using hand leverage only either on atmospheric pressure channel or on outside circumference of rear plate.

After plates have been loosened, remove assembly from vise and complete disassembly on bench, front plate down. Unscrew rear plate completely and carefully lift it off front plate hub, grasping valve plunger

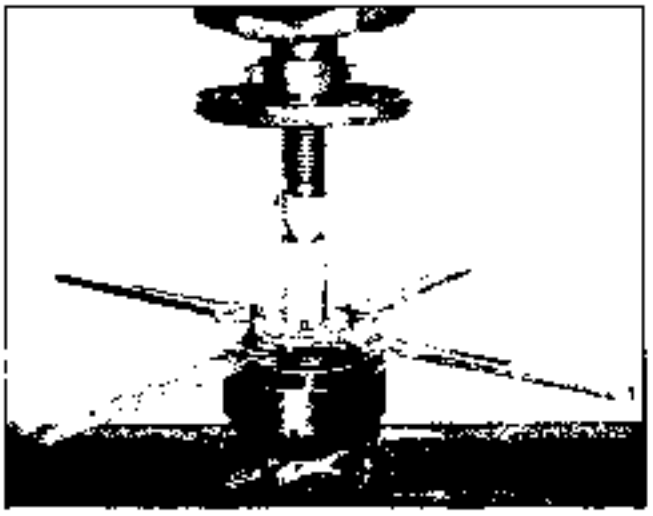


Fig. 5C-3A Power Unit Mounted in Press

and spring with other hand and remove them from bore of front plate hub.

Remove square ring seal from shoulder of plate

NOTE: Seal may stick to shoulder of either front or rear plate.

Using small rod or screwdriver through center bore of front plate, push out reaction disc. Loosen front diaphragm from center plate and slide center plate carefully off front plate hub.

CAUTION: DO NOT DAMAGE OR REMOVE SEAL FROM CENTER BORE OF CENTER PLATE.

Remove diaphragm from front plate.

REMOVAL OF VACUUM CHECK VALVE AND GROMMET (Fig. 5C-1)

NOTE: Do NOT remove vacuum check valve unless it is defective.

To remove vacuum check valve from front shell,

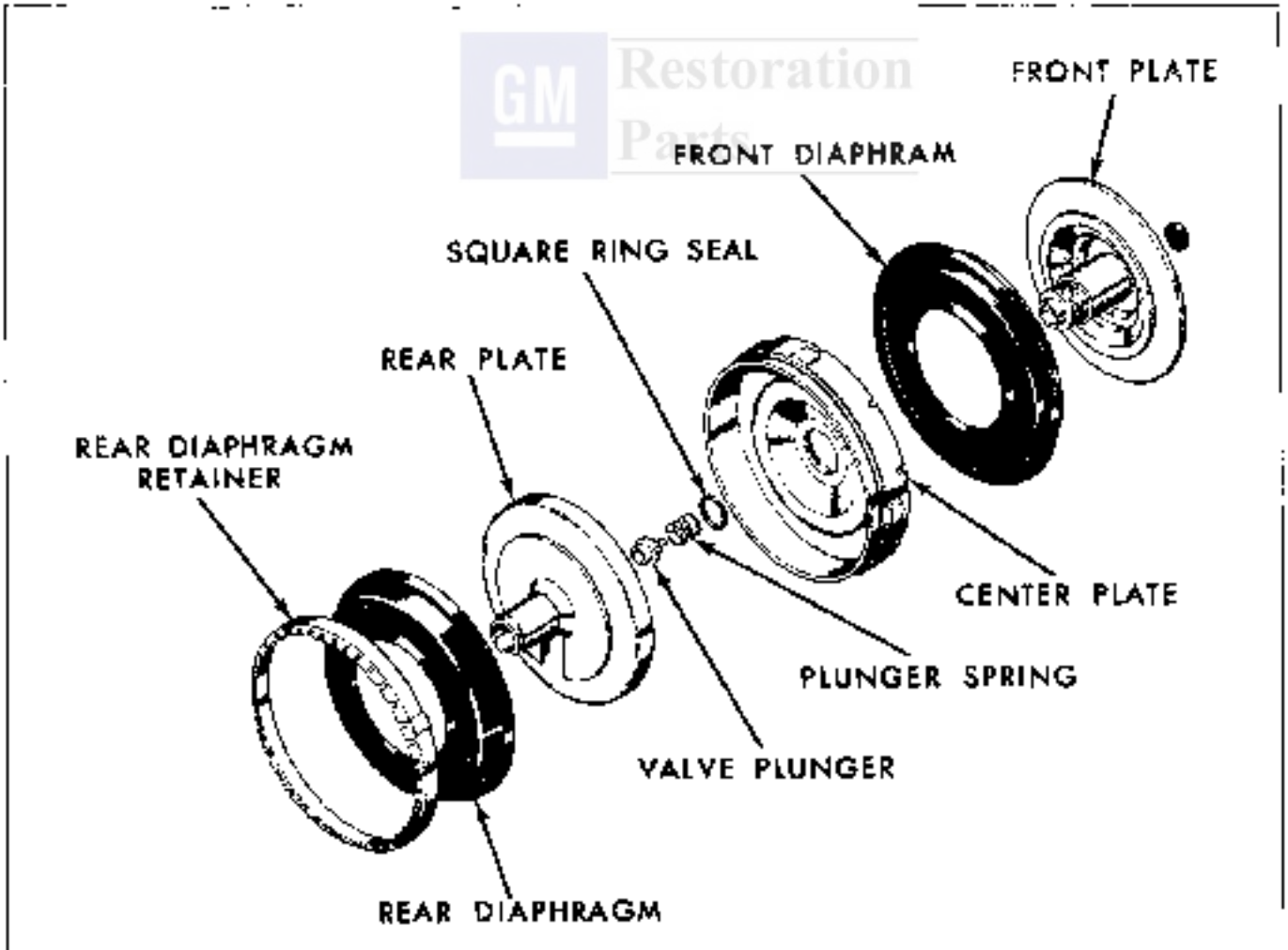


Fig. 5C-4 Diaphragms, Plates, Retainer and Plunger

work from inside front shell with sharp penknife or razor blade to cut off bead of rubber grommet. Remove check valve and grommet.

DISASSEMBLY OF MASTER CYLINDER (Fig. 5C-5)

Always use the correct master cylinder repair kit when overhauling the master cylinder. Always replace all rubber parts. Metal parts cleaner should NOT be used on any parts used in the hydraulic section. Gasoline and kerosene also should never be used. Rinse all hydraulic parts in clean alcohol and use emery or crocus cloth to polish them, if necessary. If the bore contains rust, corrosion or pitted areas, a master cylinder hone may be used; but do not attempt to re-use a cylinder if the resulting bore is more than .008" oversize.

1. Pry water and dirt seal and retainer out of shallow cavity around master cylinder hub.

2. Press in against rear piston with round-end rod to relieve spring load on piston stop screw under master cylinder bore. Use a 3/8" wrench to remove stop screw and O-ring seal. Maintain pressure on rear piston and use Tru-Arc pliers to remove snap ring from groove in master cylinder bore.

3. Remove rear piston and spring assembly and discard. Do NOT attempt to disassemble it since a complete new assembly is provided in the repair kit.

4. Remove front piston assembly, front return spring and retainer. Slide primary cup and protector off nose of front piston. Use dull scribe to lift both secondary seals from the grooves at the rear end of the piston. Discard all old rubber parts.

NOTE: Check valves should not be replaced unless one or more of conditions exist as outlined in Section 3 under Master Cylinder Disassembly.

5. Install spare tube nut in outlet ports. Place thin washer on self-tapping screw and install screw in tube seat with washer bottomed against tube nut. Hold screw with screwdriver and use wrench to remove tube nut, screw, washer and tube seat. Remove rubber check valve and spring from both outlet ports and discard both valves and springs.

NOTE: On master cylinder used with caliper disc brakes, outlet for front wheels does not incorporate a check valve and spring. Tube seat should only be removed when the tube seat, itself, is damaged and requires replacement.

CLEANING

Wash all hydraulic system parts in alcohol. If necessary, dip metal parts in a reputable cleaner to remove rust or corrosive deposits. Polish parts with emery or crocus cloth immediately and rinse in alcohol. Remove spots, deposits or pitted areas inside the master cylinder bore with emery cloth, crocus cloth or a hone. Do NOT attempt to re-use a cylinder if the resulting bore is more than .008" oversize. Discard all old rubber parts, except filler diaphragm.

INSPECTION

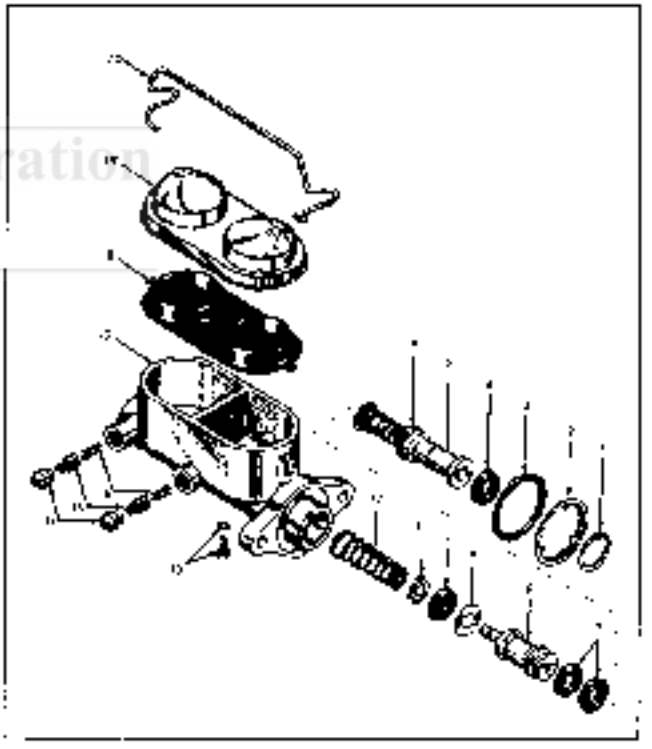
Inspect all metal parts for damage or excessive wear. Replace any damaged or worn parts.

ASSEMBLY

ASSEMBLY OF MASTER CYLINDER (Fig. 5C-5)

1. Clamp master cylinder in vise with hub end tilted slightly upward.

2. Install new secondary seals, back to back, in grooves on rear end of front piston. Dip seals in



1. Snap Ring
2. Splash Shield Retainer
3. Splash Seal
4. Secondary Seal
5. Rear Piston and Spring Assembly
6. Primary Cup
7. Secondary Seals
8. Front (Floating Piston)
9. Protector
10. Primary Cup
11. Retainer
12. Front Piston Return Spring
13. Piston Stop Screw and Seal
14. Tube Seats
15. Check Valves
16. Springs
17. Master Cylinder Casing
18. Hermetic Diaphragm
19. Reservoir Cover
20. Bale-Type Retainer

Fig. 5C-5 Master Cylinder—Exploded View

brake fluid and lat them carefully into grooves with full scribe. Slide protector and primary cup onto nose of front piston.

3. Stack front piston return spring and retainer on nose of front piston and dip assembly in brake fluid. Slide assembly to bottom of master cylinder bore. Press and twist piston to ease cups past snap ring groove.

4. Dip new rear piston and spring assembly in brake fluid and slide assembly into bore. Use scribe and press piston to ease cups into bore.

5. Press in against rear piston with round-end rod to compress return springs. Do NOT use screwdriver or other sharp-edged tool since this will damage the push rod seal inside the piston. Maintain pressure on piston and use Tri-Arc pliers to install snap ring in groove inside bore. Make sure snap ring is seated securely in groove.

6. Install piston stop screw and new O-ring seal in port underneath bore. Torque screw with 3/8" wrench to 40 lbs. in.

7. Install new spring and check valve in both outlet ports unless master cylinder is to be used on disc brake equipped vehicle. Press new tube seat into each port using spare tube nut. Make sure tube seat is bottomed in port. Torque tube nut to 40 lbs. in. to be sure tube seat is bottomed in port.

8. Remove master cylinder from vise. Install reservoir diaphragm and cover and plug ports, temporarily, to prevent entry of dust or dirt.

ASSEMBLY OF VACUUM SEAL IN REAR SHELL (Fig. 5C-1)

Place rear shell on block of wood, studs down, and press new seal, plastic bearing face first, into recess in rear shell. Top outside flange of seal should be pressed .30" (approximately 5/16") below flat shell surface next to seal cavity.

ASSEMBLY OF PLATES PLUNGER AND DIAPHRAGM (Fig. 5C-4)

Install front diaphragm on front plate. Apply a light film of power brake lubricant to outside surface of front plate hub and liberally to the seal in the center plate bore. Carefully guide center plate and seal assembly, seal side first, onto front plate hub using tool J-22738. Apply power brake lubricant lightly to front and rear bearing surfaces of valve plunger, being careful NOT to get any lubricant on rubber grommet inside plunger.

Assemble valve plunger return spring on valve plunger as shown and set spring and plunger in recess of front plate hub, grommet side up. Place vacuum seal firmly against shoulder on outside of front plate hub. Set rear plate, threaded bore down, over valve plunger and, using hands only, screw rear plate into front plate hub. To tighten plates, place 1-1/16" hex bar stock or tool J-22839 in vise and set plate assembly, front plate down, on hex bar. Using arc channel slot on rear plate edges, hand torque plates to 12 1/2 lb. ft. Remove plate assembly from vise. Install rear diaphragm on rear plate and over lip of center plate. Assemble rear diaphragm spring retainer over rear diaphragm and lip of center plate. Using fingers, press retainer onto center plate until it seats against shoulder of center plate.

ASSEMBLY OF DIAPHRAGMS AND PLATES IN FRONT AND REAR SHELLS (Fig. 5C-3)

Apply power brake lubricant liberally to bearing seal in rear shell. Apply power brake lubricant liberally to scalloped cut-outs on edge of front shell. When assembling diaphragm and plate assembly in rear shell, the rear diaphragm and center plate lugs must be aligned between lances on rear shell. Carefully guide valve housing sleeve through bearing seal in rear shell, keeping diaphragm and plates in correct alignment. Work outer rim of front diaphragm into rear shell so that outer rim of front diaphragm is under each of retaining lances on rear shell.

1. Secure power section front shell to tool J-8433 and J-9407-02 as in Fig. 5C-3.

2. Assemble rear shell to spanner wrenches J-9504 as shown in Fig. 5C-3.

3. Secure front shell to arbor press.

4. Place power diaphragm return spring in front shell, small coil first.

5. Position rear shell, spanner wrenches, and tool J-22559-1 over spring so that scribe marks will be aligned when the shells are locked together.

6. Slowly compress assembly keeping in a parallel plane.

7. When front and rear shells are mated rotate spanner wrenches until the two shells are locked together.

CAUTION: Do not compress assembly to the point of damaging power unit.

8. Release pressure from assembly and remove all tools from front and rear shells.

ASSEMBLY OF VACUUM CHECK VALVE, REACTION DISC AND PUSH ROD (Fig. 5C-1)

Apply power brake lubricant liberally to entire surface of rubber reaction disc and to piston end of hydraulic push rod. Place reaction disc on piston end of push rod.

CAUTION: Under NO condition should lubricant be allowed to get on adjustment screw or threads.

Insert push rod with reaction disc on piston end into cavity in front plate hub. Twist push rod to make certain reaction disc is seated in front plate hub and to eliminate air bubbles between hub, disc and push rod piston. Assemble seal, support plate side first, over adjustment screw end of push rod. Press seal into recess in front shell until seal bottoms against shell.

If vacuum check valve was removed, wet new grommet in alcohol and press grommet into front shell, beveled side first. Make certain grommet is seated in shell. Wet shoulder of check valve and inside diameter of grommet with alcohol and assemble check valve in grommet. Press check valve into grommet until entire circumference of check valve flange bears against grommet.

ASSEMBLY OF VALVE ROD, FILTERS, RETAINER AND POPPET PARTS (Fig 5C-2)

Wet poppet valve in alcohol and assemble poppet in valve housing, small diameter end of poppet first; wet poppet retainer in alcohol and assemble in housing with flange out. Press in against retainer to make certain shoulder on retainer is positioned inside poppet. Assemble retainer, valve silencers and filters and valve return spring over ball end of valve rod, as shown. Wet rubber grommet in valve plunger inside valve hub and ball end of valve rod with alcohol. Guide spring, filters and silencers into valve housing and assemble ball end of valve rod in valve plunger. Tap end of valve rod with soft hammer to lock ball end of rod in valve plunger grommet. Press filters into position in housing and assemble retainer on end of valve housing, being careful not to chip plastic.

ASSEMBLY OF DUST GUARD AND MASTER CYLINDER TO POWER UNIT (Fig. 5C-1)

Assemble silencer in dust guard. Dip small diameter of dust guard in alcohol and assemble dust guard over end of valve rod, using care to avoid tearing guard. Press guard against valve housing and seat large end of guard over scalloped flange of rear shell.

NOTE: Before mounting master cylinder, check

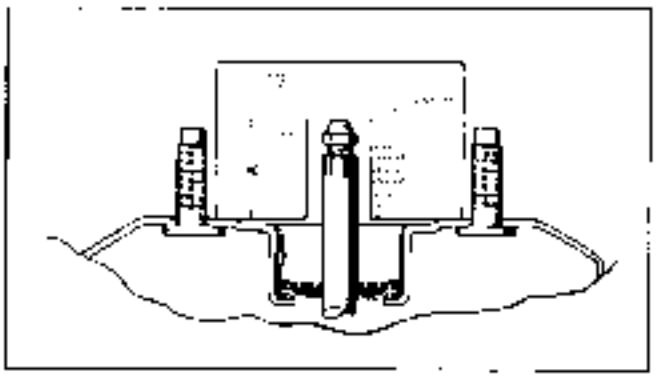


Fig. 5C-6 Gaging Push Rod Length

distance A (Fig. 5C-6) from end of hydraulic push rod to master cylinder mounting face on front shell. This dimension A, as shown in Figure 5C-6, should be 1.200". If push rod length is not correct, follow adjustment procedure below. When push rod length is correct, attach master cylinder to power section with lockwashers and nuts. Tighten nuts securely. Install clevis on threaded end of valve rod.

PUSH ROD ADJUSTMENT

The self-locking adjustment screw is set to correct dimension at time of original assembly of power unit. Under normal service, no further adjustment should be needed provided push rod assembly remains in original unit. If, however, push rod is transferred to another unit or new push rod is used, adjustment will be necessary. To adjust push rod, hold serrated end of push rod with pliers and turn adjusting screw IN to shorten or OUT to lengthen push rod. Measure push rod height with push rod installed in unit, using either a height gauge or tool J 7723-01. See Figure 5C-7 for details for making height gauge.

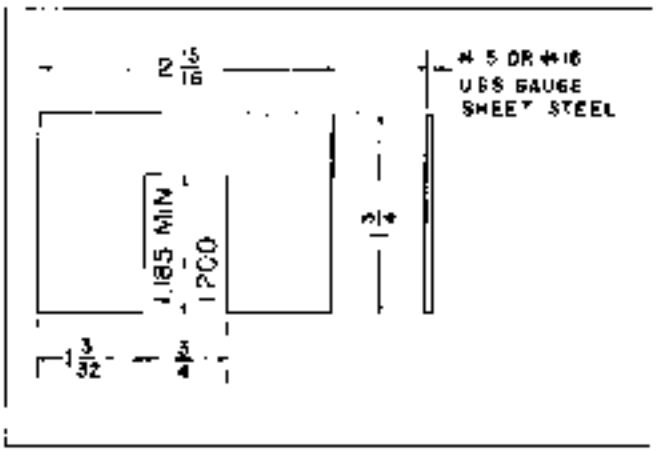


Fig. 5C-7 Push Rod Gauge

POWER BRAKE ASSEMBLY—INSTALL

1. Place power brake into position and install four rear housing to cowl attaching lock washers and nuts from inside of car. Tighten nuts to 25 lb. ft. torque.

2. Attach clevis to brake pedal and install pin and retainer.

NOTE: Pedal height is not adjustable.

3. Adjust stop light switch if necessary to provide 3/16" plunger extension from body. Attach wire.

4. Attach vacuum hose to vacuum check valve.

5. Attach hydraulic lines.

6. Bleed brakes as necessary and fill fluid reservoirs. Fluid level should be as shown in Section 6.

TORQUE SPECIFICATIONS

Power cylinder housing to master cylinder nuts	25 lb. ft.
Rear housing to dash nuts	25 lb. ft.

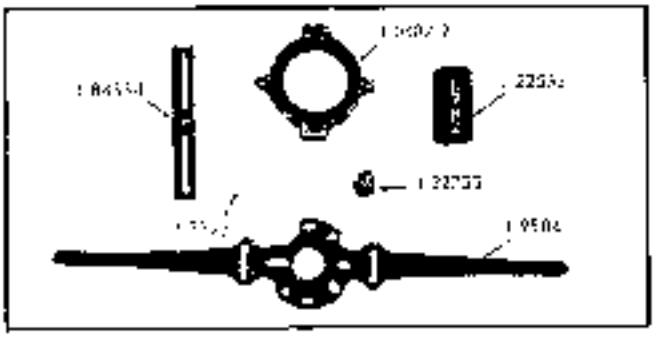


Fig. 8C-9 Special Tool Construction

DISC BRAKES

CONTENTS OF THIS SECTION

SERVICE PROCEDURES

BRAKE SHOES—REMOVE AND REPLACE

The linings should be inspected whenever the wheels are removed for any reason (tire rotation, etc.). Shoe and lining should be changed if the lining is approximately .020" or less in thickness over the rivet heads. A slightly tapered wear condition of the lining must be considered normal and is not cause for replacement unless there is less than the minimum clearance to rivet heads.

1. Raise car and remove front wheels.

2. Attach a drain hose to caliper bleed screw and submerge other end of hose in a container partially filled with brake fluid. When bottoming pistons, open bleed screw to allow excess fluid to drain. After pistons are bottomed, tighten bleed screw before relieving pressure on shoes and linings.

NOTE: This step is necessary when replacing worn disc brake shoes, since insertion of full thickness lining will force the pistons back into caliper, displacing fluid into master cylinder, causing reservoir to overflow. Do not drain reservoir completely as there is the possibility that air could be pumped into the system, if brake pedal is depressed, which would make it mandatory to bleed system.

3. Remove and discard cotter pin from inboard end of shoe retaining pin and slide out retaining pin.

4. Starting with inboard shoe (shoe closest to car), push back as far away from disc as possible. Do not pry against disc. Slip piston retainer J 22074 over caliper bolt, with flat side between piston and back of shoe or using a screwdriver or putty knife between shoe and lining assembly and piston, press pistons to bottom of cylinder bores. Piston springs will not allow pistons to remain completely bottomed.

5. Remove worn shoes and insert new replacements by rotating either end out of caliper and pulling shoe from caliper. If any difficulty is experienced in removing or installing shoe, rotate shoe in opposite direction. Shoes are to be replaced in axle sets only. Shoes are interchangeable.

NOTE: Be sure lining material is next to disc.

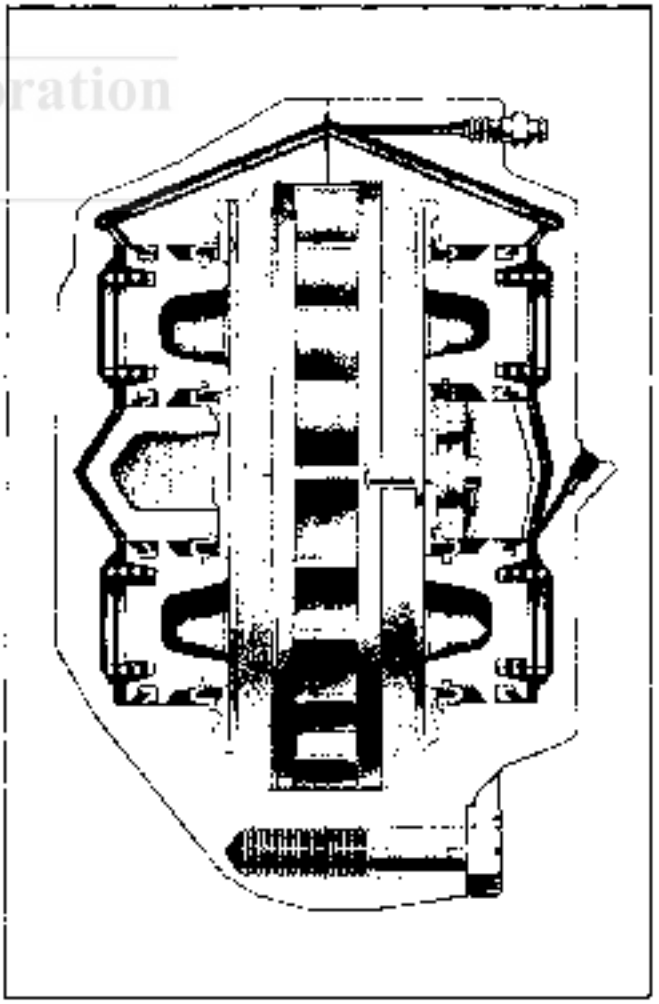


Fig. 5D-1 Disc Brake Assembly

6. Remove shoe retaining pin through outboard caliper half, outboard shoe, inboard shoe and inboard caliper half. Place a new, 3/32" x 5/8" stainless steel cotter pin through retaining pin and lock. Remove piston retaining clips.

7. Repeat steps 2 through 6 at other front wheel.

8. Install wheels and tighten wheel nuts to 75 lb. ft. (Pontiac), 70 lb. ft. (Tempest and Firebird).

9. Lower hoist or remove jack stands.

10. Check master cylinder fluid level and fill, if necessary. Depress brake pedal several times to seat linings on disc. Recheck master cylinder fluid level and refill, if necessary. If brake pedal feels spongy, bleed brakes.

CAUTION: Do not move car until a firm brake pedal is obtained.

BRAKE DISC—REMOVE

1. Raise car and remove front wheels.

2. Remove brake hose support to caliper mounting bracket screw.

3. Remove caliper to mounting bracket bolts. Hang caliper from upper suspension.

NOTE: Do not place strain on brake hose.

4. Remove spindle nut and disc and hub assembly.

BRAKE DISC—INSTALL

1. Install new bearings or seal as necessary.

2. Install hub and disc assembly on spindle. See Section 3—Front Suspension for Wheel Bearing Adjustment Procedure.

3. Install caliper and tighten bolts to 65 lb. ft. Mount tube support bracket and tighten bolt to 27 lb. ft. (Pontiac), 17 lb. ft. (Tempest and Firebird).

4. Mount wheel and tighten wheel bolt nuts to 75 lb. ft. (Pontiac), 70 lb. ft. (Tempest and Firebird). Lower hoist or remove jackstands.

5. Depress brake pedal several times to seat linings on disc.

CAUTION: Do not move car until a firm brake pedal is obtained.

DISC BRAKE CALIPER OVERHAUL

CALIPER—REMOVE (Fig. 5D-6)

1. Disconnect brake line tube nut from inboard caliper side of the calipers. Plug end of tube to prevent entrance of dirt and loss of fluid.

2. Detach caliper assembly from mounting bracket by removing two hex head bolts and take to clean work area.

CALIPER—DISASSEMBLE

1. Remove and discard cotter pin from inboard end of shoe retaining pin, slide out retaining pin and remove shoes. If old shoes are to be reused, they should be marked for proper installation at time of assembly. Clean outside of caliper with a reputable cleaner or clean denatured alcohol.

2. Separate caliper halves by removing two large hex head bolts. Remove two small O rings from cavities around fluid transfer holes in both ends of outboard caliper halves.

3. To free piston boots so pistons may be removed, push piston down into caliper as far as it will go. Insert a screwdriver blade under inner edge of steel ring on boot and using piston as a fulcrum, pry boot from its seat in caliper half. (Fig. 5D-2)

CAUTION: Do not damage cylinder bore during disassembly of boot.

4. Remove piston assemblies and springs from caliper half. Remove boot and seal from piston.

INSPECTION AND CLEANING OF CALIPER

Inspect cylinder bore for scoring or corrosion. If cylinder bore is corroded, the caliper half should be replaced.

NOTE: Staining is not to be confused with corrosion. Corrosion can be identified as pits or excessive roughness.

Polish any discolored or stained area with crocus cloth by rotating the cloth supported by a finger in the bore. Do not slide the cloth in or out of bore under pressure. *Do not use any other form of abrasive or abrasive cloth.*

Clearance of piston in bore as checked using a feeler gage should be .0045" to .010".

All rubber parts, boots, seals and O-rings, should be replaced with new parts. All rubber parts are contained in repair kit.

Use a reputable cleaner or denatured alcohol to remove all traces of dirt or grease. Do not use mineral base solvents to clean brake parts. Using an air hose, blow out all fluid passages in caliper halves, making sure that there is no dirt or foreign material blocking any passage. During reassembly, use care to keep dirt out of caliper assembly.

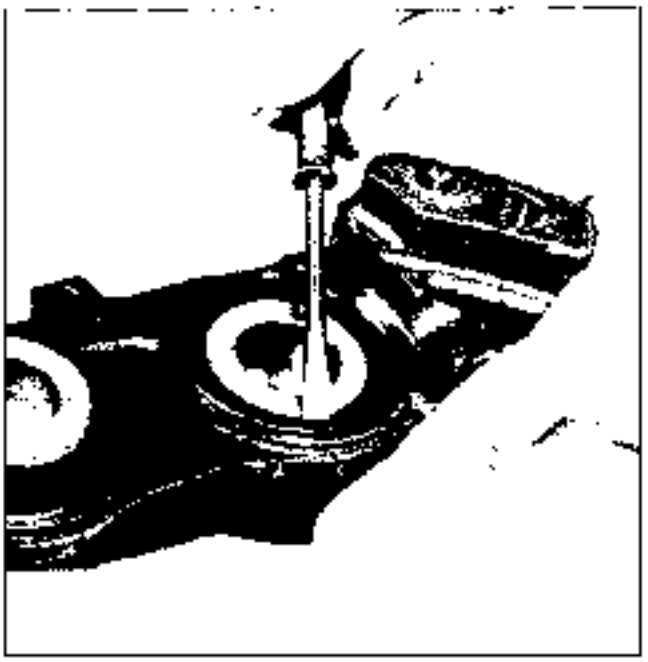


Fig. 5D-2 Removing Piston Boot

CALIPER—ASSEMBLE

1. Assemble seal in groove in piston which is closest to flat end of piston. The lip on the seal must face toward large end of piston. Be sure seal lips are in piston groove and do not extend over step in end of groove. (Fig. 5D-3)

2. Place spring in bottom of piston bore.

3. Lubricate piston seal and cylinder bore with clean brake fluid.

4. Install piston in bore, using piston installer J 22261. (Fig. 5D-4)

5. Depress pistons and check that they slide smoothly into bore until end of piston is flush with end of bore. If not, recheck piston and location of piston spring and seal.

6. Assemble boot in groove of piston closest to concave end of piston. Fold in boot must face toward end of piston with seal on it.

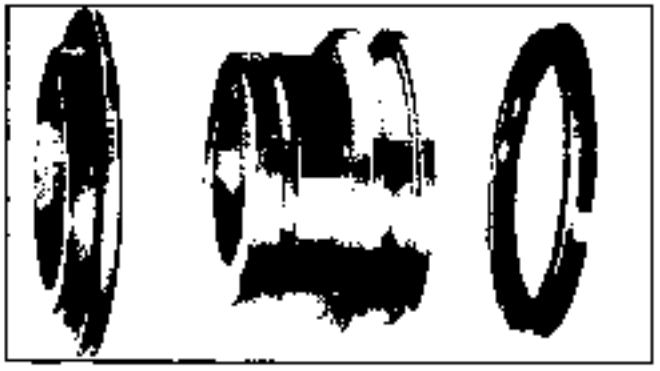


Fig. 5D-3 Exploded View of Piston

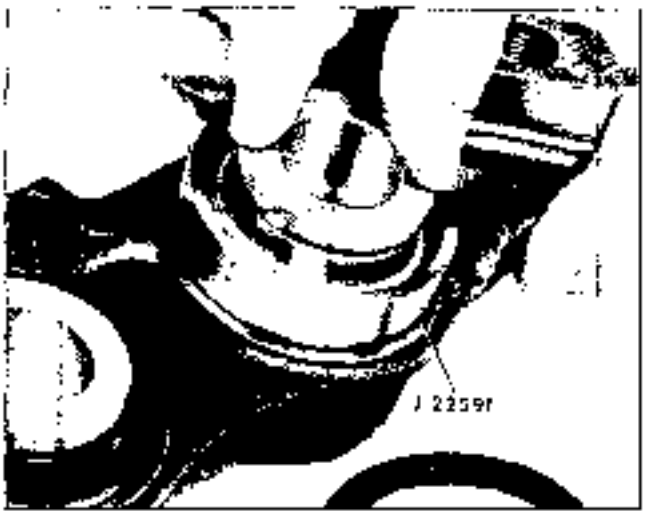


Fig. 5D-4 Installing Piston in Bore

7. Position installer J 22262 over piston and seat steel boot retaining ring evenly in counterbore. The boot retaining ring must be flush or below machined face of caliper. Any distortion or uneven seating could allow contaminating and corrosive elements to enter bore. (Fig. 5D-5)

8. Repeat steps 2 through 7 for other three pistons.

9. Position O-rings in small cavities around fluid transfer holes on both ends of outboard caliper

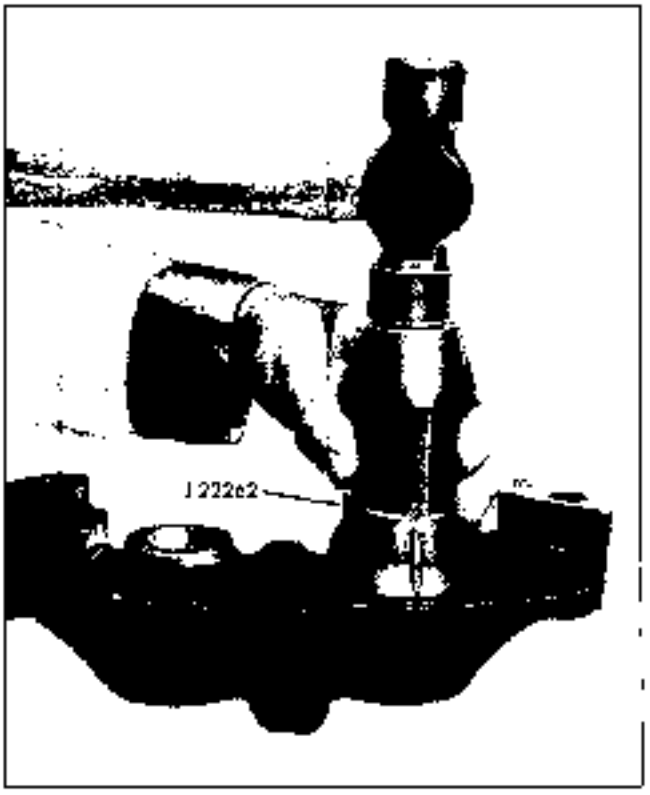


Fig. 5D-5 Installing Piston Boot

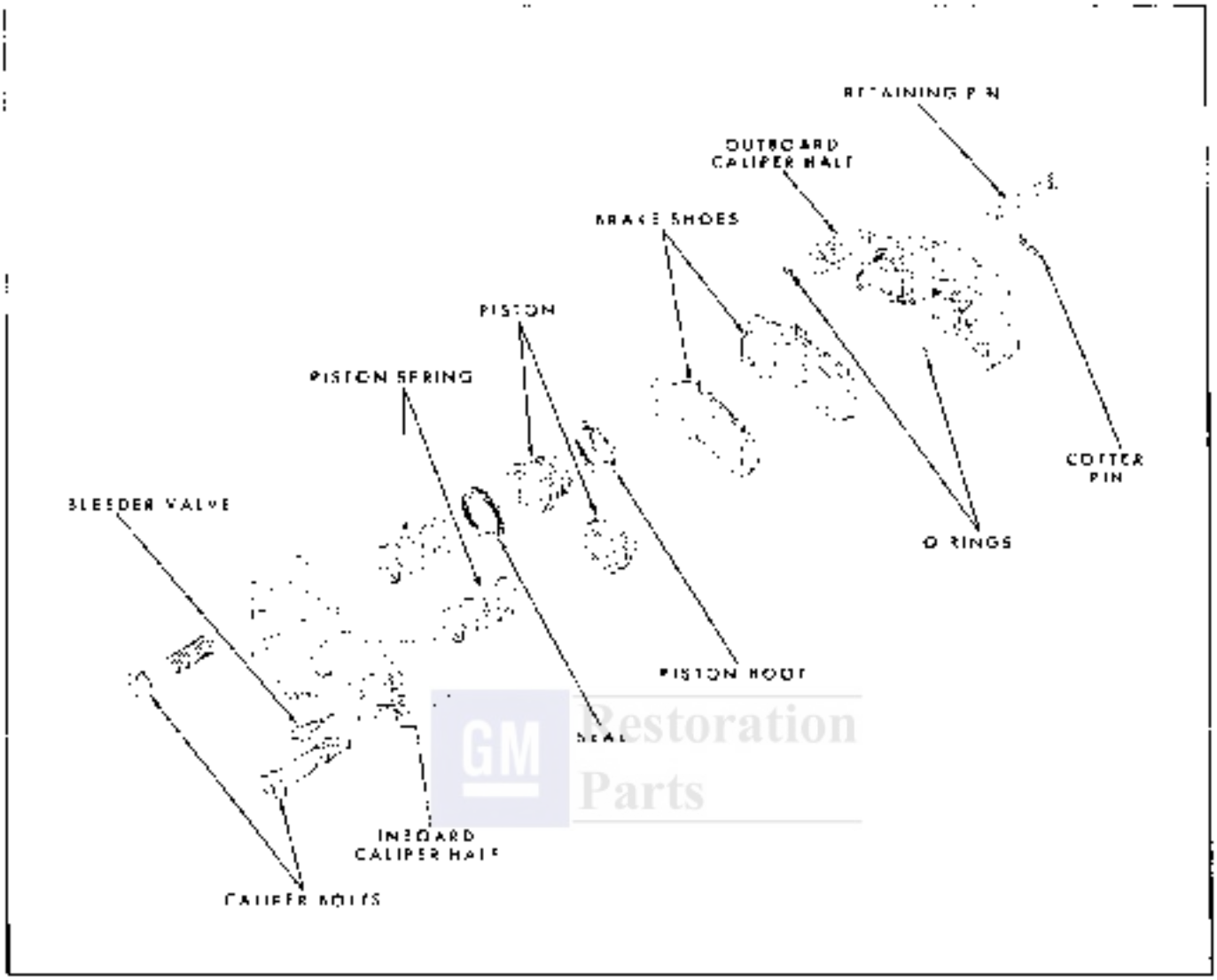


Fig. 3D-6 Exploded View of Caliper

halves. Lubricate hex head bolts with brake lubricant, or dip in clean brake fluid. Fit caliper halves together, install bolts and torque to 130 ft. lb.

NOTE: It is very important that caliper bolts be lubricated and torqued to values specified. Use a reliable torque wrench.

10. Install shoe assemblies in caliper and push pistons into bore.

11. Install retaining pin and cotter pin.

NOTE: Head of retaining pin must be on outboard side of caliper.

CALIPER—INSTALL

1. Position caliper over disc and attach to mounting bracket with two hex head bolts. Torque mounting bolts to 75 ft. lb.

2. Connect brake line tube nut to caliper.

3. Calipers are now ready to be bled with Delco Supreme No. 11 brake fluid or equivalent.

BRAKE DISC

In manufacturing brake disc, tolerance of rubbing surfaces for flatness is .001" and for parallelism is .0005", while lateral runout of the faces must not exceed .004" total. Maintenance of these close controls of the shape of the rubbing surfaces is necessary to prevent brake roughness. In addition, surface finish must be non-directional and maintained at 30-50 micro-inch. This control of rubbing surface finish is necessary to avoid pulls and erratic performance and promote long lining life and equal lining wear of both left and right brakes. (Fig. 3D-7)

Light scoring of disc surfaces not exceeding .015" in depth, which may result from normal use, is not detrimental to brake operation.

When total disc thickness is less than .965" (Tempest) or 1.315" (Pontiac), disc should be replaced.

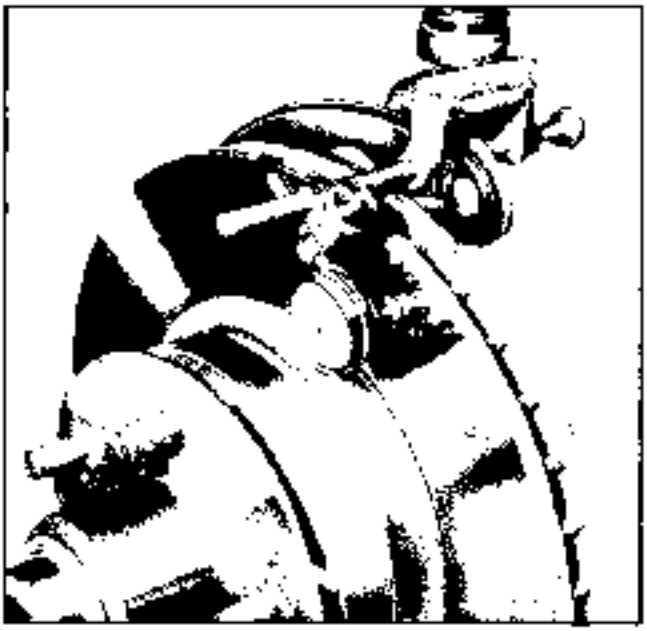


Fig. 5D-7 Checking Disc Runout

Disc thicknesses less than this can permit shoes to come out of contact with shoe abutments and cause malfunction. Because performance is not impaired by surface imperfection not exceeding .015" deep, refinishing of rubbing surface is not recommended.

PROPORTIONING VALVE—REMOVAL AND INSTALLATION

1. Place dry rags below valve to absorb any fluid spilled during removal of valve.

2. Disconnect hydraulic brake lines from both sides of switch. Cover open lines with clean, lint-free material to prevent foreign matter from entering the system.

3. Remove mounting screw and remove switch from vehicle.

4. To install, reverse above procedure and bleed brakes as outlined below.

BLEEDING DISC BRAKES

The bleeding operation for disc brakes is the same as for drum brakes. The only exception is that the metering valve must be held open. This is done by depressing and holding in the plunger in the end of the valve either by hand or by tapping. Tool J 22793 may also be used to aid bleeding.

SPECIFICATIONS

Disc Brake Type	Fixed Caliper – Disc
Location	Front Wheels Only
Disc Type	Ventilated – Cast Iron
Disc Diameter	11"
Disc Runout (Maximum)	.004" Total
Disc Surface Finish	30-50 Micro-Inch
Disc Thickness, New	Pontiac 1.250" - 1.260" Firebird-Tempest .995" - 1.005"
Disc Thickness, Minimum	Pontiac 1.215" Firebird-Tempest: .965"
Disc Parallelism (Thickness Variation)	.0005"
Brake Shoe and Lining Type	Riveted
Brake Shoe and Lining Thickness (New)	.495" - .505"
Brake Shoe and Lining Length	5.050"
Brake Shoe and Lining Minimum Thickness Before Replacement	.138"
Master Cylinder Diameter	1.125"

TORQUE SPECIFICATIONS

Torque	Size	Application	
120 lb. ft.	5/8-18	Bolt	Splash Shield and Mounting Bracket to Knuckle (Upper)
75 lb. ft.	1/2-20	Bolt & Nut	Splash Shield and Mounting Bracket to Knuckle (Lower)
60 lb. ft.	7/16-14	Bolt	Caliper to Mounting Bracket
130 lb. ft.	9/16-18	Bolt	Caliper Assembly
65 lb. in.	Special	Screw	Caliper Bleeder

SPECIAL TOOLS

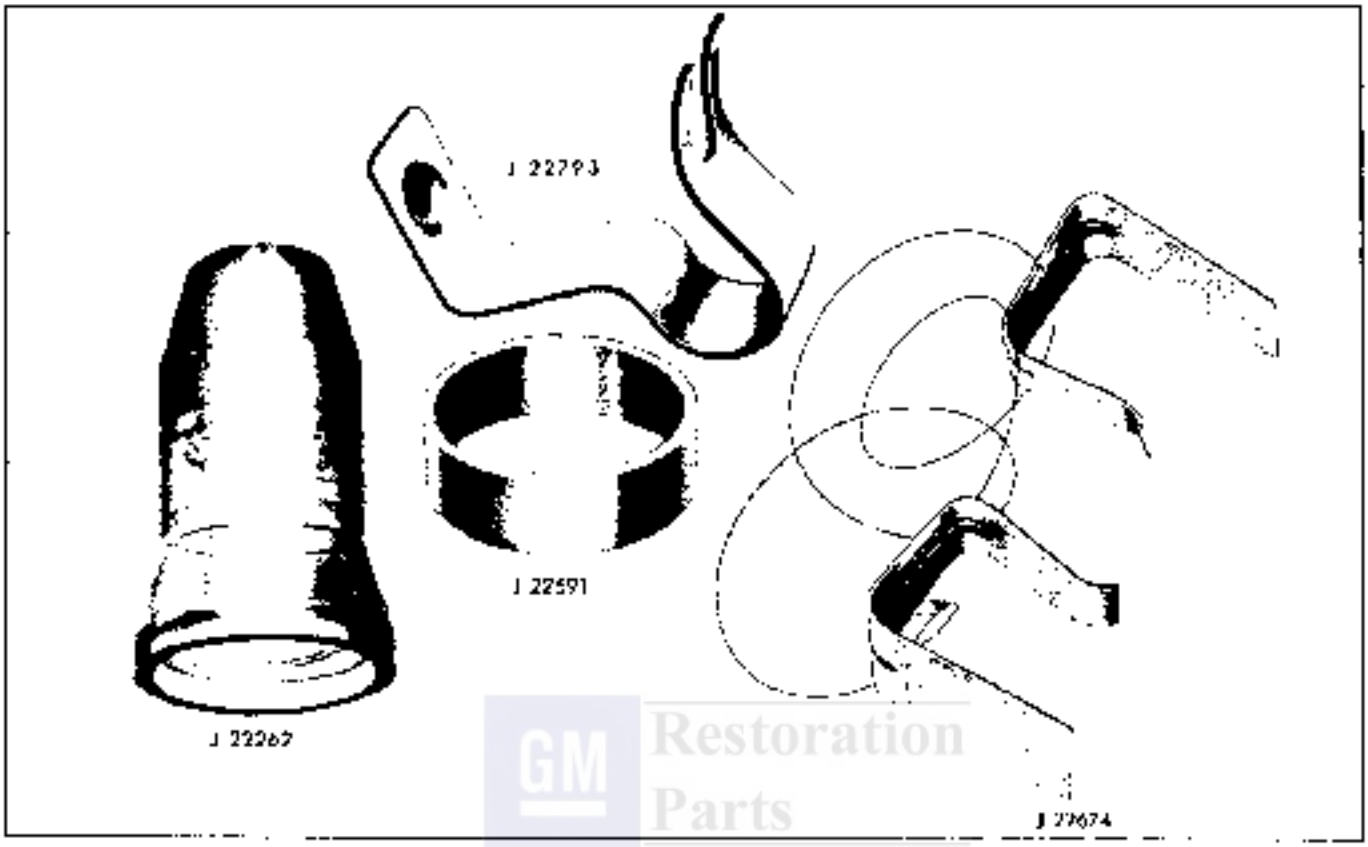


Fig. 5D-6 Special Tools

J 22591 Disc Brake Piston Installer
J 22262 Disc Brake Boot Installer (Overhead Camshaft Oil Seal Installer)
J 22674 Disc Brake Piston Retainers
J 22793 Metering Valve Clip

ENGINE MECHANICAL

CONTENTS OF THIS SECTION

SIX CYLINDER ENGINE
V-8 ENGINE

GENERAL DESCRIPTION

TEMPEST AND FIREBIRD ENGINES

The Pontiac Tempest and Firebird uses a 250 cubic inch inline overhead camshaft six-cylinder engine as standard equipment. This engine has a 3 7/8" bore and 3 17/32" stroke with a compression ratio of 9.0:1. An optional overhead camshaft engine equipped with a four-barrel carburetor has a compression ratio of 10.5:1 with the same bore and stroke.

Six optional V-8 engines are available on special order, two having 350 cubic inch displacement with 3 7/8" bore and 3 3/4" stroke. The compression ratios are 9.2:1 and 10.5:1. Four 400 cubic inch displacement engines available in the G.T.O. have a 4.120" bore and 3 3/4" stroke. These engines have compression ratios of 8.6:1 and 10.75:1. One of these engines is for use in Ram-Air cars only and incorporates a camshaft and valve train specifically for the Ram-Air engine.

Twenty-five different engine transmission combinations are available. These combinations and their usages are shown on the engine chart (Figs. 6-2 and 6-3).

Engine identification is facilitated by a letter code stamped below the production engine serial number on V-6 engines (Fig. 6-5). The code is stamped on the block in front of the right bank of cylinders. The engine code for 6-cylinder engines is stamped on the cylinder head contact surface of the block behind the oil filler pipe (Fig. 6-4). By referring to the identification code and the engine chart, each engine may be readily identified.

The vehicle identification number is stamped on the right rear lower side of the six-cylinder engine block and to the right of the timing chain cover on V-8 engines (Fig. 6-6).

PONTIAC ENGINES

Pontiac V-8 engine is used in all models. Displacement is 400 cubic inches provided by 4.120" bore and 3 3/4" stroke in all models. A 420 and 428 High Output are available on special order. Displacement in these special order engines is 428 cubic inches provided by 4.120" bore and 4" stroke.

Three compression ratios are available: 8.6:1 on regular fuel engines, 10.5:1 on premium engines, and 10.75:1 on 428 high output.

Eleven different engine-transmission combinations are available; these combinations and the major components of each are shown in Fig. 6-1.

Engine identification is facilitated by a letter code stamped below the production engine number. By referring to Fig. 6-1 and using the identification letters, major engine components can be determined.

The engine features completely machined combustion chambers, overhead valves, ball pivot rocker arm construction, harmonic balancer, hydraulic lifters, aluminum pistons, straight valve guides, superior crankcase ventilation and lubrication systems, and large displacement combined with high compression ratio for utmost performance and economy.

HORSEPOWER	ENGINE CODE	DISP. TRANS.				CARB.		COMP. RATIO			CAMSHAFT				STANDARD DISTRIBUTOR							VALVE SPRINGS		SPECIAL EXHAUST MANIFOLDS
		400	428	MANUAL	AUTOMATIC	2-BBL	QUADRAJET	8.6	10.5	10.75	9777254	9779066	9779067	9779068	1111272	1111270	1111449	1111300	1111448	1111435	1111450	STD. TWO	H.D. TWO (SPEC.)	
290	WA	X		X		X			X			X							X			X		
290	W3	X		X		X			X			X							X			X		
265	YA	X			X	X		X			X				X							X		
290	YC	X			X	X			X				X		X							X		
340	YE	X			X		X		X			X						X				X		
350	XZ	X		X			X		X				X					X				X		
350	XH	X			X		X		X			X						X				X		
375	WG		X	X			X		X					X			•				X	X		
390	WJ		X	X			X			X			X				•						X	X
375	YH		X		X		X		X				X						X			X		
390	YK		X		X		X			X			X			•						X		X

• With 60 PSI Oil Pump Spring
All Cars Use CCS

Fig. 6-1 Pontiac Engine Chart

HORSEPOWER	ENGINE CODE	DISP. TRANS.					CARB			COMP RATIO				CAMSHAFT					STANDARD DISTRIBUTOR							VALVE SPRINGS			
		250	350	400	MANUAL	AUTOMATIC	4-BBL	2-4BL	QUADRAJET	8.6	9.0	9.2	10.5	10.75	9777254	9779067	9779068	9783744	9796376	9792539	1110482	1110491	1111281	1111282	1111447	1111272	1111270	1111448	SINGLE	STD TWO	H.D. TWO (SPEC.)	RAM AIR
175	ZK	X			X		X				X								X		X							X			
175	ZK	X				X	X				X								X		X							X			
215	ZO	X			X				X				X							X		X							X			
215	ZE	X				X			X				X							X		X							X			
265	WO		X		X			X			X				X								X						X			
265	YN		X			X		X			X				X								X			X			X			
320	WR		X		X				X				X		X										X				X			
320	YP		X			X			X				X		X									X					X			
265	XM			X		X		X		X					X											X			X			
360	WT			X	X				X				X		X	X											•		X			
350	YS			X		X			X				X			X											•		X			
360	W5			X	X				X				X					X									•			X		
350	YZ			X		X			X				X			X											•		X			
365	X5			X	X				X				X					X									•				X	
365	XP			X		X			X				X				X										•				X	

• With 60 PSI Oil Pump Spring
All Cars Use CCS

Fig. 6-2 Tempest Engine Chart

HORSEPOWER	ENGINE CODE	DISP. 250	350	400	TRANS. MANUAL	AUTOMATIC	CARB. 1-BBL	2-BBL	QUADRAJET	COMP. RATIO 9.0	9.2	10.5	10.75	CAMSHAFT 9777254	9779066	9779067	9779068	9785744	9790826	9792539	STANDARD DISTRIBUTOR 1110430	1110431	1111281	1111282	1111447	1111270	1111449	VALVE SPRINGS SINGLE	STD. TWO	H.O. TWO (SPEC.)	RAM AIR
175	ZK	X			X		X			X									X		X							X			
175	ZN	X				X	X			X									X		X							X			
215	ZD	X			X				X			X								X		X							X		
215	ZE	X				X			X			X								X		X							X		
265	WC		X		X			X			X			X									X						X		
265	YJ		X			X		X			X			X									X						X		
320	WK		X		X				X			X			X										X				X		
320	YM		X			X			X			X			X									X					X		
335	XN			X		X			X				X				X									•					X
335	WQ			X	X				X				X				X										•			X	
335	WI			X	X				X				X					X									•				X
335	WZ			X	X				X				X			X											•			X	
330	YW			X		X			X				X			X										•			X		
330	YT			X		X			X				X			X										•			X		

• With 60 PSI Oil Pump Spring
All Cars Use CCS

Fig. 6-3 Firebird Engine Chart

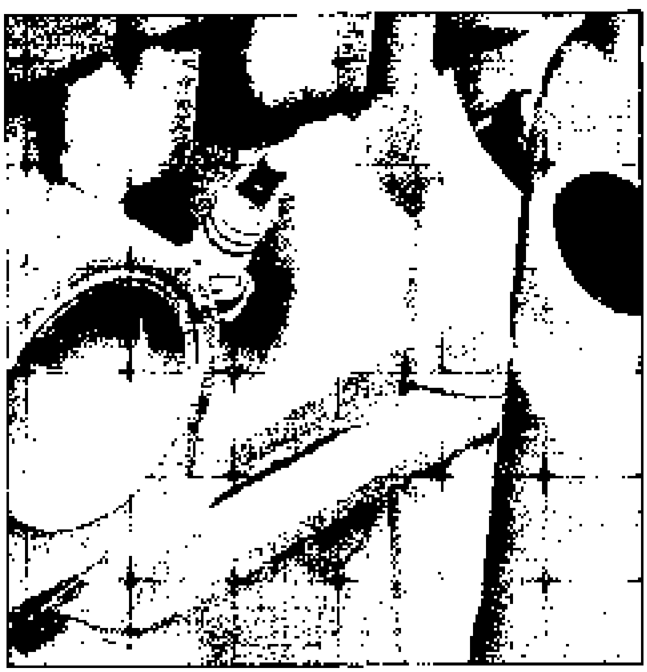


Fig. 6-4 Engine Number and Code Location—6 Cyl.

Fig. 6-5 Engine Number and Code Location—V-8

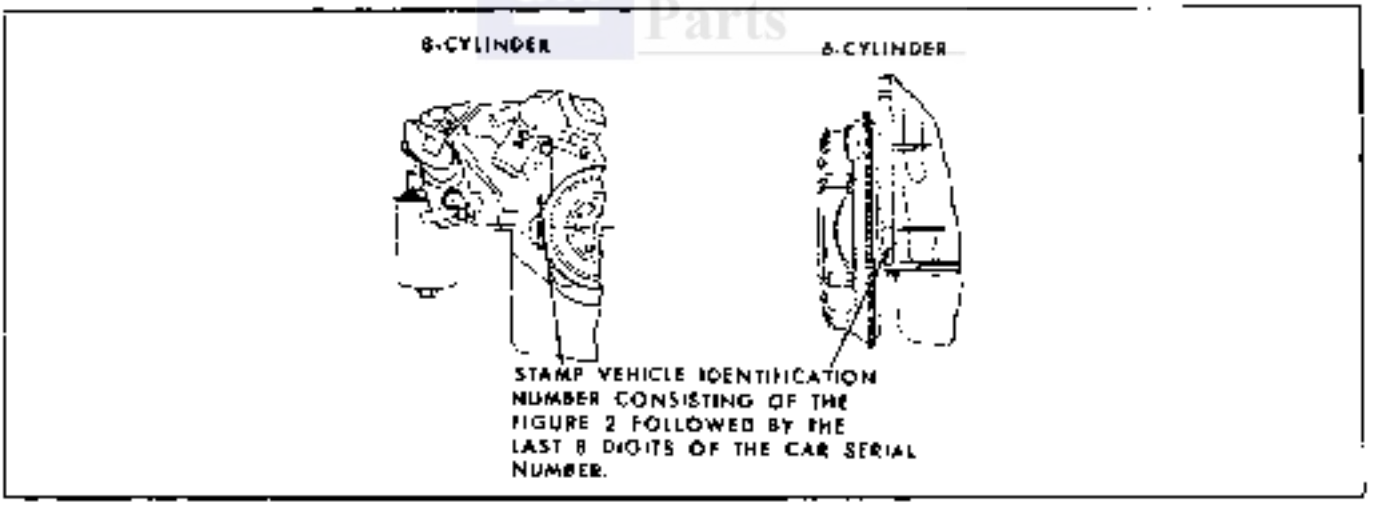


Fig. 6-6 Vehicle Identification Number Location

SIX CYLINDER ENGINE

(For Contents of V-8 Engine, See Page 6-38)

PERIODIC SERVICE

There are no periodic services required on the mechanical portions of the engine. Periodic services connected with the engine consist of tune-up, lubrication, replacing oil filter, PCV valve, fuel filter, etc. Procedures and recommendations for these services will be found in appropriate sections of this book.

SERVICE OPERATIONS ON CAR

ENGINE INSULATORS—REMOVE AND REPLACE

FRONT INSULATORS (Fig. 6-5)

1. Rotate harmonic balancer until timing mark is at bottom.

2. Bolt J 22773 (Firebird) or J 22345 (Tempest) Engine Support Bracket to front of harmonic balancer (Fig. 6-10).

3. Remove insulator to bracket bolts.

4. With suitable equipment, raise engine at lifting tool until insulator clears brackets.

CAUTION: Safety brackets must be bolted to Firebird engine lifting tool whenever in use to prevent engine from moving aside in the raised position (Fig. 6-16).

5. Raise engine approximately 1" above front insulators.

6. Remove insulators by removing two insulator-to-block bolts. On manual trans 4 bbl, Overhead Cam engine, remove two bolts and two spacers.

7. Install new insulator reversing procedure number six and tighten bolts to 45 lb. ft.

8. Lower front of engine into position and install

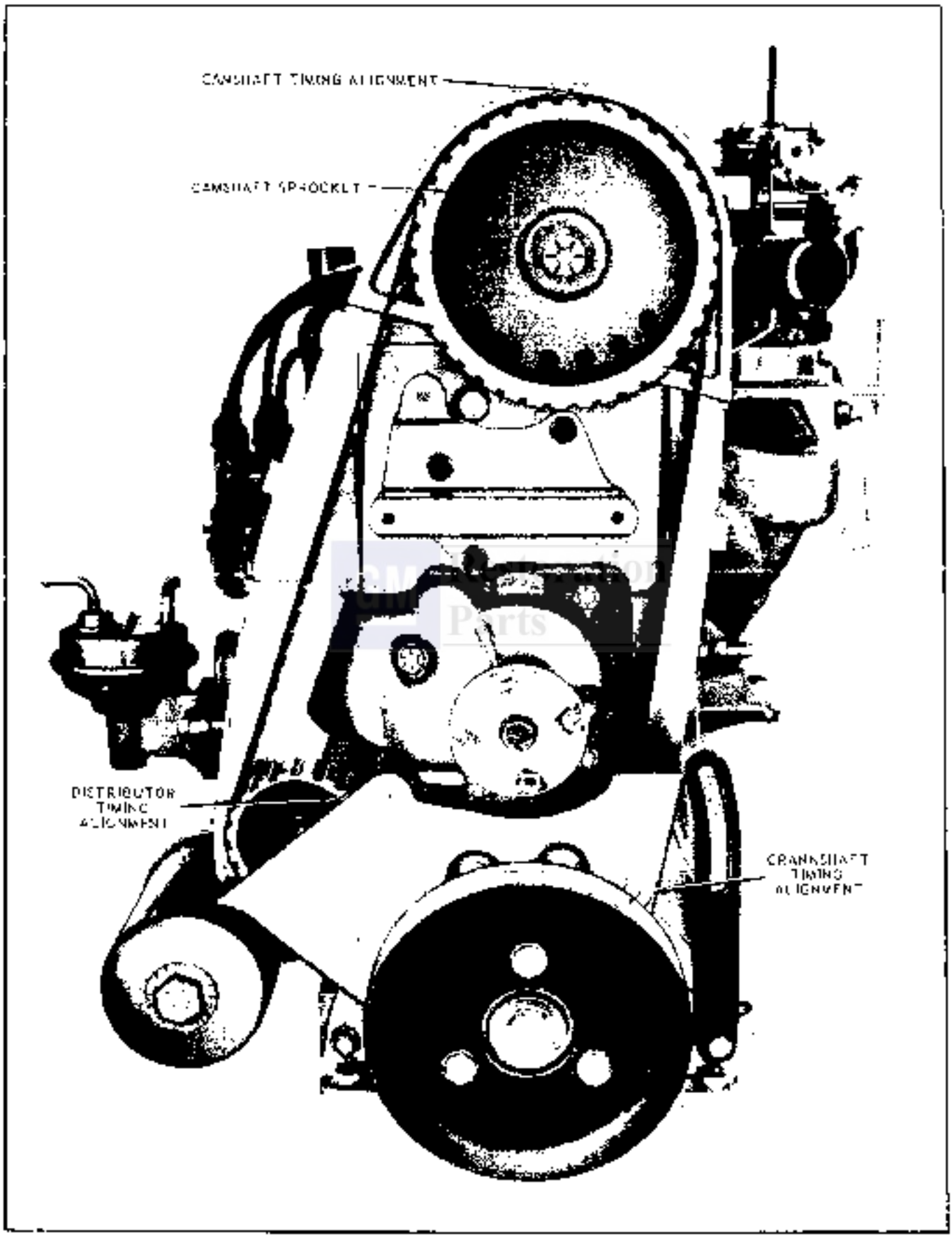


Fig. 6-7 Valve Timing Marks

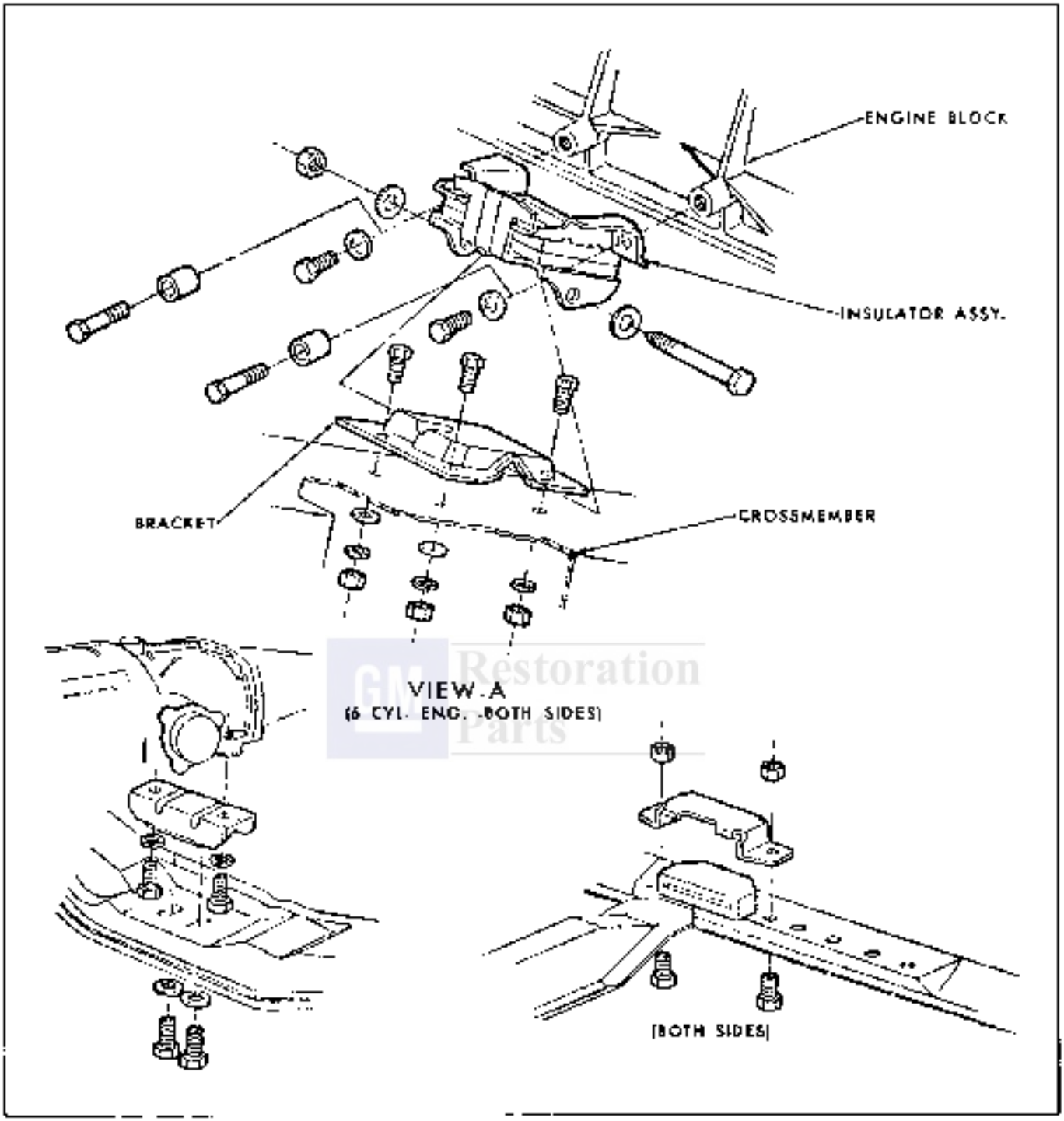


Fig. 6-8 6 Cyl. Engine Mounting—Tempest

insulator-to-engine bracket bolts and tighten to 30 lb. ft.

DRIVE BELTS—ADJUST (EXCEPT TIMING BELT)

Engine fan and accessory drive belts may be adjusted by use of the Borroughs Belt Tension Gauge. Belt Tension Specifications are given in Section 6A.

ENGINE—REMOVE AND INSTALL

REMOVE:

1. Disconnect battery cables at battery.

2. Drain cooling system.

3. Scribe alignment marks on hood around hood hinges and remove bolts from hinges.

4. Disconnect engine wire harness and engine-to-body ground straps.

5. Remove air cleaner.

6. Remove fan shield or shroud.

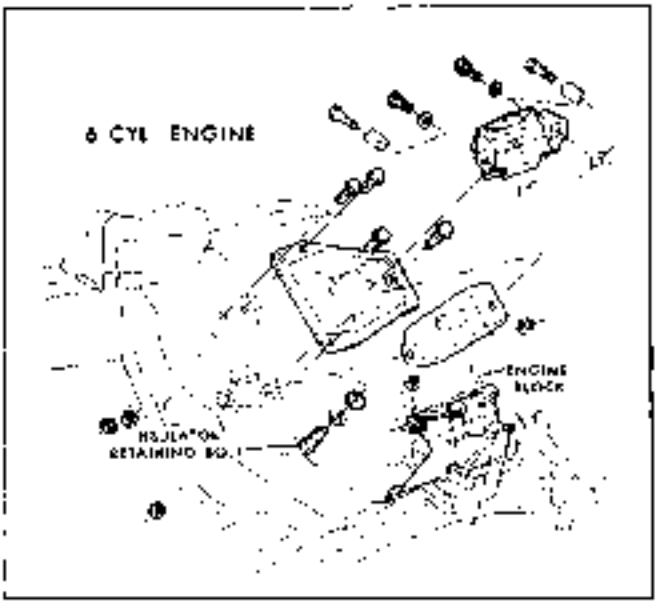


Fig. 6-9 6 Cyl. Engine Mounting—Firebird

7. Disconnect radiator and heater hoses at engine attachments.

8. If equipped with manual transmission, remove radiator.

9. If equipped with power steering or air conditioning, remove pump and compressor from mounting brackets and set aside. Do not disconnect hoses.

10. Remove engine fan and pulley.

11. Disconnect accelerator control linkage.

12. Disconnect transmission vacuum modulator line and power brake vacuum line at carburetor and fold back out of way.

13. Raise vehicle and drain crankcase.

14. Disconnect gas tank lines at fuel pump.

15. Disconnect exhaust pipes from manifolds.

16. Disconnect starter wires.

17. If equipped with automatic transmission, remove converter cover, remove three converter retaining bolts and slide converter to rear.

18. If equipped with manual transmission, disconnect clutch linkage and remove clutch cross shaft.

19. Remove four lower bell housing bolts (two each side).

20. Disconnect transmission filler tube support and starter wire harness shield from cylinder head.

21. Remove two front motor mount to frame bracket bolts.

22. Lower vehicle.

23. Using jack and block of wood, support transmission.

24. Remove two remaining bell housing bolts.

25. Raise transmission slightly.

26. Using suitable lifting equipment, remove engine.

INSTALL

1. Install engine lifting equipment to engine and lower engine into chassis, guiding engine to align engine with bell housing.

2. With engine supported by lifting equipment, install two upper bell housing bolts.

CAUTION: Do not lower engine completely while jack is supporting transmission. (Automatic transmission.)

3. Remove transmission support jack.

4. Lower engine and remove lifting equipment.

5. Raise vehicle.

6. Install remaining bell housing bolts.

7. Replace two front motor to frame bracket thru bolts.

8. For remaining installation procedures, reverse steps 1 thru 18.

INTAKE AND EXHAUST MANIFOLD OR GASKETS—REMOVE AND REPLACE

REMOVE

1. Remove air cleaner.

2. Disconnect throttle cable at bell crank and remove throttle return spring.

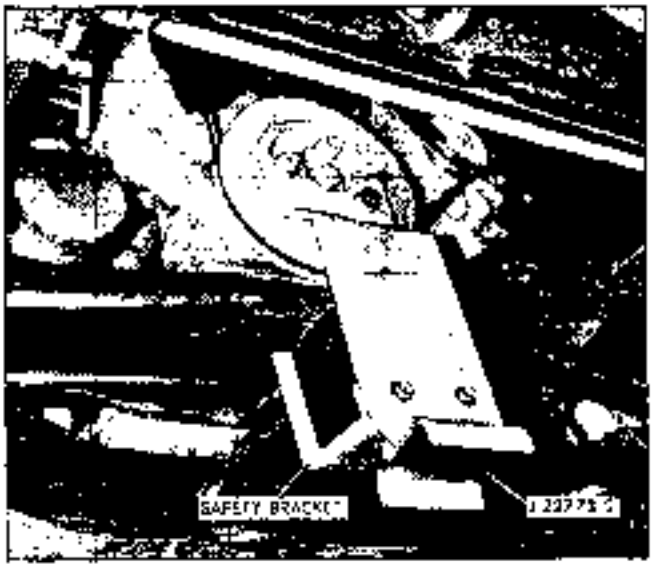


Fig. 6-10 J 22773 Installed

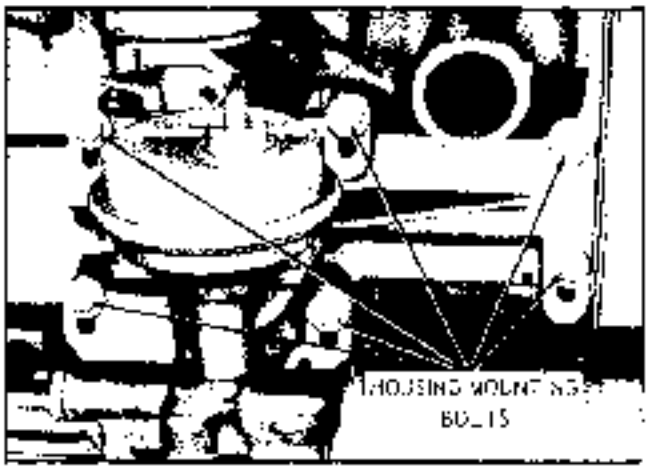


Fig. 6-11 Accessory Drive Housing Mounting Bolts

3. Disconnect fuel and vacuum lines from carburetor.

4. Depending upon accessories remove necessary drive belts and mounting brackets.

5. Remove carburetor for intake manifold replacement.

6. Disconnect exhaust pipe at manifold flange.

7. Remove manifold to cylinder head attaching bolts and clamps and remove manifolds as an assembly.

REPLACE

1. Clean gasket flanges on cylinder head and manifolds.

2. Check for cracks on manifold castings.

3. If necessary to replace either intake or exhaust manifold, separate them by removing one attaching bolt and two nuts at center of assembly. Reassemble manifolds using new gasket. Tighten finger tight and torque nuts to 25 lb. ft. and bolt to 22 lb. ft. after assembly to cylinder head.

4. Position new gasket over manifold studs on cylinder head and carefully install the manifold in position, making sure the gasket is in place.

5. Coat face of manifolds liberally with a solution of graphite in alcohol.

6. Install bolts and clamps while holding manifold in place with one hand.

7. Tighten bolts to 30 lb. ft.

8. Connect exhaust pipe to manifold.

9. Reverse steps 1-5 of Removal to complete installation procedure.

TIMING BELT TOP FRONT COVER— REMOVE AND REPLACE

REMOVE

1. Remove three retaining screws on front of cover.

2. Lift up cover to disengage side clips.

3. Remove retaining clips from cover.

REPLACE

1. Place cover in position and install three attaching screws. Tighten to 12 lb. ft.

2. Install two side clips.

TIMING BELT ADJUSTMENT PROCEDURE

TIMING BELT ADJUSTMENT

NOTE: Engine should be at room temperature whenever timing belt tension is checked.

1. Remove timing belt top front cover.

2. Using J 22232-2 calibration bar as shown in Fig. 6-12) set pointer of tension fixture J 22232-1 to line up with mark on minus side.

NOTE: This calibration must be performed prior to each use of the J 22232 fixture to insure an accurate timing belt adjustment.

3. Remove the camshaft sprocket to camshaft bolt and washer and install J 22232-1 tension fixture on the belt with the rollers on the outside (smooth) surface of belt. Thread the fixture mounting bolt into camshaft sprocket bolt location finger-tight.

4. Squeeze indicator end (upper) of fixture and quickly release, so that fixture assumes released or relaxed position.

5. With J 22232-1 installed as above, adjust accessory drive housing (Fig. 6-11) up or down as required to obtain a tension adjustment indicator centered in the green range with drive housing mounting bolts torqued to 15 lb. ft.

6. Align bolt on pulley by rotating engine 1/2 turn using socket and bar on harmonic balancer retaining bolt, and recheck tension.

CAUTION: Be certain ignition is off.

7. Remove tension fixture and replace sprocket retaining bolt making sure threads and washer are free from dirt.

8. Install upper front timing belt cover.

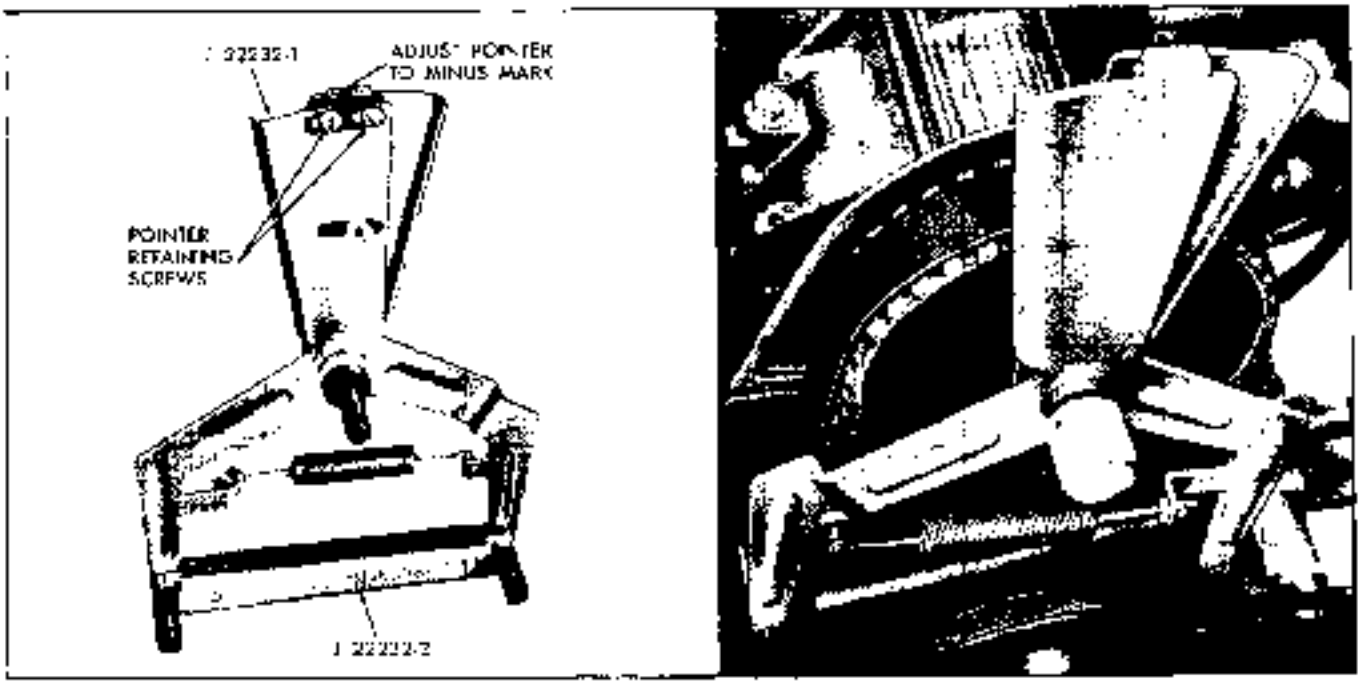


Fig. 6-12 Adjusting Timing Belt Tension

CAMSHAFT SPROCKET OR SEAL— *REMOVE AND REPLACE*

CAUTION: Do not use tools of any type, other than hands, to pry on the timing belt during belt removal or replacement or during other service operations.

REMOVE

1. Remove timing belt top front cover.

2. Remove sprocket to camshaft retaining bolt (Fig. 6-7).

NOTE: For ease of reassembly, index three timing marks as shown in Fig. 6-7

3. Loosen six accessory drive to engine block mounting bolts (Fig. 6-11).

4. Remove timing belt from camshaft sprocket.

5. Remove camshaft sprocket.

6. If necessary to replace camshaft seal, reinstall camshaft sprocket retaining bolt.

7. Thread tool J 22261-2 into camshaft seal (Fig. 6-13).

8. Tighten center bolt on tool J 22261-1 until seal is extracted.

REPLACE

1. Remove camshaft sprocket retaining bolt.

2. Install J 22262-2 seal protector and pilot on end of camshaft.

3. Position camshaft seal on pilot J 22262-2 (Fig. 6-14).

4. Drive seal into position using J 22262-1 seal installer (Fig. 6-14).

5. Install camshaft sprocket indexing pin on sprocket with hole in camshaft.

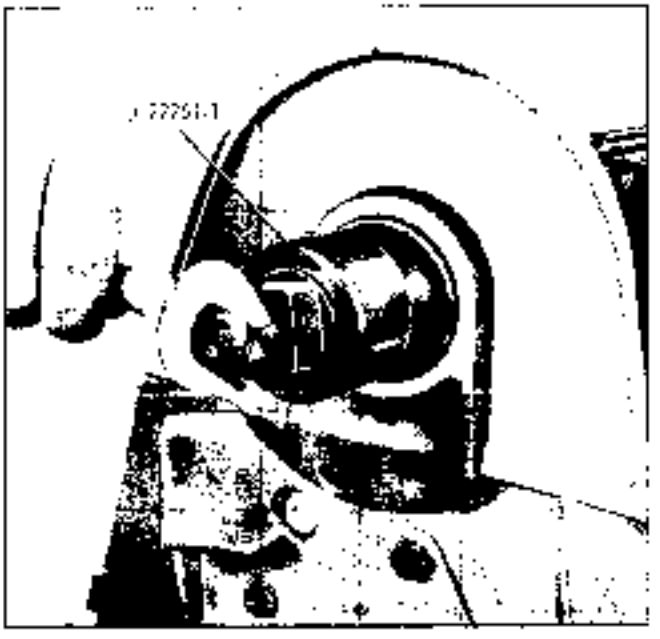


Fig. 6-13 Removing Camshaft Seal

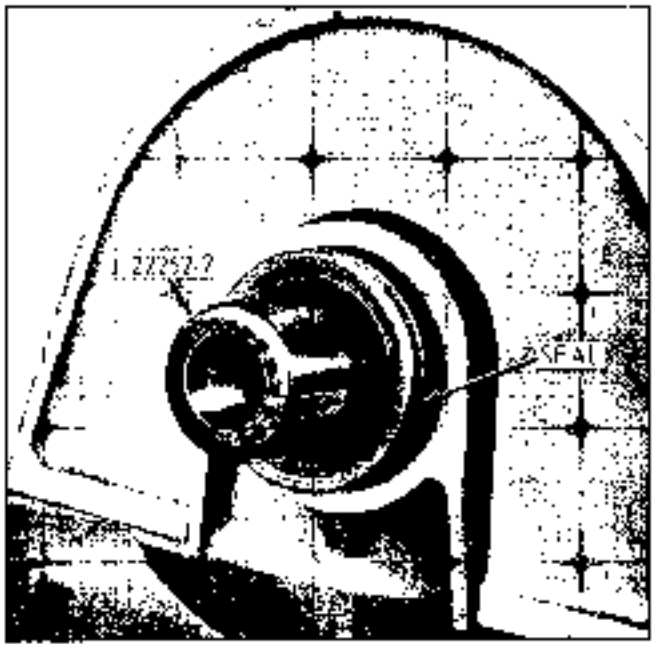


Fig. 6-14 Installing Camshaft Seal

8. Install sprocket retaining bolt. Tighten finger tight.

7. Align timing marks (Fig. 6-7) and install timing belt.

8. Adjust timing belt tension.

9. Tighten camshaft sprocket retaining bolt to 40 lb. ft.

10. Install top front cover.

ROCKER ARM COVER ASSEMBLY AND GASKET—REMOVE AND REPLACE

REMOVE

1. Drain cooling system.

2. Remove water outlet fitting from rocker arm cover assembly, leaving hose attached, and position out of way. Remove thermostat.

3. Remove timing belt top front cover.

4. Loosen accessory drive housing bolts.

5. Align timing marks (Fig. 6-7) and remove timing belt from camshaft sprocket.

6. Disconnect necessary fuel and vacuum lines.

7. Remove rocker arm cover assembly to cylinder head attaching bolts and nuts.

8. Lift rocker arm cover assembly up to clear four mounting studs.

9. Remove rocker arm cover to cylinder head gasket and clean gasket flanges.

REPLACE

1. Install new rocker arm cover gasket on cylinder head.

2. Check all rocker arms for correct position on hydraulic valve lash adjusters and valves.

3. Install rocker arm cover assembly on four mounting studs.

4. Install rocker arm cover assembly retaining bolts. Tighten to 15 lb. ft.

5. Install timing belt rear upper cover and four rocker arm cover to cylinder head retaining nuts. Tighten to 15 lb. ft.

6. Reverse steps one through five of Removal to complete installation procedure.

NOTE: Install camshaft seal following procedure as previously outlined.

CAMSHAFT, ROCKER ARM COVER AND/OR ROCKER ARM COVER CORE PLUG—REMOVE AND REPLACE

REMOVE

1. Remove camshaft sprocket and seal.

2. Remove rocker arm cover assembly.

3. Using J 22284 adapter and slide hammer J 2619 carefully drive camshaft rearward from rocker arm cover (Fig. 6-15).

CAUTION: Do not allow camshaft to damage bearing surfaces of rocker arm cover.

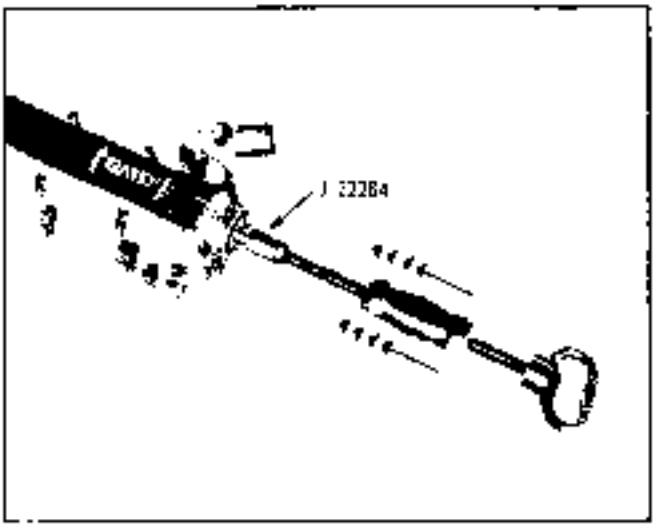


Fig. 6-15 Removing Camshaft From Cover

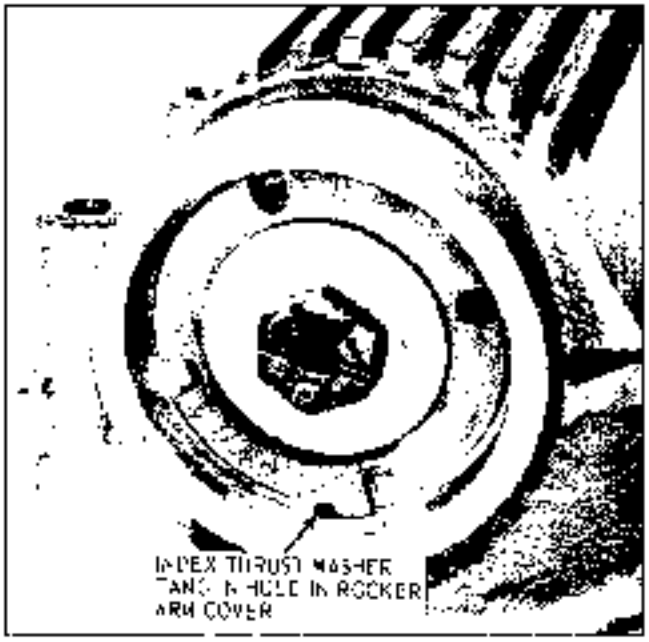


Fig. 6-16 Thrust Washer Installation

4. Remove slide hammer and adapter using the above caution, remove camshaft from rocker arm cover.

5. Remove thrust washer, retaining washer and bolt from rear of camshaft.

6. Clean all parts in a suitable solvent.

7. Inspect rocker arm cover for cracks or porosity.

8. Inspect gasket surface and front seal area.

9. Inspect bearing surface for excessive wear or scoring.

NOTE: Minor nicks and scratches on edge of bearing surface can be corrected using a suitable scraper or file.

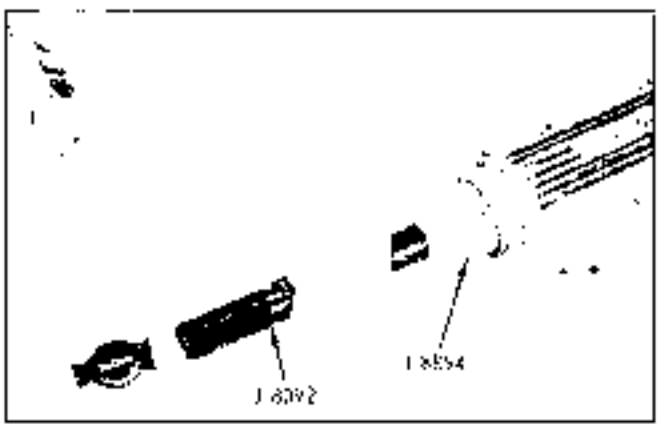


Fig. 6-17 Installing Camshaft Rear Plug

10. Inspect rear camshaft plug opening and thrust washer retaining slot for wear.

11. Inspect camshaft finished surfaces for wear and scoring.

12. Inspect camshaft oil passages for restrictions.

REPLACE

1. Install camshaft from the rear, in rocker arm cover using caution not to damage bearing surfaces in rocker arm cover.

2. Install thrust washer in rocker arm cover as shown (Fig. 6-16).

3. Install retaining washer and bolt. Tighten to 40 lb. ft.

4. Using J 8894 install new oversize camshaft bore plug until fully seated (Fig. 6-17).

IMPORTANT: A camshaft bore plug not fully seated could result in excessive camshaft end play. Correct end play is .003"-.009" when read at the sprocket end with a dial indicator. Fig. 6-18.

NOTE: Lubricate camshaft lobes and rocker arm pads with Engine Oil Supplement (E.O.S.) before replacing camshaft and cover assembly. Installation of new camshaft requires the use of new rocker arms.

5. Replace thermostat and water outlet fitting. Tighten to 25 lb. ft.

6. Install rocker arm cover assembly and adjust camshaft belt as previously outlined.

NOTE: Engine must be run at idle for five minutes after installing camshaft. This will ensure

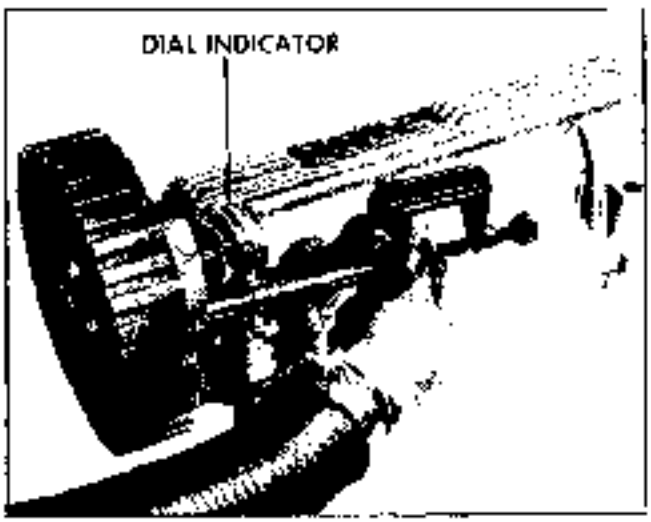


Fig. 6-18 Measuring Camshaft End Play

adequate lubrication to the camshaft and rocker arm mating surfaces.

NOTE: Owner should be advised to follow recommended running-in procedure following camshaft replacement.

ROCKER ARM OR HYDRAULIC VALVE LASH ADJUSTER—REMOVE AND REPLACE

REMOVE

1. Remove rocker arm cover assembly.

2. Remove rocker arm and hydraulic lash adjuster assembly and store so that each assembly can be installed in its original location.

If a lash adjuster becomes stuck in the cylinder for some reason and normal methods of removal are unsuccessful proceed as follows:

1. Remove rocker arm.

2. Fill the vent hole adjacent to the lifter with engine oil (see Fig. 6-24).

3. Insert a 4" length of 3/16" diam. rod into the vent hole and strike the end of the rod with a hammer.

The hydraulic effect of the oil on the base of the adjuster will break it free from the loosening bore in the cylinder head.

REPLACE

NOTE: If new lash adjuster is to be installed, it will be necessary to check the leak down rate and prime before installation.

1. Place hydraulic lash adjuster in original location.

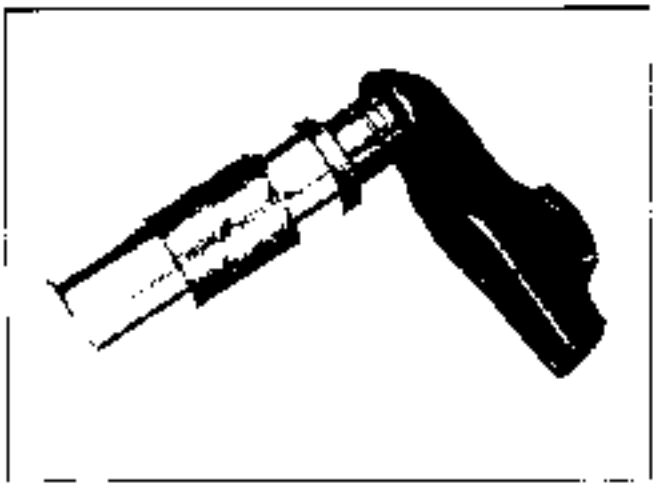


Fig. 6-19 Rocker Arm and Lash Adjuster

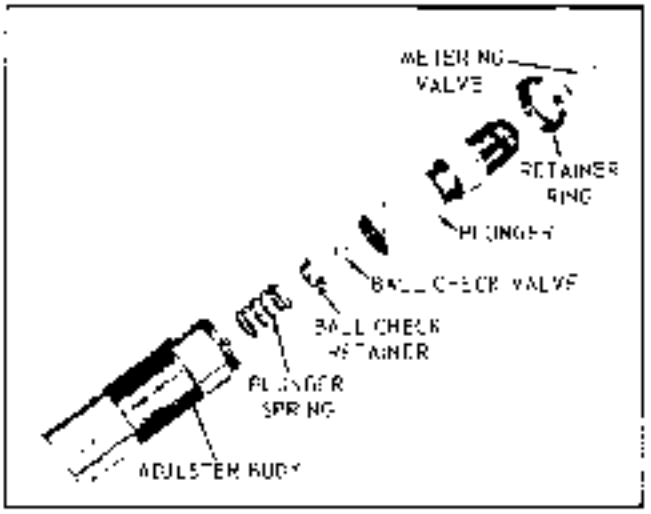


Fig. 6-20 Lash Adjuster—Exploded View

2. Install rocker arms and cover assembly.

HYDRAULIC LASH ADJUSTER—RECONDITION

NOTE: Because of the important part hydraulic lash adjusters play in the operation of an engine and the close tolerances to which they are manufactured, proper handling, and above all, cleanliness, cannot be overstressed when servicing these parts.

New adjusters are serviced as individual units packaged with a plastic coating. Leave the coating on until ready to check leak-down rate. It is necessary to remove the oil from new adjusters prior to checking leak-down rate since special oil is in new adjusters. Fill adjusters with SAE 10 oil before checking leak-down rate.

Wash tank and tray, J 5821, is recommended for cleaning lash adjusters. This tank should be used only for lash adjusters and should be kept covered when not in use. All servicing should be done in an area removed from grinders or other sources of dust and foreign material.

Adjusters should at all times be stored in a covered box which will aid in keeping them clean. The box should be kept dry and as free of oil as possible.

LASH ADJUSTER—DISASSEMBLE (Fig. 6-20)

1. Remove plunger retainer with small screwdriver.

2. Remove plunger, ball, ball retainer and spring.

NOTE: It may be necessary to soak an adjuster having a stuck plunger in cleaning solvent for several minutes in order to remove the plunger.

3. Drain oil out of adjuster body and place all lash

adjuster parts in separate compartment of tray from wash tank.

CAUTION: Lash adjuster body and plunger are selectively fitted and must not be interchanged with parts of other adjusters. Keeping all parts of adjusters together will also aid in trouble diagnosis.

LASH ADJUSTER—CLEAN AND INSPECT

Wash tank, J 5821, is recommended for cleaning lash adjuster parts. This tank consists of two chambers, a tray and a cover. One chamber is for cleaning solvent and the other is for kerosene. Whenever the tank is not being used (and when parts are soaking), the cover should be closed.

1. Before placing tray of parts in cleaning solvent, first immerse it in kerosene chamber to remove as much engine oil as possible. (This reduces contamination of solvent, thus prolonging its useful life.)

2. Submerge tray in cleaning solvent and allow to soak for approximately one hour. More time may be required, depending on varnish condition and effectiveness of solvent. Light agitation of tray in solvent at 10-15 minute intervals will hasten cleaning action.

3. After varnish has dissolved or has been sufficiently softened to permit removal by wiping, suspend tray above solvent, utilizing hooks on tray handles. Allow tray and parts to drain for a brief period.

4. Rinse tray of parts in kerosene chamber to cut solvent and to avoid injury to hands (from solvent).

5. Wipe out tank cover and place tray of parts on cover in front of tank. A shop towel under tray and clean paper on remainder of cover will ensure cleanliness.

6. Working on one adjuster at a time and using clean, lint-free cloths, thoroughly wipe off adjuster parts. Clean plunger and external and internal surfaces of body with a hard wiping action. A bristle brush may be used to clean internal surface of adjuster body.

CAUTION: Do not use wire brush or sand paper, as these may damage machined surfaces.

NOTE: Absolute cleanliness can be assured if each adjuster is inspected and assembled after cleaning but before proceeding to the next adjuster.

7. Inspect adjuster body. Both inner and outer surfaces of adjuster body should be inspected for scoring. Adjuster assembly should be replaced if body is roughly scored, grooved, or galled.

8. Inspect adjuster plunger. Using a magnifying glass, inspect check ball seat for defects. Inspect outer surface of plunger for scratches or scores. Small score marks with a rough satiny finish will cause the plunger to seize when hot but operate normally when cool. Defects in check ball seat or scores or scratches on outer surface of plunger which may be felt with a fingernail are causes for replacing the adjuster assembly. This rule does not apply to the slight edge which may sometimes be present where the lower end of plunger extends below the ground inner surface of body. This edge is not detrimental unless it is sharp or burred.

A blackened appearance is not a defective condition. Sometimes discoloration serves to highlight slight grinder chatter marks and give the outer surface of plunger a ridged or fluted appearance. This condition will not cause improper operation, therefore, it may be disregarded.

9. Inspect lash adjuster ball. Carefully examine ball for nicks, embedded material or other defects which would prevent proper seating. Such defects may cause intermittently noisy adjuster operation. Also inspect plunger face of ball retainer for excessive wear.

LASH ADJUSTER—ASSEMBLE (Fig. 6-20)

NOTE: All parts must be absolutely clean when assembling a hydraulic lash adjuster. Since lint and dust may adhere to parts, they should not be blown off with air or wiped with cloths. All parts should be rinsed in clean kerosene and assembled without drying. A small container with clean kerosene (separate from cleaning tank) should be used for each set of adjusters being overhauled.

Figure 6-20 shows the relative position of component parts of lash adjusters. The recommended procedure for assembly is given in the following steps.

1. Rinse plunger spring and ball retainer and position retainer in spring.

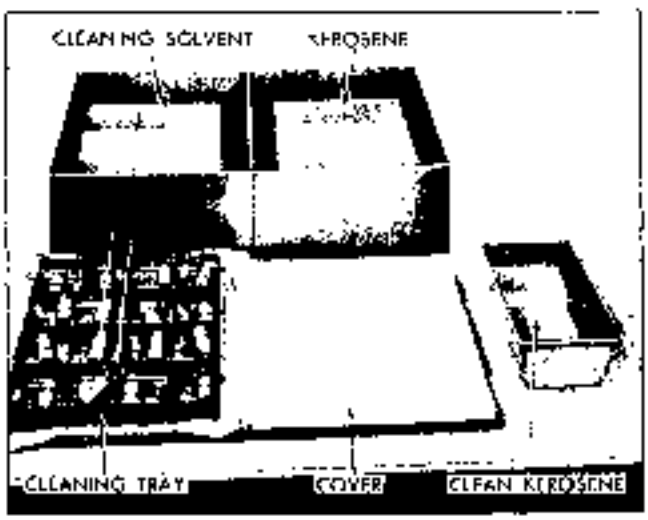


Fig. 6-21 Lash Adjuster—Wash Tank and Tray

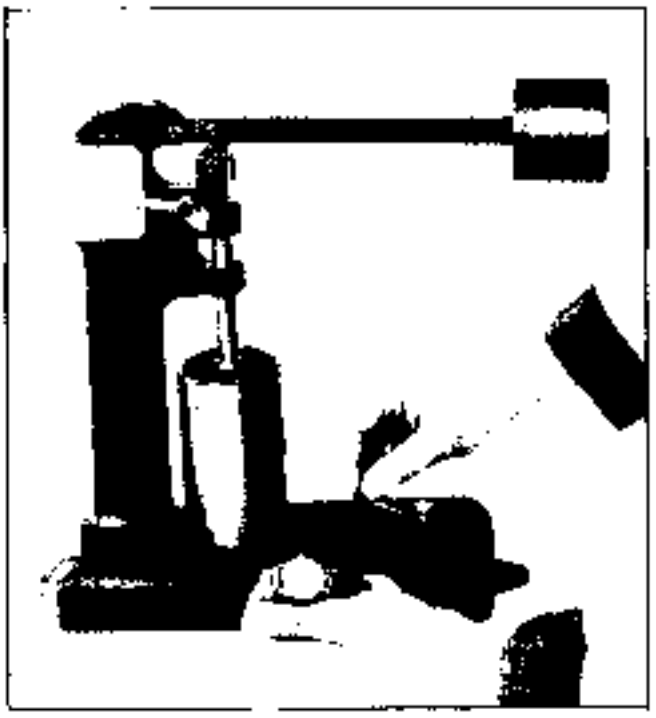


Fig. 6-22 Testing Leak Down Rate

2. Rinse check ball and place in retainer.

3. Rinse plunger and place on retainer so that seat on plunger mates with ball.

4. Invert plunger with parts assembled thus far and after rinsing adjuster body, install body over spring and plunger.

5. Place adjuster body on clean paper, rinse and install retainer ring.

6. After adjuster has been assembled, place in adjuster box and close lid to preserve cleanliness.

LASH ADJUSTER TEST LEAK-DOWN RATE

After all adjusters have been assembled, the leak-down rate must be checked before they are installed in the engine. Valve lifter leak-down tester, J 5790 (Fig. 6-22), is designed to test leak-down rate of adjusters to determine whether or not they are within specified limits. As with previous service operations concerned with lifters, cleanliness is paramount. The tester cup and ram should be thoroughly cleaned, and testing should be done in an area free of dust and dirt. The testing procedure is described in the following steps:

1. Fill tester cup to approximately one inch from top with SAE 10 engine oil.

2. Swing weight arm up out of the way, raise ram, and position adjuster into boss in center of tester cup.

3. Adjust ram (with weight arm clear of ram) so that the pointer is positioned on the set line (marked S). Tighten jam nut to maintain setting.

4. Operate adjuster through full travel of plunger by pumping weight arm to fill adjuster with test fluid and force out air. (Adjuster must be completely submerged at all times.) Continue pumping for several strokes after definite resistance is detected.

5. Raise weight arm to allow plunger spring to expand fully; lower arm onto ram.

Time indicator travel from lower line (first line above set line) to line marked .125" or 1/8". Lifter is satisfactory if rate is 24 seconds or above when temperature is between 70° - 90°.

VALVE SPRINGS, SHIELD OR SEAL— REMOVE AND REPLACE

REMOVE

1. Remove rocker arm cover assembly.

2. Remove rocker arm of valve to be serviced.

3. Remove spark plug from cylinder of valves to be serviced and install J 22276 (Fig. 6-23).

CAUTION: If piston is not in its full down position, fix will burn.

4. Connect air hose with a constant source of compressed air to J 22276.

5. Install hook end of tool J 22269-2 into oil feed hole in lash adjuster bore (Fig. 6-23).

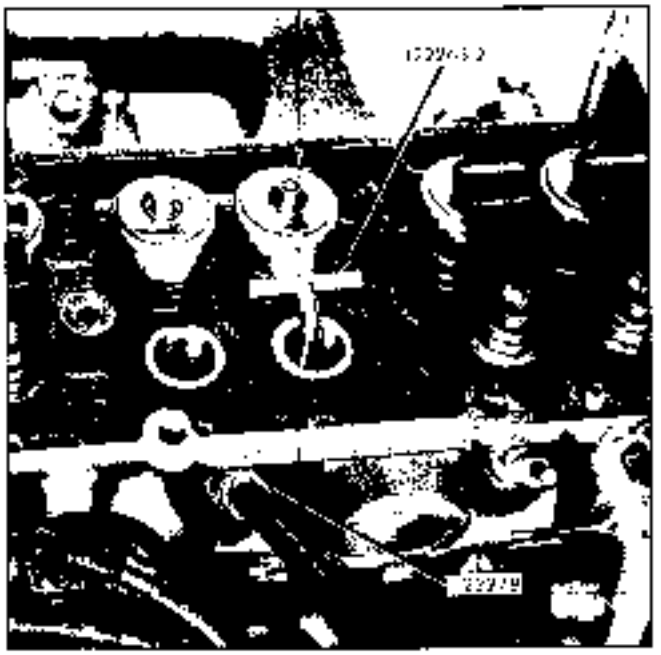


Fig. 6-23 Valve Spring Removal Hook-Up

6. Hold J 22263-2 in place and install fork end of compressor J 22263-1 on J 22263-2 (Fig. 6-24).

7. Pivot J 22263 so that the recessed side of the disc contacts the valve spring retainer cup shield.

8. Depress valve spring using compressor J 22263-1 and remove valve spring retainer cup locks, then both pieces of the valve spring compressor, valve spring and retainer cup shield, valve stem seal, and intake valve quick seal.

REPLACE

1. Install valve spring and valve spring retainer cup and compress spring with both pieces of J 22263 (while holding valve up with compressed air and J 22278).

2. Install valve stem seal, intake valve guide seal and retainer cup locks. Remove both pieces of valve spring compressor, then test valve stem seal using J 22330.

When replacing intake valve guide seals, place plastic installation cap over valve stem and push valve guide seal into place using a seal installing tool VSIT-1 (Fig. 6-25).

3. Replace spark plug.

4. Install rocker arms.

5. Install rocker arm cover assembly.

CYLINDER HEAD OR GASKET—REMOVE AND REPLACE

REMOVE

1. Drain cooling system and remove air cleaner.

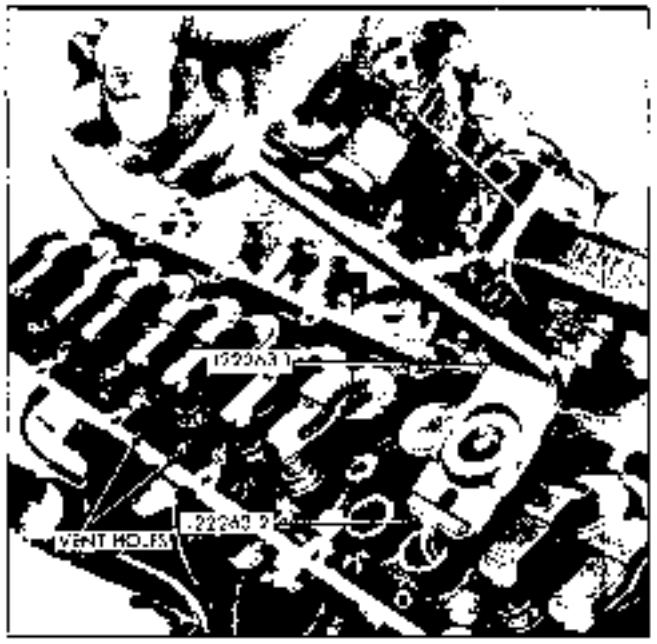


Fig. 6-24 Valve Spring Removal

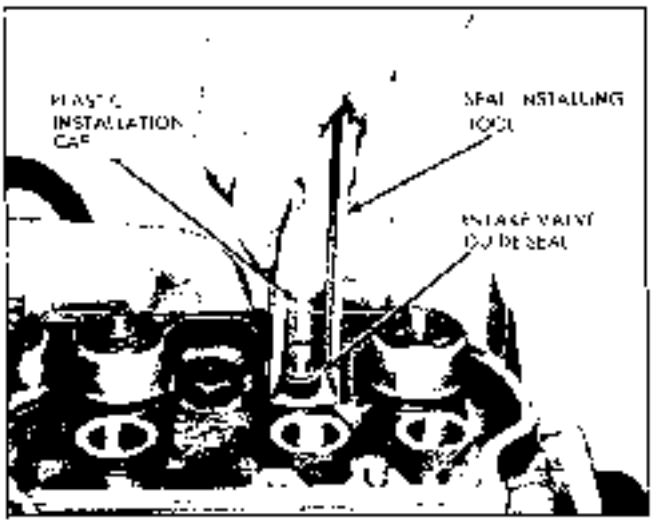


Fig. 6-25 Intake Valve Guide Seal Installation

2. Disconnect accelerator pedal cable at bell crank on manifold and fuel and vacuum lines at carburetor.

3. Disconnect exhaust pipe at manifold flange, then remove manifold bolts and clamps and remove manifolds and carburetor as an assembly.

4. Remove rocker arm cover assembly.

5. Remove timing belt upper front cover mounting support bracket and rear lower cover.

6. Disconnect spark plug wires.

7. Remove rocker arms and hydraulic valve lash adjusters. Store rocker arms and hydraulic lash adjusters so that they can be replaced in exactly the same location.

8. Remove cylinder head bolts, cylinder head and gasket. Place cylinder head on two blocks of wood to prevent damage.

9. Clean gasket surfaces of cylinder head and block.

REPLACE

When installing new head, transfer all serviceable parts to new head using new seals on intake and exhaust valve stems and new manifold gaskets.

1. After applying sealer, place a new cylinder head gasket in position over dowel pins in cylinder block (Fig. 6-26).

2. Carefully guide cylinder head into place over dowel pins and gasket.

3. Start all bolts in threads.

NOTE: Bolts are of two different lengths. When inserted in proper holes, all bolts will project an

equal distance from head. Do not use sealer of any kind on threads.

4. Tighten cylinder head a little at a time with a torque wrench. Tighten center bolts and then end bolts (Fig. 6-27). The final torque should be 95 ft. lb.

Reverse steps 1-7 of Removal to complete installation procedure using new gaskets and seals as required.

CYLINDER HEAD AND VALVES—RECONDITION

RECONDITION

The condition of the cylinder head and valve mechanism significantly determines power, performance and economy of a valve-in-head engine. Extreme care should be exercised when conditioning the cylinder head and valves to maintain correct valve stem to guide clearance, correctly ground valves, valve seats of correct width and correct valve adjustment.

DISASSEMBLE

1. Remove cylinder head and gasket as previously described. Place cylinder head on two blocks of wood to prevent damage.

2. Using tool J 8062, compress the valve springs and remove valve keys. Remove spring caps, spring seats, oil seals, and springs.

3. Remove valves from bottom of cylinder head and place them in a rack in their proper sequence so they can be assembled in their original positions.

CLEAN AND INSPECT

1. Clean all carbon from combustion chambers and valve ports.

2. Thoroughly clean the valve guides using tool J 8101 (Fig. 6-28).

3. Clean all carbon and sludge from rocker arms.

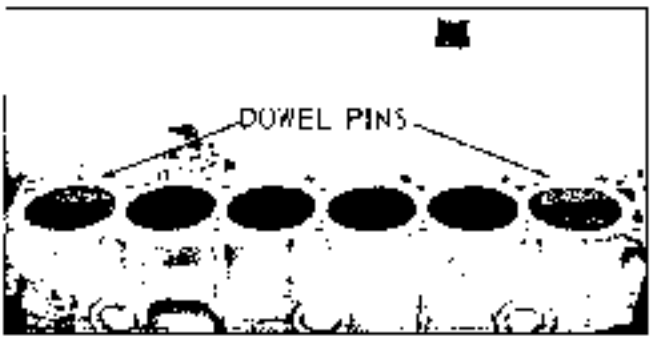


Fig. 6-26 Cylinder Head Locating Dowel Pins

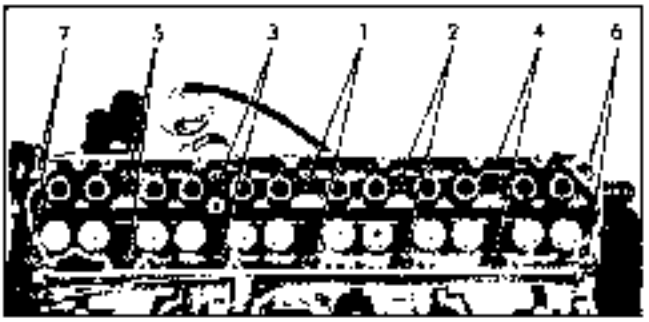


Fig. 6-27 Cylinder Head Bolt Tightening Sequence

4. Clean valve stems and heads on a buffing wheel.

5. Clean carbon deposits from head gasket mating surfaces.

6. Wash all parts in cleaning solvent and dry them thoroughly.

7. Inspect the cylinder head for cracks in the exhaust ports, combustion chambers, or external cracks in the water chamber.

8. Inspect the valves for burned heads, cracked faces or damaged stems.

9. Check fit of valve stems in their respective bores.

NOTE: Excessive valve stem to bore clearance will cause lack of power, rough idling and noisy valves, and may cause valve breakage. Insufficient

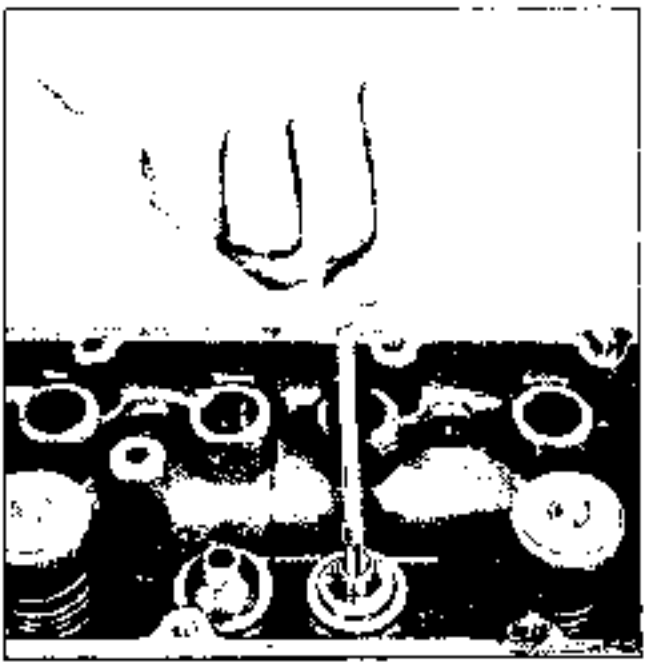


Fig. 6-28 Cleaning Valve Guide Bore

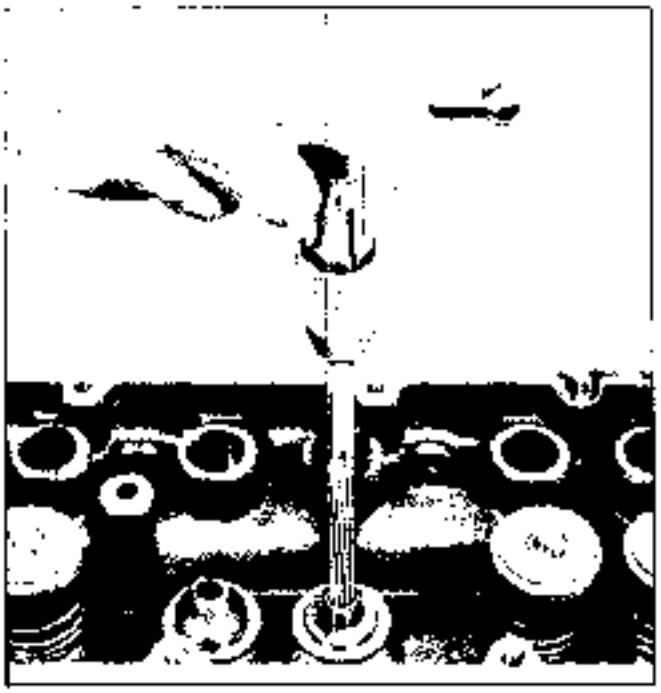


Fig. 6-29 Reaming Valve Guide Bore

clearance will result in noisy and sticky functioning of the valve and disturb engine smoothness of operation. Intake valve stem-to-bore clearance should be .0016" to .0033" while exhaust stem clearance should be .0021" to .0038". By using a micrometer and suitable telescope hole gauge, check the diameter of valve stem in three places: top, center and bottom. Insert telescope hole gauge in valve guide bore, measuring at center. Subtract highest reading of valve stem diameter from valve guide bore center diameter to obtain valve to valve guide clearance. If clearance is not within limits, use next oversize valve and ream bore to fit using suitable reamer.

FITTING VALVE STEMS TO GUIDES

Correct valve stem clearance for valve guides is .0016" to .0033" for the intake valve and .0021" to .0038" for the exhaust valve.

Valves with oversize stems are available in .001", .003" and .005" larger than standard. The same valve stem to guide clearance applies for oversize stems.

Oversize reamers are required to enlarge valve guide holes to fit the oversize stems. When reamer is turned through valve guide, it will size the hole to fit valve stem according to above limits.

Carefully ream the valve guide using valve guide reamer J 5830-1 for .003" oversize stems and valve guide reamer J 6621 for .005" oversize stems (Fig. 6-29). For best results when installing .005" oversize valve stem use the .003 oversize reamer first and then ream the .005" oversize. Always reface the valve seat after reaming valve guide.

NOTE: Valves are marked .001, .003 or .005 with colored ink.

VALVES AND SEATS—RECONDITION

1. Surface valves and seats as follows:

Valves should be ground on a special bench grinder designed specifically for this purpose and built by a reputable manufacturer. Valve seats should be ground with reputable power grinding equipment having stones of the correct seat angle and a suitable pilot which pilots in the valve stem guide. To ensure positive sealing of the valve face to its seat, the grinding stones should be carefully refaced before any grinding is done.

The intake valve seat angle is 30° with a face angle of 29°. The exhaust valve has a seat angle of 45° with a face angle of 44° (Fig. 6-30). This will provide hairline contact between valve and seat to provide positive sealing and reduce build-up of deposits on seating surfaces.

DO NOT USE REFACING EQUIPMENT EXCESSIVELY; only enough material should be removed to true up surfaces and remove pits. The valve head will run hotter as its thickness is diminished; therefore, if valve face cannot be cleaned up without grinding to point where outside diameter of valve has a sharp edge, the valve should be replaced. Whenever it is necessary to replace a valve, the new valve should be of same stem diameter as valve removed (unless the valve guide is reamed to provide proper fit).

Width of exhaust valve seats should be 1/16" to 3/32". Intake valve seats should be 1/32" to 1/16" wide. If seat width is excessive, it should be narrowed by grinding with a flat stone. This is the only method that should be used to narrow seat.

2. Check concentricity of valve seat and valve guide. Concentricity of valve seat and valve guide

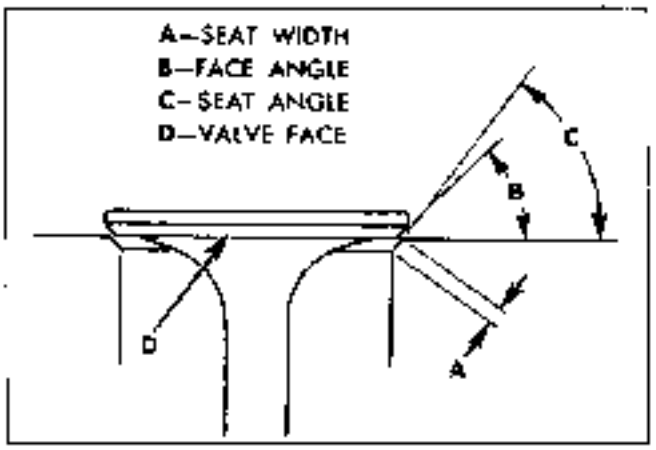


Fig. 6-30 Valve Seat and Face Angle

can be checked by using a suitable dial indicator or prussian blue. When using dial indicator, total run-out should not exceed .002".

When prussian blue is used, a light coat should be applied to face of valve only and valve rotated in its seat. If blue appears all the way around valve seat, valve seat and valve guide are concentric with one another.

3. Check concentricity of valve stem and face of valve. After cleaning prussian blue from valve and seat, lightly coat valve seat with prussian blue again and rotate valve in guide. If blue appears all the way around valve, valve stem and valve face are concentric with one another.

NOTE: Both tests in steps 2 and 3 are necessary to insure proper valve seating.

IMPORTANT: If it is necessary to grind any pit from rocker arm end of valve stem, feed end squarely against grinding wheel. Only the extreme end of the valve stem is hardened to resist wear. Do not grind end excessively.

ASSEMBLE

1. Starting with No. 1 cylinder place exhaust valve in the port and place valve spring and cap in position. Place spring and cap on exhaust valves. Then using J 8062 spring compressor, compress spring and install oil seal with J 22930 and valve keys. See that seal is flat and not twisted in the valve stem groove and that keys seat properly in valve stem groove.

NOTE: Place valve springs in position with closed coil and toward cylinder head.

2. Assemble remaining valves, valve springs, shields, spring caps, oil seals and valve locks in cylinder head. Check seals by placing vacuum cup of J 22930 over valve stem and cap, squeeze vacuum cup to make sure no oil leaks past oil seal.

3. Install cylinder head as previously described.

HARMONIC BALANCER—REMOVE AND REPLACE

1. Loosen generator at adjusting bracket and pivot bolt and remove fan belt from harmonic balancer. On cars equipped with power steering, also remove power steering pump belt from harmonic balancer.

2. Position fan so wide angles will be at top and bottom, allowing access to balancer.

3. Remove harmonic balancer attaching bolt and retainer washer.

4. Remove harmonic balancer using puller J 6978. Use of a washer (manifold bolt washer) on end of shaft will prevent tool damaging threads in crankshaft.

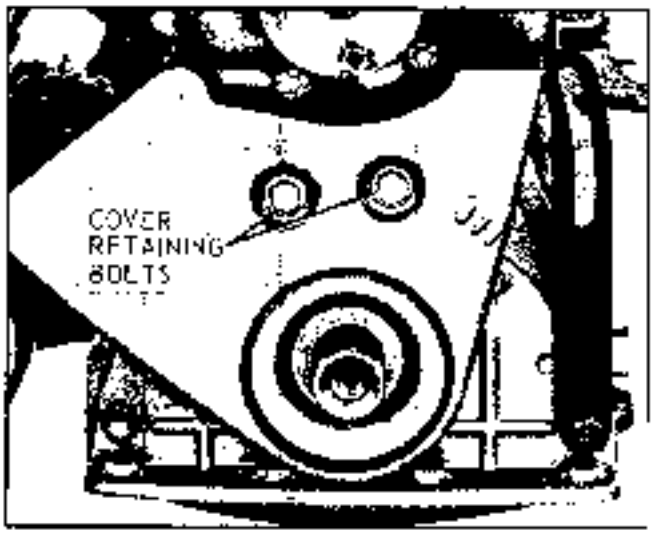


Fig. 6-31 Lower Front Timing Cover Retaining Bolts

5. Install new harmonic balancer using suitable instrument by reversing above steps, lining up keyway in balancer with key on crankshaft.

6. Tighten harmonic balancer attaching bolt to 160 lb. ft. torque.

NOTE: Remove flywheel cover and lock flywheel before tightening balancer bolt.

LOWER FRONT TIMING BELT COVER—REMOVE AND REPLACE

1. Remove harmonic balancer, fan and water pump pulley.

2. Remove two attaching bolts and remove cover (Fig. 6-31).

3. Install cover by reversing above steps. Tighten cover attaching bolts to 20 lb. ft.

CRANKSHAFT TIMING BELT SPROCKET OR CRANKCASE COVER SEAL—REMOVE AND REPLACE

REMOVE

1. Remove upper front timing cover.

2. Align timing marks (Fig. 6-7).

3. Remove fan and water pump pulley.

4. Remove harmonic balancer.

5. Remove timing belt lower front cover (Fig. 6-31).

6. Loosen accessory drive mounting bolts to provide slack in timing belt.

7. Remove timing belt.

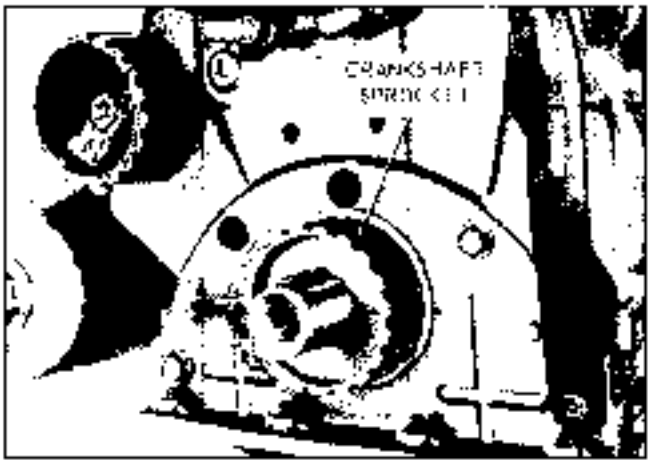


Fig. 6-32 Crankshaft Sprocket

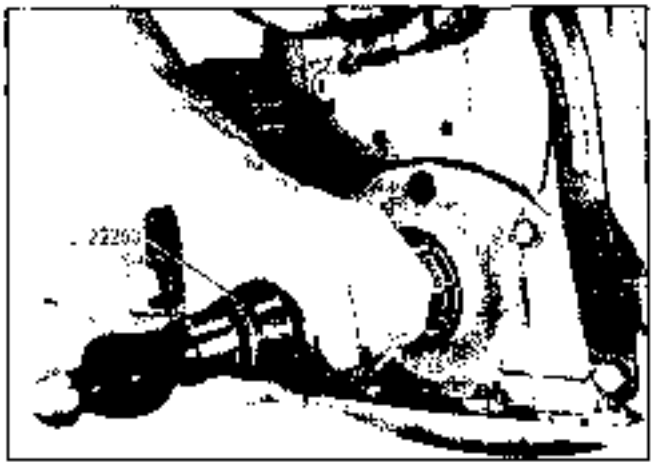


Fig. 6-34 Installing Crankshaft Front Seal

8. Remove crankshaft timing belt flange and sprocket (Fig. 6-32).

9. Pry seal from crankcase cover (Fig. 6-33) using care not to distort the cover.

REPLACE

1. Install new seal with lip of seal inward using seal installer J 22260 (Fig. 6-34).

2. Replace crankshaft timing belt sprocket and flange.

3. Align timing marks (Fig. 6-7) and replace timing belt.

4. Replace timing belt lower front cover and harmonic balancer.

5. Adjust timing belt tension.

6. Replace water pump pulley and fan.

7. Replace timing belt upper front cover.

FRONT CRANKCASE COVER AND GASKET—REMOVE AND REPLACE

1. Remove crankshaft timing belt sprocket as shown above.

2. Remove four front oil pan to crankcase cover retaining bolts.

3. Loosen remaining oil pan bolts as necessary to provide clearance between crankcase cover and oil pan.

NOTE: It may be necessary to jar the oil pan to gain the necessary clearance.

4. Remove five front crankcase cover attaching bolts.

5. Remove front crankcase cover and gasket and clean gasket surface, using care that gasket particles do not fall into oil pan.

6. Inspect cover seal for signs of wear or distortion.

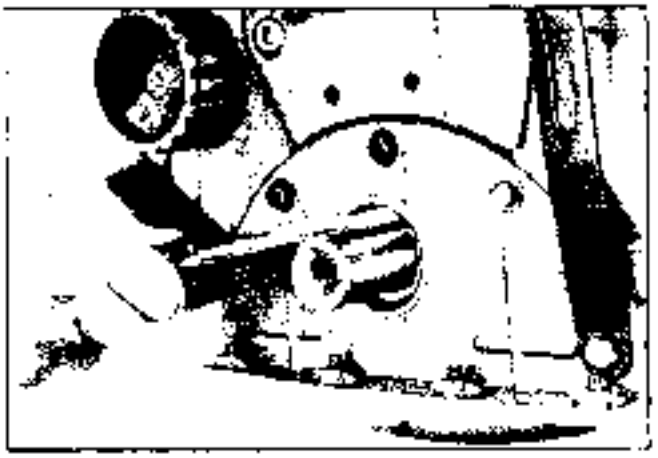


Fig. 6-33 Removing Crankshaft Front Seal

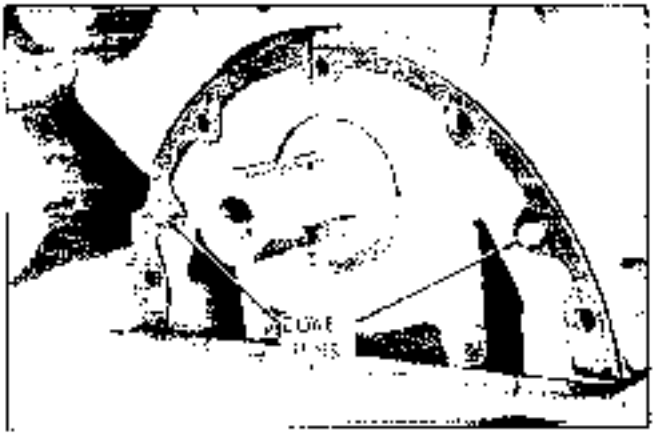


Fig. 6-35 Crankcase Front Cover Gasket and Dowel Pins

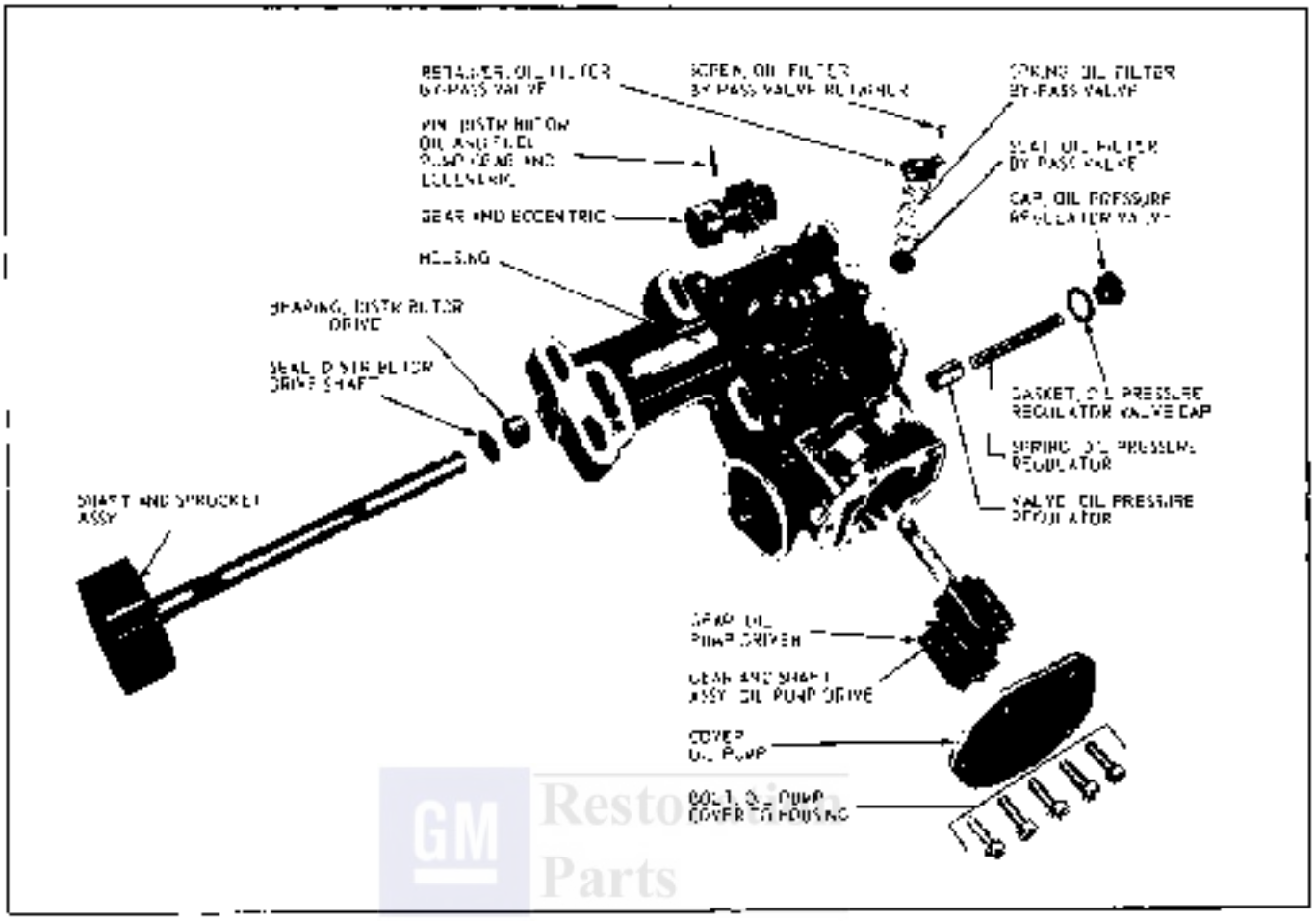


Fig. 6-36 Accessory Drive Housing—Exploded View

7. Using new gasket installed over dowels (Fig. 6-35) and if necessary, new seal, reverse removal procedures tightening oil pan and crankcase cover bolts to 12 lb. ft.

HOUSING ASSEMBLY—OIL PUMP, DISTRIBUTOR AND FUEL PUMP (Fig. 6-36)

PRESSURE REGULATOR VALVE—OIL PUMP

REMOVE AND REPLACE

1. Remove cap washer and spring from housing assembly.

2. Using magnet, remove valve from housing assembly.

3. Install valve on spring and install as an assembly.

4. Install cap and washer.

OIL PUMP

REMOVE AND REPLACE

1. Remove oil pump cover and gasket.

2. Remove drive gear and driven gear (Fig. 6-37).

3. Inspect gears for wear and pump cover for excessive scoring.

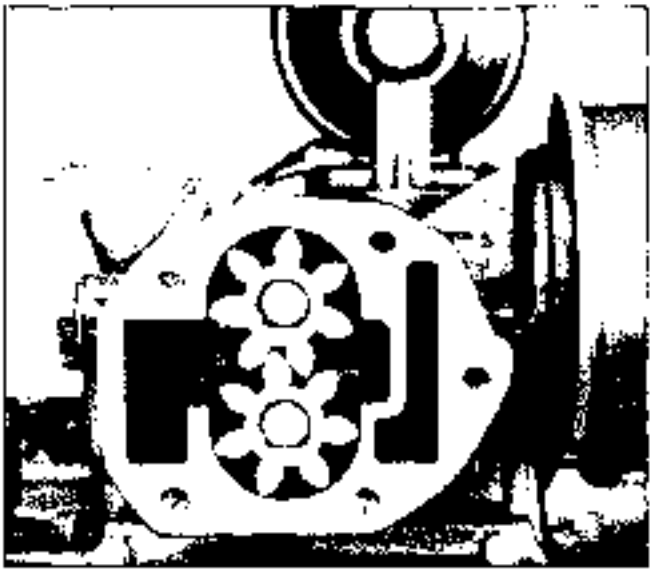


Fig. 6-37 Oil Pump Gears

4. Install gears.

5. Replace cover using new gasket. Tighten bolts to 20 lb. ft.

HOUSING ASSEMBLY REMOVE AND REPLACE

REMOVE

1. Remove timing belt top front cover.

2. Align timing marks (Fig. 6-7).

3. Loosen six housing assembly to cylinder block retaining bolts.

4. Remove timing belt from camshaft sprocket and distributor drive.

5. Disconnect fuel lines from fuel pump.

6. Remove distributor cap, vacuum lines and wires from distributor.

7. Remove housing assembly by removing six retaining bolts (Fig. 6-38).

REPLACE

1. Using new gaskets, loosely install housing assembly to cylinder block using six retaining bolts.

2. Align timing marks (Fig. 6-7) and install timing belt.

3. Connect fuel lines to fuel pump.

4. Replace distributor cap, vacuum lines and wires.

5. Adjust timing belt tension. See Fig. 6-12.

6. Replace timing belt top front cover.

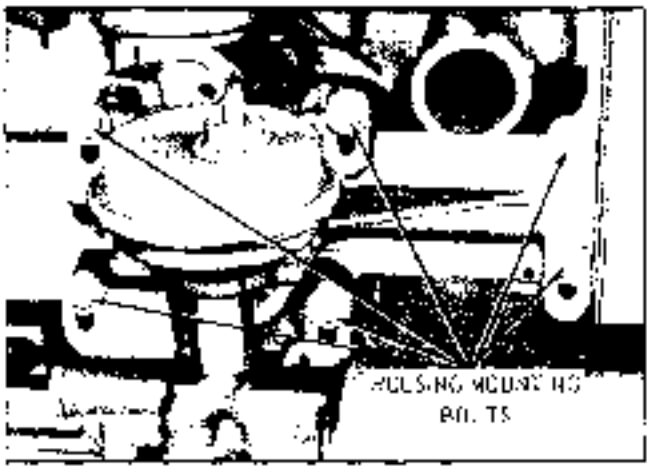


Fig. 6-38 Housing Mounting Bolts

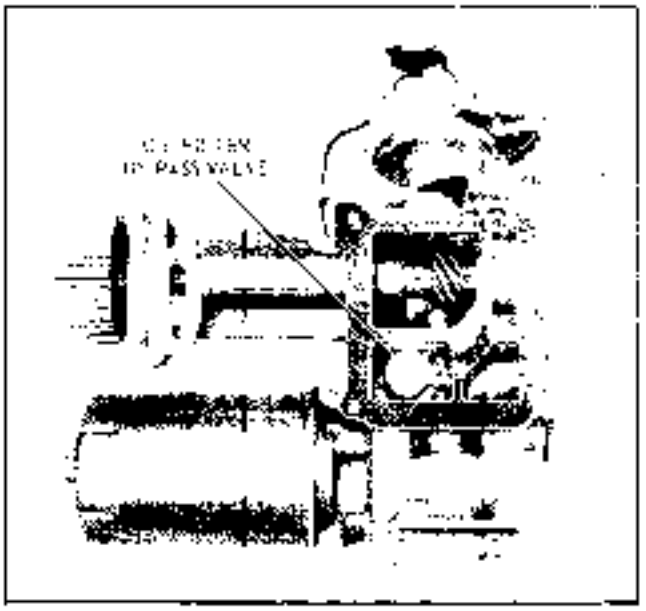


Fig. 6-39 Oil Filter Bypass Valve

OIL FILTER BY-PASS VALVE

REMOVE AND REPLACE

1. Remove housing assembly.

2. Remove by-pass valve retaining screw (Fig. 6-39).

3. Remove by-pass valve.

4. Replace by reversing the above procedures.

SHAFT AND SPROCKET ASSEMBLY—SHAFT SEAL AND/OR BEARING—FUEL PUMP—ECCENTRIC AND DISTRIBUTOR DRIVE GEAR

1. Remove housing assembly.

2. Observing and recording location of sprocket timing mark and direction of distributor rotor, remove distributor.

3. Remove fuel pump eccentric and distributor drive gear retaining pin (Fig. 6-40).

NOTE: Position shaft assembly so as to allow adequate clearance in housing body for pin removal.

4. Remove shaft and sprocket assembly from housing.

5. Inspect shaft assembly seal and bearing.

6. If necessary to replace bearing or seal, use J 22264 and slide hammer to remove seal or bearing and seal together (Fig. 6-41).

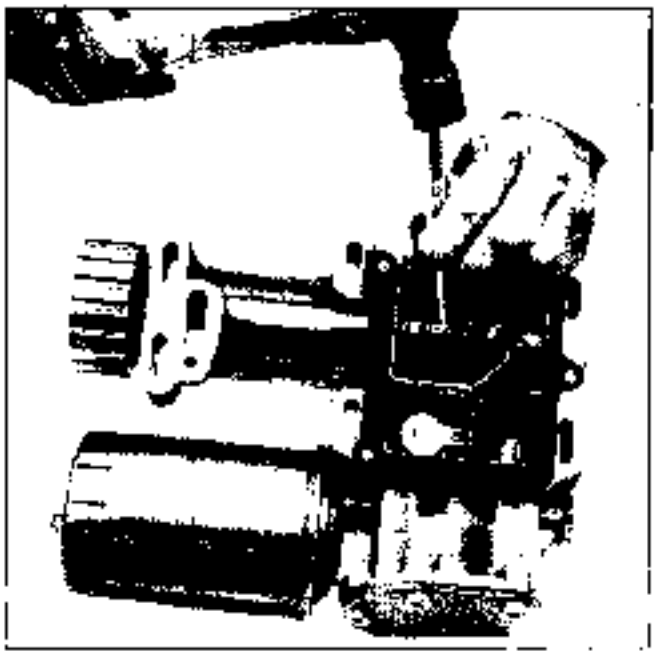


Fig. 6-40 Removing Eccentric and Distributor Drive Gear Pin

7. Use tool J 22267-1 and install bearing (Fig. 6-42).

8. Use tool J 22267-1 and -2 and install seal (Fig. 6-43).

9. Reassemble by reversing steps 1 thru 4.

OIL PAN—REMOVE AND REPLACE

REMOVE

1. Disconnect battery cable.

2. Remove air cleaner assembly.

3. On air-conditioned cars, remove compressor from mounting brackets and position to one side.

4. Inspect all water hoses and wiring harness for

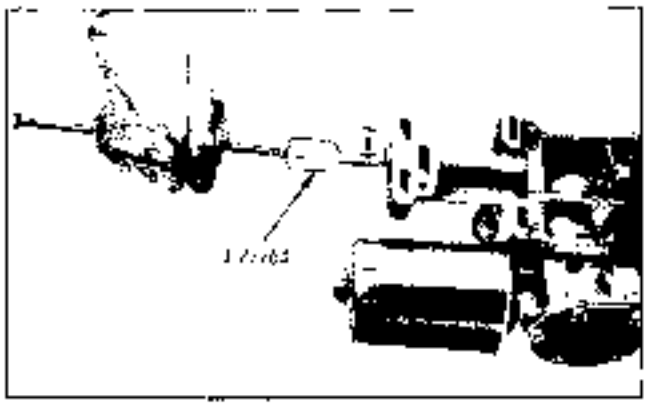


Fig. 6-41 Removing Bearing and Seal

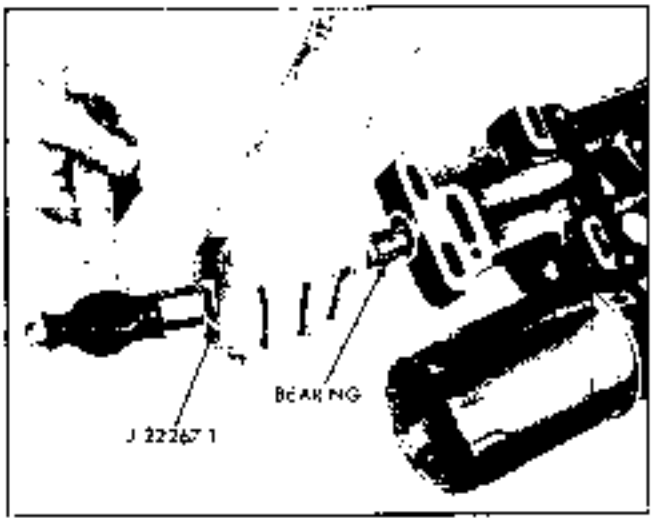


Fig. 6-42 Installing Bearing

proper routing to prevent excessive binding when engine is raised.

NOTE: Before raising vehicle pump hood open at least 4" to insure adequate clearance between timing belt cover and inner hood panel.

5. Raise vehicle and drain crankcase.

6. Remove starter assembly and flywheel cover.

7. Re-route or disconnect any wiring between bellhousing and floor pan to insure against damage when bellhousing contacts floor pan.

8. Loosen transmission insulator to crossmember retaining bolts.

9. Remove right and left engine insulator to frame bracket thru-bolts.

10. Rotate harmonic balancer until timing mark

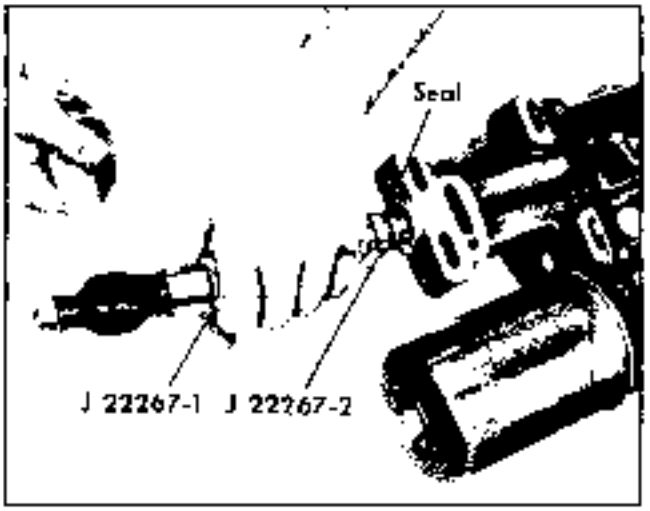


Fig. 6-43 Installing Seal

is at bottom. (This puts the crankshaft counterweights in the proper position.)

11. Bolt J 22345 (Tempest) or J 22775 (Firebird) engine support bracket to front of harmonic balancer.

NOTE: Safety bracket on Firebird tool must engage in crossmember reinforcement bar (Fig. 6-19)

12. With suitable equipment, raise engine at J 22345 or J 22775 until insulators clear frame brackets.

13. Remove oil pan bolts.

14. On Tempest raise engine approximately 4 1/2". Apply a rearward force on the engine-transmission assembly until oil pan clears the flywheel housing and remove oil pan.

On Firebird raise engine approximately 2" or until oil pan clears the flywheel housing and remove oil pan.

REPLACE

1. Install new gasket on oil pan.

2. Apply rearward force to engine-transmission assembly sufficient to allow oil pan to clear flywheel housing (Tempest).

3. Install oil pan and tighten retaining bolts to 12 lb. ft.

4. Lower engine, remove engine support bracket and install engine insulator bracket to frame thru-bolts.

5. Tighten transmission insulator to crossmember bolts to 30 lb. ft.

6. Replace flywheel cover and starter assembly.

7. Lower vehicle.

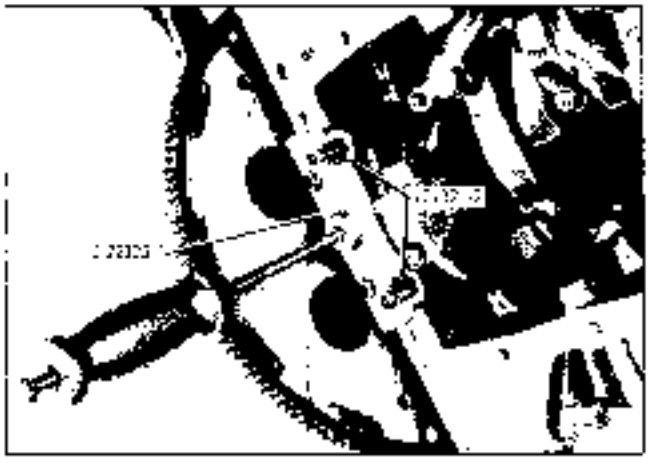


Fig. 6-44 Removing Rear Main Bearing Cap

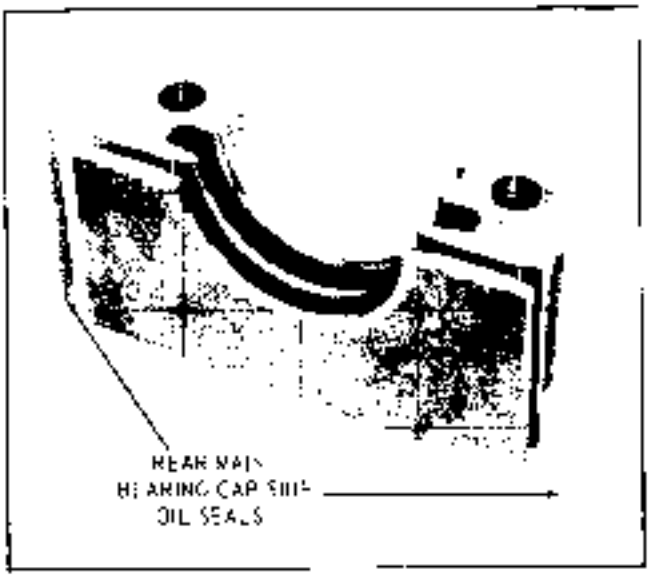


Fig. 6-45 Rear Main Bearing Cap Side Oil Seals

8. On air-conditioned vehicles, replace compressor and adjust belt tension.

9. Replace air cleaner assembly.

10. Refill crankcase.

11. Connect battery cable.

REAR MAIN BEARING OIL SEAL—REMOVE AND REPLACE

The rear main bearing oil seal can be removed (both halves) without removal of the crankshaft.

NOTE: Always replace upper and lower seal as a unit.

1. Remove oil pan. (See "Oil Pan—Remove and Replace".)

2. Remove rear bearing cap using J 22325 (Fig. 6-44).

3. Remove oil seal from groove, prying from bottom, using a small screwdriver.

NOTE: Always clean crankshaft surface before installing a new seal.

4. Remove rear bearing cap side oil seals. Place new seals in position and place bearing cap in vise and compress seals into place (Fig. 6-45).

5. Insert a new seal well lubricated with engine oil in bearing cap groove, gradually push with a hammer handle until seal is rolled into place.

6. To replace the upper half of seal, use a small hammer and brass pin punch to tap one end of oil

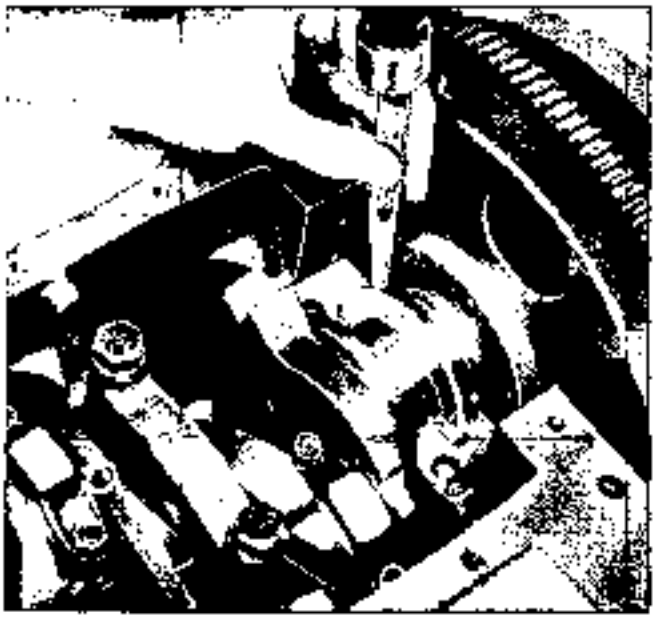


Fig. 6-46 Removing Upper Rear Main Oil Seal

seal (Fig. 6-46) until it protrudes far enough to be removed with pliers. Push new seal into place.

NOTE: Avoid scraping seal on edge of cap and block seal locating grooves.

7. Install bearing cap using J 22525 (Fig. 6-44) and torque bearing cap bolts 100 lb. ft.

8. Install oil pan. Do not overtighten.

MAIN BEARINGS—REMOVE AND REPLACE

The main bearings are of precision insert type and do not utilize shims for adjustment. If the clearances are found to be excessive, a new standard or undersize bearing insert, both upper and lower halves, will be required.

NOTE: To replace the upper half of the rear main bearing, it will be necessary to loosen all main bearing caps. Slowly rotate the crankshaft and force bearing out with a fatty knife or similar tool.

REMOVE

1. Remove oil pan. (See - "Oil Pan - Remove and Replace".)

2. Remove cap on main bearing requiring replacement and remove bearing from shaft.

3. Install a main bearing shell removing and installing tool such as KMO 734 in the oil hole in the crankshaft.

NOTE: If such a tool is not available, a cotter pin may be bent as required to do the job (Fig. 6-47).

4. Rotate the crankshaft clockwise as viewed from front of engine. This will roll upper bearing shell out of engine.

REPLACE

1. Oil new upper bearing shell and insert plain (unnotched) end of shell between crankshaft and indented or notched side. Rotate the bearing into place.

2. Install new bearing shell in bearing cap.

3. Check bearing clearance using Plastigage method as outlined below.

4. Install oil pan using new gaskets and seals.

PLASTIGAGE METHOD OF DETERMINING MAIN BEARING CLEARANCE

1. Place a .002" brass shim between the crankshaft journal and lower bearing in each bearing cap next to that being checked. Tighten all cap bolts to 100 lb. ft. This causes the crankshaft to be forced against the upper bearing and insures an accurate measurement of total clearance.

2. Remove the bearing cap of bearing to be checked. Wipe bearing and journal free of oil.

3. Place a piece of Plastigage, the length of bearing (parallel to crankshaft), on journal or bearing surface (Fig. 6-48). Install cap and tighten cap bolts to proper torque.

NOTE: Do not turn crankshaft with Plastigage in place.

4. Remove bearing cap and using Plastigage scale on envelope measure width of compressed Plastigage before removing it from the bearing or journal (Fig. 6-49). If bearing clearance is between .0003" and .002", the clearance is satisfactory. If clearance is more than .002", replace bearing with next under-

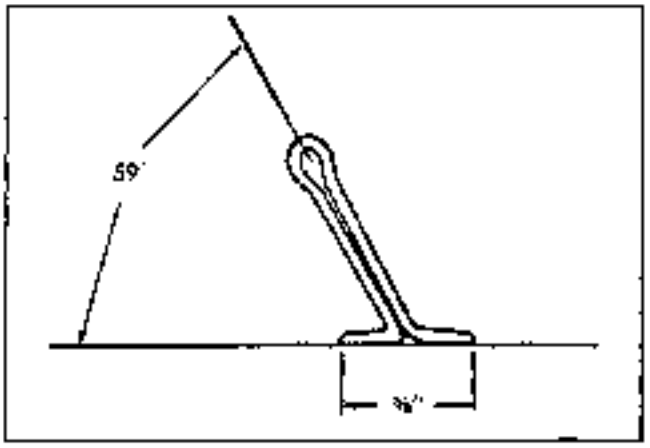


Fig. 6-47 Tool For Removing Upper Half of Main Bearing

size bearing and recheck clearance. Bearings are available in standard size .001" and .002" undersize.

5. Install a new rear main bearing oil seal in cylinder block and main bearing cap if rear main bearing was re-cored and/or replaced.

6. Check crankshaft end play with feeler gauge at No. 7 main bearing (Fig. 6-52). If end play is over .006, replace bearing.

CONNECTING ROD BEARINGS— REMOVE AND REPLACE

Connecting rod bearing inserts are available in standard size and undersizes of .001" and .002". These bearings are not shimmed and when clearances become excessive the next undersized bearing insert should be used. DO NOT FILE ROD OR ROD CAPS.

REMOVE

1. Remove oil pan. (See Oil Pan - Remove and Replace.)

2. Rotate crankshaft as necessary to bring crankpin carrying bearing to be replaced straight toward bottom of block.

3. Remove bearing cap.

4. Install connecting rod bolt guide set J 5239 on connecting rod bolts. Push piston and rod assembly up far enough to remove upper bearing.

5. Remove bearings from cap and rod.

6. Inspect crankpin for damage, out-of-round and taper.

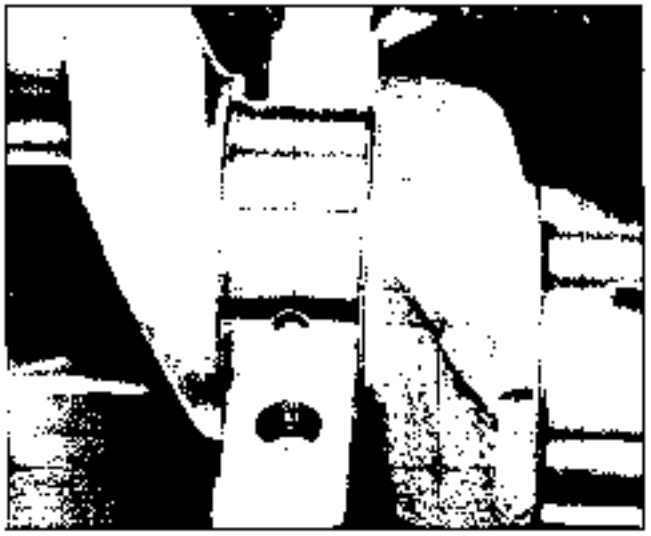


Fig. 6-48 Plastigage In Place

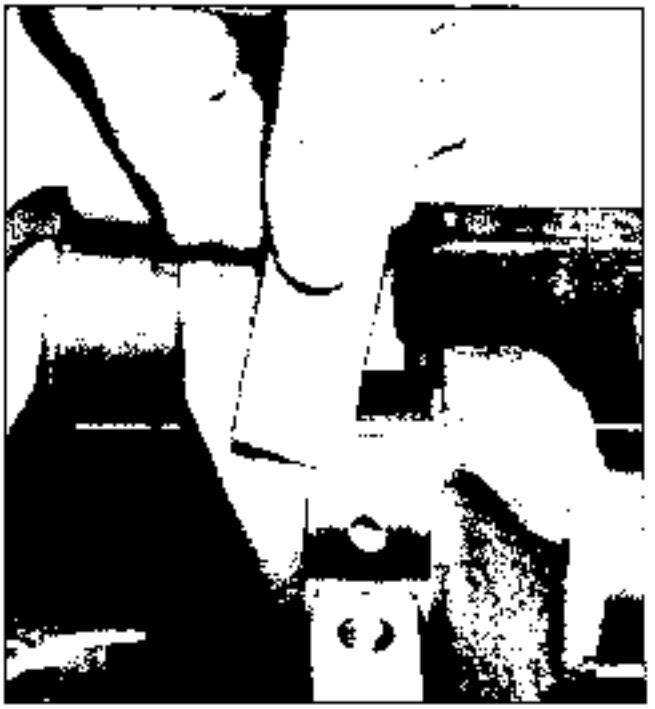


Fig. 6-49 Measuring Plastigage

REPLACE

1. Reassemble cap and rod with new bearings and check clearance with Plastigage as outlined below.

2. Install oil pan using new gaskets and seals.

PLASTIGAGE METHOD OF DETERMINING CONNECTING ROD BEARING CLEARANCE

1. Remove cap of bearing to be checked. Wipe the bearing and the crankpin free of oil.

2. Place a piece of Plastigage, the length of bearing (parallel to crankshaft), on the crankpin or bearing surface (Fig. 6-48). Install the cap and tighten cap bolts to 33 lb. ft.

NOTE: Do not turn crankshaft with Plastigage in place.

3. Remove bearing cap and using Plastigage scale on envelope measure width of compressed Plastigage before removing it from the crankpin or bearing (Fig. 6-49). If bearing clearance is between .0005" and .0030", clearance is satisfactory. If clearance is more than .0028", replace bearing with next size undersize bearing and recheck clearance. Bearings are available in .001", and .002" undersize.

4. Rotate the crankshaft after bearing adjustment to be sure bearings are not tight.

5. Check connecting rod end clearance between connecting rod cap and side of crankpin (Fig. 6-50). Clearance should be .009" - .014". If clearance is more than .014", replace connecting rod.

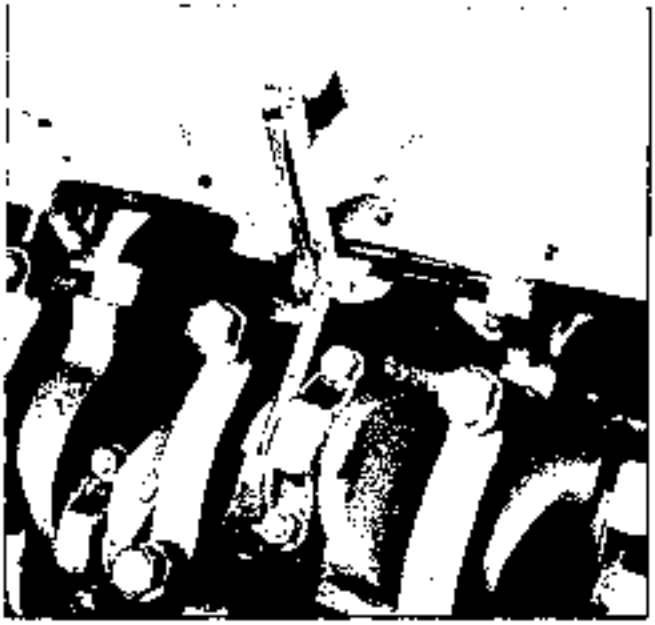


Fig. 6-50 Checking Connecting Rod Side Clearance

CONNECTING ROD AND PISTON ASSEMBLY—REMOVE AND REPLACE

REMOVE

1. Remove rocker arm cover.

2. Disconnect fuel line and vacuum lines at carburetor.

3. Remove cylinder head, intake and exhaust manifolds as an assembly.

4. Remove ring ridge using a suitable ring ridge remover (Fig. 6-51).

5. Remove oil pan.

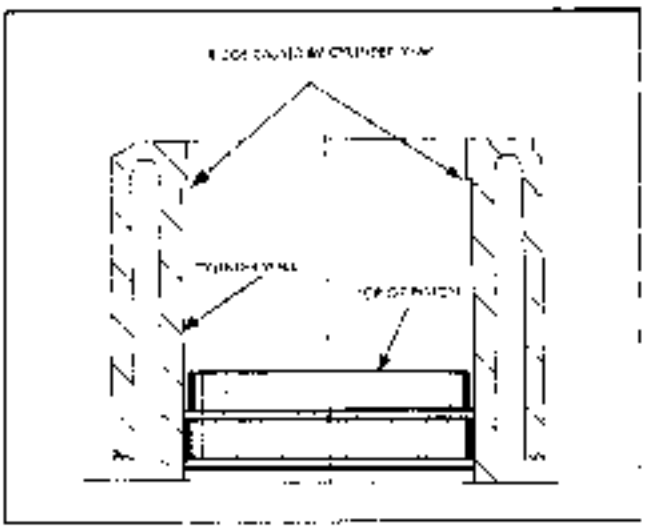


Fig. 6-51 Cylinder Ring Ridge

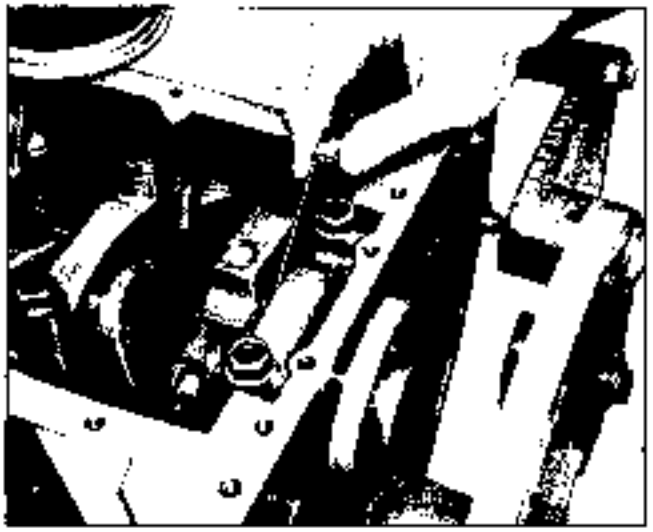


Fig. 6-52 Checking Crankshaft End Play

6. Check connecting rod and piston for cylinder number identification and if necessary, mark them.

7. Remove bearing cap and install connecting rod bolt guide set J 5239.

8. Carefully remove connecting rod and piston assembly by pushing out with knurled handle of long guide.

CONNECTING ROD AND PISTON—DISASSEMBLE

NOTE: Use care at all times when handling and servicing connecting rods and pistons. To prevent possible damage to these units, do not clamp rod or piston in vise since they may become distorted. Do not allow pistons to stroke against one another, against hard objects or bench surfaces, since distortion of piston contour or nicks in the soft aluminum material may result.

Step A (Fig. 6-53)

1. Remove piston rings using J 8021.

2. Install J 9510-2 pilot on piston pin.

3. Place spring and J 9510-2 into base J 9510-1 and index J 9510-2 with piston pin.

4. Using J 9510-2 as a guide, press piston pin out approximately 1/4".

Step B (Fig. 6-54)

1. Remove J 9510-2 and spring from support J 9510-1.

2. Press piston pin rest of way out of piston.

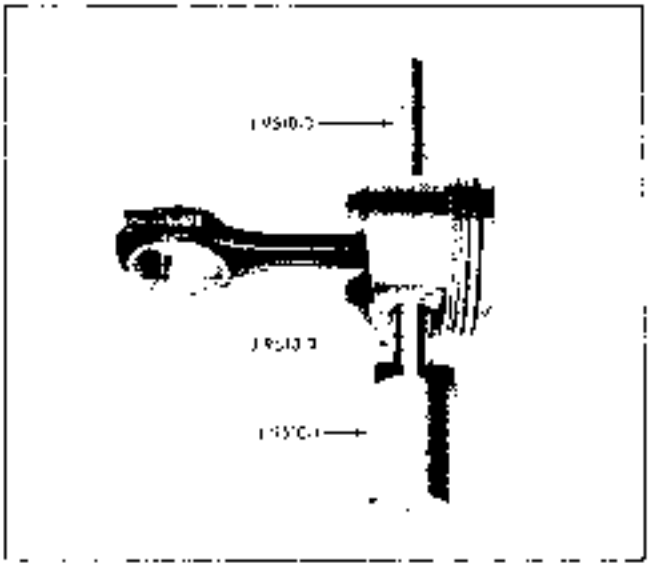


Fig. 6-53 Removing Piston Pin—Step A

CONNECTING ROD AND PISTON — CLEAN AND INSPECT

1. Clean carbon, varnish, and gum from piston surfaces, including underside of piston head. Clean ring grooves, and oil holes in oil ring groove, using suitable cleaning tools and solvent.

2. Clean piston pin, rod, cap, bolts and nuts in suitable solvent. Reinstall cap on connecting rod to assure against subsequent mixing of caps and connecting rods.

3. Carefully examine piston for rough or scored bearing surfaces, cracks in skirt or head; cracked, broken, or worn ring lands; and scored, galled, or worn piston bosses. Damaged or faulty pistons should be replaced.

4. Inspect piston pin for scoring, roughness, or uneven wear and proper fit.

5. Inspect bearing shells to see that they are serviceable. Fit of bearings should be checked when engine is assembled.

PISTON PIN FIT

The piston pin fit in piston is .0000" to .0005" loose with pin and bosses clean and dry.

NOTE: Piston and pin must be at room temperature when checking fit and pin must be able to fall from piston by its own weight (Fig. 6-55).

Piston pins are available separately in .001 and .005 oversizes. If the pin fit becomes loose it should be replaced with a new oversized pin.

CYLINDER BORES—INSPECT

Inspect cylinder bores for out-of-round or excessive taper, with an accurate cylinder gauge J 8087 or comparable, at top, middle and bottom of bore, (Fig. 6-56). Measure cylinder bore parallel and at right angles to the centerline of the engine to determine out-of-round. Variation in measure from top to bottom of cylinder indicates the taper in cylinder. (Fig. 6-57) illustrates area in cylinder where normal wear occurs. Cylinder bores can be measured by setting cylinder gauge dial at zero in the cylinder at the point of desired measurement. Lock dial indicator at zero before removing from cylinder, and measure across gauge contact points with outside micrometer, with the gauge at same zero setting when removed from the cylinder (Fig. 6-58).

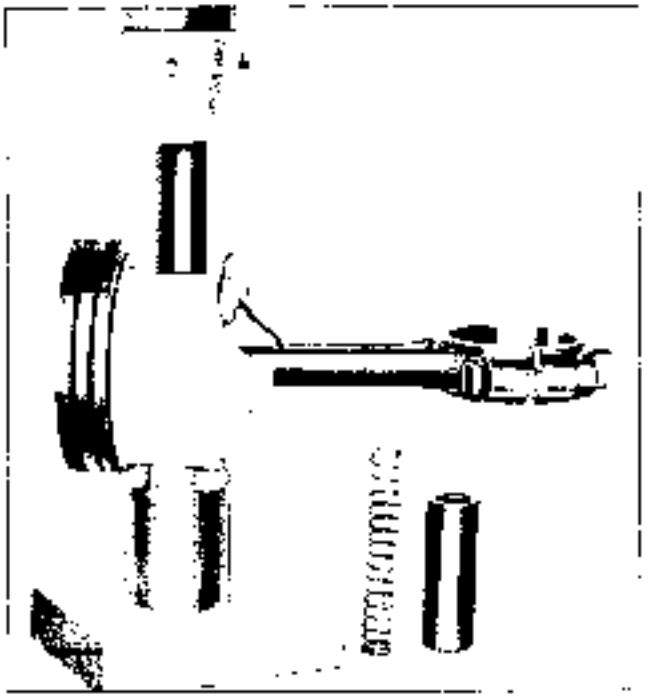


Fig. 6-54 Removing Piston Pin—Step B

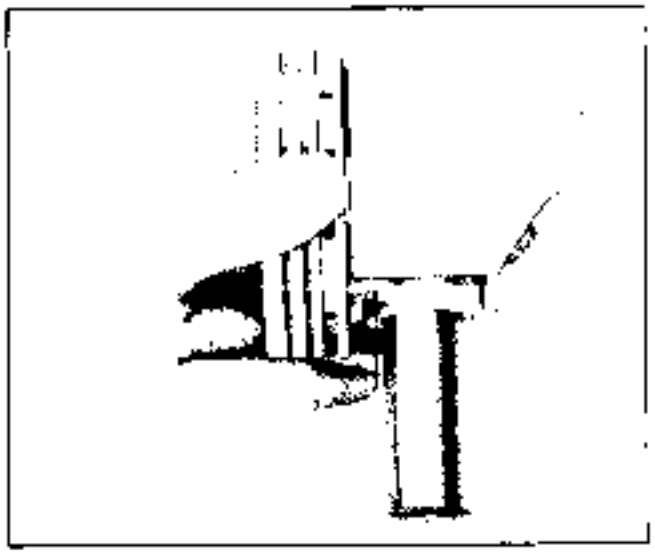


Fig. 6-55 Checking Piston Pin Fit

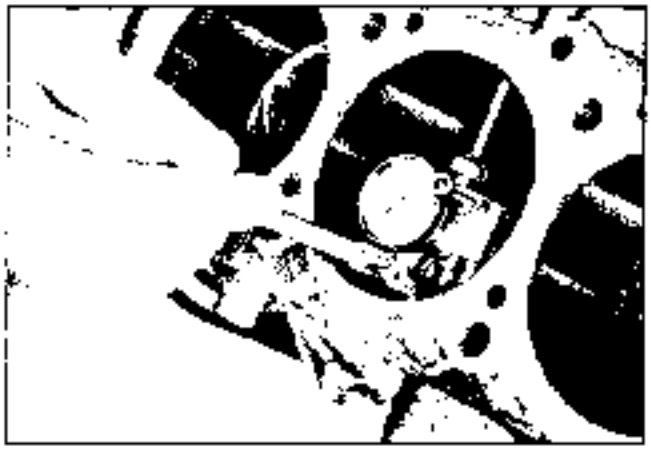


Fig. 6-56 Measuring Out of Round Taper

Take several measurements parallel and at right angles to the crankshaft, between 1/2" and 4" from the top of the cylinder. Subtract the smallest measurement found from the largest. If this figure exceeds .0005", a piston cannot be fitted properly, and the cylinder must be honed. New rings and a new oversized piston must then be fitted.

Fine vertical scratches made by ring ends will not cause excessive oil consumption, therefore, honing to remove is unnecessary.

HONING OR BORING

If a piston in excess of .005" oversize is to be installed, cylinder should be bored, rather than honed, to effect a true bore.

To eliminate the possibility of honing taper into the cylinder, full strokes of the hone should be made in addition to checking measurement at top, middle and bottom of bore repeatedly.

When boring, always be sure crankshaft is out of way of boring cutter when boring each cylinder.

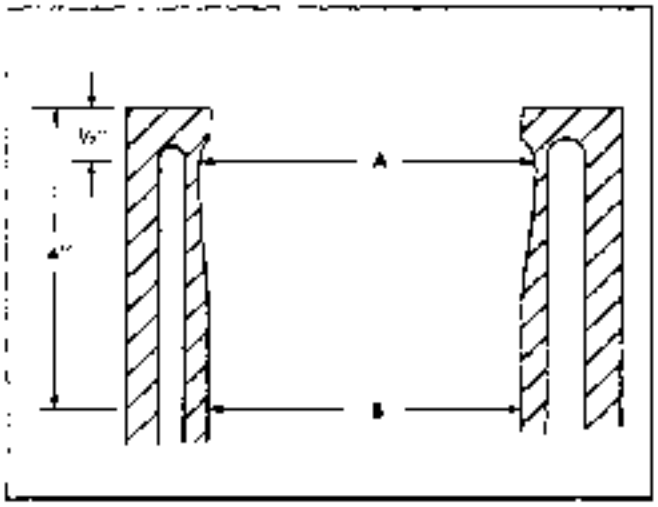


Fig. 6-57 Normal Cylinder Wear Pattern

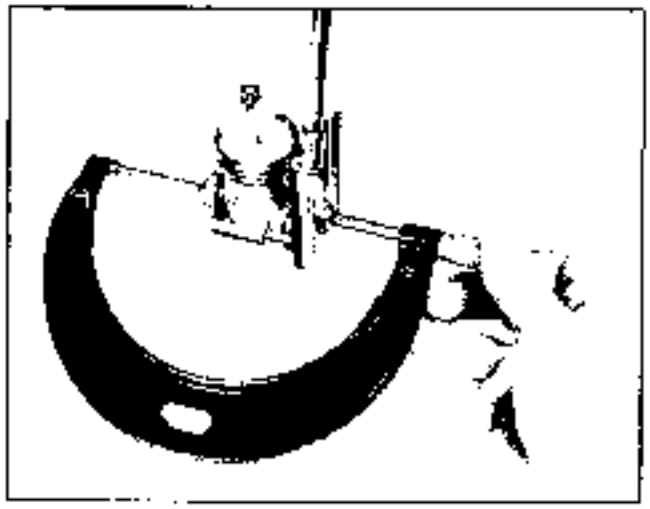


Fig. 6-58 Measuring Cylinder Gauge

Crankshaft bearings and other internal parts must be covered or taped to protect them during boring or honing operation. When taking final cut with a boring bar, leave .001" on the diameter for finish honing to give required piston to cylinder clearance specifications.

NOTE: Honing or boring operation must be done under close supervision so that specified clearance between pistons, rings, and cylinder bores is maintained.

By measuring the piston to be installed at sizing points (Fig. 6-59) and adding the means of clearance specification, the finish hone cylinder measurement can be determined. It is important that both block and piston be measured at normal room temperature, 60°-90° F.

After final honing and before piston is checked for fit, each cylinder bore must be thoroughly cleaned. Use soapy water solution and wipe dry to remove

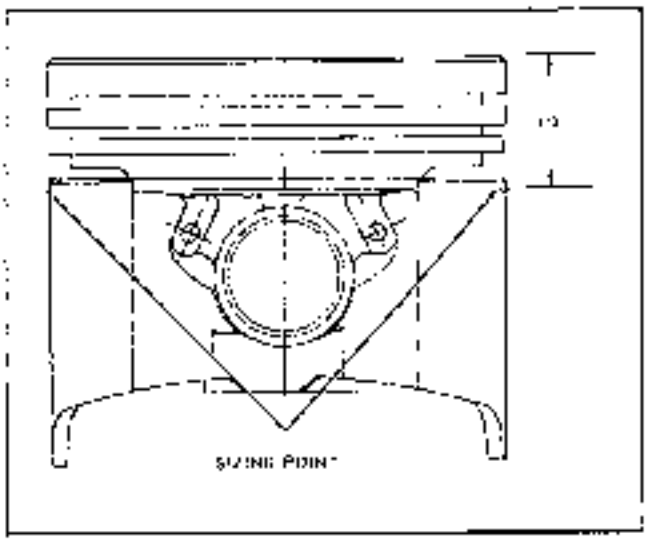


Fig. 6-59 Piston Spring Points

all traces of abrasive. If all traces of abrasive are not removed, rapid wear of new rings and piston will result.

Interchanging different size pistons has no effect on engine balance as all Pontiac pistons from standard size, up to .030" oversize, weigh exactly the same. Pontiac does not recommend boring beyond .010" during warranty period so that if necessary, engine can be serviced at high mileage without cylinder block replacement.

PISTON—FIT AND REPLACE

Pistons should be fitted in bores by actually measuring fit. Clearance between the piston and the cylinder bore should be .0022" to .0028".

If cylinder bores have been reconditioned or if pistons are being replaced, reconditioning of bores and fitting of pistons should be closely coordinated.

If bore has been honed, it should be washed thoroughly with hot, soapy water and stiff bristle brush.

Using a cylinder checking gauge, measure the cylinder bore crosswise of block to find smallest diameter. Record smallest diameter of each bore.

NOTE: When measuring cylinder bores and pistons, it is very important that block and pistons be at room temperature. If any or all parts are hotter or colder than normal room temperature, improper fitting will result.

Measure piston skirt perpendicular to piston pin boss (piston pin removed) at sizing point indicated in Fig. 6-59.

Make sure the micrometer is in full contact.

As pistons are measured they should be marked for size identification and measurements recorded.

If there is excessive clearance between a cylinder bore and piston which was installed in that bore, a new piston should be used.

New pistons are serviced in standard size and .001", .002", .005", .010", .020" and .030" oversize.

NOTE: Since these are nominal or basic sizes, it is important that new pistons be measured to ensure proper fit. All new pistons are serviced with selectively fitted piston pins.

After all measurements have been made, match new pistons with cylinders where they will fit with proper clearance. Honing cylinder bore may be necessary to effect a proper fit. When properly marked, mark pistons with cylinder numbers they fit so they will not become mixed.

CONNECTING ROD TO PISTON—ASSEMBLE

There is a notch cast in top of all piston heads to facilitate proper installation. The piston assemblies should always be installed with notch toward front of engine.

1. Lubricate piston pin holes in piston and connecting rod bushing with graphite lubricant.

2. Position connecting rod in its respective piston so that oil squirt hole faces toward distributor side of engine. Fig. 6-60.

3. Install piston pin on installer and pilot spring and pilot (J 9510-4) in support (Fig. 6-61). Use piston pin removing and installing tool J 9510.

4. Install piston and rod on support, indexing pilot through piston and rod.

5. Place support on arbor press, start pin into position and press on installer until pin pilot bottoms.

6. Remove installer and support assembly from piston and connecting rod assembly.

7. Check piston pin for freedom of movement in piston bore.

PISTON RINGS—REPLACE

1. Remove connecting rod and piston assembly

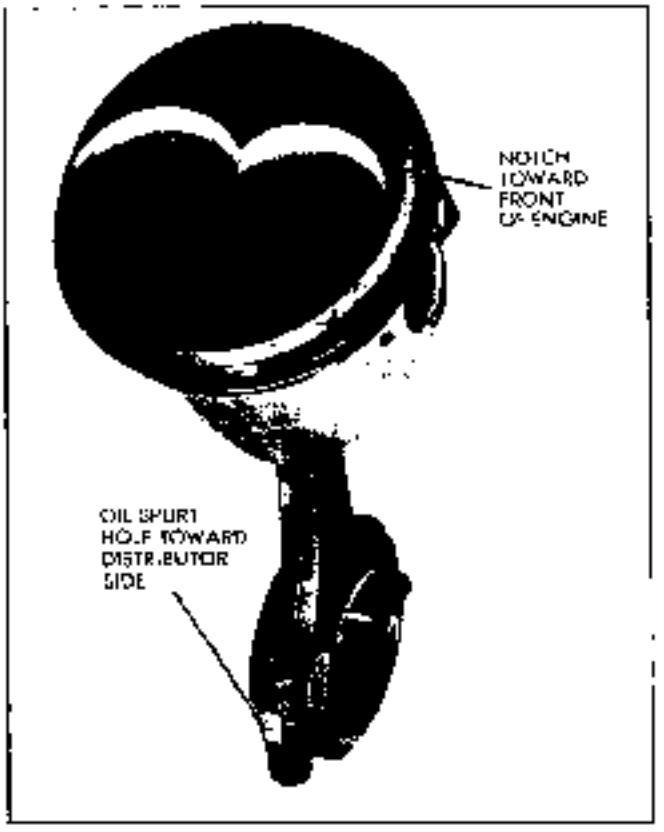


Fig. 6-60 Piston and Rod Assembly

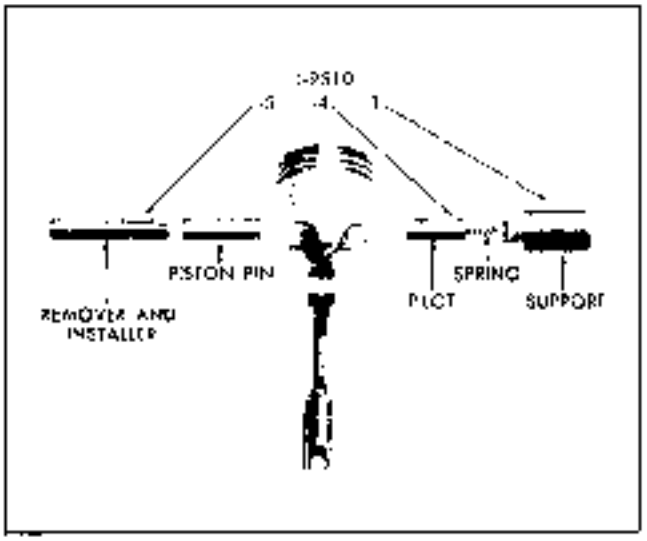


Fig. 6-61 Piston Pin Replacement

face CONNECTING ROD AND PISTON ASSEMBLY - REMOVE AND REPLACE in this section).

2. Remove piston rings using J 0021.

3. Clean carbon, varnish, and gum from piston surfaces, including underside of piston head. Clean ring grooves, and oil holes in oil ring grooves, using suitable cleaning tools and solvent.

4. Carefully examine piston for rough or scored bearing surfaces; cracks in skirt or head; cracked, broken, or worn ring lands; scored, galled, or worn piston bosses. Damaged or faulty pistons should be replaced.

5. Inspect bearing shells to see that they are serviceable. Fit of bearings should be checked when engine is being assembled.

6. Inspect cylinder bores for out-of-round or excessive taper. See CYLINDER BORES—INSPECT.

PISTON RINGS -INSTALL

Two compression rings and one 3-piece oil control ring, all above piston pin, are used on pistons for both standard and premium fuel engines. The compression rings are taper faced and also have either a step or a chamfer on the inside diameter of the bottom side. The top compression ring is molybdenum filled, which results in the center section of the ring seating edge appearing porous or grainy. The lower compression ring is lubrite finished (black).

Always install compression rings with the stamped markings toward the top of the piston.

New rings are serviced for the standard size pistons, and for .005", .010", .020", and .030" oversize pistons. When selecting rings be sure they match size of piston on which they are to be installed, i.e. standard rings for standard pistons, .010" oversize rings for .010" oversize pistons, etc. Ring gap and side clearance should be checked while installing rings as follows:

1. Check pistons to see ring grooves and oil return holes have been properly cleaned.

2. Place ring down at bottom of ring traveled part of cylinder bore in which it will be used. Square ring in bore by pushing it into position with head of piston.

3. Measure gap between ends of ring with feeler gauge (Fig. 6-62). Gaps should be as follows:

Compression Rings	.005-.025
Oil Ring	.005-.055

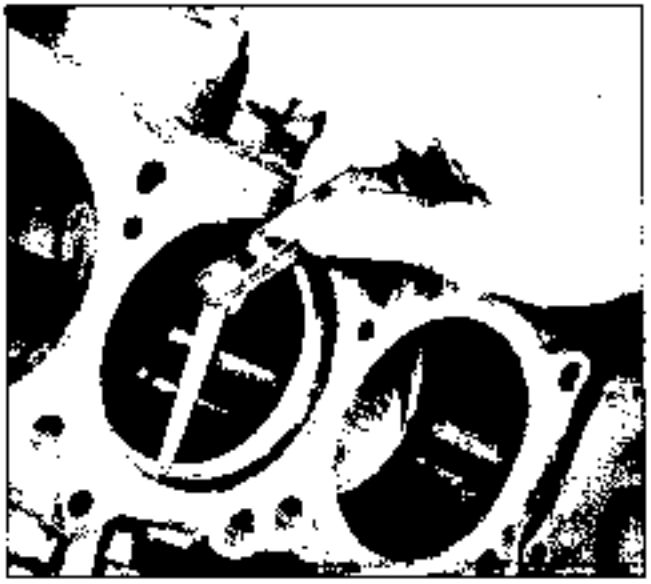


Fig. 6-62 Checking Ring Gap

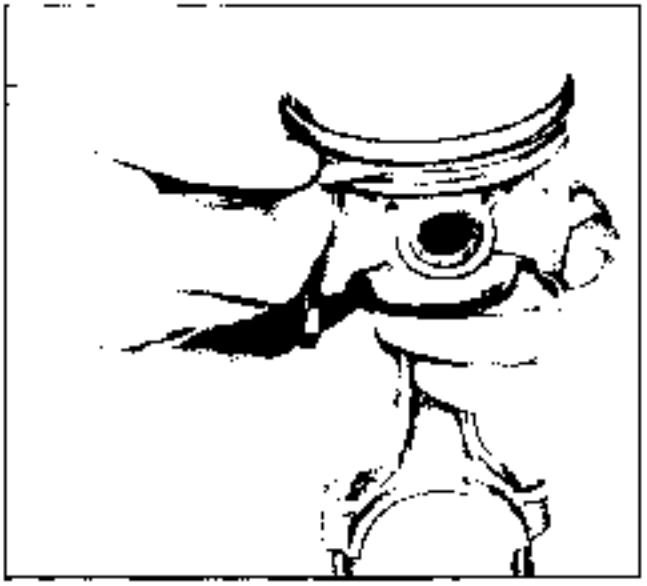


Fig. 6-63 Checking Ring Side Clearance

Incorrect ring gap indicates that wrong size rings are being used. If rings are selected according to the size of the bore (standard .005", oversize, etc.) they should have proper gap. It should not be necessary to alter ring gap by filing.

4. Install rings on piston using J 8037 to prevent breakage or fracture of rings, or damage to pistons.

5. Measure side clearance of rings in ring groove (Fig. 6-63) as each ring is installed. Clearance with new pistons and rings should be .0015-.0050.

If side clearance is excessive, piston should be replaced.

CONNECTING ROD AND PISTON ASSEMBLY--REPLACE

1. Install connecting rod bolt guide set J 5239 on connecting rod bolts (Fig. 6-64).

2. Using piston ring compressor J 8037, insert rod and piston assembly into cylinder so notch in top of piston is facing front of engine (Fig. 6-65).

3. From beneath engine, pull connecting rod with bearing into place against crankpin.

4. Remove guide set J 5239 and install bearing cap. Tighten cap nuts to 38 lb. ft.

5. Install oil pan.

6. Install cylinder head, intake and exhaust manifold as an assembly.

7. Connect fuel line and vacuum lines to carburetor.

8. Install rocker arm cover.

CRANKSHAFT—REMOVE AND REPLACE

REMOVE

1. Remove engine from vehicle.

2. Remove clutch from engine.

3. Mount engine on suitable stand.

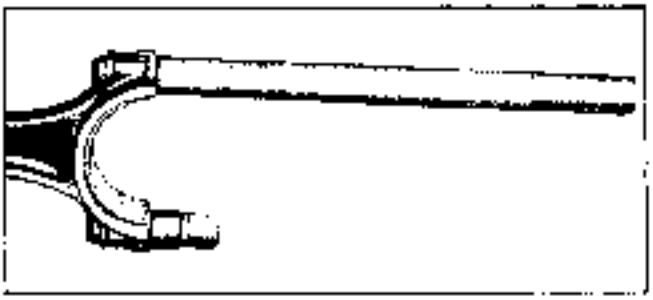


Fig. 6-64 Connecting Rod Guide Tool

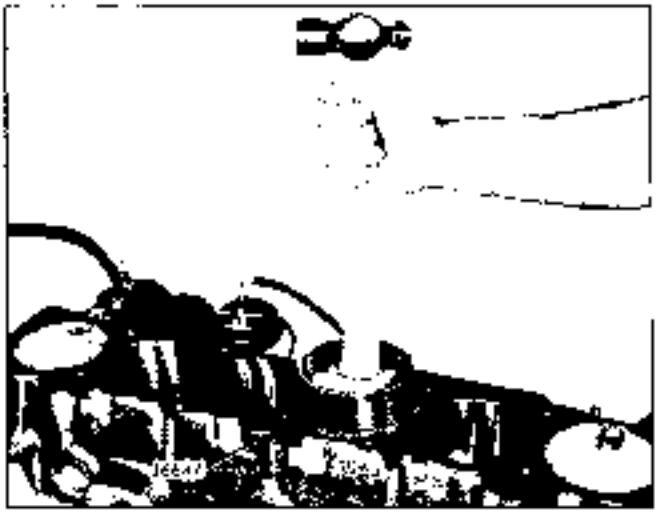


Fig. 6-65 Installing Piston in Cylinder

4. Remove spark plugs.

5. Remove fan and fan pulley.

6. Remove harmonic balancer.

7. Remove oil pan and crankcase front cover.

8. Remove connecting rod bearing caps with bearings and identify each for reinstallation.

9. Push connecting rod and piston assemblies away from crankshaft.

10. Remove main bearing caps with bearings and identify for reinstallation.

11. Remove crankshaft.

REPLACE

1. With upper bearings installed position crankshaft in block.

2. Using new seals in rear main bearing cap install main bearing caps (with lower bearings), but do not tighten cap bolts.

3. Pull connecting rods (with upper bearings installed) and pistons into place.

4. Install rod bearing caps (with bearings), but do not tighten nuts.

5. With rubber mallet hit both ends of crankshaft to center thrust bearing.

6. Tighten main bearing caps 100 lb. ft.

7. Tighten connecting rod bearing caps 38 lb. ft.

8. Install key from old crankshaft keyway in new crankshaft.

9. Install crankcase front cover using new seal and gaskets.

10. Install oil pan.

11. Install harmonic balancer.

12. Install fan pulley and fan.

13. Install spark plugs.

14. Remove engine from stand.

15. Attach clutch to engine.

16. Install complete assembly in vehicle.

FITTED BLOCK ASSEMBLY—REPLACE

Fitted block assembly contains pistons, rings, pins and main bearing caps.

DISASSEMBLE

1. Remove engine from vehicle.

2. Remove clutch and flywheel from engine.

3. Install engine in suitable stand.

4. Remove ground straps and dipstick.

5. Remove harmonic balancer.

6. Remove front timing belt covers.

7. Remove fuel and oil pump housing assembly and timing belt.

8. Remove water pump.

9. Remove remaining accessory mounting brackets and engine mounts.

10. Remove rocker arm cover assembly.

11. Remove cylinder head and manifolds.

12. Remove crankshaft flange, sprocket and front crankcase cover.

13. Remove oil pan.

14. Remove oil pump pick-up tube and crankcase splash baffles.

15. Remove crankshaft.

16. Remove all connecting rod and piston assemblies and identify each connecting rod according to cylinder from which it was removed.

17. Remove connecting rods from pistons.

18. Remove old block from stand and mount new block on stand.

19. Remove new piston and pin assemblies from new block and identify each according to cylinder from which it was removed.

This completes disassembly for block assembly replacement. Use new gaskets and pay special attention to torque requirements.

ASSEMBLE

1. Assemble old connecting rods to new piston and pin assemblies according to cylinders from which they were removed.

2. Install crankshaft and plastigage main bearings.

3. Install connecting rod and piston assemblies in proper cylinders.

4. Install crankcase splash baffles and oil pump pick-up tube.

5. Install oil pan.

6. Install front crankcase cover, crankshaft sprocket and flange.

7. Install cylinder head and manifolds.

8. Install rocker arm cover assembly.

9. Install accessory mounting brackets and engine mounts.

10. Install water pump.

11. Install fuel and oil pump housing assembly and timing belt.

12. Install lower front timing belt cover.

13. Install harmonic balancer.

14. Align timing marks and adjust timing belt tension.

NOTE: It will be necessary to remove distributor cap to make certain that the rotor arm points toward number one cylinder spark plug contact. See Fig. 6E-28.

15. Install upper front timing belt cover.

16. Install ground straps and dipstick.

17. Remove engine from stand and install flywheel and clutch. Tighten flywheel to crankshaft bolts 60 lb. ft.

18. Install engine in vehicle.

6-CYLINDER ENGINE WRENCH TORQUE SPECIFICATIONS

NOTE: Torque in lb. ft. unless otherwise shown.

APPLICATION	TORQUE
Bolt - Main Bearing Cap to Block	100
Bolt - Rear Main Bearing Cap to Block	100
Bolt - Cylinder Head	95
Bolt - Flywheel to Crankshaft	60
Nut - Connecting Rod Bearing Cap	33
Bolt - Accessory Drive Housing to Block	15
Bolt (& Nut) - Intake and Exhaust Manifold to Head	30
Bolt - Oil Pan to Block	12
Bolt - Camshaft Thrust Washer	40
Bolt - Camshaft to Sprocket	40
Spark Plug to Head	20
Bolt - Rocker Arm Cover to Head	15
Bolt - Harmonic Balancer	100

6-CYLINDER ENGINE SPECIFICATIONS

Type	In-Line 6, Overhead Cam
Bore and Stroke	3-7/8 x 3-17/32
Displacement	250 cu. in.
Taxable Horsepower	36.0

HORSEPOWER AND TORQUE

Engine	Carburetor	Compression Ratio	Horsepower	Torque
250	1-Bbl.	9.0	175 @ 4800	240 @ 2600
250	Q-Jet	10.5	215 @ 5200	255 @ 3000

Compression Pressure at Cranking Speed:	
1-Bbl.	150-170 PSI @ 155-165 RPM
Q-Jet	185-205 PSI @ 155-165 RPM
Firing Order	1-5-3-6-2-4
Engine Number Location	Pad Behind Oil Filler Neck
Cylinder Nos., Front to Rear	1-2-3-4-5-6
Cylinder Block	
Material	Alloy Cast Iron
Installation Angle	4° 18'
Cylinder Head	
Material	Alloy Cast Iron
Combustion Chamber	Wedge Type - Fully Machined
Pistons	
Material	Tin-Plated Aluminum Alloy
Type	Cam and Contour Ground - Slipper Skirt
Measurement Taken At	Top of Skirt
Clearance in Cylinder	.0022"-.0028"
Piston Rings	
Compression Rings	Two Cast Iron, Reverse Twist, Taper Face
Material - Upper	Chamel Moly Filled
- Lower	Lubrite Finish
Oil Ring	Three-Piece
Material - Rails (2)	Chrome Plated Steel
- Expander	Stainless Steel

6-CYLINDER ENGINE SPECIFICATIONS (Cont.)

Ring Gap	
Compression (-.010)	.015"
Oil (-.020)	.035"
Side Clearance (Ring to Groove)	.0015"-.005"
Piston Pin	
Material	Extruded SAE 5015 Steel
Diameter	.9272"
Wall Thickness	.87"
Length	3.00"
Fit in Piston	.0003"-.0005"
Fit in Rod	Press
Connecting Rod	
Material	SAE 1037 or 1038 Steel
Weight (Oz.)	20.5
Length (Center to Center)	5.70"
Bearings	
Length	.84"
Clearance	.0005"-.0025"
Material - 1-Bbl.	Moraine 100-A
- Q'Jet	Moraine 400-A
Endplay on Crankshaft	.006"-.014"
Crankshaft	
Material	Nodular Iron
No. of Bearings	7
Main Bearing Material - 1-Bbl.	Durex 100-A
- Q'Jet	Moraine 400
Thrust Taken On	No. 7
Crankshaft Endplay	.002"-.006"
Journal Diameter	2.30"
Main Bearing Length - 1-6	.80"
- Rear	1.01"
Clearance	.0003"-.0025"
Crankpin Diameter	2.00"
Flywheel and Sprockets	
Flywheel-Material-Manual	Cast Iron
-Automatic	Stamped Steel
-No. of Teeth	155
Starter Motor Drive-No. of Teeth	9
Crankshaft Sprocket-Material	Hardened Cast Iron
-No. of Teeth	19
Camshaft Sprocket-Material	Hardened Cast Iron
-No. of Teeth	38
Timing Chain	Neoprene Belt with Fiber Glass Cord Reinforcement
-No. of Teeth	98
Harmonic Balancer	Cast Iron Weight with Rubber Floated Cast Pulley
Camshaft	
Material	Hardened Alloy Cast Iron
Bearings - Number	7
- Type	Integral with Aluminum Cover
- Diameter-All	2.22"
Valve System	
Valve Lifter	None
Lash Taken Up By	Stationary Hydraulic Lash Adjuster
Leak-Down Rate	34 Sec. Min. With 50 Lb. Load
Plunger Travel (For Gauging Purposes)	.125"
Pushrod	None
Rocker Arm - Type	Cam Follower
- Material	Hardened Alloy Cast Iron
- Ratio	1.5:1
Rocker Arm Pivot Point	Lash Adjuster

6-CYLINDER ENGINE SPECIFICATIONS (Cont.)

		1-Bbl.	Q'Jet
Timing			
- Camshaft			
- Intake Opens	(BTC) (DEG)	14	14
Closes	(ABC) (DEG)	46	50
Duration	(DEG)	240	244
Lift	(IN)	.400"	.438"
- Exhaust Opens	(BBC) (DEG)	46	52
Closes	(ATC) (DEG)	14	12
Duration	(DEG)	240	244
Lift	(IN)	.400"	.438"
Valve Overlap	(DEG)	28	26

Valve Springs	1-Bbl.	Q'Jet
Pressure @ Length		
	PSI	PSI
Outer	185-175 @ 1.233"	116-128 @ 1.193"
	94-100 @ 1.663"	62-68 @ 1.653"
Inner	—	58-64 @ 1.173"
	—	29-35 @ 1.613"

Valves

Material - Intake	SAE 1041 Steel with Aluminized Face and Chrome-Plated Stem
- Exhaust	21-2N Steel with Aluminized Face and Chrome-Plated Stem
Diameter of Head - Intake	1.92"
- Exhaust	1.60"
Overall Length - Intake - 1-Bbl.	4.81"
- Q'Jet	4.90"
- Exhaust - 1-Bbl.	4.80"
- Q'Jet	4.89"
Diameter of Stem	.34"
Stem to Guide Clearance - Intake	.0016"-.0030"
- Exhaust	.0021"-.0038"
Valve Seat Angle - Intake	30°
- Exhaust	45°
Valve Face Angle - Intake	29°
- Exhaust	44°

Lubrication System

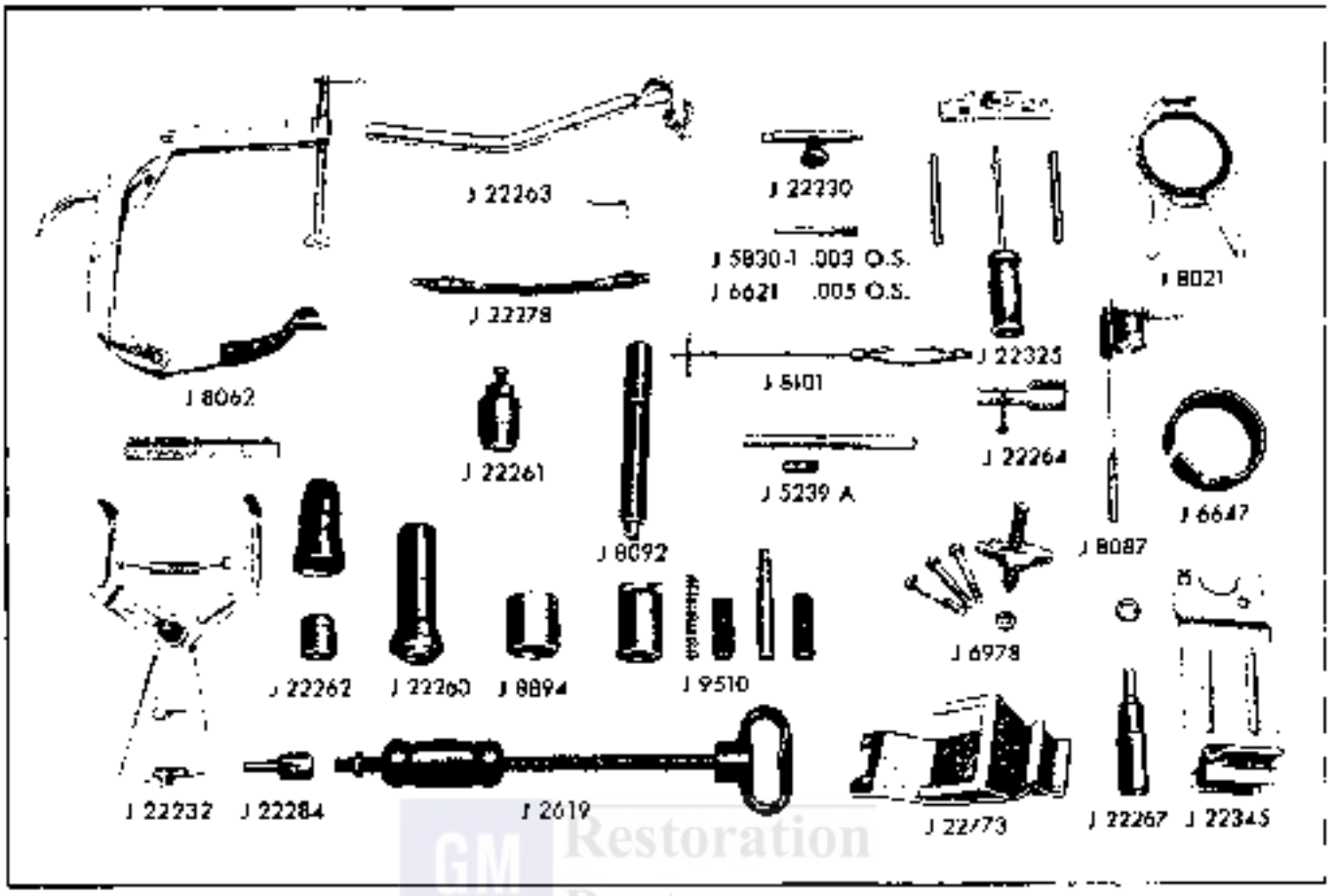
Type of Lubrication - Main Bearings	Pressure
- Connecting Rods	Pressure
- Piston Pins	Splash
- Camshaft Bearings	Pressure
- Lash Adjusters and Cam Followers	Pressure
- Timing Gears & Bell	None
- Cylinder Walls	Metered Jet
Oil Pump - Type	Spur Gear - Externally Mounted
- Oil Pickup	Stationary Screen
- Pressure	26-36 PSI @ 2800 rpm
Oil Capacity	5 Qts.
- With Filter	6 Qts.

Fuel System

Fuel Pump Pressure (PSI)	4.5-5.5
Fuel Filter	Pleated Paper (MV) Sintered Bronze (BV) in Carburetor
Carburetor-Type-1 Bbl. MT	Rochester Monojet
-1 Bbl. AT	Rochester BV
-4 Bbl.	Rochester Quadrajet
-Barrel Size-1 Bbl.	1.75" (MV) 1.75" (BV)
-Q'Jet	1.38 Primary, 2.25 Secondary

Cooling System

Radiator Cap Pressure (PSI)	14-17
Thermostat Opens At	190° F
Water Pump Rate (GPM)	16



J 2619 Camshaft Puller
J 5239-A Connecting Rod Bolt Guide Set
J 5830 Valve Guide Reamer
J 6621 Valve Guide Reamer
J 6647 Piston Ring Compressor
J 6978 Harmonic Balancer Puller
J 8021 Piston Ring Remover and Installer
J 8062 Valve Spring Compressor
J 8087 Cylinder Bore Gauge
J 8092 Camshaft Rear Bore Plug Installer
J 8101 Valve Guide Cleaner
J 8894 Adapter—Bore Plug Installer
J 9510 Piston Pin Remover and Installer Set
J 22230 Valve Seal Installer and Tester
J 22232 Timing Belt Adjustment Fixture
J 22260 Crankshaft Front Cover Seal Installer
J 22262 Camshaft Oil Seal Remover
J 22284 Camshaft Oil Seal Installer
J 22260 Valve Spring Compressor
J 22264 Bearing and Seal Remover—Housing
J 22267 Bearing and Seal Installer—Housing
J 22278 Adapter—Air Line
J 22284 Adapter—Camshaft Remover
J 22325 Main Bearing Cap—Remover and Installer
J 22345 Engine Lifting Tool—Tempest
J 22773 Engine Lifting Tool—Firebird

Fig. 6-66 6 Cylinder Special Engine Tools

V-8 ENGINE—SERVICE

CONTENTS OF THIS SECTION

GENERAL DESCRIPTION

V-8 engine is standard equipment on Pontiac and G.T.O. models, and optional on all Firebird and Tempest models. The optional Tempest V-8 has displacement of 350 cubic inches with 3 7/8" bore and 3 3/4" stroke. This engine is available in two compression ratios: 9.2:1 and 10.5:1.

A 400 cubic inch V-8 engine is standard on Pontiac and G.T.O.'s. This engine has 4.120" bore and 3 3/4" stroke and is available in three compression ratios: 8.6:1, 10.5:1 and 10.75:1.

Both the 350 and 400 cubic inch V-8 engines are optional on the Firebird model.

A 428 cubic inch V-8 engine is optional on Pontiac models. This engine has 4.120" bore and 4" stroke. The compression ratio is 10.5:1 with a 428 high output engine at 10.75:1.

CYLINDER BLOCK

The cylinder block used for 400 and 428 engines has three core hole plugs on each side and is more rigid with improved machining. Cylinder blocks for the 350, 400 and 428 engines are shown in Figs. 6-67 and 6-68.

428 cubic inch and 400 cubic inch Ram-Air engines have four attaching bolts in the three center main bearing caps as compared to two bolts per cap in other engines. Fig. 6-68 shows the four-bolt cap installation.

CYLINDER HEAD

Two types of cylinder heads differing in valve

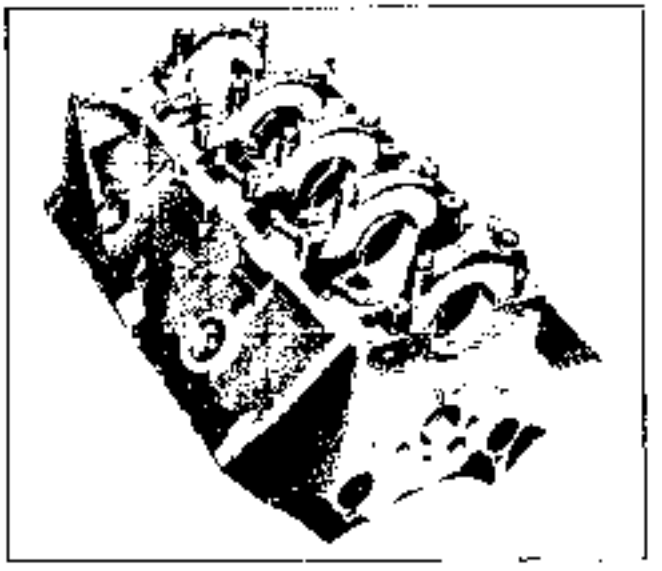


Fig. 6-67 Cylinder Block-350 and 400 Engine

sizes are used (Figs. 6-69 and 6-70). Both types have fully machined combustion chambers. Valve guides are cast integral with the cylinder head and valve heads are surrounded by water jackets.

All cylinder heads are new for 1968. The cylinder heads have been redesigned to reflect the use of revised valve angles and increased distance between centrelines of valves. Combustion chambers have also been redesigned for improved efficiency.

CAMSHAFT AND DRIVE

Five different camshafts are used. The engine charts (Figs. 6-1 and 6-2) show the application of each. Camshafts can be identified by a letter stamped on the front end of the shaft.

PISTONS AND CONNECTING RODS

The pistons used in all compression ratio engines are flat on top as shown in Fig. 6-71. The top of the piston has a relief machined into it for valve clearance.

VALVE TRAIN

All V-8 engines utilize the simple ball pivot-type valve train, consisting of the valve, rocker arm, push rod, and valve lifter.

Rocker studs are pressed into the cylinder head on the standard engines and are screwed in on G.T.O., Grand Prix, and 428. All heads use stamped steel push rod guide plates to minimize push rod guide wear (Fig. 6-72).

Umbrella type valve guide seals are used on

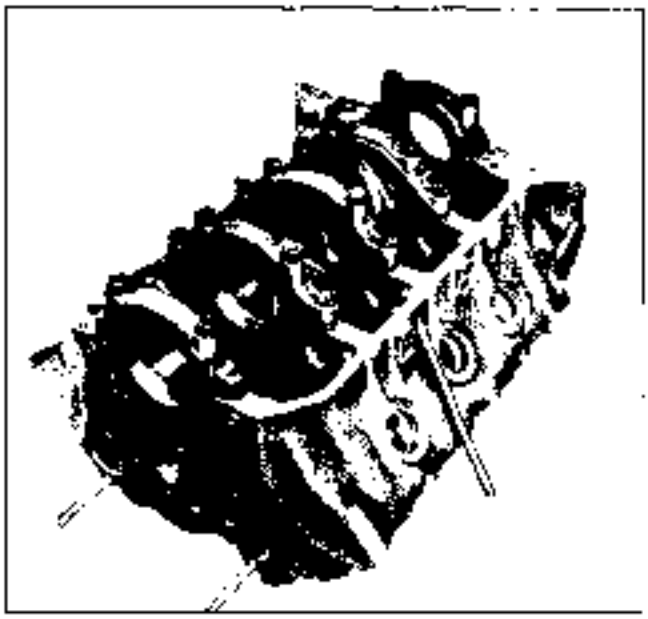


Fig. 6-68 Cylinder Block—428 and 400 Ram Air Engines

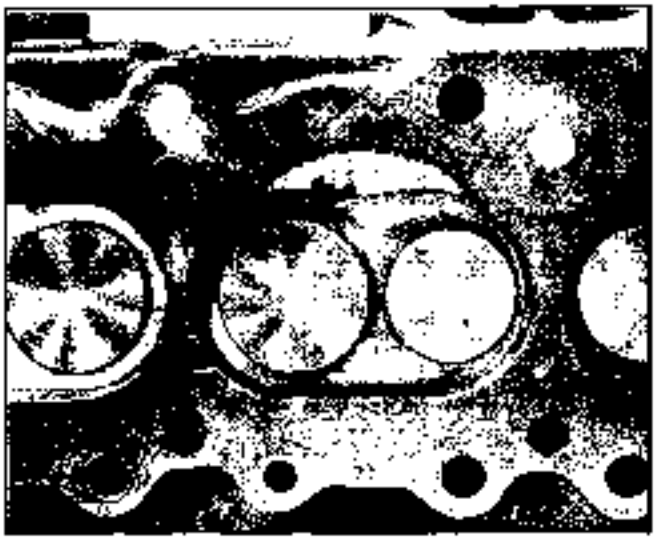


Fig. 6-69 Combustion Chamber—Standard Head

350H.O., 400H.O., 428 and G.T.O. 4 bbl. intake valves in addition to the "O" ring seals (Fig. 6-73).

Double valve springs are used on all engines.

PERIODIC SERVICE

There are no periodic services required on the mechanical portions of the engine. Periodic services connected with the engine consist of tune-up, lubrication, replacing oil filter, etc. Procedures and recommendations for these services will be found in appropriate sections of this manual, and the owners manual.

Fig. 6-70 Combustion Chamber—Large Head

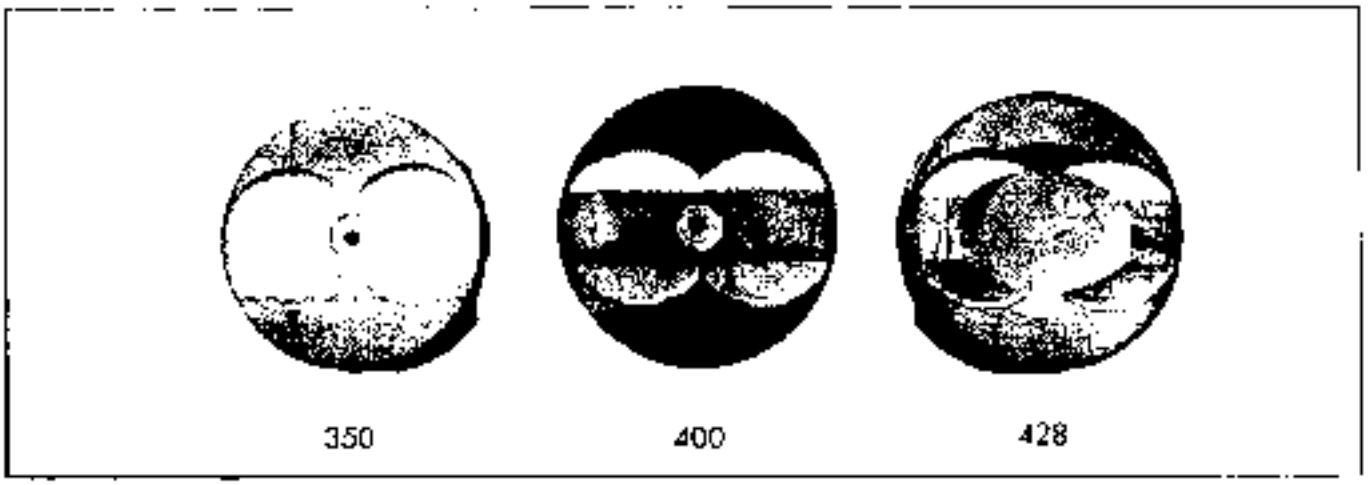


Fig. 6-71 Piston Identification

SERVICE OPERATIONS ON CAR

ENGINE INSULATORS—REMOVE AND REPLACE (Fig. 6-73) PONTIAC

FRONT INSULATORS

NOTE: If a new rear insulator is also to be installed, it should be installed first since the engine locates from the rear insulator.

1. Raise hood and, using J 22603 engine lifting tool, (Fig. 6-74), take weight of engine off front insulators.

CAUTION: Disconnect battery ground strap before raising engine. When engine is raised, the starting motor solenoid terminals may contact the steering gear which could energize the starting motor if ground cable is not disconnected.

2. Remove bolts fastening engine insulators to engine.

3. Remove bolt which fastens insulators to frame.

4. Raise engine just clear of insulator.

5. Remove insulator.

6. Position new insulator against engine and install attaching screws and washers. Tighten to 70 lb. ft. torque.

7. Lower engine.

8. Install frame to insulator bolt with lockwasher and plain washer and tighten to 50 lb. ft.

REAR INSULATOR

1. Support transmission at rear to remove engine weight from rear insulator, using suitable lifting equipment.

2. Remove transmission engine rear mounting insulator lower retainer cross member support nut and raise transmission until retainer stud is disengaged from lower cross member support.

3. Remove engine rear mounting insulator upper retainer bolts from transmission extension.

4. Remove insulator assembly.

5. Install new insulator between transmission extension and cross member support.

6. Install upper retainer to transmission extension bolts. Tighten to 30 lb. ft. torque.

7. Lower transmission until lower retainer stud engages lower cross member support. Install flat washer, lockwasher and nut and tighten to 30 lb. ft. torque.

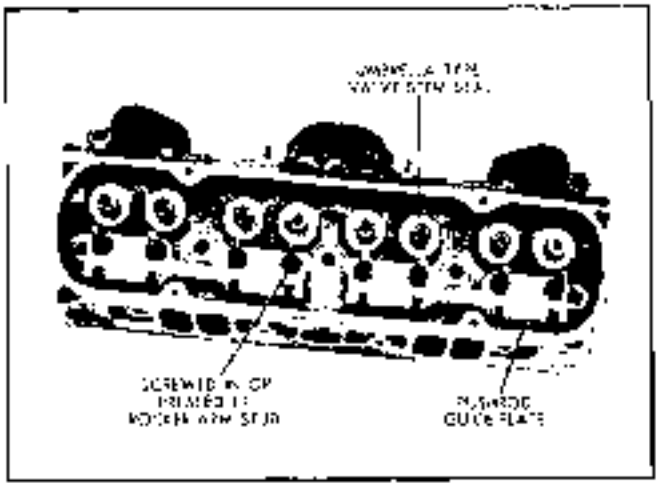


Fig. 6-72 Cylinder Head—Typical

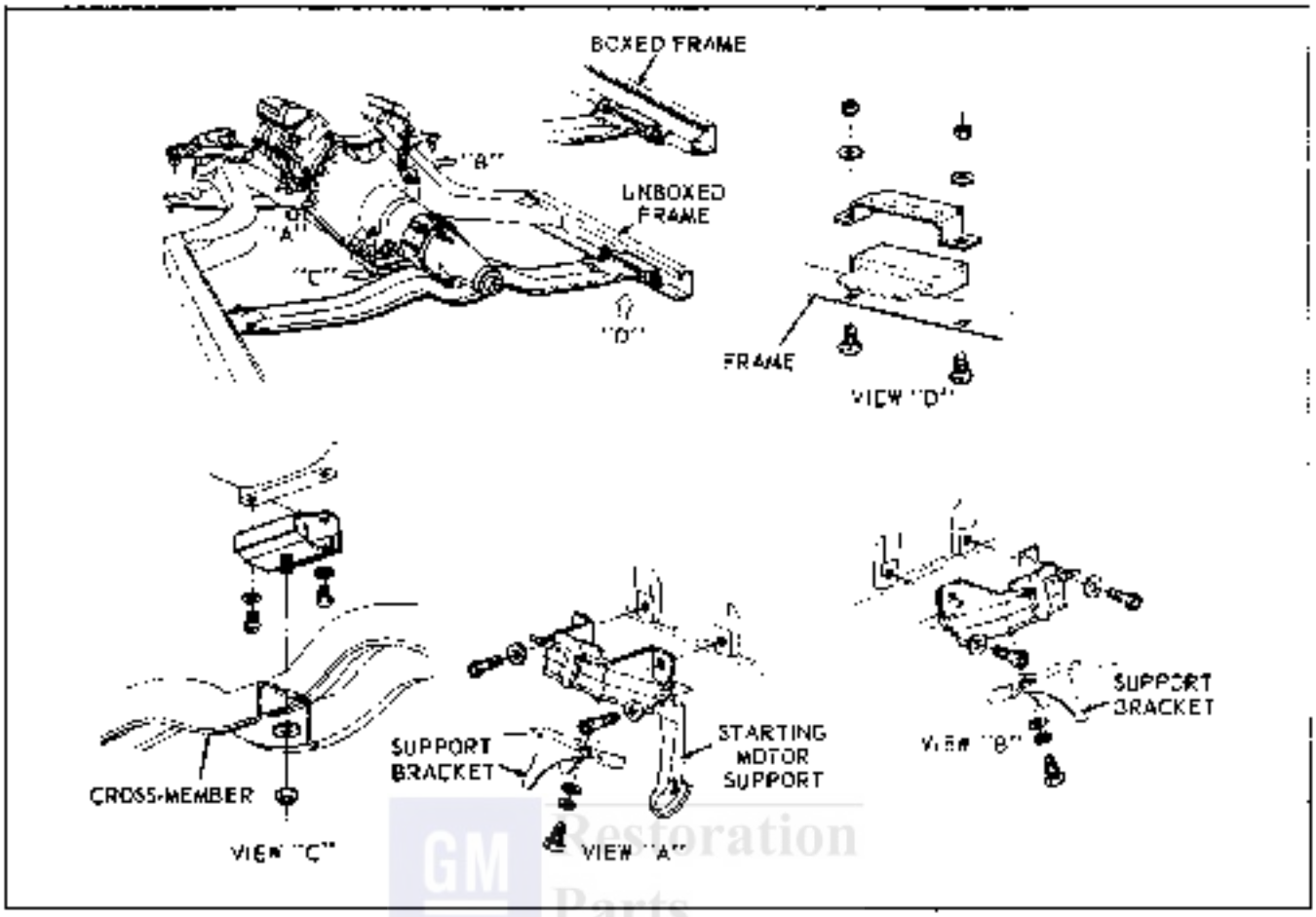


Fig. 6-73 Pontiac Engine Insulators

ENGINE INSULATORS—REMOVE AND REPLACE
TEMPEST (Fig. 6-75) and FIREBIRD (Fig. 6-76)

FRONT INSULATORS

1. Raise hood and, using J 22603 engine lifting tool, Fig. 6-74, take weight of engine off front insulators.

NOTE: Disconnect battery ground strap before raising engine. When engine is raised, the starter motor solenoid terminals may contact the steering gear which could energize the starting motor if ground cable is not disconnected.

2. Loosen rear insulator by removing crossmember to insulator bolts and raise rear of engine.

3. Remove bolts which fasten front insulators to frame bracket.

4. Raise engine just clear of insulators.

5. Remove insulator to engine bolts and remove insulators.

6. Position new insulators against engine and install attaching bolts and washers. Tighten to 70 lb. ft. torque.

7. Lower engine.

8. Install frame bracket to insulator bolts with lockwashers and tighten to 50 lb. ft. torque.

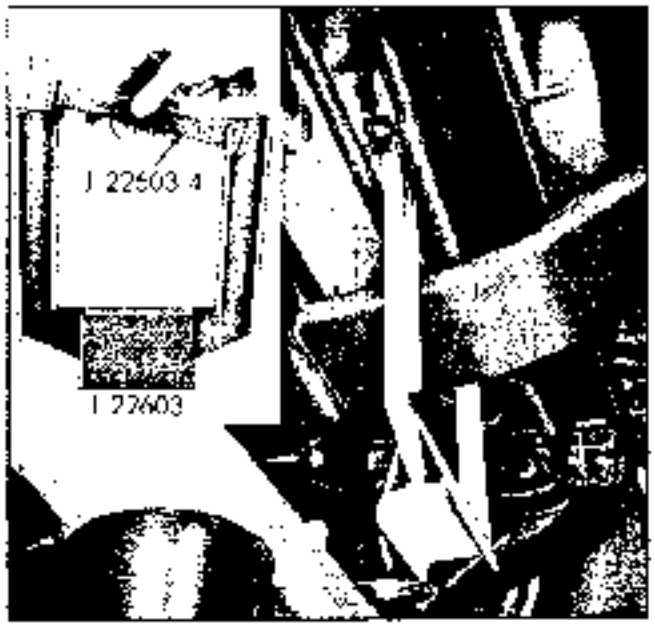


Fig. 6-74 Engine Lifting Tool Installed—Pontiac and Tempest

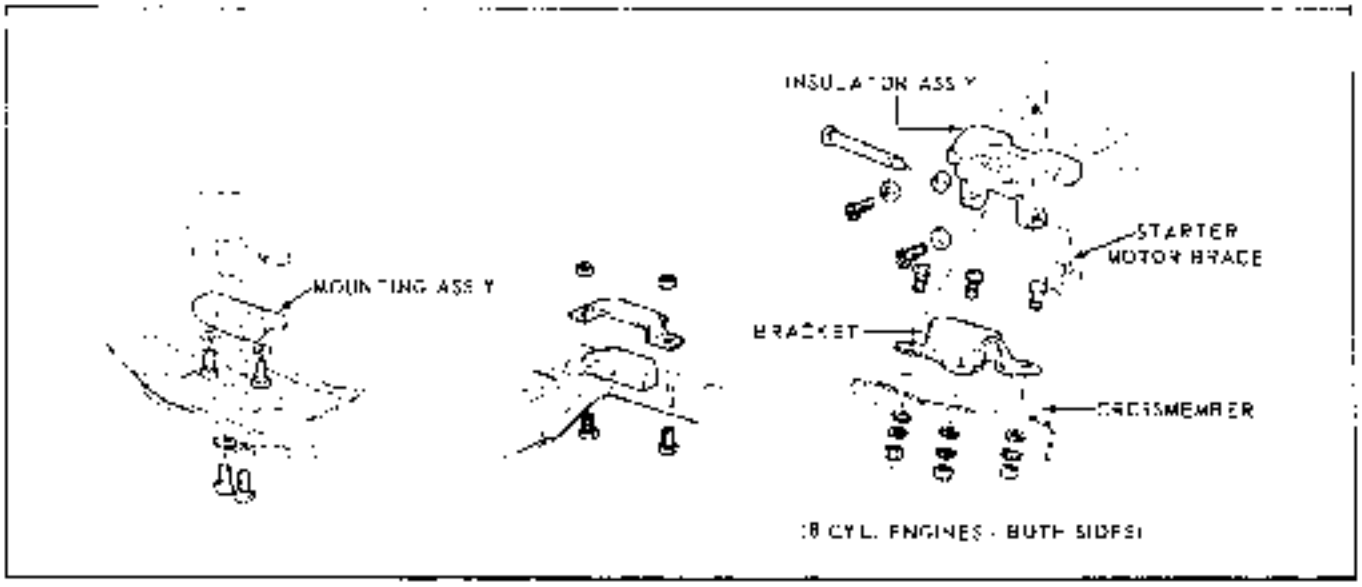


Fig. 6-75 Tempest Engine Insulators

9. Lower rear of engine and transmission so that rear insulator positions on crossmember. Install two crossmember to insulator bolts and washers and tighten to 30 lb. ft. torque.

REAR INSULATOR

1. Remove two crossmember-to-insulator bolts.

2. With suitable lifting equipment, raise transmission at rear to provide clearance for removing insulator to transmission housing bolts.

3. Remove two insulator-to-transmission bolts and remove insulator.

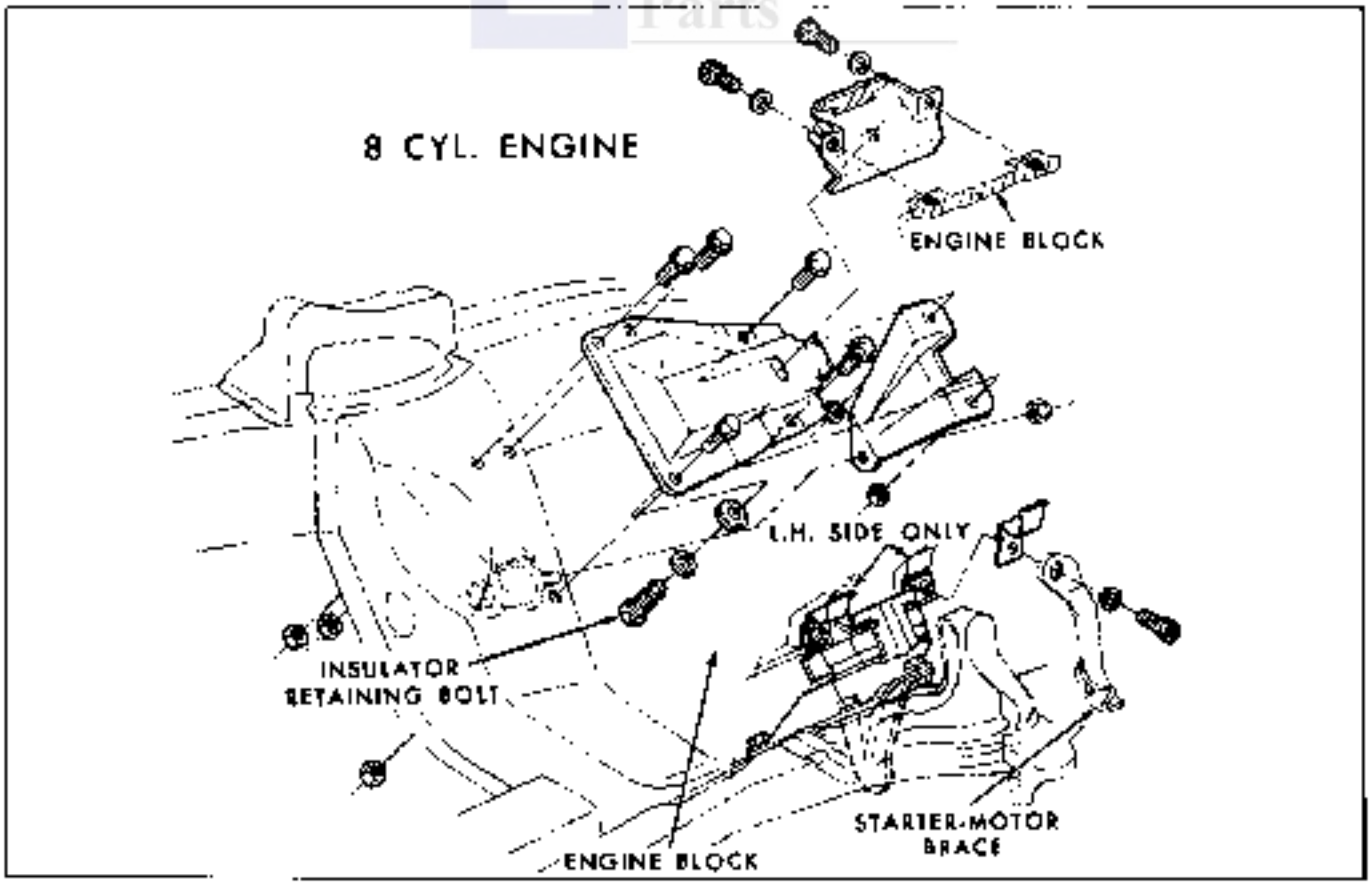


Fig. 6-76 Firebird Engine Insulators

4. Install new insulator with two insulator-to-transmission housing bolts and washers and tighten to 30 lb. ft. torque.

5. Lower rear of transmission so that insulator positions are above crossmember.

6. Install two crossmember to insulator bolts with washers and tighten to 30 lb. ft. torque.

DRIVE BELTS—ADJUST

Engine fan and accessory drive belts may be adjusted by use of the Borroughs Belt Tension gauge. Section 6A gives the correct specifications.

ENGINE—REMOVE AND INSTALL

REMOVE

1. Disconnect battery cables at battery.

2. Drain cooling system.

3. Scribe alignment marks on hood around hood hinges and remove hood from hinges.

4. Disconnect engine wire harness and engine-to-body ground straps.

5. Remove air cleaner.

6. Remove fan shield.

7. Disconnect radiator and heater hoses at engine attachment.

8. If equipped with manual transmission, remove radiator.

9. If equipped with power steering or air conditioning, remove pump and compressor from mounting brackets and set aside. Do not disconnect hoses.

10. Remove engine fan and pulley.

11. Disconnect accelerator control linkage and remove accelerator linkage support bracket.

12. Disconnect transmission vacuum modulator line and power brake vacuum line at carburetor and fold back out of way.

13. On Firebird equipped with A/C, remove windshield wiper motor.

14. Raise vehicle and drain crankcase.

15. Disconnect gas tank lines at fuel pump.

16. Disconnect exhaust pipes from manifolds.

17. Disconnect starter wires.

18. If equipped with automatic transmission, remove converter cover, remove three converter retaining bolts and slide converter to rear.

19. If equipped with manual transmission, disconnect clutch linkage, remove clutch cross shaft, starter and lower flywheel cover.

20. Remove four lower bell housing bolts (two each side).

21. Disconnect transmission filler tube support and starter wire harness shield from cylinder heads.

22. Remove two front motor mount bolts at frame.

23. Lower vehicle.

24. Using jack and block of wood, support transmission.

25. Remove two remaining bell housing bolts.

26. Raise transmission slightly.

27. Using suitable lifting equipment, remove engine.

INSTALL

1. Install engine lifting equipment to engine and lower engine into chassis, guiding engine to align engine with bell housing.

2. With engine supported by lifting equipment, install two upper bell housing bolts.

CAUTION: Do not lower engine completely while jack is supporting transmission.

3. Remove transmission support jack.

4. Lower engine and remove lifting equipment.

5. Raise vehicle.

6. Install remaining bell housing bolts.

7. Replace two front motor mount to frame bolts.

8. For remaining installation procedures, reverse steps 1 thru 19.

MANIFOLD—VALVE TRAINS—CYLINDER HEADS

RIGHT SIDE EXHAUST MANIFOLD OR GASKET—REMOVE AND REPLACE

REMOVE

1. Disconnect exhaust pipe from manifold.

2. Straighten tabs on manifold front and rear individual bolt locks and remove manifold attaching bolts, manifold, and gaskets.

NOTE: Locks are used on front and rear pairs of bolts only.

REPLACE

1. Thoroughly clean gasket surfaces of cylinder head and exhaust manifold. Check condition of heat control valve and related parts.

2. Replace exhaust manifold and new gasket. Use new individual manifold bolt locks on front and rear pairs of bolts.

NOTE: Place manifold outlet in position over end of exhaust pipe but do not permit weight of manifold to rest on exhaust pipe. Since the end holes of gasket are slotted, installation of gasket may be simplified by first installing manifold, using only the front and rear bolts to retain manifold. Allow clearance of about 3/16" between cylinder head and exhaust manifold. After inserting gasket between head and manifold, the remaining bolts may be installed.

3. Tighten all bolts evenly and securely to 30 lb. ft. torque. Bend tab of screw locks against bolt heads.

NOTE: Be sure tabs are bent against sides of bolt heads, not on top of bolt heads.

4. Attach exhaust pipe to manifold with bolts and tighten to 30 lb. ft.

LEFT SIDE EXHAUST MANIFOLD OR GASKET— REMOVE AND REPLACE

REMOVE

1. Remove generator belt and remove generator and mounting bracket as an assembly.

2. Disconnect exhaust pipe from manifold.

3. Remove carburetor air pre-heater shroud.

4. Straighten tabs on manifold individual bolt locks. (Tabs can be straightened from beneath car by using long-handled screwdriver.)

NOTE: Locks are used on front and rear pairs of bolts only.

5. Remove manifold attaching bolts and remove manifold.

REPLACE

1. Thoroughly clean gasket surfaces of cylinder head and exhaust manifold.

2. Place manifold in position against cylinder head and install two end bolts, finger tight.

3. Slide gasket between manifold and cylinder head.

4. Install remaining bolts and new bolt locks.

5. Tighten all bolts evenly and securely to 30 lb. ft. torque. Bend tabs of bolt lock against bolt heads.

6. Install carburetor air pre-heater shroud.

7. Attach exhaust pipe to manifold and tighten to 30 lb. ft. torque.

INTAKE MANIFOLD OR GASKET— REMOVE AND REPLACE

REMOVE

1. Drain water from radiator and from each side of cylinder block.

NOTE: Most water can be drained from the block through radiator drain by raising rear end of car approximately 15 to 18" off floor.

2. Remove air cleaner and disconnect closed ventilation pipe at air cleaner, air cleaner vacuum source at manifold and hot air duct by loosening clamp holding elbow to snorkel.

3. Remove water outlet fitting bolts and position fitting out of way, leaving radiator hose attached.

4. Disconnect heater hose from fitting.

5. Disconnect wire from thermogauge unit.

6. Remove spark plug wire brackets from manifold.

7. On cars equipped with power brakes, remove power brake vacuum pipe from carburetor.

8. Disconnect distributor to carburetor vacuum hoses.

NOTE: Vacuum retard hose is located at lower rear of vacuum unit.

9. Disconnect fuel line connecting carburetor and fuel pump.

10. Disconnect crankcase vent hose from intake manifold.

11. Disconnect throttle rod from carburetor.

12. Remove screws retaining throttle control bracket assembly.

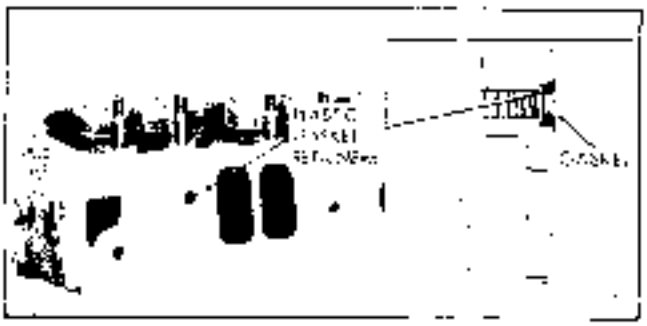


Fig. 6-77 Intake Manifold Gasket Retainer

13. Remove intake manifold retaining bolts and nuts, and remove manifold and gaskets.

NOTE: Make certain O-ring seal between intake manifold and timing chain cover is retained and installed during assembly if not damaged.

REPLACE

NOTE: When a new manifold is to be installed, transfer carburetor, thermostat, heater hose fitting and thermogauge fitting. Use new gaskets on these units requiring gaskets and new O-ring seal between manifold and timing chain cover.

1. Install new gaskets on cylinder heads, positioning them with plastic retainers (Fig. 6-77).

2. Install intake manifold on engine.

3. Install O-ring seal.

4. Install cap bolts and nuts loosely.

5. Position throttle control bracket assembly on manifold and install cap bolts.

6. Tighten timing chain cover to intake manifold bolt until both units are metal-to-metal (15 lb. ft. torque).

7. Tighten all nuts and bolts evenly to 40 lb. ft. torque.

8. Connect throttle rod to carburetor.

9. On cars equipped with power brakes, install vacuum pipe to carburetor.

10. Install fuel pipe connecting carburetor to fuel pump.

11. Install crankcase vent hose to intake manifold fitting.

12. Connect heater hose to fitting.

13. Install water outlet fitting.

14. Connect wire to thermogauge unit terminal.

15. Install vacuum hoses, connecting distributor vacuum advance unit to carburetor. Care should be taken not to interchange advance and retard hoses.

16. Install spark plug wire bracket.

17. Replace air cleaner, attaching closed ventilation pipe, vacuum source and hot air duct.

18. Close drain plug and fill radiator to proper level.

19. Check accelerator linkage adjustments.

PUSH ROD COVER OR GASKET— REMOVE AND REPLACE

REMOVE

1. Remove intake manifold, retaining O-ring seal.

2. Remove crankcase ventilator hose.

3. Remove screws from push rod cover and remove cover.

REPLACE

1. Cement new gasket on push rod cover.

2. Replace push rod cover and tighten screws.

3. Replace positive crankcase ventilation hose.

4. Install intake manifold and O ring seal.

VALVE SPRINGS, SHIELD OR SEAL— REMOVE AND REPLACE (Figs. 6-78, 6-79 and 6-80)

REMOVE

1. Remove rocker arm cover, spark plug and distributor cap. (Remove rear generator bracket on right side.)

2. Install air fitting J 22278 in spark plug hole and attach air line.

3. Remove rocker arm.

4. After removing rocker arm, thread valve spring compressor stud J 8929-1 on rocker arm stud and compress valve spring, using compressor J 6384-1 and nut J 8929-2. (Fig. 6-78). Remove valve spring retainer cup locks and then remove valve spring compressor, valve spring retainer cup shield and valve stem seal.

REPLACE

1. Install new part or parts, compress springs with valve spring compressor J 6384-1 and nut

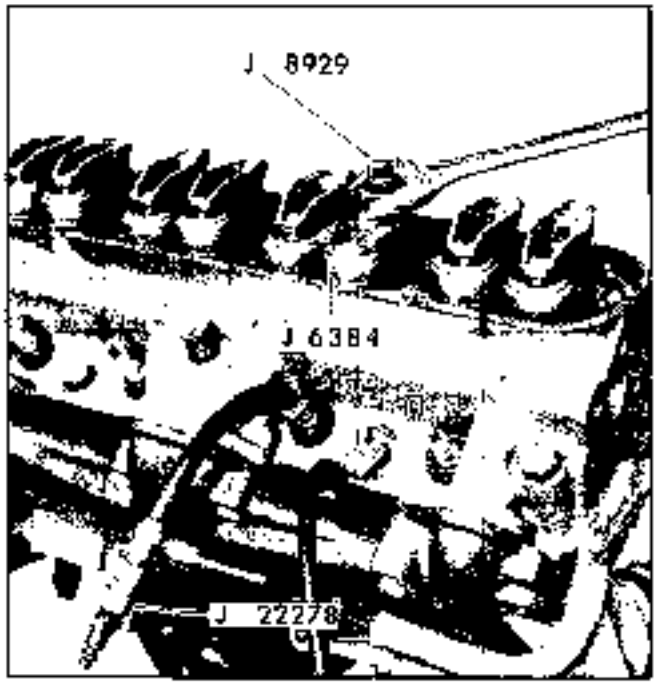


Fig. 6-78 Compressing Valve Spring

J 8929-2. Install valve stem seal (Fig. 6-79) and retainer cap locks. Remove spring compressor and valve holder, then test valve stem seal, using suction cup end of tool J 22230 (Fig. 6-80).

2. Install rocker arm, tighten rocker arm ball retaining nut to 20 lb. ft. torque.

3. Remove air fitting J 22278.

4. Replace rocker arm cover, spark plug, distributor cap and connect spark plug wire.

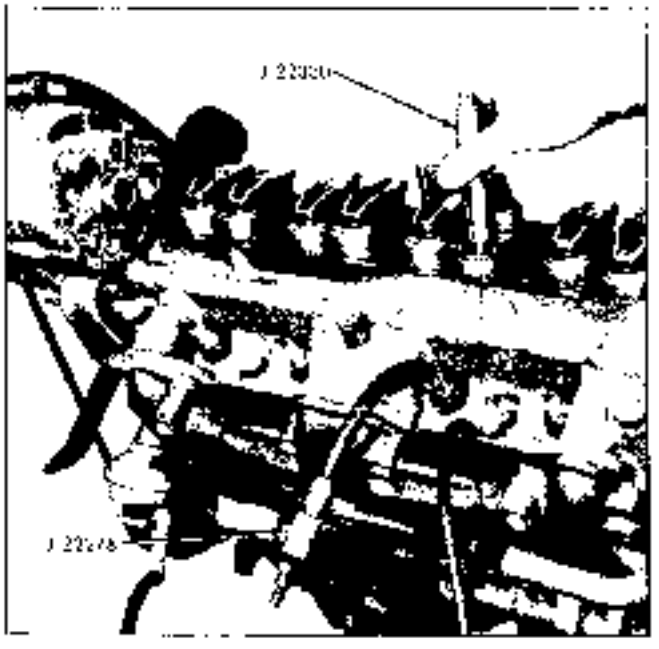


Fig. 6-79 Installing Valve Stem Seal

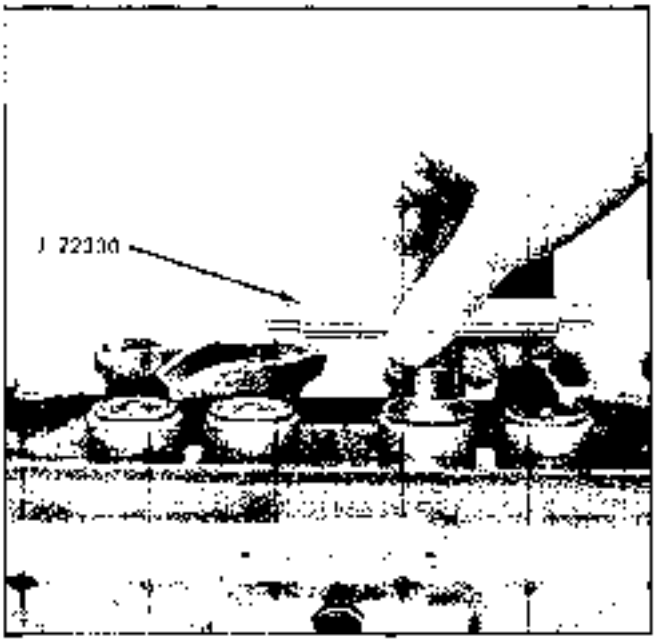


Fig. 6-80 Checking Valve Stem Seal

PUSH ROD OR VALVE LIFTER— REMOVE AND REPLACE

REMOVE

1. Remove intake manifold, retaining O-ring seal.

2. Remove push rod cover.

3. Remove rocker arm cover.

4. Loosen rocker arm ball nut and move rocker arm off push rod.

5. Remove push rod.

6. Remove lifter. Hydraulic valve lifter remover J 3049 may facilitate removal of lifter.

NOTE: If more than one lifter is to be replaced, store push rods in a stand and lifters in a lifter box so they can be re-installed in exactly the same place and position. See GENERAL INFORMATION ON ENGINE SERVICE.

REPLACE

NOTE: If new lifter is to be installed, be sure to remove all sealer coating from inside of new lifter and check leak-down rate.

1. Place new lifter in lifter boss.

2. Replace push rod exactly as removed (same end against rocker arm).

3. Position rocker arm on push rod and tighten rocker arm ball retaining nut to 20 lb. ft. torque.

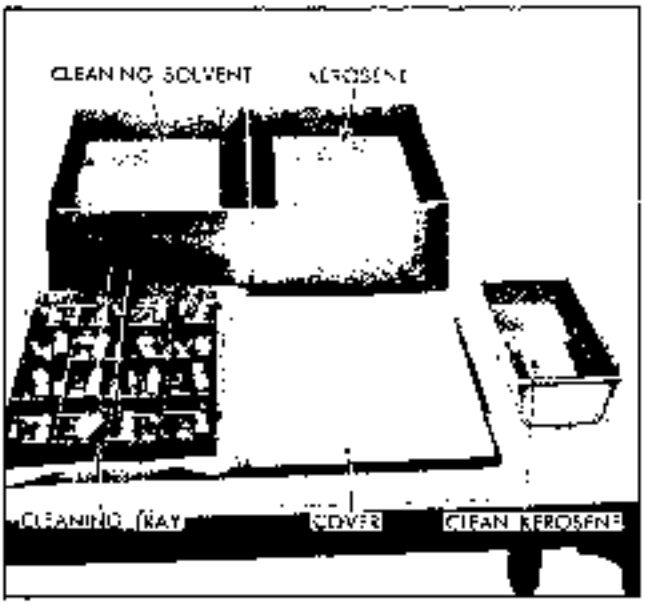


Fig. 6-81 Lifter Wash Tank and Tray

4. Replace rocker arm cover.

5. Inspect condition of push rod cover gasket and replace if necessary; replace push rod cover and tighten screws. New gasket must be cemented securely to push rod cover before installation.

6. Replace intake manifold using new gaskets and replace O-ring seal.

VALVE LIFTER—RECONDITION

NOTE: Because of the important part hydraulic valve lifters play in the operation of an engine and the close tolerances to which they are manufactured, proper handling, and above all, cleanliness, cannot be overstressed when servicing these parts.

New lifters are serviced as individual units packaged with a plastic coating. Leave the coating on until ready to check leak-down rate. It is not necessary to remove the oil from new lifters prior to checking leak-down rate since special leak-down oil is already in new lifters.

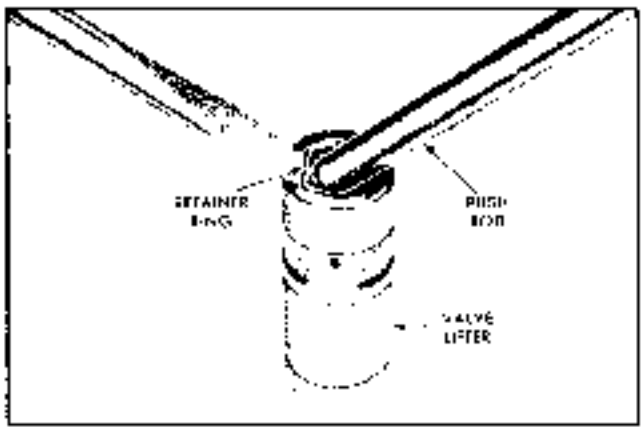


Fig. 6-82 Removing Push Rod Seat Retainer

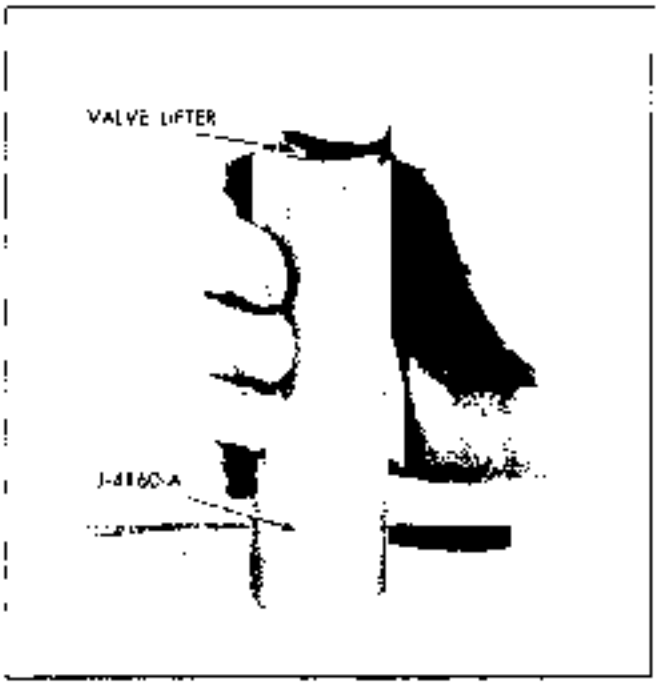


Fig. 6-83 Removing Stuck Plunger

Wash tank and tray J 8821 (Fig. 6-81) is recommended for cleaning valve lifters. This tank should be used only for valve lifters and should be kept covered when not in use. All servicing should be done in an area removed from grinders or other sources of dust and foreign material.

Lifters should at all times be stored in a covered box which will aid in keeping them clean. The lifter box should be kept dry and as free of oil as possible.

VALVE LIFTER—DISASSEMBLE

1. Remove push rod seat retainer ring by holding seat down with push rod while dislodging spring from lifter body with a pointed tool (Fig. 6-82).

2. Invert lifter and allow push rod seat and plunger to slide out of body. If plunger sticks in body, place lifter in large end of hydraulic valve lifter plunger remover J 4160-A, with push rod end of lifter downward. Hold tool firmly in hand with thumb over lifter body and sharply strike the tool against a block of wood (Fig. 6-83) until plunger falls out.

NOTE: It may be necessary to soak a lifter having a stuck plunger in cleaning solvent for several minutes in order to remove the plunger.

3. Drain oil out of lifter body and place all valve lifter parts in separate compartment of tray from wash tank J 8821 (Fig. 6-81).

CAUTION: Valve lifter body and plunger are selectively fitted and must not be interchanged with parts of other lifters. (Keeping all parts of lifters together will also aid in trouble diagnosis.)

VALVE LIFTER—CLEAN AND INSPECT

Wash tank J 3421 is recommended for cleaning valve lifter parts. This tank consists of two chambers, a tray and a cover. One chamber is for cleaning solvent and the other is for kerosene. Whenever the tank is not being used (and when parts are soaking), the cover should be closed.

1. Before placing tray of parts in cleaning solvent, first immerse it in kerosene chamber to remove as much engine oil as possible. (This reduces contamination of solvent, thus prolonging its useful life.)

2. Submerge tray in cleaning solvent and allow to soak for approximately one hour. More time may be required depending on varnish condition and effectiveness of solvent. Light agitation of tray in solvent at 10-15 minute intervals will hasten cleaning action.

3. After varnish has dissolved or has been sufficiently softened to permit removal by wiping, suspend tray above solvent, utilizing hooks on tray handles. Allow tray and parts to drain for a brief period.

4. Rinse tray of parts in kerosene chamber to cut solvent and to avoid injury to hands (from solvent).

5. Wipe out tank cover and place tray of parts on cover in front of tank (Fig. 6-81). A slip towel under tray and clean paper on remainder of cover will enhance cleanliness.

NOTE: Absolute cleanliness can be assured if each lifter is inspected and assembled after cleaning before proceeding to the next lifter.

6. Working on one lifter at a time and using clean, lint-free cloths, thoroughly wipe off lifter parts. Clean plunger and external and internal surfaces of body with hard wiping action. A bristle brush may be used to clean internal surface of lifter body.

CAUTION: Do not use wire brush or sand paper, since damage to machined surface is likely.

7. Inspect lifter body. Both inner and outer surfaces of lifter body should be inspected for scoring. Lifter assembly should be replaced if body is roughly scored, grooved, or galled. Inspect cam contact surface on lower end of lifter body. Replace lifter assembly if this surface is excessively worn, galled or otherwise damaged.

8. Inspect lifter plunger. Using magnifying glass, inspect check ball seat for defects. Inspect outer surface of plunger for scratches or scores. Small score marks with rough, satiny finish will cause plunger to seize when hot but operate normally when cool. Defects in check ball seat or scores or scratches on outer surface of plunger which may be felt with fingernail are causes for replacing lifter assembly. This rule does not apply to slight edge which may sometimes be present where lower end of plunger extends below the ground inner surface of body. This edge is not detrimental unless it is sharp or burred.

A blackened appearance is not a malfunctioning condition. Sometimes discoloration serves to highlight slight grinder chatter marks and give the outer surface of plunger a ridged or fluted appearance. This condition will not cause improper operation, therefore, it may be disregarded.

9. Inspect push rod seat. Inspect push rod seat for roughness and make sure that hole in center is open.

10. Inspect valve lifter ball. Carefully examine ball for nicks, imbedded material or other defects which would prevent proper seating. Such defects may cause intermittently noisy lifter operation. Also inspect plunger face of ball retainer for excessive wear.

VALVE LIFTER—ASSEMBLE

NOTE: All parts must be absolutely clean when assembling a hydraulic lifter. Since lint and dust may adhere to parts they should not be blown off with air or wiped with cloths. All parts should be rinsed in clean kerosene and assembled without drying. A small container with clean kerosene (separate from cleaning tank) should be used for each set of lifters being overhauled.

Figure 6-84 shows the relative position of component parts of valve lifters. The recommended procedure for assembly is given in the following steps.

1. Rinse plunger spring and ball retainer and position retainer in spring.

2. Rinse lifter ball and place in retainer.

3. Rinse plunger and place on retainer so that seat on plunger mates with ball.

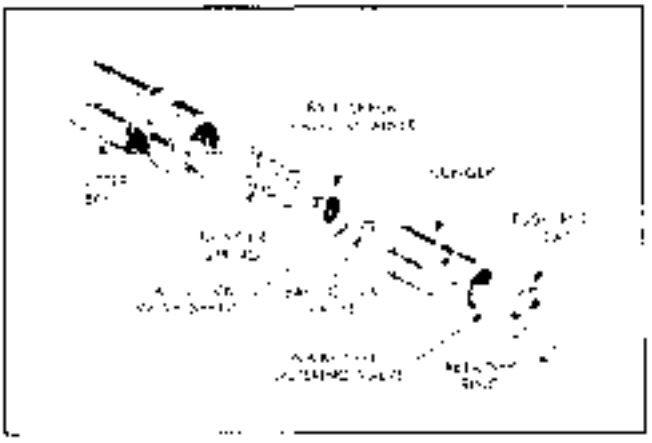


Fig. 6-84 Hydraulic Valve Lifter—Exploded View

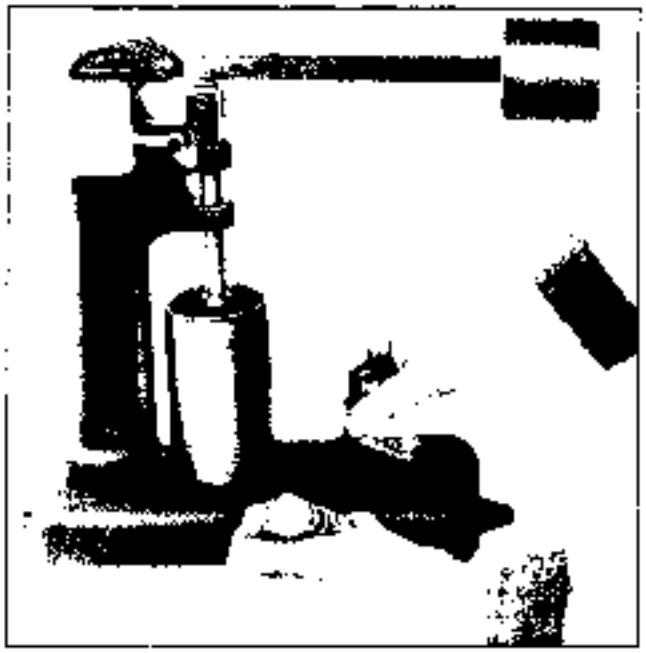


Fig. 6-85 Testing Leak-Down Rate

4. Invert plunger with parts assembled thus far and, after rinsing lifter body, install body over spring and plunger.

5. Place orifice feed plate in plunger.

6. Place lifter body on clean paper; rinse and install push rod seat and retainer ring.

7. After lifter has been assembled, place in lifter box and close lid to preserve cleanliness.

TEST VALVE LIFTER LEAK-DOWN RATE

After all lifters have been assembled, the leak-down rate must be checked before they are installed in the engine. Valve lifter leak-down tester J 5790 (Fig. 6-85) is designed to test leak-down rate of lifters to determine whether or not they are within specified limits. As with previous service operations concerned with lifters, cleanliness is important. The tester cup and ram should be thoroughly cleaned, and testing should be done in an area free of dust and dirt. The testing procedure is described in the following steps:

1. Fill tester cup to approximately one inch from top with special fluid which is available from your lifter tester dealer.

NOTE: No other type fluid is recommended.

2. Swing weight arm up out of the way, raise ram, and position lifter into boss in center of tester cup.

3. Adjust ram (with weight arm clear of ram) so that the pointer is positioned on the set line (marked "S"). Tighten jam nut to maintain setting.

4. Operate lifter through full travel of plunger by pumping weight arm to fill lifter with test fluid and force out air. (Lifter must be completely submerged at all times.) Continue pumping for several strokes after definite resistance is detected.

5. Raise weight arm to allow plunger spring to expand fully; lower arm onto ram and commence turning crank slowly (1 revolution every 2 seconds). Time indicator travel from lower line (first line above set line) to line marked .125 or 1/8", while still rotating cup with crank (Fig. 6-85). Lifter is satisfactory if rate is between 20 and 90 seconds.

A doubtful lifter should be tested three or four times. Disassemble, inspect, and re-test doubtful lifters. If leakdown still is not within specifications, replace lifter.

6. After each lifter is tested, replace in lifter box to insure cleanliness. Leave lifters in box until ready for installation in cylinder block.

7. When all lifters have been tested, empty cup, clean, and place cover over tester to maintain its cleanliness.

CYLINDER HEAD OR GASKET— REMOVE AND REPLACE

REMOVE

1. Remove intake manifold, push rod cover, and rocker arm cover.

2. Loosen all rocker arm retaining nuts and move rocker arms off push rods.

3. Remove push rods and place in a support stand so they can be replaced in exactly the same position from which they were removed. See GENERAL INFORMATION ON ENGINE SERVICE.

4. Remove exhaust pipe to manifold attaching bolts.

5. On Firebird models, remove compressor attaching bolts, if equipped with A/C, and move compressor to one side when removing head.

6. Remove battery ground strap and engine ground strap on left head or engine ground strap and automatic transmission oil level indicator tube bracket on right head.

7. Remove cylinder head bolts (dowel pins will hold head in place) and remove head with exhaust manifold attached, using lifting hooks J 4266.

CAUTION: Extreme care should be taken when handling or storing cylinder heads as the rocker arm studs are hardened and may crack if struck.

NOTE: If left head is being removed, it will be necessary to raise head off dowel pins, move it forward and rearward the head in order to clear the power steering and power brake equipment if car is so equipped.

NOTE: On Firebird models, when removing the right head on V-8's equipped with A/C, it is necessary to remove the right insulator to frame bolt and raise engine approximately 2" to gain access to the right rear valve cover bolt and right rear cylinder head bolt. Care must be taken to avoid the fan contacting the fan shroud.

9. Remove cylinder head gasket.

REPLACE

NOTE: Right and left cylinder heads are the same. New heads are complete with rocker arm studs (exc. heads with screwed in studs) and oil plugs.

When installing new head, transfer all serviceable parts to new head, using new seals on intake and exhaust manifold valve stems, and new exhaust manifold gasket. Install new intake manifold gasket plastic retainers. Clamp straight edge into position as shown in Fig. 6-86 and check rocker arm position with valve train gauge J 8929.

1. Remove straight edge from cylinder head and thoroughly clean gasket surfaces of head and block. Place new gasket on block, and replace cylinder head.

NOTE: On Firebird models, when replacing right cylinder head on V-8 equipped with A/C, it will be necessary to insert the right rear bolt into the head before replacing the head on the block.

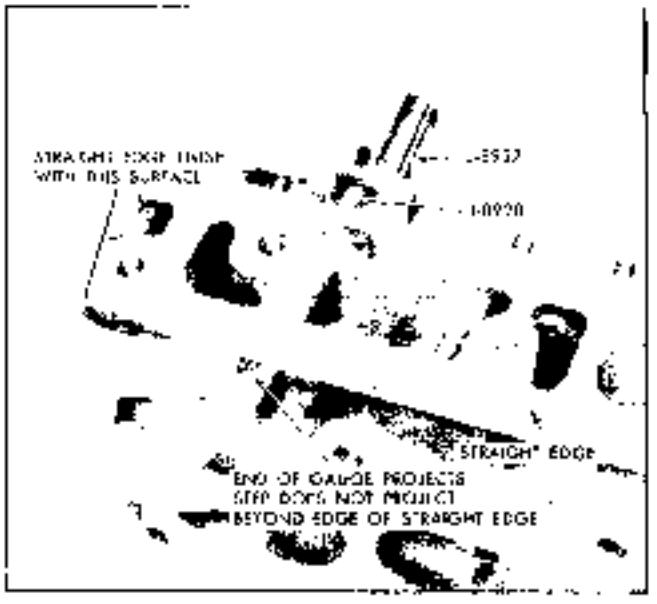


Fig. 6-86 Checking Stud Height

2. Start all bolts.

NOTE: Bolts are three different lengths. When inserted in proper holes all bolts will project an equal distance from the head. Do not use sealer of any kind on the threads.

3. Tighten bolts evenly to 95 lb. ft. torque.

4. Install push rods in same location from which they were removed and with the same end up against rocker arm.

5. Reposition rocker arms and tighten rocker arm ball retaining nuts to 20 lb. ft. torque.

6. Replace rocker arm cover and tighten screws.

7. Replace push rod cover and tighten screws.

8. Replace battery ground strap and engine ground strap on left hand or engine ground strap and automatic transmission oil level indicator tube bracket on right head. Also replace the engine oil level indicator on right side.

9. Replace intake manifold using new gaskets.

10. Install exhaust-pipe-to-manifold attaching nuts.

11. On Firebird models, replace right side insulator-to-bracket bolt on A/C equipped V-8's.

ROCKER ARM STUDS—REMOVE AND REPLACE

PRESSED IN STUDS

NOTE: ONLY .005" OVERSIZE STUDS ARE AVAILABLE. THIS STUD IS TO BE USED IF STUD HAS BECOME LOOSE, BROKEN OR BECAUSE OF FAULTY THREADS.

The procedures shown are for replacement without removal of cylinder head. If it is found necessary to remove the cylinder head for another reason, this procedure can be used with slight modification.

1. Disconnect battery and drain radiator.

2. Remove rocker arm cover.

3. Pack oily rags around stud and engine openings.

4. With rocker arm removed, file two slots 3/32" to 1/8" deep on opposite sides of rocker arm stud (Fig. 6-87). Top of slots should be 1/4" to 3/8" below thread travel.

5. Place washer at bottom of rocker arm stud.

6. Position rocker arm and remover J 8933 on rocker arm stud and tighten screws securely with 5/32" allen wrench.

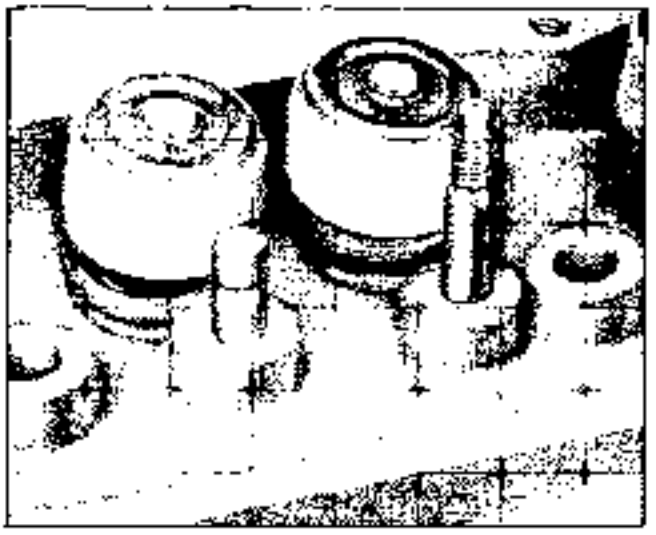


Fig. 6-87 Slots Filed in Rocker Arm Stud

7. Place spacer over stud remover J 6934.

8. Thread 7/8" standard nut on stud remover and turn nut until rocker arm stud is out of cylinder head (Fig. 6-88).

9. After removing stud, carefully ream stud hole using reamer J 22126. Stud hole must first be reamed with pilot shaft attached to reamer. Pilot shaft should then be removed and stud hole must be reamed again.

10. Clean stud hole and surrounding area.

NOTE: INSPECT STUD HOLE. IF REAMER DID NOT CLEAN UP COMPLETELY, IT WILL BE NECESSARY TO REPLACE CYLINDER HEAD.

11. Remove intake manifold and push rod cover.

12. Position rocker arm on new rocker arm stud and place rocker arm stud installer J 8927 on stud in place of rocker arm ball.

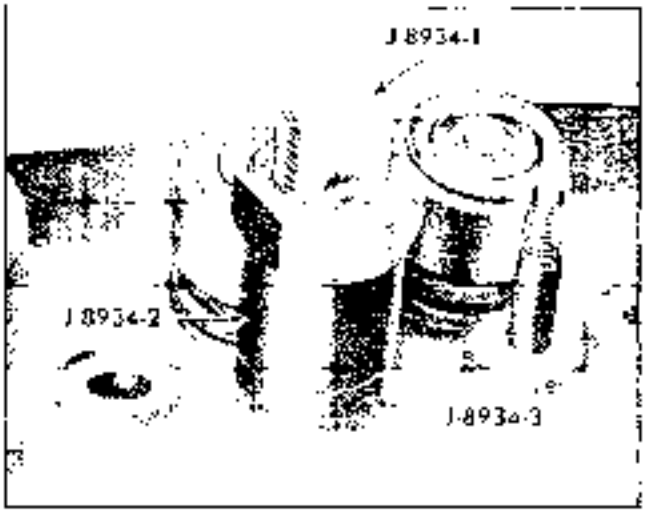


Fig. 6-88 Rocker Arm Stud Removal

13. Coat rocker arm stud with white lead and oil; carefully drive stud into cylinder head until it is in about halfway (7/16").

14. Clamp straightedge on cylinder head as shown in Fig. 6-86, and position valve train gauge J 8928 in push rod hole so that it seats properly in rocker arm.

NOTE: WHEN WORKING ON RIGHT CYLINDER HEAD, HEATER HOSE CONNECTOR WILL HAVE TO BE REMOVED BEFORE STRAIGHT EDGE CAN BE POSITIONED CORRECTLY.

15. With valve seated, slowly drive rocker arm stud into cylinder head until gauge projects about midway between end of gauge and step with respect to straightedge (Fig. 6-86).

16. Install push rod, rocker arm, ball and rocker arm ball retaining nut.

17. Replace push rod cover, intake manifold and rocker arm cover.

18. Connect battery cable and refill radiator.

SCREWED IN STUDS

1. Remove rocker arm cover.

2. Remove rocker arm and nut.

3. Using a deep well socket, remove rocker stud.

4. Install new stud and tighten to 50 ft. lbs. torque.

5. Install rocker arm and tighten nut to 20 ft. lbs.

6. Install rocker arm cover using new gasket.

CYLINDER HEAD AND VALVES—RECONDITION

CYLINDER HEAD AND VALVES—DISASSEMBLE

1. Remove valve spring retainer cup locks (keepers), valve stem oil seals, valve spring retainer cups, valve stem shields, valve springs, and valves, using valve spring compressor J 8062. Valve stem oil seals must be discarded and replaced with new seals any time they are removed.

2. Place valves in valve and valve train holding stand.

CYLINDER HEAD AND VALVES—CLEAN AND INSPECT

Efficient engine performance depends to a great degree upon the condition of engine valves. Close inspection of intake valves is especially important as excessive clearance of valve stems in guides

will permit oil to be pulled into the combustion chamber, causing fouled spark plugs and clogged piston rings. Oil deposited on valve heads will carbonize and burn, causing valves to leak with resultant loss of engine power. Therefore, valves must operate properly and if inspection discloses any malfunction of valves, the trouble must be corrected to avoid future damage to valves or related engine parts.

1. Inspect valves and seats to determine condition before cleaning. Also water passage plugs for evidence of leakage.

2. Clean valves thoroughly to remove deposits from head and stem.

3. Clean and inspect cylinder head as follows:

a. Clean carbon deposits from combustion chambers and all sludge or foreign matter from other areas of cylinder head. If a scraper or wire brush is used for cleaning, use care to prevent damage to valve seats.

CAUTION: To prevent damage to valve seat it is good practice to keep wire brush well away from seat.

b. Clean cylinder head thoroughly, using suitable cleaning equipment.

4. Clean valve guides thoroughly, using valve guide cleaner J 8101 (Fig. 6-89).

5. Visually inspect valve guides for evidence of wear, especially the end toward the spring seat. If a guide is scored or galled, install valve with proper oversize stem according to procedure.

6. Clean valve springs and inspect to see that they meet specifications.

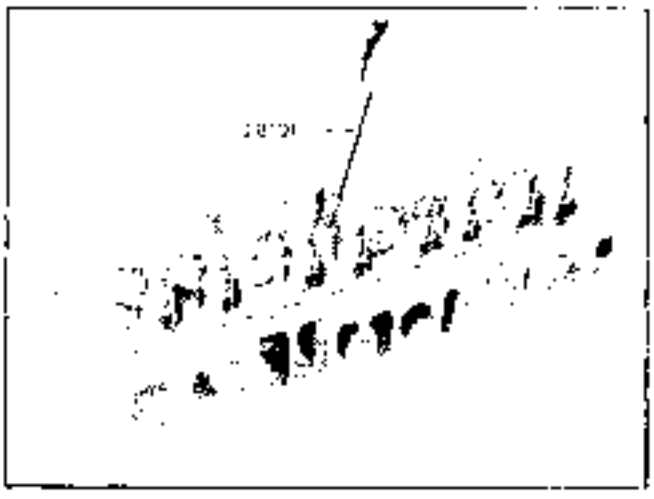


Fig. 6-89 Cleaning Valve Guide

7. Clean push rods and thoroughly clean out oil passage through center of rod. Inspect to see that the rod is straight.

8. Clean rocker arms and rocker arm balls, and visually inspect for evidence of wear.

9. Clean spark plugs as outlined in ELECTRICAL SECTION.

10. Clean and inspect valve lifters.

VALVES AND SEATS—RECONDITION

1. Reface valves and seats as follows:

Valves should be ground on a special bench grinder designed specifically for this purpose and built by a reputable manufacturer. Valve seats should be ground with reputable power grinding equipment having stones of the correct seat angle and a suitable pilot which pilots in the valve stem guide. To ensure positive sealing of the valve face to its seat, the grinding stones should be carefully refaced before any grinding is done. Intake valve seat angle is 30°, exhaust valve seat angle is 45°. Intake valve face angle is 29° and exhaust valve face angle is 44°. This will provide hairline contact between valve and seat to provide positive sealing and reduce build-up of deposits on seating surfaces (Fig. 6-90).

DO NOT USE REFACING EQUIPMENT EXCESSIVELY; only enough material should be removed to true up surfaces and remove pits. The valve head will run better as its thickness is diminished; therefore, if valve face cannot be cleaned up without grinding to point where outside diameter of valve has a sharp edge, the valve should be replaced. Whenever it is necessary to replace a valve, the new valve should be of the same stem diameter as the valve removed (unless the valve guide is reamed to provide proper fit).

Width of exhaust valve seats should be 1/16" (.048"-.070"). Intake valve seat should be between 3/64" and 1/16" (.045"-.071"). If seat width is excessive it should be narrowed by grinding with a

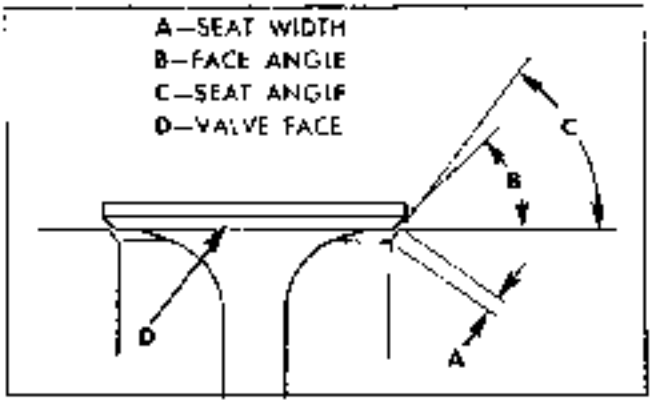


Fig. 6-90 Valve Seat and Face Angles

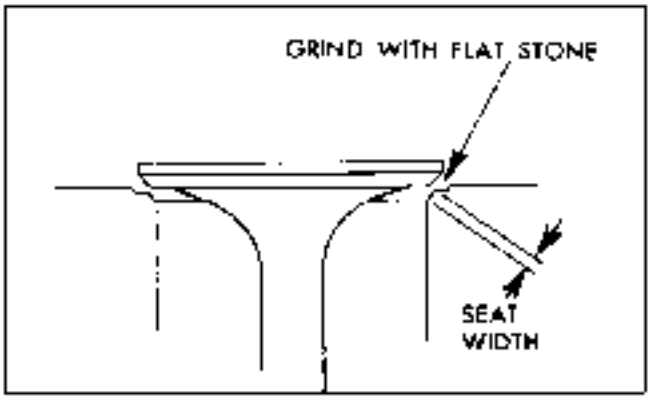


Fig. 6-91 Valve Seat After Grinding With Flat Stone

flat stone (Fig. 6-91). This is the only method that should be used to narrow the seat.

NOTE: Lapping of valve seats is not required or recommended.

2. Check concentricity of valve seat and valve guide. Concentricity of valve seat and valve guide can be checked by using a suitable dial indicator or prussian blue. When using a dial indicator, total runout should not exceed .002".

When prussian blue is used, a light coat should be applied to the face of the valve only and the valve rotated in its seat. If blue appears all the way around valve seat, the valve seat and valve guide are concentric with one another.

3. Check concentricity of valve stem and face of valve. After cleaning prussian blue from valve and seat from preceding check, lightly coat valve seat with prussian blue and rotate valve in guide. If blue appears all the way around valve, the valve stem and valve face are concentric with one another.

NOTE: Both tests in steps 2 and 3 are necessary to insure proper valve service.

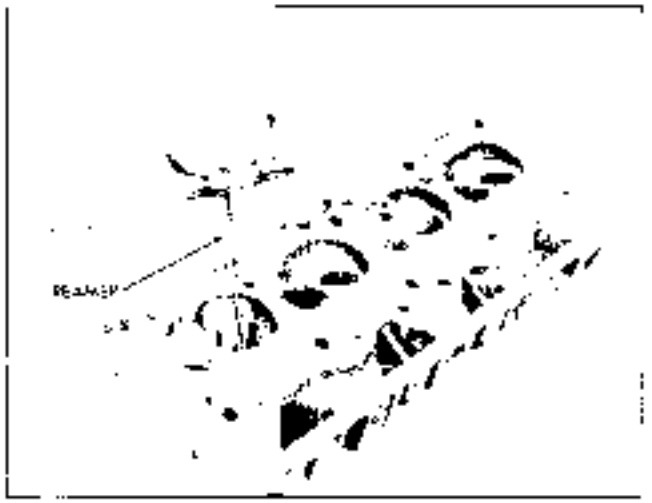


Fig. 6-92 Reaming Valve Guide

FITTING VALVE STEMS TO GUIDES

Correct valve stem clearance for valve guides is .0016" to .0033" for intake valve and .0021" to .0028" for exhaust valve.

Valves with oversize stems are available in .001", .003" and .005" larger than standard. The same valve stem to guide clearance applied for oversize stems.

Oversize reamers are required to enlarge valve guide holes to fit the oversize stems. When the reamer is turned through valve guide it will size hole to fit valve stem according to above limits.

Carefully ream valve guide using valve guide reamer J 5830-1 for .003" oversize stems and valve guide reamer J 6621 for .005" oversize stems (Fig. 6-92). For best results when installing .005" oversize valve stem, use .003" oversize reamer first and then ream to .005" oversize. Always reface valve seat after reaming valve guide.

NOTE: Valves are marked .001, .003 or .005 with colored ink.

CYLINDER HEAD AND VALVES—ASSEMBLE

1. Install valves, valve springs, valve stem shields valve spring retainer cups, valve stem seals and retainer cup locks, using suitable spring compressor. The valve stem seals must be installed in the second groove (from end of stem). Valve stem seal installer and tester J 22330 can be used to install this seal (Fig. 6-79). Where necessary, install new umbrella type seal using suitable plastic protector over end of valve stem.

After valves have been installed, the suction cup end of special tool J 22330 should be used to test for leaks between the valve spring retainer cup and valve stem seal (Fig. 6-80). The suction cup will tend to be held to the valve spring retainer cup by suction when seal is satisfactory. If a leak is detected, replace seal or valve spring retainer cup as necessary. It is important to have a positive seal between the valve spring retainer cup and valve stem seal to prevent excessive amounts of oil from being drawn down the valve stem which will cause exhaust smoke and oil consumption.

2. Install spark plugs.

HARMONIC BALANCER—TIMING CHAIN COVER AND GASKET—TIMING CHAIN AND SPROCKETS—OIL SEAL—FUEL PUMP ECCENTRIC

HARMONIC BALANCER—
REMOVE AND REPLACE

1. Loosen generator adjusting strap and lower pivot bolt and remove fan belt from harmonic balancer. On cars equipped with power steering, also

remove power steering pump bolt from harmonic balancer.

2. Position fan so vane angles will be at top and bottom allowing access to balancer (Fig. 6-93).

3. Remove crank pulleys and reinforcing plate.

4. Remove harmonic balancer attaching bolt and retainer washer.

5. Remove harmonic balancer by sliding it off end of crankshaft.

NOTE: DO NOT PRY ON O.D. OF HARMONIC BALANCER. HARMONIC BALANCER IS A RUBBER MOUNTED INERTIA MEMBER AND BALANCE COULD BE AFFECTED.

6. Install new harmonic balancer by reversing above steps, lining up keyway in balancer with key on crankshaft.

7. Tighten harmonic balancer attaching bolt to 100 lb. ft. torque.

NOTE: Remove flywheel cover and lock flywheel before tightening balancer bolt.

TIMING CHAIN COVER SEAL— REMOVE AND REPLACE

1. Loosen generator adjusting bolts.

2. Remove fan and accessory drive belts.

3. Remove harmonic balancer.

4. Remove timing chain cover seal by prying out of bore with a pry bar (Fig. 6-94).

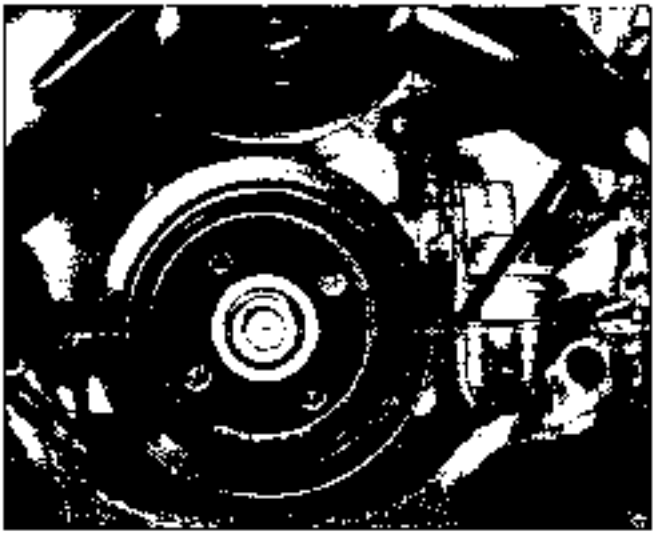


Fig. 6-93 Harmonic Balancer

5. Install new seal with lip of seal inward, using seal installer J 21147.

6. Replace harmonic balancer.

7. Install drive belts and adjust to proper tension.

TIMING CHAIN COVER, GASKET, OR FUEL PUMP ECCENTRIC— REMOVE AND REPLACE

1. Drain radiator and cylinder block.

2. Loosen generator adjusting bolts.

3. Remove fan bolt and accessory drive belt.

4. Remove fan and pulley from hub of water pump.

5. Disconnect lower radiator hose.

6. Remove fuel pump.

7. Remove harmonic balancer.

8. Remove front four oil-pan-to-timing-chain cover screws.

9. Remove timing chain cover to block attaching bolts and nuts and timing chain cover to intake manifold bolt.

10. Pull timing chain cover forward to clear studs and remove.

11. Remove O-ring seal from recess in intake manifold water recirculation passage.

12. Remove timing chain cover gasket and thoroughly clean gasket surfaces on block and cover. Use care to prevent gasket particles and other foreign material from falling into oil pan.

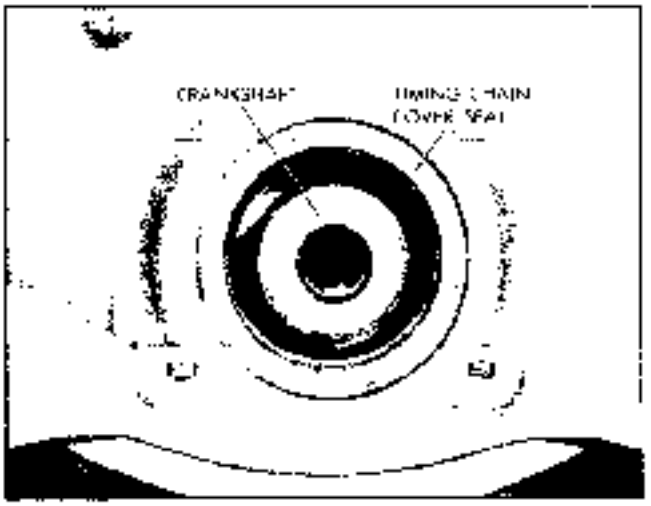


Fig. 6-94 Timing Chain Cover Seal

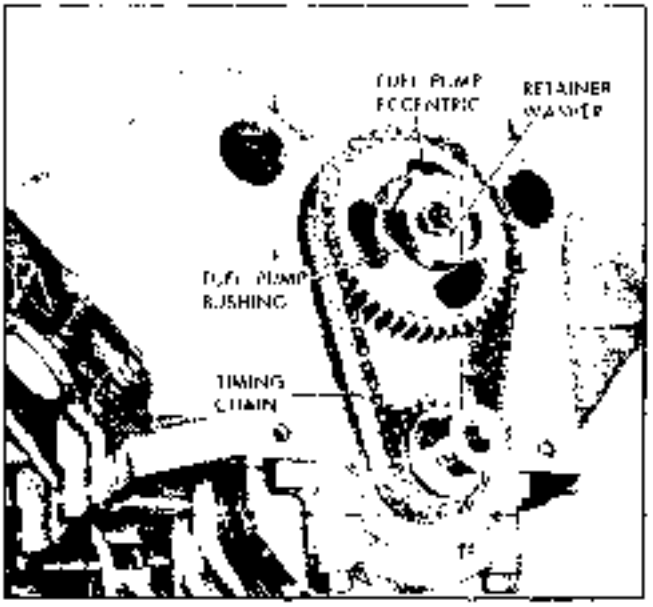


Fig. 6-95 Front of Engine with Timing Chain Cover Removed

13. Inspect front oil pan gasket and replace if damaged. If new gasket is installed, it should be cemented to oil pan.

14. If new fuel pump eccentric and bushing are to be installed, remove camshaft sprocket retainer bolt and retaining washer and remove the eccentric and bushing. Place fuel pump bushing over eccentric with rolled flange toward camshaft sprocket (Fig. 6-95).

NOTE: Bushing retaining flange should be between eccentric and sprocket for retention of bushing in operation.

Install bushing and eccentric, indexing tang on eccentric with keyway cutout in camshaft sprocket. Insert retaining screw with retainer washer and tighten securely.

15. Position new timing chain cover gasket over studs and dowels against block.

16. Transfer water pump to new timing chain cover if new cover is to be installed.

17. Install new O-ring seal in water recirculation passage of intake manifold.

18. Position timing chain cover on engine indexing over dowels, install bolts and nuts and tighten securely.

19. Install four oil-pan-to-timing-chain-cover screws and tighten to 12 lb. ft. torque.

20. Install harmonic balancer, retainer bolt with retainer, and tighten to 160 lb. ft. torque.

21. Connect lower radiator hose to pump inlet.

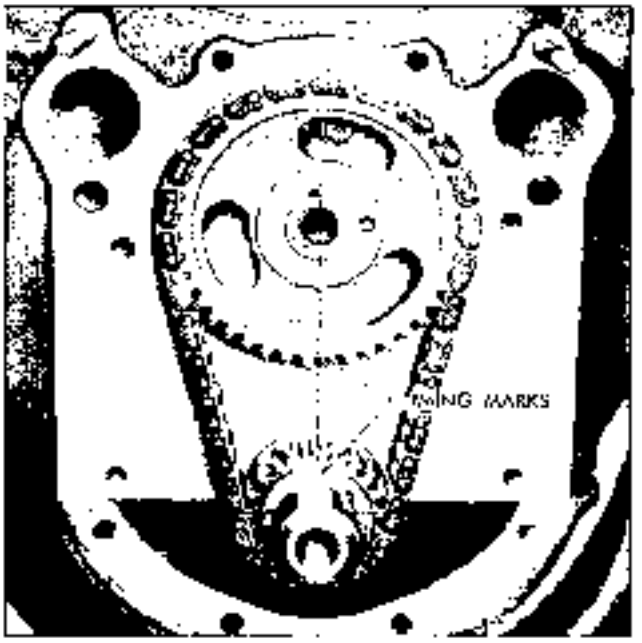


Fig. 6-96 Aligning Timing Marks

22. Position pulley and fan on water pump hub and install attaching bolts. Tighten to 20 lb. ft. torque.

23. Install power steering pump and belt on cars so equipped.

24. Install generator adjusting strap.

25. Install fan belt and accessory drive belts. Adjust to proper tension.

26. Install fuel pump.

27. Refill cooling system and check for leaks.

TIMING CHAIN AND SPROCKETS— REMOVE AND REPLACE

1. Remove timing chain cover, making certain O-ring seal and hollow dowels are retained for installation at assembly.

2. Remove fuel pump eccentric, bushing and timing chain cover oil seal.

3. Align timing marks to simplify proper positioning of sprockets during reassembly (Fig. 6-96).

4. Slide timing chain and sprockets off ends of crankshaft and camshaft.

5. Install new timing chain and/or sprockets, making sure marks on timing sprockets are aligned exactly on a straight line passing through the shaft centers (Fig. 6-96). Camshaft should extend through sprocket so that hole in fuel pump eccentric will locate on shaft.

6. Install fuel pump eccentric and spacing, indexing tab on eccentric with keyway cut-out in sprocket. Install retainer bolt with retainer washer and tighten securely.

7. Making certain hollow dowels are in place in block, place timing chain cover gasket over studs and dowels.

8. Install timing chain cover, making sure O-ring seal is in place.

CAMSHAFT AND/OR CAMSHAFT BEARING—REMOVE AND REPLACE

The camshaft and camshaft bearings can be replaced with engine installed in car or with engine removed and disassembled for overhaul; however, to replace the rear camshaft bearing without removing and completely disassembling engine, the propeller shaft, transmission and clutch housing must first be removed.

To replace the camshaft and/or the rear center, center, front center or front camshaft bearing without removing and completely disassembling the engine, proceed as follows:

1. Drain radiator.

2. Remove carburetor air cleaner.

3. Disconnect all water hoses, vacuum hose and spark plug wires.

4. Disconnect carburetor linkage, fuel lines and wires to thermogauge unit.

5. Remove hood latch brace.

6. On air-conditioned cars, remove generator mounting bracket and generator.

7. Remove crankcase ventilator hose, and remove both rocker arm covers and gaskets.

8. Remove distributor hold-down clamp and remove distributor.

9. Remove intake manifold and gaskets.

NOTE: Make certain O-ring seal between intake manifold and timing chain cover is retained and installed during assembly.

10. Remove push rod cover.

11. Loosen rocker arm ball retaining nuts so that rocker arms can be disengaged from push rods and turned sideways.

12. Remove push rods and hydraulic lifters. Store push rods in stand and lifters in a lifter box so they can be reinstalled in original positions.

13. Remove harmonic balancer.

14. Remove fuel pump.

15. Remove four oil-pan-to-timing-chain-cover screws.

16. Remove timing chain cover and gasket.

17. Remove fuel pump eccentric and fuel pump bearing.

18. Align timing marks on timing chain sprockets and remove timing chain and sprockets.

19. Remove camshaft thrust plate.

20. Carefully pull camshaft from engine, exercising caution so as not to damage bearings in block.

NOTE: The clearance for camshaft removal is very limited and, in cases where engine mounts are worn excessively, it may be necessary to raise the front of the engine to permit removal.

21. Stuff clean rags through openings in engine block as an aid in preventing foreign material or parts of bearing remover tool from dropping into block.

CAUTION: It is imperative that operator exercise extreme caution when inserting bearing remover adapters or key through openings in engine block to prevent them from dropping into engine.

CAMSHAFT BEARING—REMOVE

1. Insert remover adapter J 6173-4 into front bearing to act as a support for shaft J 6173-1 (Fig. 6-97).

NOTE: If front bearing is to be replaced, insert installer adapter in center bearing to act as support for shaft.

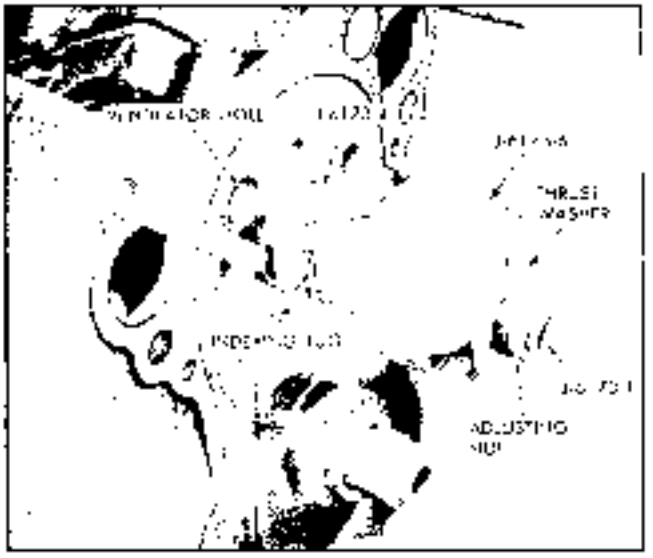


Fig. 6-97 Positioning Index Collar

Fig. 6-98 Removing Camshaft Bearing

2. Insert replacer adapter J 6173-3 into rear of bearing to be removed so that shoulder on remover bears against rear edge of bearing.

NOTE: If rear bearing is to be removed, it will be necessary to remove camshaft rear plug.

3. Place indexing collar J 6073-6 on threaded end of shaft with open side toward unthreaded end and start thrust washer and nut on shaft (Fig. 6-97).

4. Insert shaft and indexing collar through remover and replacer adapters and position lug on indexing collar in ventilator hole in front of block (Fig. 6-97). This indexes shaft so that it cannot rotate.

5. Slip key J 6073-5 into notches in shaft behind bearing to be removed (Fig. 6-98).

6. Turn nut on front of shaft to pull key against remover adapter J 6173-4, then continue to turn nut until bearing is pulled out of its hole.

CAMSHAFT BEARING--REPLACE

1. Place a clean rag against each side of transverse member just below bearing hole to catch any shavings and carefully clean up hole. All scratches or nicks in cast iron should be smoothed with a scraper or file. Chamfer the rear edge of hole slightly to reduce possibility of shaving down the outer diameter of bearing when it is installed.

2. Insert remover adapter J 6173-4 into front bearing to act as a support for the shaft.

NOTE: If front bearing is being replaced, insert remover adapter in center bearing to act as support for the shaft.

3. Insert pilot J 6173-7 into hole in which bearing is to be installed.

4. Coat outside of new bearing with oil and place it over replacer adapter J 6173-3, indexing notch in edge of bearing with pin on replacer adapter.

NOTE: The notch in edge of bearing is used to properly position the bearing, with respect to oil holes, when it is installed. When bearings are installed in production, notches all face front except the one in rear bearing. In service it is necessary to install bearings with notch facing the rear.

5. Position replace adapter J 6173-3, with bearing in position against shoulder, against rear of hole in which bearing is to be installed (Fig. 6-99). Index mark on shoulder of replacer must point down (toward crankshaft side) to properly position bearing.

6. Insert shaft with indexing collar, thrust washer, and nut through remover, pilot and replacer adapters. Index lug on collar with ventilation hole in front of block (Fig. 6-97).

7. Slip key J 6173-6 into notches in shaft behind replacer adapter J 6173-3 and tighten nut to start bearing into hole (Fig. 6-99). Continue to tighten nut until bearing has been pulled completely into its hole. When properly positioned, it will be approximately flush with both sides of the transverse member.

NOTE: Rear bearing should be pulled in until front edge is flush with block. This will leave shoulder at end of counter bore for camshaft rear plug visible behind bearing.

8. Remove remover and replacer set J 6173.

9. Visually observe that holes in bearing line up with drillings in block.

10. Carefully remove rags used to catch particles of metal and use magnet or vacuum cleaner to make sure that all metal particles are removed from block surfaces and oil drillings.

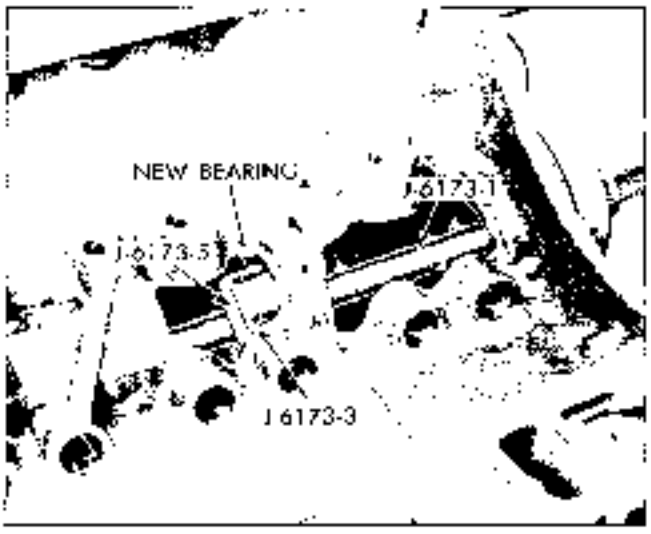


Fig. 6-99 Installing Camshaft Bearing

CAMSHAFT--REPLACE

1. Coat inner diameters of all camshaft bearings with oil. Coat camshaft lobes with heavy oil. Carefully install camshaft. Rotate camshaft through several revolutions to make sure it is completely free. If any tight spots are found, remove camshaft and very carefully polish down the center journal slightly. If still not free, polish the front and rear journals slightly. If any particular bearing causes binding of the camshaft, replace that bearing also.

NOTE: Front center and rear center journals should not be polished except to remove slight roughness or scratches. Slight warpage of the camshaft is not harmful, provided the journals are polished down until the camshaft rotates freely in its bearings.

2. With camshaft properly seated, install camshaft thrust plate and tighten bolts 20 lb. ft. torque.

3. Install timing chain sprockets and timing chain, making sure marks on sprockets are aligned properly (Fig. 6-96).

4. Install fuel pump eccentric and bushing. Tighten camshaft sprocket retaining bolt 40 lb. ft. torque.

5. Install timing chain cover dowels and new gasket and tighten cover to cylinder block bolts and cover to block stud nuts 30 lb. ft. torque.

6. Insert four oil-pan-to-timing-chain-cover screws and tighten 12 lb. ft. torque.

7. Install fuel pump and tighten bolts 25 lb. ft. torque.

8. Install harmonic balancer. Tighten bolt 160 lb. ft. torque.

9. Coat base of lifters with heavy oil. Install hydraulic lifters and push rods, making certain they are replaced in their original positions.

10. Engage rocker arms on push rods and tighten rocker arm ball retaining nuts 20 lb. ft. torque.

11. Install push rod cover.

12. Install intake manifold and gasket. Tighten bolts 40 lb. ft. torque.

NOTE: O-ring seal must be installed between intake manifold and timing chain cover before manifold is securely positioned.

13. Install distributor, positioning rotor pointer to number six cylinder, and install distributor hold-down clamp. Tighten clamp retaining screw 30 lb. ft. torque.

14. Install crankcase ventilator outlet pipe and both rocker arm covers and gaskets. Tighten cover bolts 95 lb. in. torque.

15. If generator bracket and generator were removed, install and tighten bolts 30 lb. ft. torque.

16. Install fan and pulleys.

17. Install radiator, tightening all bolts securely.

18. Install hood latch bracket and tighten bolts.

19. Connect carburetor linkage, fuel lines and thermogauge unit.

20. Connect all water hoses, vacuum hose and spark plug wires.

21. Install carburetor air filter.

22. Refill cooling system and check for leaks.

OIL PAN AND/OR OIL PAN GASKET—REMOVE AND REPLACE—PONTIAC MODELS

REMOVE

1. Disconnect battery cable.

2. Remove fan shield.

3. On air-conditioned cars, remove fan and pulley assembly.

4. Disconnect engine ground cables.

5. On air-conditioned cars, remove compressor from mounting brackets and position to one side.

6. Inspect all water hoses and wiring harnesses for proper routing to avoid excessive bind when engine is raised approximately 4 1/2".

7. Raise vehicle and drain crankcase.

8. Disconnect steering idler arm from frame.

9. Remove exhaust crossover pipe. When equipped with dual exhausts disconnect exhaust pipes from manifolds.

10. Remove starter assembly and flywheel cover.

11. Position J 22603 ENGINE LIFTING TOOL to engine and place J 22603-4 CROSS BAR in position on lifting tool (Fig. 6-74). Bolt tool to timing chain cover with bolts provided with tool.

12. Using frame jack or hydraulic transmission jack, support engine at J 22603, remove motor mounts.

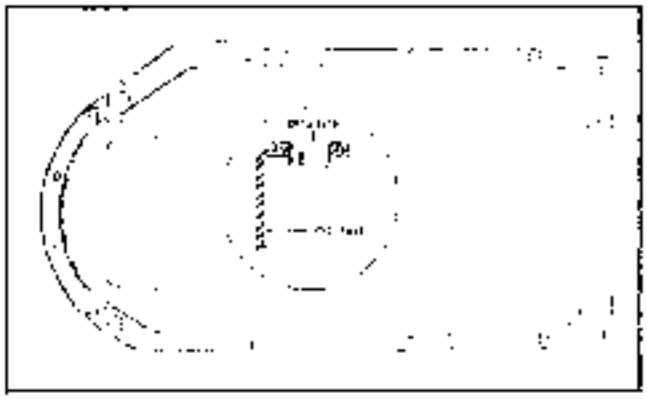


Fig. 6-100 Oil Pan Gasket Retainer

13. Loosen rear transmission mount.

NOTE: It may be necessary to remove this mount and rear part of transmission on crossmember to obtain necessary clearance.

14. Remove oil pan bolts and raise engine straight up until transmission is against floor pan.

15. Remove oil pan by first rotating clockwise (facing forward) to clear oil pump.

NOTE: IF WORK OTHER THAN OIL PAN GASKET REPLACEMENT IS TO BE PERFORMED, REMOVE JACK AND SUPPORT ENGINE WITH SUITABLE BLOCKS OF WOOD.

REPLACE

1. Install new gasket on oil pan. (Fig. 6-100, 6-101, 6-102).

2. Replace oil pan. Tighten retaining bolts to 12 lb. ft.

3. Install left motor mount to cylinder block and tighten right motor mount to block bolts.

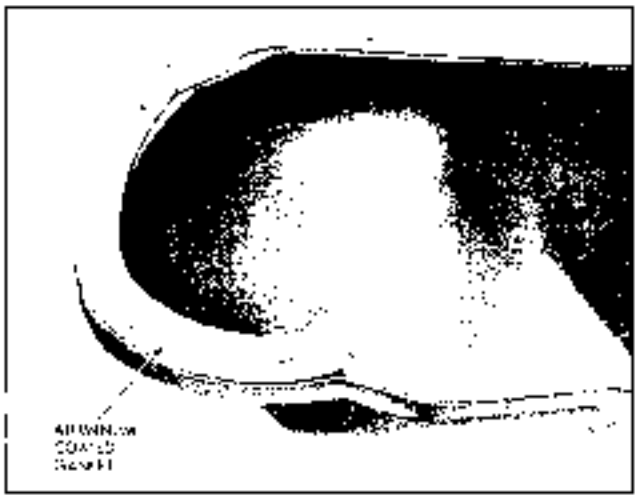


Fig. 6-101 Front Oil Pan Gasket Overlapping Side Gaskets

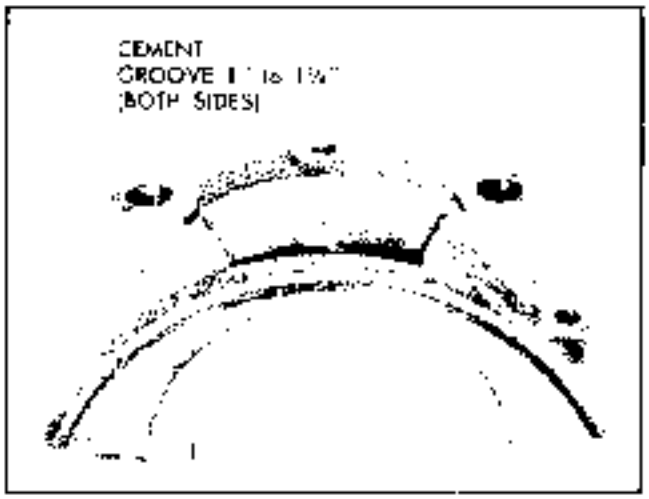


Fig. 6-102 Rear Oil Pan Gasket Positioned in Bearing Cap

4. Lower engine and remove J 22603 Engine Support Bracket.

5. Replace motor mount to frame bolts.

6. Replace flywheel cover and starter.

7. Replace exhaust crossover pipe.

8. Connect steering idler arm to frame.

9. Lower vehicle.

10. On air-conditioned cars, replace compressor, fan and pulley assembly and adjust belt tensions.

11. Replace fan shield.

12. Connect engine ground cables and battery cable.

13. Refill engine crankcase.

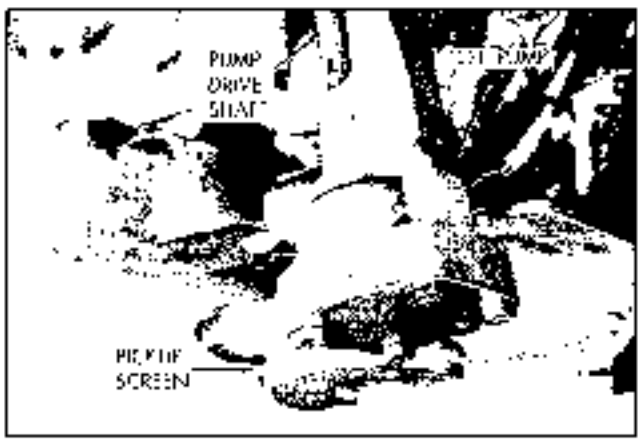


Fig. 6-103 Oil Pump and Oil Pump Drive Shaft

OIL PAN AND/OR OIL PAN GASKETS—REMOVE AND REPLACE—TEMPEST MODELS

REMOVE

1. Remove engine and clutch (SM) from vehicle.

2. Place engine on a suitable stand.

3. Remove oil pan.

REPLACE

1. Install new gasket on oil pan using gasket retainers (Figs. 6-100 and 101).

2. Install new oil pan gasket in rear main bearing cap (Fig. 6-102).

3. Install oil pan into position and torque retaining bolts 12 lb. ft.

4. Remove engine from stand.

5. Install engine in vehicle.

OIL PUMP—REMOVE AND REPLACE

1. Remove engine oil pan (See "Oil Pan - Remove and Replace"). Remove splash baffle.

2. Remove oil pump attaching bolts while holding oil pump in place. Carefully lower oil pump away from block with one hand while removing oil pump drive shaft with other hand (Fig. 6-103).

3. Position drive shaft in distributor and oil pump drive gears. Place pump against block, using new gasket between pump and block. Index drive shaft with pump drive gear shaft. Install two attaching screws with lockwashers and tighten securely.

NOTE: Removal and installation of pump does not affect ignition timing, since the oil pump and distributor drive gear is mounted on the distributor shaft.

4. Install oil pan.

OIL PUMP—RECONDITION

DISASSEMBLE

1. Remove pressure regulator spring retainer, spring, and pressure regulator ball.

2. Remove screws retaining cover to oil pump body and remove cover.

3. Remove driven gear and drive gear with shaft.

NOTE: Oil pump screen should not be removed from pump body. Be careful not to loosen screen.

CLEAN AND INSPECT

1. Clean all parts thoroughly. Screen must be thoroughly cleaned by using a fluid such as used for carburetor cleaning.

2. Inspect pressure regulator spring (Fig. 6-104) for distortion, cracks, and wear on sides.

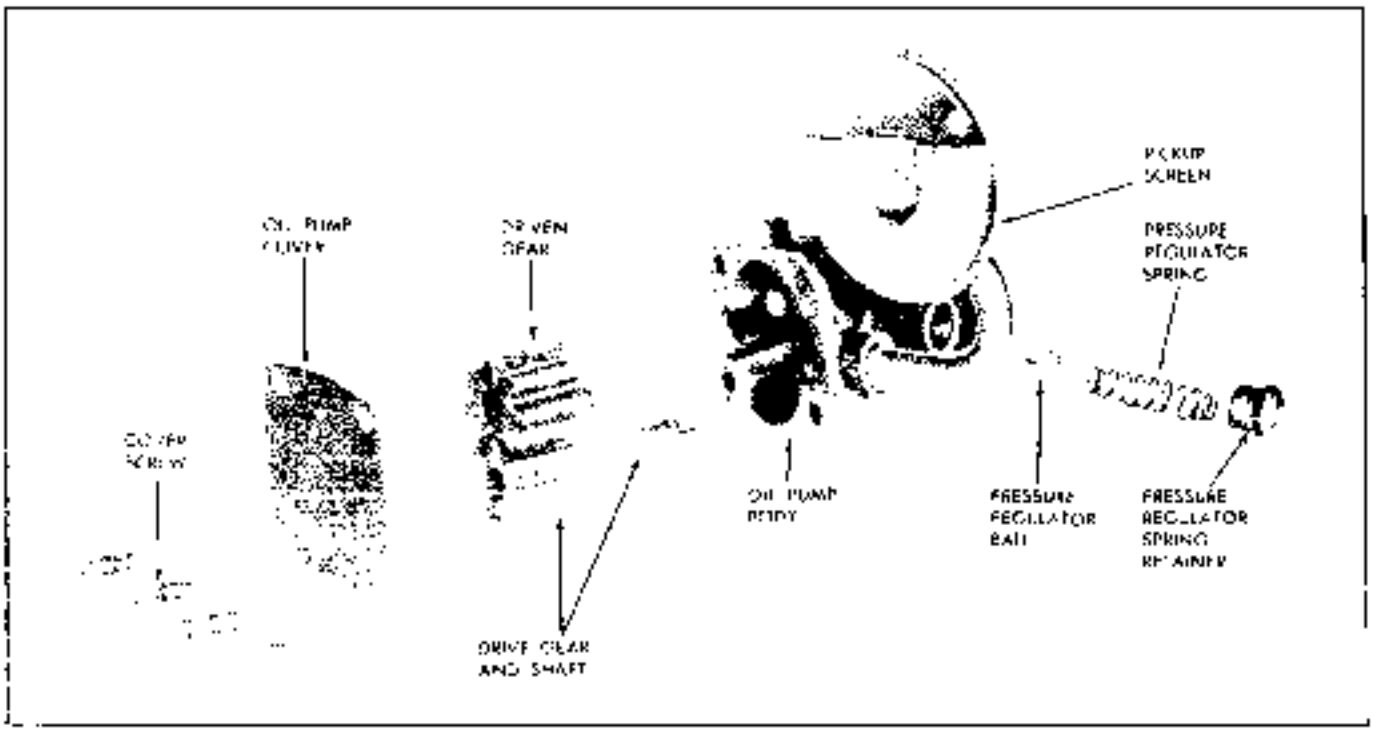


Fig. 6-104 Oil Pump—Exploded View

3. Inspect pressure regulator ball to see that it is not nicked or otherwise damaged.

4. Inspect pump body, driven gear shaft and cover for evidence of wear.

5. Inspect pump gears and end of drive gear shaft for wear (Fig. 6-104).

6. Inspect oil pump drive shaft (distributor to pump shaft) for evidence of wear and cracks.

ASSEMBLE

1. Install drive and driven gears.

2. Install cover and turn drive shaft by hand to ensure that it turns freely.

3. Install pressure regulator ball, spring and retainer.

IMPORTANT: Oil pressure regulator spring on GTO or 428 may be identified by noting appearance of distributor drive gear. If gear is cadmium plated, oil pump spring will be 60 psi pressure. Engines with unplated gear will have 50 psi spring. The 50 psi spring must not be used without cadmium plated gear.

CAUTION: Do not attempt to change oil pressure by varying length of pressure regulator valve spring.

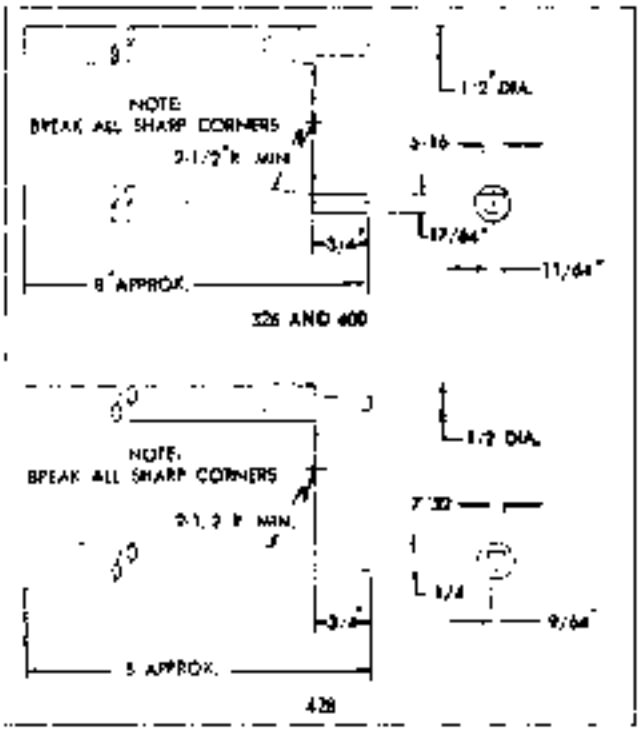


Fig. 6-103 Rear Main Scoring Seal Tool

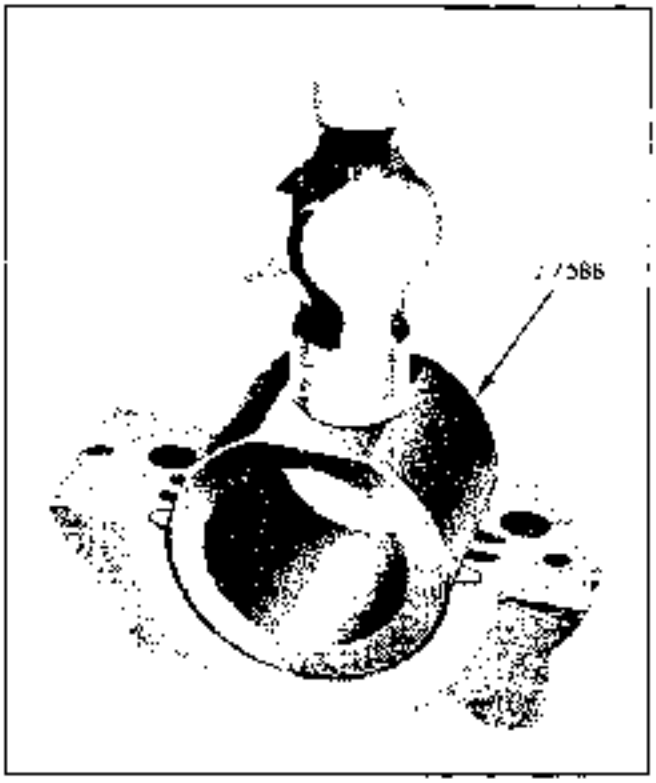


Fig. 6-104 Forcing New Seal In Car

REAR MAIN BEARING OIL SEAL— REMOVE AND REPLACE

REMOVE

1. Remove oil pan (see Oil Pan - Remove and Replace).

2. Remove oil pump and baffle (Fig. 6-107).

3. Remove rear main bearing cap.

4. Use tool shown in Fig. 6-105 made from brake bar stock to pack upper seal as follows:

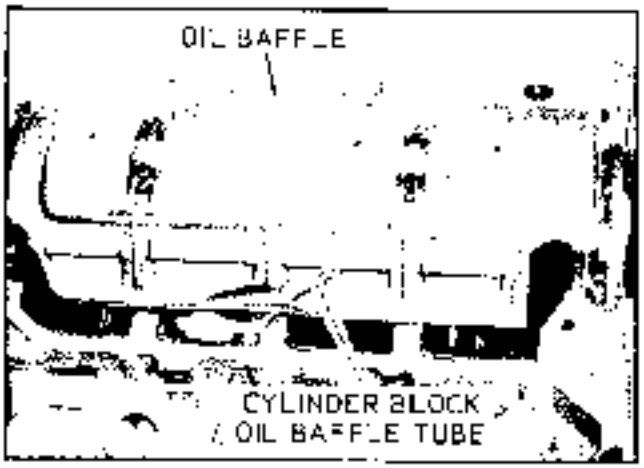


Fig. 6-107 Engine Oil Baffle and Dipstick Tube

a. Insert tool against one end of the oil seal in the cylinder block and drive the seal gently into the groove until the tool bottoms.

b. Remove the tool and repeat at the other end of the seal in the cylinder block.

5. Clean the block and bearing cap parting line thoroughly.

6. Form a new seal in the cap (Fig. 6-106).

7. Remove the newly formed seal from the cap and cut four (4) pieces approximately 3/8" long from this seal.

8. Work two 3/8" pieces into each of the gaps which have been made at the end of the seal in the cylinder block. Without cutting off the ends, work these seal pieces in until flush with the parting line and until no fibers are protruding over the metal adjacent to the groove.

9. Form another new seal in the cap (Fig. 6-106).

10. Assemble the cap to the block and tighten to 120 lb. ft. torque.

11. Remove the cap and inspect the parting line to insure that no seal material has been compressed between the block and the cap. Clean as necessary.

12. Apply a 1/16" bead of sealer from the center of seal across to the external cork groove.

13. Reassemble the cap. Tighten to 120 lb. ft. torque.

14. Install baffle and oil pump.

15. Install oil pan (see Oil Pan - Remove and Replace).

MAIN BEARINGS—REMOVE AND REPLACE

1. Remove oil pan (see Oil Pan - Remove and Replace).

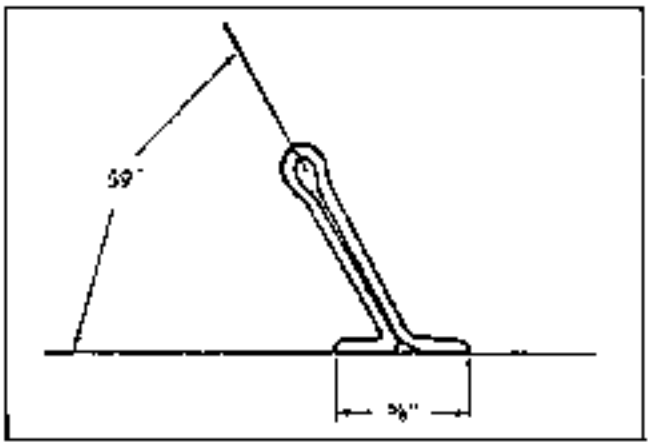


Fig. 6-108 Tool For Removing Upper Half of Main Bearing

2. To gain access to bearing caps, remove oil baffle. To gain access to rear main, remove oil pump in addition to oil baffle.

3. Remove bearing cap of main bearing to be replaced.

4. Make a tool for removing upper half of bearing shell as shown in Fig. 6-108.

5. Insert tool in oil hole of crankshaft and rotate crankshaft in usual direction of rotation. This will cause bearing to be moved from between shaft and bearing seat.

6. Oil bearing surface of shell and install by inserting plain end of bearing shell at indented side of bearing seat and gently rotating shell into place by turning shaft.

7. Install new bearing lower half by inserting in bearing cap so indentation in shell and cap coincide.

8. Install bearing cap and check fit of bearing, using Plastigage as outlined below.

CAUTION: Under no circumstances should bearing caps be filed or shimmed in an effort to effect a fit.

PLASTIGAGE METHOD FOR DETERMINING MAIN BEARING CLEARANCE

When checking main bearing clearance with engine in the car, place a .002" brass shim between the crankshaft journal and the lower bearing in each bearing cap next to the one being checked (Fig. 6-109).

Tighten all cap bolts to proper torque as follows: rear - 120 lb. ft., all others 100 lb. ft. This causes the crankshaft to be forced against the upper bearing and insures an accurate measurement of the total clearance.

1. Remove the bearing cap of the bearing to be checked. Wipe the bearing and the journal free of oil.

2. Place a piece of type PG-1 Plastigage the length of the bearing (parallel to the crankshaft) on the

Fig. 6-109 .002 Shim Positioned in Cap for Checking Bearing Clearance

Fig. 6-110 Measuring Plastigage

journal or bearing surface. Install the cap and tighten cap bolts to proper torque.

NOTE: Do not turn crankshaft with Plastigage in place.

3. Remove bearing cap and using Plastigage scale on envelope (Fig. 6-110), measure width of compressed Plastigage before removing it from the bearing or journal. If the bearing clearance is between .0002" and .0020", the clearance is satisfactory. If the clearance is more than .0020", replace the bearing with the next size undersize bearing and recheck clearance. Bearings are available in standard size, .001" and .002" undersize.

4. Install a new rear main bearing oil seal in the cylinder block and main bearing cap if the rear main bearing was checked and/or replaced.

5. Replace oil pump, cylinder block to oil baffle tube, and oil baffle if they were previously removed.

6. Replace oil pan, using new gaskets.

CONNECTING ROD BEARINGS— *REMOVE AND REPLACE*

1. Remove oil pan (see Oil Pan - Remove and Replace).

2. To gain access to numbers 5, 6, 7 or 8 connecting rod caps it will be necessary to remove oil pump screen and oil baffle. Pump must be removed as an assembly. Screen tube is a press fit in pump body and must not be rotated or removed.

3. Rotate crankshaft as necessary to bring crank

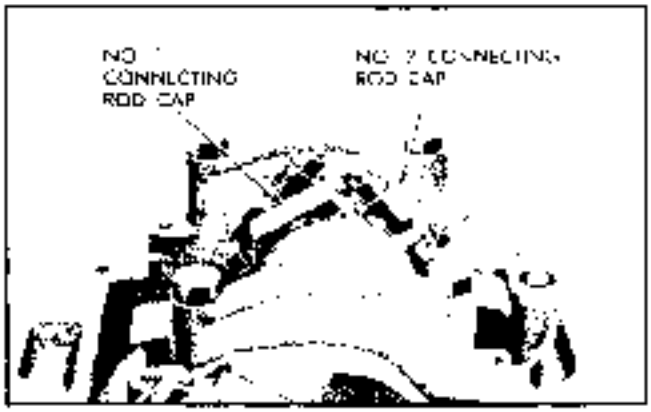


Fig. 6-111 Crankshaft Positioned For Removal of No. 1 and No. 7 Connecting Rod Caps

pin carrying bearing to be replaced straight down (Fig. 6-111).

4. Remove bearing cap of bearing to be replaced.

5. Install connecting rod bolt guide set J 5239 on connecting rod bolts (Fig. 6-113).

6. Push piston and rod assembly up far enough to allow removal of bearing shell. Remove bearing shells from rod and cap.

7. Inspect crank pin for damage, out-of-round, and taper.

8. Reassemble cap and rod with new bearing shells and check fit, using Plastigage as outlined below.

CAUTION: Under no circumstances should a bearing cap be filed or shimmed in an effort to affect a fit.

NOTE: In 1968, a number of 2 bbl. equipped V-8's will have .010" undersize crankpins. These crankshafts may be identified by a .010" U.S. stamp on the front of the No. 1 counterweight and the rear of the No. 8 counterweight. A check should be made for this undersize crankshaft before replacing rod bearings.

PLASTIGAGE METHOD FOR DETERMINING CONNECTING ROD BEARING CLEARANCE

1. Remove the cap of the bearing to be checked. Wipe the bearing and the crankpin free of oil.

2. Place a piece of type PG-1 Plastigage the length of the bearing (parallel to the crankshaft) on the crankpin or bearing surface. Install the cap and tighten cap bolts to 40 lb. ft.

NOTE: Do not turn crankshaft with Plastigage in place.

3. Remove bearing cap and using Plastigage scale on envelope (Fig. 6-110) measure width of compressed Plastigage before removing it from the

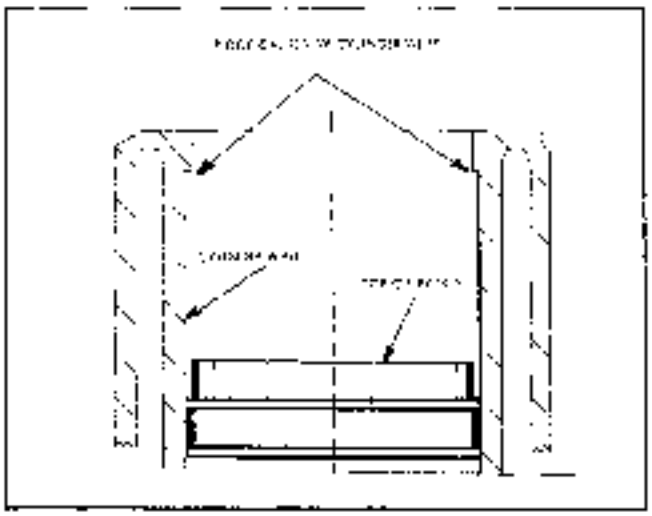


Fig. 6-112 Cylinder Ring Ridge

crankpin or bearing. If the bearing clearance is between .0005" and .0025", the clearance is satisfactory. If clearance is more than .0025", replace bearing with the next size undersize bearing and recheck clearance. Bearings are available in .001" and .002" undersize.

4. Rotate the crankshaft after bearing adjustment to be sure bearings are not tight.

CONNECTING ROD AND PISTON ASSEMBLY—REMOVE AND REPLACE

REMOVE

1. Remove oil pan, oil baffle and oil pump (see Oil Pan - Remove - and Replace).

2. Remove intake manifold and cylinder head on bank from which piston is to be removed.

3. Rotate crankshaft so crankpin carrying assembly to be replaced projects straight downward (Fig. 6-111).

4. Remove ring ridge (Fig. 6-112) using suitable ring ridge remover.

5. Remove bearing cap and install connecting rod bolt guide set J 5239.

6. Carefully remove connecting rod and piston assembly by pushing out with knurled handle of long guide (Fig. 6-113).

REPLACE

1. Install connecting rod bolt guide set on connecting rod bolts with long handle guide on same side as oil groove in rod.

2. Using J 6547 or J 5684 (Fig. 6-114) ring compressor, insert piston and connecting rod assembly into cylinder so that notch in top of piston is toward front of engine. Be certain oil spurt hole (Fig. 6-121) in connecting rod is toward camshaft.

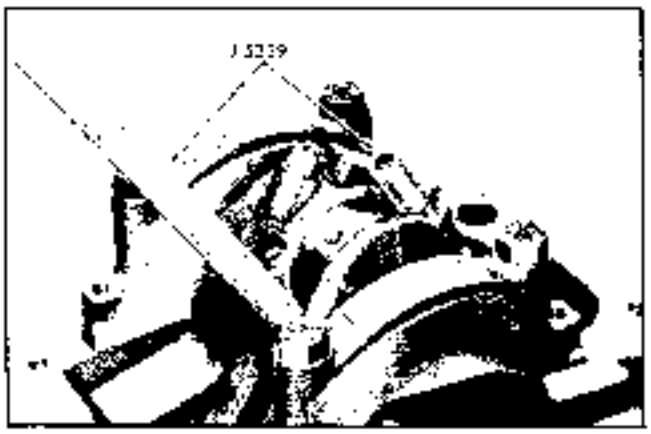


Fig. 6-113 Connecting Rod Bolt Guide Set Installed

3. From beneath engine, pull connecting rod, with bearing shell in place, into position against crankpin.

4. Remove guide set J 5239. Install bearing cap and cap nuts and tighten to 43 lb. ft. torque.

5. Replace oil pump and oil baffle, if they were removed.

6. Install cylinder head and intake manifold.

CONNECTING ROD AND PISTON ASSEMBLY—RECONDITION

NOTE: Use care at all times when handling and servicing connecting rods and pistons. To prevent possible damage to these units, do not clamp rod or piston in vise since they may become distorted.

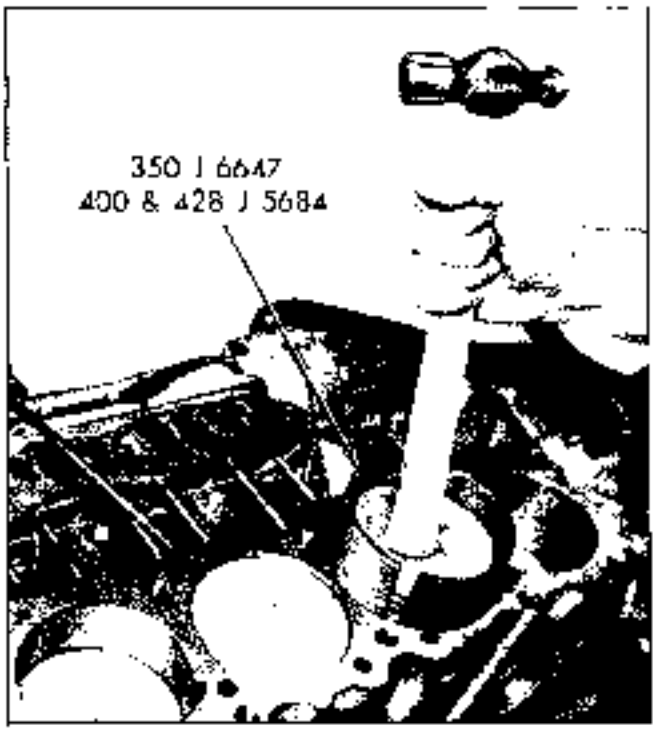


Fig. 6-114 Installing Piston Assembly

Do not allow pistons to strike against one another, against hard objects, or bench surfaces, since distortion of piston contour or nicks in soft aluminum material may result.

CONNECTING ROD AND PISTON—DISASSEMBLE

1. Remove piston rings, using J 8021 or J 7117 piston ring remover.

NOTE: It is important that rings be removed carefully to prevent scratching or burring of ring grooves and lands.

2. Using a suitable arbor press place the spring and plunger into the bore of the base support and position on an arbor press with the pilot plunger indexed in the bottom of piston pin bore. See Fig. 6-115 insert for correct base support and pilot plunger for the type pistons being serviced.

3. Using the pilot plunger (or plate) indicated in Fig. 6-115, the pin may be pressed out far enough to index with the bore in the base.

4. Remove pilot plunger and spring from base.

5. Complete removal of pin using pin driver J 6901-3 and base alone.

6. Remove bearing cap and bearings.

CONNECTING ROD AND PISTON—CLEAN AND INSPECT

1. Clean carbon, varnish, and gum from piston surfaces, including underside of piston head. Clean ring grooves, and oil slots in oil ring groove, using suitable cleaning tools and solvent.

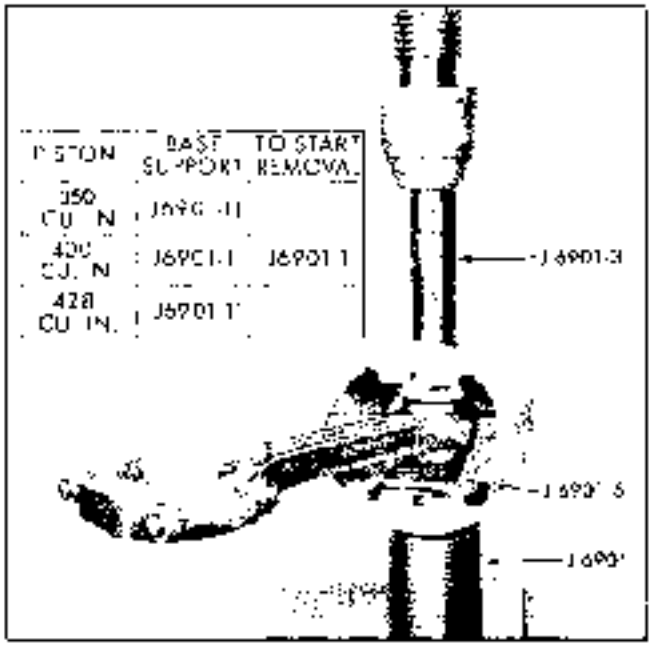


Fig. 6-115 Removing Piston Pin

2. Clean piston pin, rod, cap, bolts and nuts in suitable solvent. Reinstall cap on connecting rod to assure against subsequent mixing of caps and connecting rods.

3. Carefully examine piston for rough or scored bearing surfaces; cracks in skirt or head; cracked, broken, or worn ring lands; scored, galled, or worn piston bosses. Damaged or faulty pistons should be replaced.

NOTE: If piston pin bosses are rough or worn out-of-round and the piston is otherwise serviceable, the pin bosses may be honed for oversize pins. Before fitting oversize pins, however, it is advisable to check fit of piston in bore.

4. Inspect piston pin for scoring, roughness, or uneven wear.

5. Inspect bearing shells to see that they are serviceable. Fit of bearings should be checked when engine is being assembled.

CYLINDER BORES—INSPECT

Inspect cylinder bores for out-of-round or excessive taper with an accurate cylinder gauge J 8087 or comparable, at top, middle and bottom of bore. Measure cylinder bore parallel and at right angles to the center line of engine to determine out-of-round. Variation in measure from top to bottom of cylinder indicates taper in cylinder.

Fig. 6-116 illustrates area in cylinder where normal wear occurs. Cylinder bore can be measured by setting cylinder gauge dial at zero in cylinder at the point of desired measurement. Lock dial indicator at zero before removing from cylinder, and measure across the gauge contact points with outside micrometer with gauge at the same zero setting when removed from cylinder (Figs. 6-117 and 6-118).

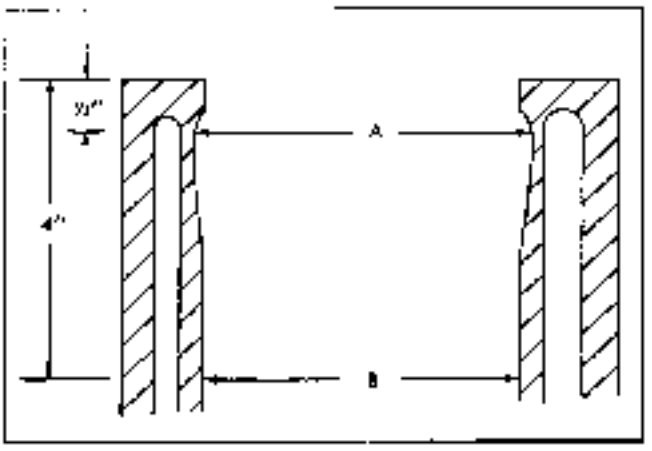


Fig. 6-116 Normal Cylinder Wear Pattern

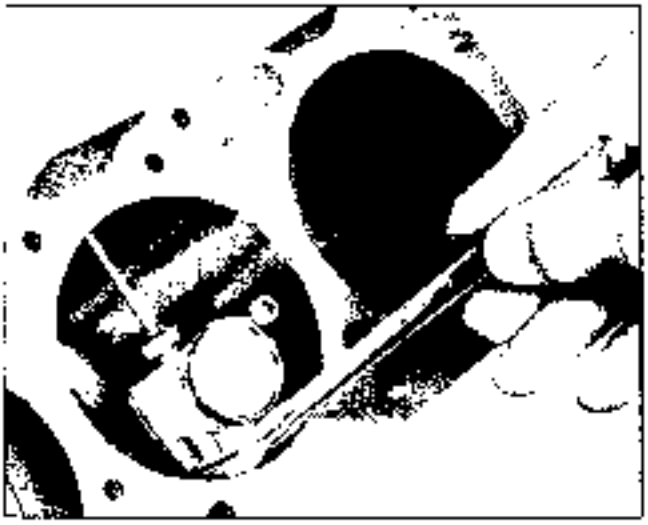


Fig. 6-117 Measuring Cylinder Bore

Fig. 6-118 Measuring Cylinder Gauge

Take several measurements parallel and at right angles to the crankshaft, between 1/2" and 4" from the top of the cylinder. Subtract the smallest measurement found from the largest. If this figure exceeds .0005", a piston cannot be fitted properly, and the cylinder must be honed. New rings and a new oversized piston must then be fitted.

Fine vertical scratches made by ring ends will not cause excessive oil consumption, therefore, honing to remove is unnecessary.

HONING OR BORING

If a piston in excess of .005" oversize is to be installed, the cylinder should be bored, rather than honed, to effect a true bore.

To eliminate the possibility of honing taper into the cylinder, full strokes of the hone should be made in addition to checking measurement at top, middle and bottom of bore repeatedly.

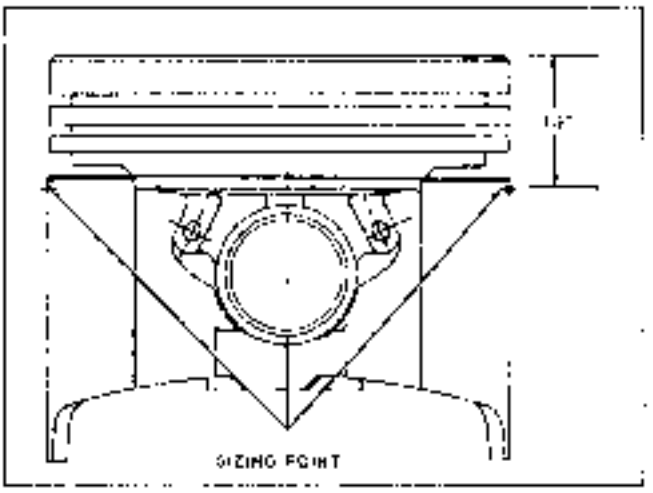


Fig. 6-119 Piston Sizing Point

When boring, always be sure the crankshaft is out of way of boring cutter when boring each cylinder. Crankshaft bearings and other internal parts must be covered or taped to protect them during boring or honing operation. When taking final cut with a boring bar, leave .001" on the diameter for finish honing to give required piston-to-cylinder clearance specifications.

NOTE: Honing or boring operation must be done under close supervision so that specified clearance between pistons, rings, and cylinder bores is maintained.

By measuring the piston to be installed at the sizing points (Fig. 6-119) and adding the mean of the clearance specification, the finish hone cylinder measurement can be determined. It is important that both block and piston be measured at normal room temperature, 60°-90°F.

After final honing and before the piston is checked for fit, each cylinder bore must be thoroughly cleaned. Use soapy water solution and wipe dry to remove all traces of abrasive. If all traces of abrasive are not removed, rapid wear of new rings and piston will result.

Intermixing different size pistons has no effect on engine balance as all Pontiac pistons from standard size up to .030" oversize weigh exactly the same. Pontiac does not recommend boring beyond .010" during warranty period so that if necessary, engine can be serviced at high mileage without cylinder block replacement.

FIT AND REPLACE PISTON

Pistons should be fitted in the bores by actually measuring the fit. Clearance between the piston and the cylinder bore should be .0025" to .0031" on standard engines; and .0030" to .0038" on 428 engines.

If cylinder bores have been reconditioned, or if pistons are being replaced, reconditioning of bores

and fitting of pistons should be closely coordinated. If bore has been honed, it should be washed thoroughly with hot soapy water and a stiff bristle brush.

Using a cylinder checking gauge, measure the cylinder bore crosswise of the block to find the smallest diameter. Record the smallest diameter of each bore.

NOTE: When measuring cylinder bores and pistons it is very important that the block and pistons be at room temperature. If any or all of the parts are hotter or colder than normal room temperature, improper fitting will result.

Measure the piston skirt perpendicular to the piston pin boss (piston pin removed) and at sizing point indicated in Fig. 6-119.

Make sure the micrometer is in full contact (Fig. 6-120).

As the pistons are measured they should be marked for size identification and the measurements recorded.

If there is excessive clearance between a cylinder bore and the piston which was installed in that bore, a new piston should be used.

New pistons are serviced in standard size and .001", .002", .005", .010", .020" and .030" oversize.

NOTE: Since these are nominal or basic sizes, it is important that new pistons be measured to ensure proper fit. All new pistons are serviced with selectively fitted piston pins.

After all measurements have been made, match the new pistons with cylinders where they will fit with proper clearance. Honing of cylinder bore may be necessary to effect a proper fit. When properly mated, mark pistons with cylinder numbers they fit so they will not become mixed.

FITTING PIN IN PISTON

The piston pin fit in the piston is .0005" to .0007" loose with pin and bosses clean and dry.

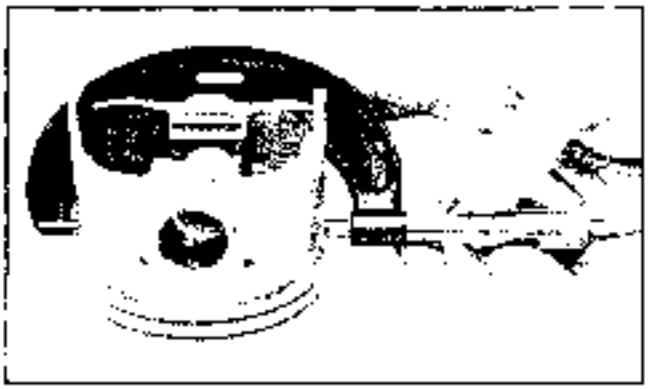


Fig. 6-120 Measuring Piston

NOTE: Piston and pin must be at room temperature when checking fit and pin must be able to fall from piston by its own weight.

FITTING OVERSIZE PINS IN PISTONS AND CONNECTING ROD PIN BORES

In case the standard size piston pin does not fit properly in the piston, an oversize piston pin must be fitted. Piston pins are available in .001" and .003" oversize.

When oversize pins are used, the piston pin bosses must be honed to give required fit. It will also be necessary to hone the connecting rod pin bore to fit the oversize pin, using a Sunnen hone or similar accurate equipment.

NOTE: A special grit hone is used for honing the connecting rod pin bore. The piston pin size should be .0008" to .0016" larger than connecting rod pin bore for proper press fit. The piston pin should not show any movement under 1500 lb. minimum load after assembly in rod.

ASSEMBLE CONNECTING ROD TO PISTON

There is a notch cast in the top of all piston heads to facilitate proper installation. The piston assemblies should always be installed with notch toward front of engine. Position rod in piston so that oil squirt hole (Fig. 6-121) is toward camshaft.

REPLACE PISTON PIN

1. Place pilot plunger and spring in the support base to be used as a pilot and slug. See Fig. 6-122 insert for correct base support and pilot plunger for type pistons being serviced.

2. Place pilot plunger of tool J 6901 in piston pin bore and place on arbor press.

3. Coat piston pin and rod lightly with graphite lubricant.

4. Place tool J 6901-3 in piston pin and press pin into piston and connecting rod (Fig. 6-122) until piston pin bottoms against plunger of tool J 6901. Piston must turn freely on pin. If piston binds on pin, disassemble, hone piston pin bosses slightly and reassemble.

PISTON RINGS—REPLACE

1. Remove piston and rod assembly. See CONNECTING ROD AND PISTON ASSEMBLY—REMOVE AND REPLACE.

2. Remove piston rings using J 7117 or J 22553.

3. Clean carbon, varnish, and gum from piston surfaces, including under side of piston head. Clean ring grooves, and oil holes in oil ring groove, using suitable cleaning tools and solvent.

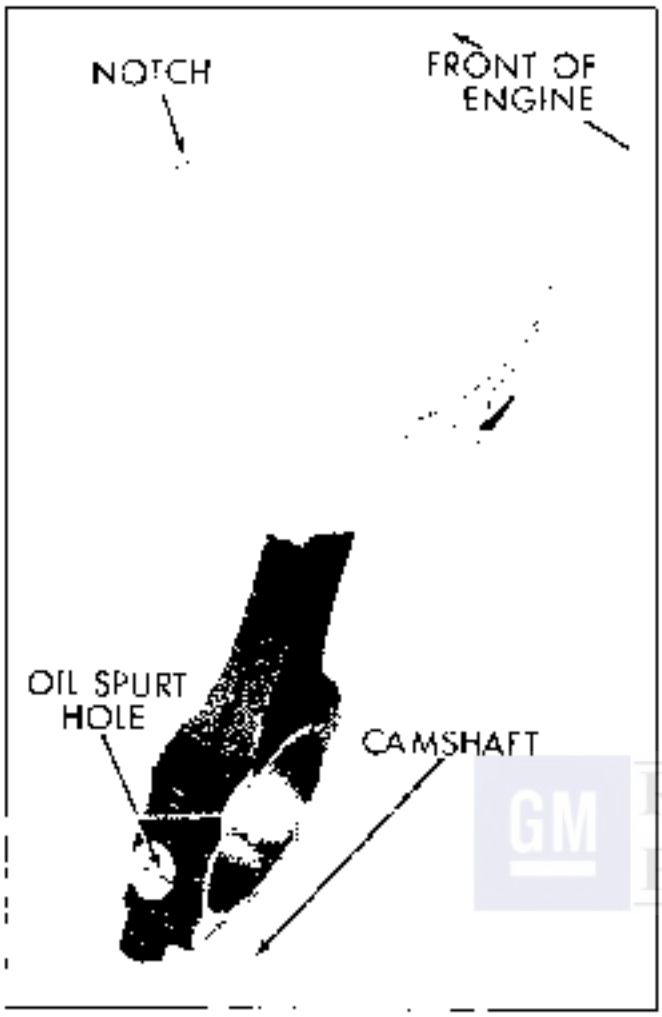


Fig. 6-121 Piston and Rod Assembly

4. Carefully examine piston for rough or scored bearing surfaces; cracks in skirt or head; cracked, broken, or worn ring lands; scored, galled, or worn piston bosses. Damaged or faulty pistons should be replaced.

5. Inspect bearing shells to see that they are serviceable. Fit of bearings should be checked when engine is being assembled.

6. Inspect cylinder bores for out-of-round or excessive taper. See CYLINDER BORES-INSPECT.

PISTON RING CHECK AND INSTALL ON PISTON

Two compression rings and one 3-piece oil control ring, all above the piston pin, are used on pistons for both standard and premium fuel engines. The compression rings are taper faced and also have either a step or chamfer on the inside diameter of the bottom side. The top compression ring is molybdenum filled, which results in the center section of ring sealing edge appearing porous or grainy. The

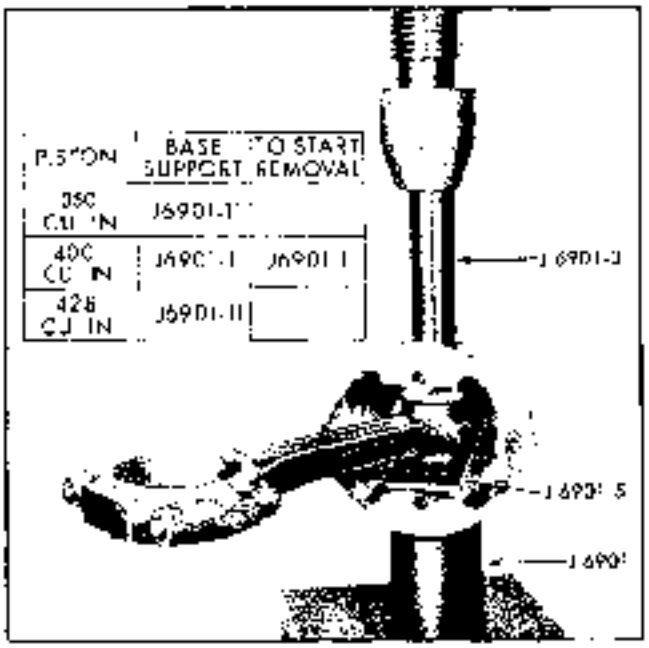


Fig. 6-122 Installing Piston Pin

lower compression ring varies depending upon the engine. See specifications Pg. 6.

Regardless of engine type, always install compression rings with the stamped markings toward the top of piston.

New rings are serviced for the standard size pistons, and for .005", .010", .020", and .030" oversize pistons. When selecting rings be sure they match the size of the piston on which they are to be installed, i.e., standard rings for standard pistons, .010" oversize rings for .010" oversize pistons, etc. Ring gap and side clearance should be checked while installing as follows:

1. Check pistons to see that ring grooves and oil return holes have been properly cleaned.

2. Place ring down at the bottom of the ring traveled part of the cylinder bore in which it will be used. Square ring in bore by pushing it into position with head of piston.

3. Measure gap between ends of ring with feeler gauge (Fig. 6-123). Gaps should be as follows:

Compression Ring	.010"-.030"
Oil Ring	.015"-.055"

Incorrect ring gap indicates that wrong size rings are being used. If rings are selected according to the size of the bore (standard .020" oversize, etc.), they should have the proper gap. It should not be necessary to alter ring gap by filing.

4. Install rings on piston, using J 22503 or J 7117 to prevent breakage or fracture of rings, or damage to pistons.

Fig. 6-123 Checking Ring Gap

5. Measure side clearance of rings in ring groove (Fig. 6-124) as each ring is installed. Clearance with new pistons and rings should be .0015"-.0050".

If side clearance is excessive, piston should be replaced.

CRANKSHAFT—CHECK

These checks are to be made with oil pan and baffle removed and with all main caps and rods installed and properly torqued.

1. Check endplay (Fig. 6-125). Using hammer, tap end of crankshaft at rear until it is tight against front of thrust bearing (No. 4 main bearing). Measure clearance between crankshaft counterweight and thrust bearing. Proper clearance is .003" to .009". If clearance is outside these limits, a new thrust bearing is required.

2. Check connecting rod side clearance. Using hammer, gently tap lower end of connecting rod

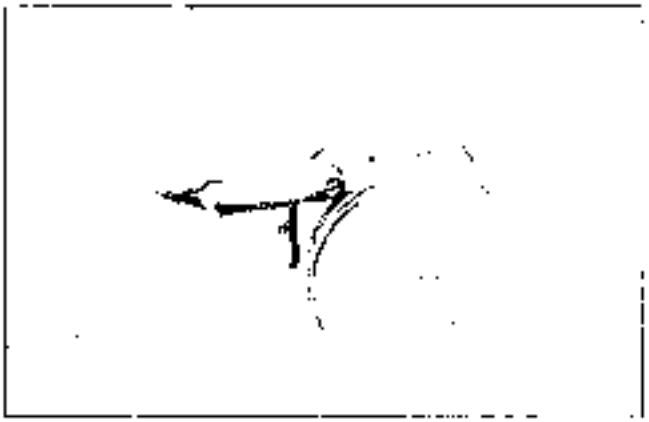


Fig. 6-124 Measuring Side Clearance of Ring in Groove

Fig. 6-125 Measuring Crankshaft End Play

toward front of engine. Measure clearance between rear of connecting rod and crankpin. Proper clearance is .006" to .011". If clearance is outside these limits, a new rod or rods is required.

CRANKSHAFT—REMOVE AND REPLACE

In order to remove the crankshaft the engine assembly must be removed from the vehicle.

The crankshaft can then be removed and replaced with cylinder heads, pistons, rods, manifolds and other upper engine components installed, but the flywheel, clutch and transmission assemblies must be removed.

REMOVE

1. Remove engine and clutch (SM) as an assembly. See ENGINE—REMOVE AND INSTALL.

2. Remove clutch (SM) and install engine on suitable stand.

3. Remove spark plugs.

4. Remove engine oil pan.

5. Remove oil pump assembly and oil pump drive shaft (Fig. 6-103).

6. Remove oil baffle and oil baffle tube.

7. Remove harmonic balancer.

8. Remove fuel pump.

9. Remove timing chain cover, gasket and O-ring seal.

10. Remove fuel pump eccentric and bushing (Fig. 6-95).

11. Remove sprockets and timing chain (Fig. 6-96).

12. Remove connecting rod caps.

NOTE: Mark connecting rod caps for proper reinstallation.

13. Remove main bearing caps from block.

NOTE: Before removing crankshaft tape threads of connecting rod bolts to prevent damage to crankshaft. Depress pistons until connecting rods are free of crankshaft.

14. Lift crankshaft from block.

REPLACE

1. With upper bearings installed, position crankshaft in block.

2. Install main bearing caps (with bearing shells in place) but do not tighten retaining bolts.

3. Pull connecting rods and piston assemblies into place, rotating crankshaft as necessary to properly seat rods.

NOTE: Make sure upper bearings remain in proper position.

4. Remove tape from connecting rod threads and install connecting rod caps (with bearings) and retaining nuts, but do not tighten.

5. Check fit of all main and rod bearings with plastigage and install proper sized new bearings.

6. Tighten rear main bearing cap to 130 lb. ft. torque and all remaining bearing caps 100 lb. ft. torque. Tighten connecting rod bearing cap retaining nuts 43 lb. ft. torque.

7. Install sprockets and timing chain, making sure timing marks on sprockets are aligned properly (Fig. 6-96).

8. Install fuel pump eccentric and bushing and insert sprocket retaining bolt with washer. Tighten securely.

9. Install timing chain cover, new cover gasket and new O-ring seal.

10. Install fuel pump.

11. Install harmonic balancer.

12. Install oil baffle and oil baffle tube.

13. Install oil pump drive shaft and oil pump assembly.

14. Install engine oil pan.

15. Install spark plugs.

16. Remove engine from stand and install clutch (SM) to engine.

17. Install complete assembly in vehicle.

ENGINE BLOCK CORE HOLE PLUGS AND OIL PASSAGE PLUGS, INSPECT AND REPLACE

Engine moving part failures may be caused by lack of proper lubrication. In such case it may be necessary to trace oil supply in the block to determine area of obstruction. Oil pressure drop may be caused by leaking oil passage plugs. For these reasons the following procedures and block illustrations are provided.

NOTE: Oil circulation diagram is provided in the engine lubrication section. Figs. 6-127, 6-128, and 6-129 also show the various location of water jacket core hole plugs.

a. With cylinder block inverted, use pen light to see that passage from oil pump to filter is open (Fig. 6-128).

b. Check passage from filter outlet to rear main bearing by inserting wire in oil filter outlet passage and using pen light to see that wire is visible in passage to rear main bearing (Fig. 6-128).

c. Visually check passage from each main bearing to corresponding camshaft bearing (Fig. 6-129).

d. Check passage from filter outlet (through left oil gallery) to main bearings. Use rubber hose to blow smoke in oil filter outlet while observing to see that smoke passes out passages leading to all main bearings.

e. With cylinder block right side up, check oil passages to left bank lifter bosses. Use rubber

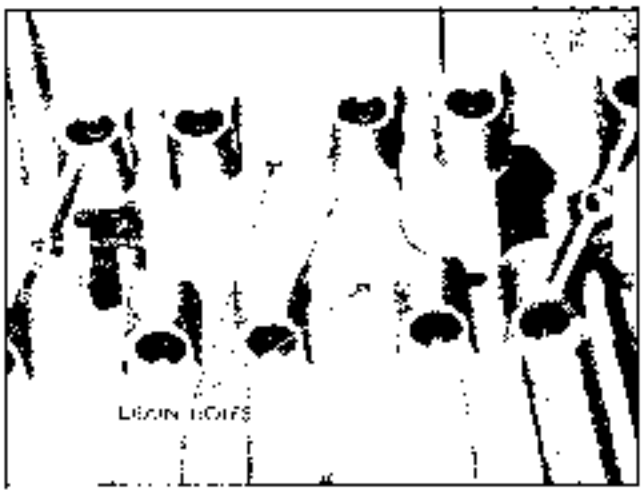


Fig. 6-128 Drain Holes & Lifter Gallery

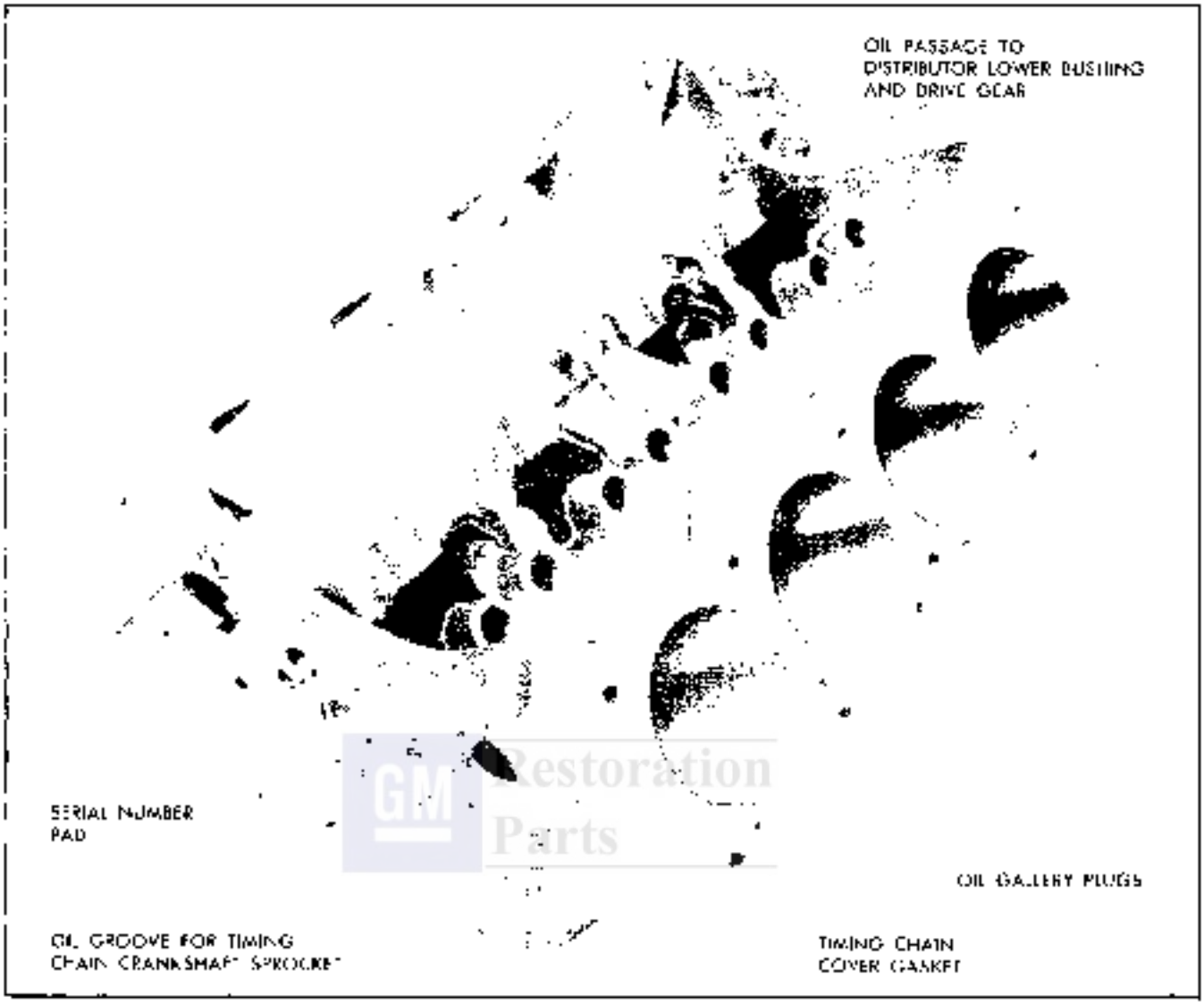


Fig. 6-127 Cylinder Block—View From Left Front

hose to blow smoke in oil filter outlet while serving for smoke passing out oil passages from left main oil gallery to lifter bosses (Fig. 6-127).

f. Check oil passages to right bank lifter bosses. Use rubber hose to blow smoke in passage from front main bearing to right main oil gallery while observing for smoke passing out passages from right gallery to lifter bosses (Fig. 6-126).

g. Use wire to check two drain holes in lifter gallery (Fig. 6-126).

INSTALL NEW PLUGS

The following plugs can be installed by driving into place, using a flat piece of metal or hard wood bearing against the outer surface: Camshaft plug, water jacket plugs, rear oil gallery plug in block, cylinder head and core hole plugs.

Front oil gallery plugs in the block must be driven into place, using a tool which bears against the bottom of the plug. A 1/2" x 3" bolt will make a satisfactory tool for this purpose.

All plugs should be driven in until the outer edge is flush with the surrounding surface.

FITTED BLOCK ASSEMBLY—REPLACE

Fitted block contains pistons, rings, pins and camshaft bearings.

DISASSEMBLE

1. Remove flywheel housing and clutch assembly.

2. Remove flywheel and mount engine in holding stand.

3. Remove motor mounts and linkage bracket.

4. Remove generator and mounting bracket.

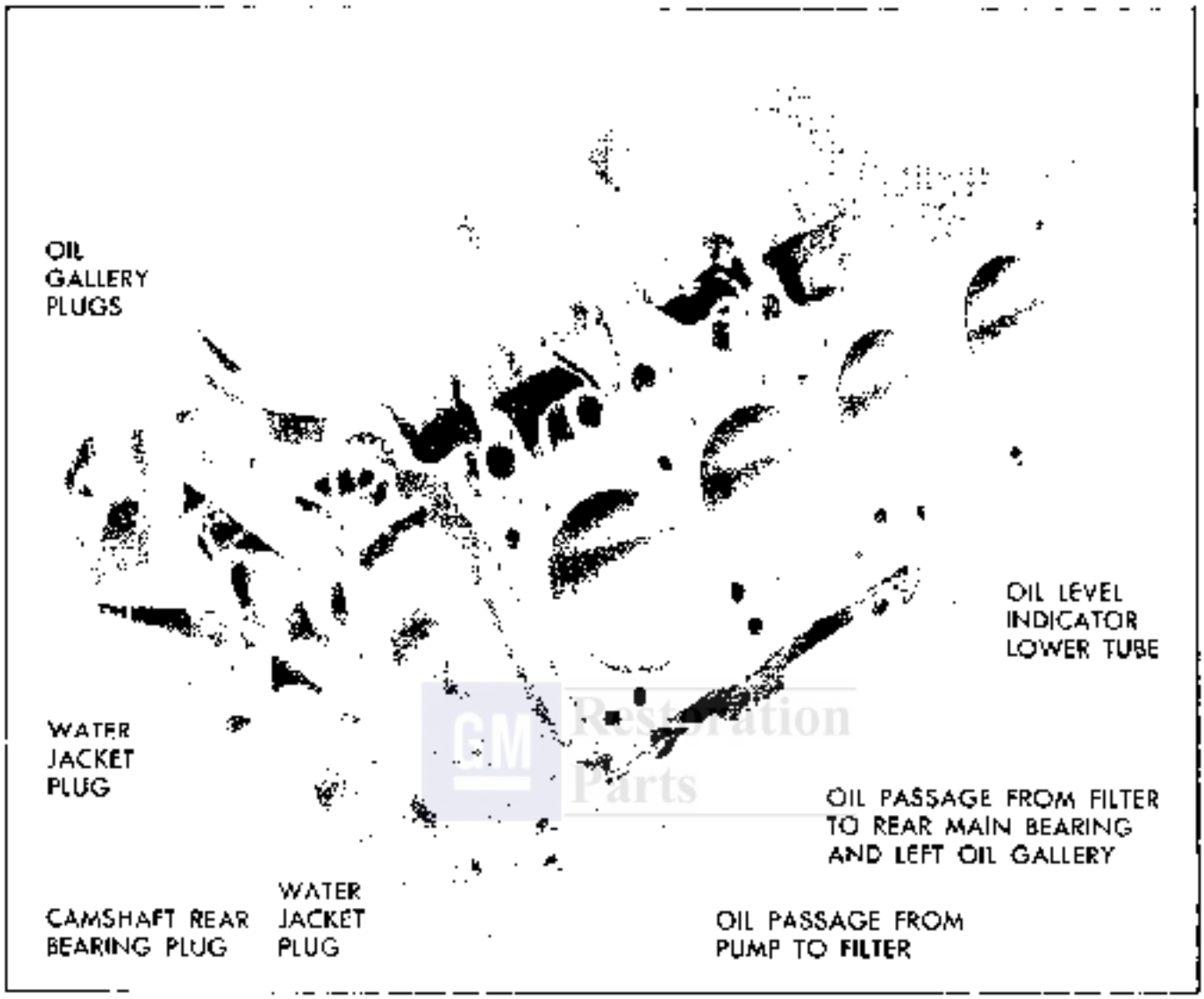


Fig. 6-12E Cylinder Block—View From Right Rear

5. Remove fuel pump.

6. Remove harmonic balancer.

7. Remove timing chain cover, fan and pulley. Remove timing cover mounting studs.

8. Remove fuel pump eccentric and bushing.

9. Slide timing chain and sprockets off end of camshaft and crankshaft.

10. Remove camshaft thrust plate.

11. Remove distributor and high tension wires.

12. Remove coil.

13. Remove starter assembly.

14. Remove intake manifold.

15. Remove push rod cover.

16. Remove oil level indicator.

17. Remove rocker arm covers.

18. Loosen rocker arm nuts, rotate rocker arms and remove push rods. Store push rods so that they may be reinstalled in the same position as removed.

19. Remove cylinder heads and exhaust manifolds.

20. Remove cylinder head gaskets.

21. Remove oil filter assembly.

22. Remove valve lifters; use J 3049 if necessary.

Place valve lifters in a storage box so lifters can be reinstalled in original location.

23. Remove camshaft.

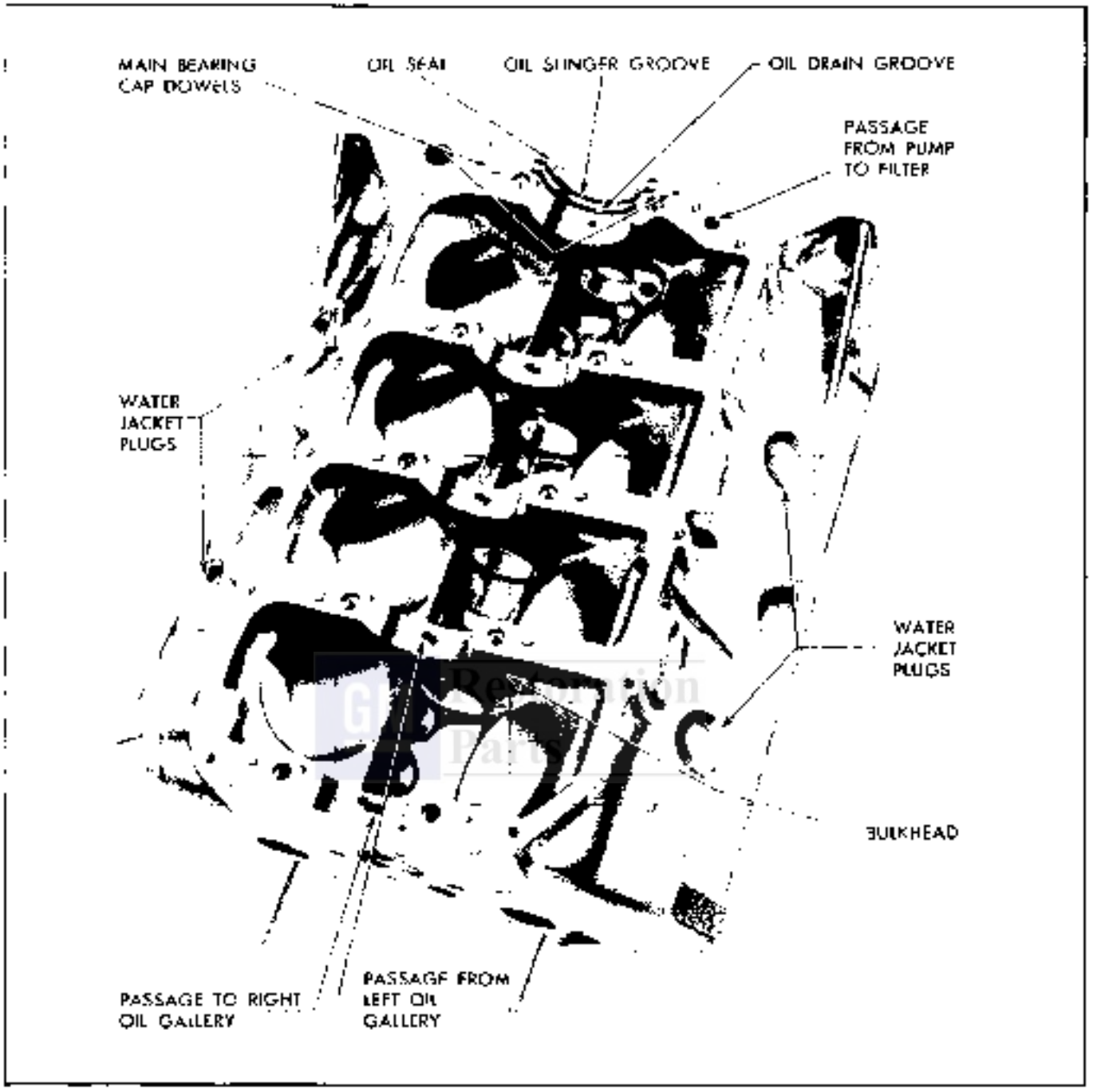


Fig. 6-129 Cylinder Block—View From Bottom

24. Invert engine and remove oil pan and flywheel front cover.

25. Remove oil pump assembly and drive shaft.

26. Remove baffle and oil indicator tube extension.

27. Remove crankshaft.

28. Remove all connecting rod and piston assemblies.

29. Remove connecting rods from pistons and identify for installation in original location.

30. Remove old block from stand and mount new fitted block on stand.

31. Remove each piston and pin assembly from new block and identify for installation in original position.

This completes disassembly for fitted block replacement. Proceed with assembly operations. Use

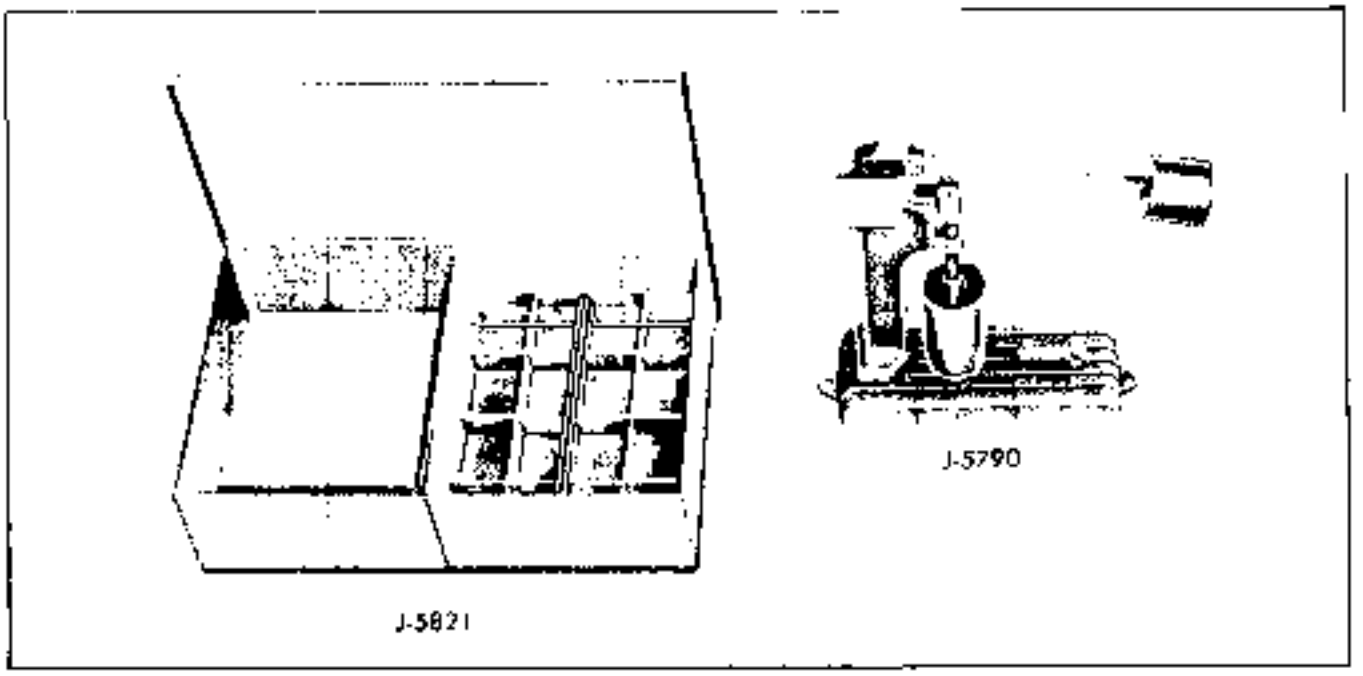


Fig. 6-139 Hydraulic Lifter Equipment

new gaskets throughout and pay special attention to torque requirements.

ASSEMBLE

1. Install old connecting rods to proper piston and pin assemblies and install in cylinder from which pistons were removed.

2. Install crankshaft and plastigage bearings.

3. Install two timing cover mounting studs.

4. Install camshaft, using care not to damage bearings.

5. Install camshaft thrust plate indexing oiling slot in plate with oil groove in block.

6. Make sure keys are in place in crankshaft and camshaft. Install timing chain and sprockets, making sure marks in sprockets are aligned exactly on a straight line passing through shaft centers. Alignment can be simplified by first installing sprockets without chain to align timing marks. If timing chain is excessively loose, new chain or new chain and sprockets should be used.

7. Position fuel pump eccentric bushing over eccentric with flange toward camshaft sprocket.

8. Install fuel pump eccentric and bushing on camshaft sprocket, indexing tang on eccentric with keyway cut-out in camshaft sprocket.

9. Position timing cover gasket over mounting studs and dowels on block.

10. Install timing cover, water pump, fan and pulley. Do not install stud nuts at this time.

11. Slide harmonic balancer onto crankshaft, and install harmonic balancer to crankshaft bolt and washer. Place hammer handle between block and crankshaft counterweight to keep crankshaft from turning and tighten harmonic balancer to crankshaft bolt 160 lb. ft. torque.

12. Install baffle and oil indicator tube extension.

13. Insert oil pump drive shaft with dimpled end towards block.

14. Install oil pump gasket.

15. Cement new gaskets to oil pan and rear main bearing cap; use retainers to hold gasket. Install oil pan except for two rear screws. Position flywheel housing front shield and gasket against oil pan and install two rear oil pan bolts.

16. Position new cylinder head gasket on block.

17. Position cylinder heads and exhaust manifolds on locating pins. Install head bolts and torque to 95 lb. ft.

NOTE: Three different length bolts are used. When inserted in proper holes, all will project an equal amount from their respective bosses.

18. Install lifters in bosses from which they were removed.

19. Install push rods in same location as originally removed and with same end facing valve lifter.

20. Tighten rocker arm ball retaining nuts to 30 lb. ft. torque.

21. Install distributor as follows:

a. Turn crankshaft to firing position of number one cylinder (number one exhaust and intake valve lifters both on base circles of their cams and timing mark on harmonic balancer indexed with pointer). NOTE: Number one intake must have just closed.

b. Position new distributor to block gasket on block.

c. Install distributor (without cap and wires) so that vacuum diaphragm faces left side of engine and rotor arm points toward contact in cap for number one cylinder. It will also be necessary to turn the oil pump drive shaft so it will index with distributor shaft.

22. Install distributor hold-down clamp and special bolt and tighten enough to hold distributor in place.

23. Install coil.

24. Cement new gasket to push rod cover and install push rod cover.

25. Cement new gaskets to rocker arm covers and install covers.

26. Install intake manifold gasket with plastic locating sleeves in cylinder head as shown in Fig. 6-77.

27. Start intake manifold to timing cover draw bolt into intake manifold.

28. Position intake manifold and install retaining screws finger tight.

29. Tighten draw bolt to 15 lb. ft. torque to obtain metal to metal contact between manifold and timing cover.

30. Tighten manifold screws to 40 lb. ft. torque.

31. Install oil filter assembly and gasket.

32. Install oil level indicator.

33. Install throttle linkage.

34. Install starter assembly.

35. Install fuel pump.

36. Install generator and bracket.

37. Install fan belt and adjust belt tension as covered in Section 6A.

V-8 ENGINE WRENCH TORQUE SPECIFICATIONS

NOTE: Torque in lb. ft. unless otherwise shown.

Application	Torque Lb.-Ft.
Bolt - Main Bearing Cap to Block	100
Bolt - Rear Main Bearing Cap to Block	120
Bolt - Cylinder Head	95
Bolt - Flywheel to Crankshaft	95
Nut - Connecting Rod Bearing Cap	43
Bolt - Oil Pan to Block	12
Bolt - Oil Pump to Block	30

Application	Torque Lb.-Ft.
Bolt - Exhaust Manifold to Head	30
Bolt - Intake Manifold to Head	40
Bolt - Camshaft to Sprocket	40
Nut - Rocker Arm to Stud	20
Stud - Rocker Arm	50
Spark Plug to Head	20

V-8 ENGINE SPECIFICATIONS

Type	90° V-8 O.H. Valve
Bore and Stroke	
(350 cu. in.)	3-7/8" x 3-3/4"
(400 cu. in.)	4.120" x 3-3/4"
(428 cu. in.)	4.120" x 4"
Taxable Horsepower	
(350 cu. in.)	44.3
(400 cu. in.)	54.3
(428 cu. in.)	54.3

HORSEPOWER AND TORQUE

Engine	Carburetor	Compression Ratio	Horsepower	Torque
350	2-BBL	9.2	265 @ 4600	355 @ 2800
350	Q-Jet	10.5	320 @ 5100	380 @ 3200
400 (Tempest)	2-BBL	8.6	255 @ 4600	397 @ 2400
400 (Tempest)	Q-Jet	10.75	350 @ 5000	445 @ 3000
400 HO (Tempest)	Q-Jet	10.75	360 @ 5100	445 @ 3600
400 Ram-Air (Tempest)	Q-Jet	10.75	350 @ 5400	445 @ 3800
400 (Firebird)	Q-Jet	10.75	330 @ 4800	430 @ 3300
400 HO (Firebird)	Q-Jet	10.75	335 @ 5000	430 @ 3400
400 Ram-Air (Firebird)	Q-Jet	10.75	335 @ 5300	430 @ 3600
400	2-BBL	8.6	265 @ 4400	397 @ 2400
400	2-BBL	10.5	290 @ 4600	428 @ 2600
400 MT & AT	Q-Jet	10.5	340 @ 4800	445 @ 2900
400 GP MT & AT	Q-Jet	10.5	350 @ 5000	445 @ 3000
428	Q-Jet	10.5	375 @ 4800	472 @ 3200
428 HO	Q-Jet	10.75	390 @ 5200	465 @ 3400

Compression Pressure at Cranking Speed	
(8.6:1 and 9.2:1 Compression Ratio-Regular Fuel)	150-170 PSI @ 155-165 RPM
Compression Pressure at Cranking Speed	
(10.5:1 Compression Ratio-Premium Fuel)	
(10.75:1 Compression Ratio-GTO & 428 HO)	185-210 PSI @ 155-165 RPM
Firing Order	1-8-4-3-6-5-7-2
Car-Engine Serial No. Location	Front Face of Right Cylinder Bank
Production Engine No. Location	Front Face of Right Cylinder Bank
Cylinder Nos.-Front to Rear	
Left Bank	1-3-5-7
Right Bank	2-4-6-8
Cylinder Block	
Material	Alloy Cast Iron
Inclination Angle	
Pontiac	4°
Tempest	4° 42'
Firebird	3° 35'
Cylinder Heads	
Material	Alloy Cast Iron
Combustion Chamber	Quenchless Type - Fully Machined

Pistons

Material	Tin-Plated Aluminum Alloy
Type	Cam and Contour Ground - Slipper Skirt
Measurement Taken At*	Top of Skirt
Clearance in Cylinder	
350 and 400	.0025" - .0021"
428	.0030" - .0026"

Piston Rings

	Upper	Lower
Compression Rings	Two Cast Iron, Reverse Twist, Taper Face	
Material		
350	Chrome Moly Filled	Tin-Plated
400 GTO, Firebird 400 and 400 R.A.	Chrome Moly Filled	Chrome Moly Filled
400 Pontiac	Chrome Moly Filled	Tin-Plated
428	Chrome Moly Filled	Tin Plated
428 H.O.	Chrome Moly Filled	Chrome Moly Filled
Oil Ring	Three-Piece	
Material		
Rails (2)	Chrome-Plated Steel	
Expander	Stainless Steel	
Ring Gap		
Compression (4.010)	.020"	
Oil (4.020)	.030"	
Side Clearance (Ring to Groove)	.0015"-.003"	

Piston Pin

Material	Extruded SAE 1018 Steel
Diameter	.9902"
Wall Thickness	.38"
Length	3.25"
Fit in Piston	.0005" - .0007"
Fit in Rod	Press

Connecting Rod

Material	Arco Steel
Weight (oz.)	31.7
Length (Center to Center)	6.625"
Bearings	
Length	.98"
Clearance	.0005"-.0025"
Material	
Standard	Moraine 400-A
GTO Firebird 400 and 428	Moraine 400-A
Endplay on Crankshaft	.006"-.011"

Timing

Camshaft	9771264	9779067	9779068	9779388	9785744
Intake					
Opens (BTC)	22	23°	30°	31°	38
Closes (ABC)	67	70°	60°	77°	83
Duration	269	273	273	288	301
Lift - Standard	.375"	.407"	.407"	-	-
GTO, GP, 428	-	.410"	.410"	.414"	.413"
Exhaust					
Opens (BBC)	72°	76	77	90	95
Closes (ATC)	25	31	25	32	36
Duration	277	289	282	302	313
Lift					
Standard	.413"	.411"	.412"	-	-
GTO, GP, 428	-	.413"	.414"	.413"	.413"
Valve Overlap	47°	54°	55°	63	76°

Valve Springs

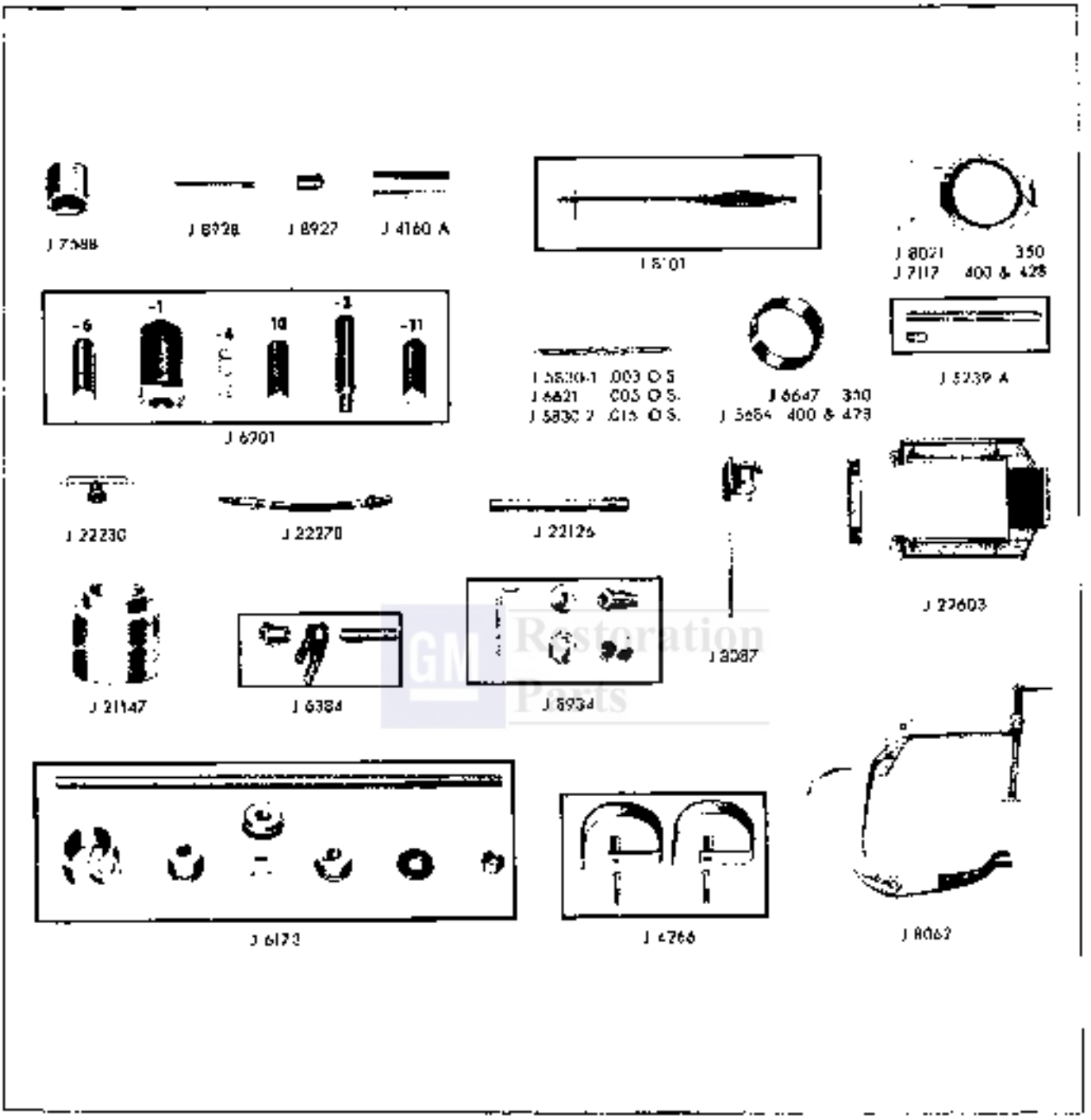
Pressure @ Length	Standard	GTO MT	GTO RAM-AIR	428 H.O. MT
	PSI	PSI	PSI	PSI
Outer	135-145 @ 1.134"	135-145 @ 1.134"	244-260 @ 1.134"	135-145 @ 1.134"
	59-65 @ 1.586"	59-65 @ 1.586"	98-108 @ 1.582"	59-65 @ 1.586"
Inner	99-105 @ 1.114"	118-128 @ 1.114"		118-128 @ 1.114"
	28-34 @ 1.566"	48-53 @ 1.566"		48-53 @ 1.566"

Valves
- Material
  - Intake (H.O. and R.A.) — GM 8440 Steel with Aluminized Face and Flash Chrome Stem
  - Intake (Standard) — SAE 3041 Steel with Aluminized Face and Flash Chrome Stem
  - Exhaust (Standard) — 21-2N Steel with Aluminized Face and Flash Chrome Plated Stem
  - Exhaust (H.O. and R.A.) — 21-2N Steel with Aluminized-Swirl Polished Face and Chrome Plated Stem
- Diameter of Head
  - Intake
    - Standard — 1.91"
    - GTO, GP, 428, H.O. and R.A. — 2.06"
  - Exhaust
    - Standard — 1.61"
    - GTO, GP, 428, H.O. and R.A. — 1.72"
- Overall Length
  - Intake
    - 350 2-Bbl — 5.02"
    - 350 4-Bbl — 5.12"
    - GTO and H.O. — 5.09"
    - 400 Reg. Fuel — 4.99"
    - 400 Prem. Fuel and R.A. — 5.08"
    - GP & 428 and H.O. — 5.09"
  - Exhaust
    - 350 2-Bbl — 5.01"
    - 350 4-Bbl — 5.19"
    - GTO and H.O. — 5.08"
    - 400 Reg. Fuel — 4.98"
    - 400 Prem. Fuel and R.A. — 5.07"
    - GP & 428 and H.O. — 5.08"
- Diameter of Stem — .34"
- Stem to Guide Clearance
  - Intake — .0016"-.0033"
  - Exhaust — .0021"-.0038"
- Valve Seat Angle
  - Intake — 30°
  - Exhaust — 45°
- Valve Face Angle
  - Intake — 29°
  - Exhaust — 44°

Crankshaft
- Material
  - 350 and 400 — Pearlitic Malleable Iron
  - 428 — Pearlitic Malleable Iron
- No. of Bearings — 5
- Main Bearing Material
  - 350 — Durex 100-A
  - GTO and Firebird 400 Upper and #5 Lower — Durex 100-A
  - GTO and Firebird 400 Lower Exc. #5 — Moraine 400-A
  - Pontiac 400 Exc. #4 Lower — Durex 100-A
  - Pontiac 400 #4 Lower — Moraine 400-A
  - 428 — Moraine 400-A
- Thrust Taken On — No. 4
- Crankshaft Endplay — .003"-.009"
- Journal Diameter
  - 350 and 400 — 3.00"
  - 428 — 3.25"
- Main Bearing Length
  - Nos. 1, 2, 3 — .94"
  - No. 4-350 & 400 — 1.13"
  - No. 4-428 — 1.19"
  - No. 5 — 1.39"
- Clearance — .0002"-.0020"
- Crankpin Diameter — 2.25

Flywheel and Sprockets
- Flywheel
  - Material
    - Manual — Cast Iron
    - Automatic — Stamped Steel
  - No. of Teeth — 166

Starter Motor Drive	
No. of Teeth	9
Crankshaft Sprocket	
Material	Carburized and Hardened Steel
No. of Teeth	21
Camshaft Sprocket	
Material	Aluminum Alloy with Nylon Covered Teeth
No. of Teeth	42
Timing Chain	Link Type - Single Side Guide
No. of Links	60
Harmonic Balancer	Cast Iron with Bolt on Stamped Pulley
Camshaft	
Material	Hardened Alloy Cast Iron
Bearings	
Number	5
Type	Steel Backed Babbitt
Diameter-All	1.9"
Valve System	
Valve Lifter	
Type	Hydraulic
Leak-Down Rate	20-90 Sec. with 50 Lb. Load
Plunger Travel (For Gauging Purposes)	.125"
Pushrod	
Material	Steel Tubing
Length	
Standard	8.72"
GTO, & Firebird 400 OP, & 428	9.36"
Rocker Arm	
Material	Stamped Steel
Ratio	1.5 to 1
Rocker Arm Stud	
Standard	Pressed in to Head
GTO, & Firebird 400, OP, & 400 & 400 S.A	Screwed in to Head
Lubrication System	
Type of Lubrication	
Main Bearings	Pressure
Connecting Rods	Pressure
Piston Pins	Splash
Camshaft Bearings	Pressure
Lifters & Rocker Arms	Pressure
Timing Gears & Chain	Metered Jet
Cylinder Walls	Metered Jet
Oil Pump	
Type	Spur Gear
Oil Pickup	Stationary Screen
Pressure	
Standard	30-40 @ 2600 RPM
GTO & 428	45-50 @ 2600 RPM
Oil Capacity	5 Qts.
with Filter	6 Qts.
Fuel System	
Fuel Pump Pressure (PSI)	5.0-6.5 PSI
Fuel Filter	Sintered Bronze on 2 BBL Pleated Paper on Q'Jet
Carburetor	
Type	
2-Bbl	Rochester 2 GC
4 Bbl	Rochester Quadrajet
Barrel Size	
2-Bbl	1.688"
Q'Jet	1.375" Primary, 2.250 Secondary
Cooling System	
Radiator Cap Pressure (PSI)	14-17
Thermostat Opens At	190 F
Water Pump Rate (GPM)	17



J 4160-A Hydraulic Valve Lifter Plunger Remover
J 4266 Cylinder Head Lifting Tools
J 5239-A Connecting Rod Bolt Guide Set
J 5684 Piston Ring Compressor - 400-428
J 5830 Valve Guide Reamer .003 O.S.
J 5830-1 Valve Guide Reamer .015 O.S.
J 6173 Camshaft Bearing Remover and Replacer
J 6384 Valve Spring Compressor Set
J 6821 Valve Guide Reamer .005 O.S.
J 6647 Piston Ring Compressor - 350
J 6701 Piston Pin Remove and Replace Set
J 7117 Piston Ring Remove and Replace Tool 400-428
J 7588 Rear Main Bearing Oil Seal Installer
J 8021 Piston Ring Remove & Replace Tool - 350
J 8062 Valve Spring Compressor
J 8087 Cylinder Bore Gauge
J 8101 Valve Guide Cleaner
J 8127 Rocker Arm Stud Installer
J 8728 Valve Train Gauge
J 8934 Rocker Arm Stud Remover
J 21147 Timing Chain Cover Seal Installer
J 22126 Rocker Arm Stud Reamer .005 O.S.
J 22230 Valve Seat Installer and Tester
J 22278 Adapter - Air Line
J 22603 Engine Lifting Tool

Fig. 5-131 V-8 Special Engine Tools

ENGINE COOLING AND LUBRICATION

CONTENTS OF THIS SECTION

GENERAL DESCRIPTION

ENGINE COOLING SYSTEM

The cooling system consists of the radiator, cap, radiator hoses, water pump, cooling fan, pellet-type thermostat and suitable passages for water circulation through the engine.

RADIATOR—ALL MODELS

A cross-flow radiator is used on all 1968 Pontiacs instead of the conventional down-flow type. The cross-flow radiator differs in the fact that water flows horizontally and the tanks are on the left and right side of the core instead of above and below the core.

The cross-flow radiator offers improved cooling capabilities while making possible a lower front end silhouette due to its reduced height. The low, wide shape of the cross-flow radiator matches the grille opening more efficiently, providing greater radiator exposure and more effective cooling surface.

Radiators used with automatic transmission have oil coolers built into the right tank with inlet and outlet fittings for circulation of transmission fluid. The Pontiac radiator used with automatic transmission is equipped with heavy duty oil cooler when used on police cars, trailer options, etc., and as optional equipment where extreme cooling conditions must be met.

The radiator used with the synchromesh transmission is a cross-flow without oil cooler. Cars equipped with air conditioning and performance options use a radiator which has more cooling capacity for greater cooling demands.

A drain cock is located at inside lower left corner of radiator.

RADIATOR CAP

A pressure-vent cap is used on the radiator to allow a build-up of 15 psi of pressure in the cooling system. This pressure raises the boiling point of coolant to approximately 258°F. at sea level.

CAUTION: As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in radiator without causing the solution to boil. Removal of the radiator cap while engine is hot and pressure is high will cause the solution to boil instantaneously and possibly with explosive force, spewing the solution over engine, fenders, and person removing cap. If the solution contains inflammable anti-freeze, such as alcohol, there is also the possibility of causing a serious fire. When removing filler cap, rotate cap toward left very slowly; if hissing of vapor is encountered tighten cap immediately and wait for system to cool sufficiently to allow removal of cap. After pressure in system has been relieved, turn cap more forcibly to left and remove. Turn cap all the way to right when installing. It should not be necessary to check coolant level unless temperature gauge shows over-heating, and then not until engine is stopped and allowed to cool to normal.

The pressure type radiator filler cap contains a blow off or pressure valve and a vacuum or atmospheric valve. The pressure valve is held against its seat by a spring of pre-determined strength which protects the radiator by relieving the pressure if an extreme case of internal pressure should exceed that for which the cooling system is designed. The vacuum valve is held against its seat by a light spring which permits opening of the valve to relieve vacuum created in the system when it cools off and which otherwise might cause the radiator to collapse.

WATER PUMP—8 CYLINDER

The centrifugal-type water pump, divider, internal housing and aluminum timing chain cover are all part of the coolant circulation system.

The water pump impeller turns on a steel shaft mounted on a double row of permanently lubricated, sealed ball bearings. A bellows-type seal is seated in the water pump body between bearing and impeller. The seal surface is a phenolic washer which is held by the spring-loaded bellows against a ceramic seal seat which seals the pump shaft via a rubber boot.

The inlet side of the pump is connected to the lower radiator tank by means of a hose. A water leg in intake manifold connects to the timing chain cover to provide recirculation of water when the thermostat is closed. The timing chain cover also has a heater water return connection.

WATER PUMP—6 CYLINDER

The centrifugal-type water pump contains an impeller which turns on a steel shaft which rotates in a ball bearing. A bellows- type seal is seated in the water pump body between the bearing and impeller.

The inlet side of the pump is connected to the right radiator tank by a hose. Above the pump inlet from the radiator is the inlet from the heater core. Located beneath the coolant outlet at the side of the rocker arm cover is the recirculation hose which connects to the inlet side of the pump.

FAN

The fan is used to increase the air flow through the radiator at all speeds.

All cars except G.T.O., 428 H.O. and air conditioned cars have a fan which has four blades which are unevenly spaced and have curled tips to provide minimum noise. A seven bladed fan is used on cars with air conditioners. A variable pitch fan is used on A/C equipped 8-cylinder cars and on G.T.O. and 428 H.O. cars without air conditioning.

A fan shroud is used to prevent recirculation of air around the fan on most air conditioned cars and a number of non-air conditioned cars.

The thermostatically controlled fan is used on most V-8's with A/C, along with a seven bladed fan. The fan clutch is also available as an option on V-6 engines, except the Ram-Air engine.

SERVICE OPERATIONS

CHECKING AND FILLING COOLING SYSTEM

The Pontiac and Tempest cooling system requires little care except for maintaining an adequate coolant level. If GM glycol-type inhibited engine coolant is used, it is not necessary to drain the coolant for summer driving because this coolant has been especially formulated to last 24 months in the cooling system. After service for 24 months, drain the system, flush it with water, and refill with an inhibited year-round coolant meeting the GM 1899M specification. If other than Pontiac-approved inhibited glycol-type antifreeze solution is used, the cooling system should be drained, flushed and refilled for the summer months. When water is used, a good corrosion inhibitor must be added to the system. Failure to use an inhibited coolant may result in severe corrosion damage to the cooling system components.

FLUSHING COOLING SYSTEM

1. Drain radiator and block by opening drain plug on radiator left tank and removing plug on left side of 6 cylinder engine block and on both sides of 8 cylinder engine block.

2. After system is empty, with drains open, run water into radiator. Engine should be running and occasionally accelerated to aid in circulating water and dislodge rust and scale.

CAUTION: Do not introduce cold water into a hot engine or block may be cracked. Allow engine to cool, then add water with engine running.

3. Where there is difficulty in getting water to run clear or there is an excessive amount of rust and scale, the cooling system should be cleaned with a cleanser (reputable source) supplied for that purpose. If force-flushing equipment is used it should be used on the radiator only (engine to radiator inlet and outlet hoses removed) as any reverse flushing of the block with the water pump in place may cause the water pump seal to leak, if flushing pressure is excessive.

PREPARING COOLING SYSTEM FOR COOLANT

The cooling system should be properly prepared for the addition of coolant every two years.

To properly prepare cooling system:

1. Bring engine up to operating temperature.

2. Flush out cooling system as indicated previously.

3. Tighten all hose connections on radiator, engine, heater and defroster. Replace any deteriorated hose. Check to see that radiator hold-down bolts are tightened properly.

4. Fill system with water and operate engine, checking for water leaks at radiator core, hose connections, water pump seal and gaskets, heater and defroster connections, and head to block joint.

5. Drain sufficient water to allow addition of proper quantity of coolant.

Do not overfill. Coolant should be 1" below filler neck opening with hot engine, 3" below filler neck with cold engine for all models.

CAUTION: A pressure radiator cap is used to provide the best cooling. When removing, rotate cap to left very slowly. If hissing noise is heard, stop and allow pressure to decrease before removing cap completely.

To assure most effective heater performance, all models are equipped with a 160°F. thermostat. Therefore, the use of Pontiac-approved inhibited glycol-type engine coolant gives best heater performance.

Non-glycol base coolant should not be used.

INHIBITORS

When only water is in the system, a cooling system corrosion inhibitor must be used.

TESTING COOLANT

In using a hydrometer to determine the freezing point of radiator solution, make sure correct hydrometer markings are read. Unless hydrometer is provided with means for temperature correction, test should be made at temperature at which hydrometer is calibrated, for if the solution is warmer or colder large errors may result (in some cases as much as 30°F.) Most good hydrometers are equipped with a thermometer and temperature correction scale which allows an accurate test of freezing point over a range of temperatures.

THERMOSTAT—REMOVE AND REPLACE

1. Drain radiator level to below thermostat and remove water outlet assembly from rocker arm cover (6 cyl.), intake manifold (8 cyl.).

2. Remove thermostat. Unless obviously defective, test thermostat as follows before replacing with new one:

a. Immerse unit and thermometer in container of water over a heater. While heating water do not rest either thermometer or thermostat on bottom of container as this will cause them to be at higher temperature than the water.

b. Agitate water to insure uniform temperature of water, thermostat and thermometer.

A new thermostat (190°) valve should start to open (.002") at a temperature of 187°F. to 193°F., and should be fully open (3/8") or more at a temperature not in excess of 222°F. A used thermostat can be about 7°F. above or below this setting (192° - 167°F.) without adverse effect and should not be replaced. If thermostat does not operate at specified temperatures, it should be replaced as it cannot be adjusted.

3. Install thermostat with pellet or cartridge projecting down into water passage.

4. Using new gasket, install water outlet fitting. Tighten bolts to 21 lb. ft. (6 cyl.), 28 lb. ft. (8 cyl.).

5. Refill radiator to approximately 3" below filler neck for all models.

WATER PUMP—8 CYLINDER

NOTE: Water pump is serviced only as an assembly.

1. Drain radiator.

2. Loosen generator at adjusting strap and remove fan belt from fan pulley.

3. Remove fan and pulley.

4. Remove water pump retaining bolts and remove pump.

5. Install pump by reversing above steps. Tighten water pump attaching bolts to 15 lb. ft. torque. Adjust belt for proper tension on chart at end of this section.

WATER PUMP—6 CYLINDER

REMOVE

1. Drain cooling system and remove water inlet and heater hoses.

2. Remove all fan and accessory drive belts.

3. Remove fan and pump pulley.

4. Remove upper front timing belt cover.

5. Remove two front bolts attaching accessory drive housing to block.

6. Remove water pump to cylinder block attaching nuts and bolts and remove pump from engine.

REPLACE

1. Install pump and attaching nuts and bolts. Tighten to 20 lb. ft. torque.

2. Replace cover and two front accessory drive attaching bolts. Tighten bolts to 15 lb. ft. torque.

3. Replace upper front timing belt cover.

4. Replace fan and pump pulley.

5. Install all fan and accessory drive belts.

6. Install water inlet and heater hoses on water pump.

7. Refill cooling system with coolant.

RADIATOR—PONTIAC AND TEMPEST—REMOVE AND REPLACE (Figs. 6A-1 & 6A-2)

1. Drain radiator.

2. Remove fan shield assembly.

3. Disconnect upper and lower radiator hoses.

4. On vehicles equipped with automatic transmission, disconnect and plug transmission cooler lines.

5. Remove fan shroud where applicable.

6. Remove radiator assembly by lifting straight up.

NOTE: The radiator assembly is held at bottom by two "cradles" secured to the radiator support.

7. If installing new radiator, transfer fittings from old radiator to new radiator.

8. Replace radiator assembly by reversing the above steps checking to assure radiator lower "cradles" are located properly in radiator recess.

9. Refill radiator. Run engine for a short period of time and check for leaks. If Automatic transmission radiator, recheck transmission oil level.

RADIATOR—FIREBIRD—REMOVE AND REPLACE (Fig. 6A-3)

REMOVE

1. Disconnect positive battery cable.

2. Open drain cock at bottom of radiator and drain radiator and cylinder block. Remove filler cap so coolant will flow freely.

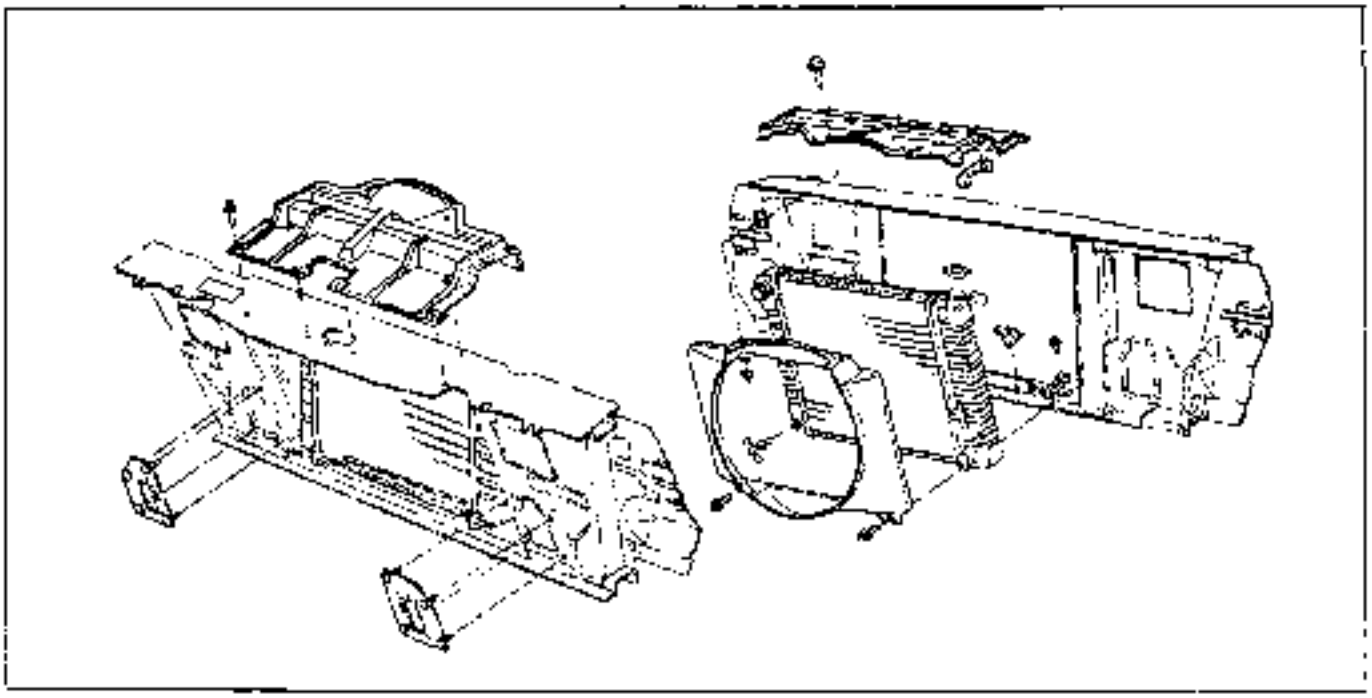


Fig. 6A-1 Radiator Support and Baffle Assembly - Pontiac

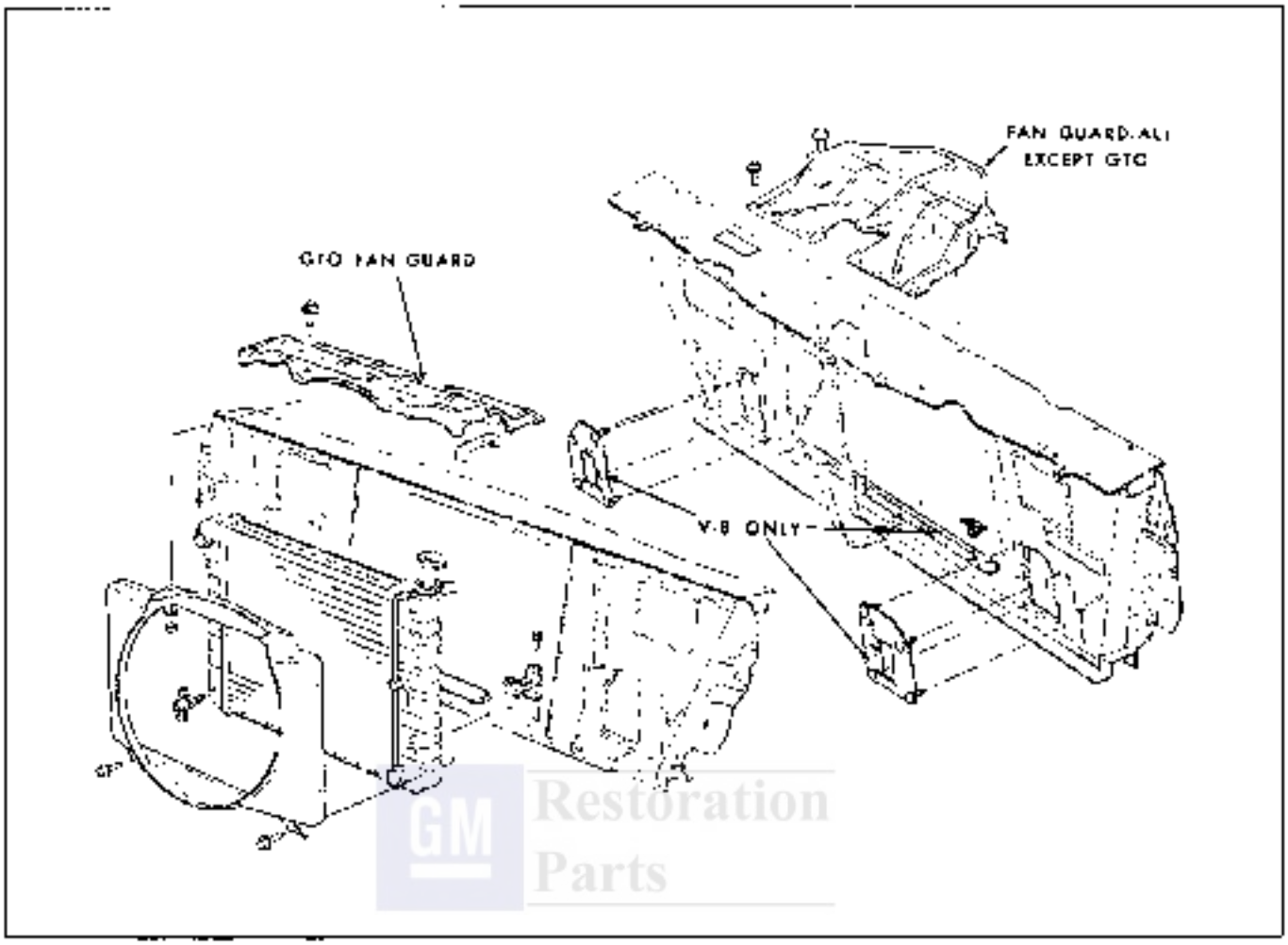


Fig. 6A-2 Radiator Support and Baffle Assembly - Tempest

NOTE: To save coolant remove radiator overflow hose and connect to drain cock.

3. Loosen hose clamps and disconnect upper and lower radiator hoses at radiator inlet and outlet pipes.

4. On cars equipped with automatic transmissions, disconnect and plug the transmission cooler lines.

5. Remove upper fan shield (six cylinder) or upper shroud bracket (V-8).

6. Remove radiator attaching screws and lift radiator and shroud out of vehicle.

REPLACE

1. Replace radiator by reversing the above procedure.

2. Torque all mounting screws to 12 lb. ft.

3. Refill radiator with enough coolant to ensure all weather corrosion protection. (-20°F protection).

ENGINE OIL

See GENERAL LUBRICATION SECTION.

OIL PUMP

See SECTION 6 (ENGINE MECHANICAL)

OIL FILTER

A full flow filter is standard on all engines and is mounted on the front side of the accessory drive housing on six cylinder engines and the right rear of the engine block on V-8 engines.

6 CYL. AND 8 CYL.—REMOVE AND REPLACE

Install a new oil filter at the first oil change and then every other oil change thereafter.

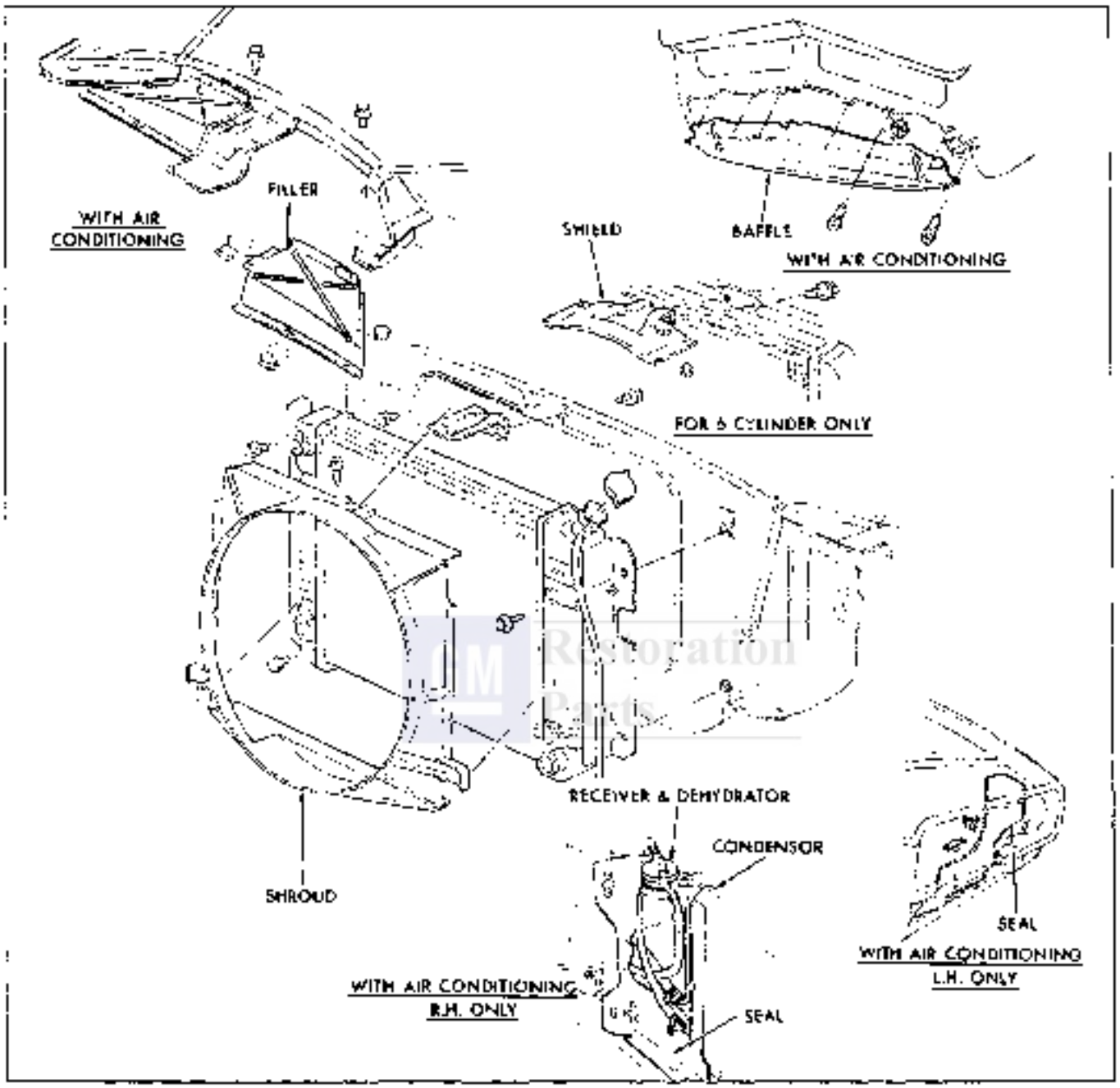


Fig. 6A-3 Radiator Support and Baffle Assembly - Firebird

1. Turn the filter counterclockwise to unscrew filter from base (Fig. 6A-4 and 5)

NOTE: This operation can be done from above on the 6 cylinder.

2. Wipe filter base with clean cloth.

3. Make sure filter base attaching screws are tight.

4. Apply Light grease or oil on gasket.

5. Hand tighten filter on hollow oil filter connector until gasket contacts filter base, then complete tightening with additional 2/3 turn of filter. Do not over-tighten. Use care when tightening to prevent pinching of gasket. Do not use wrench to tighten filter.

6. Add oil to bring to FULL mark on dipstick

7. Run engine and check for leaks at filter to base gaskets. Re-check crankcase oil level. If necessary, add oil to bring level to FULL mark on dipstick.

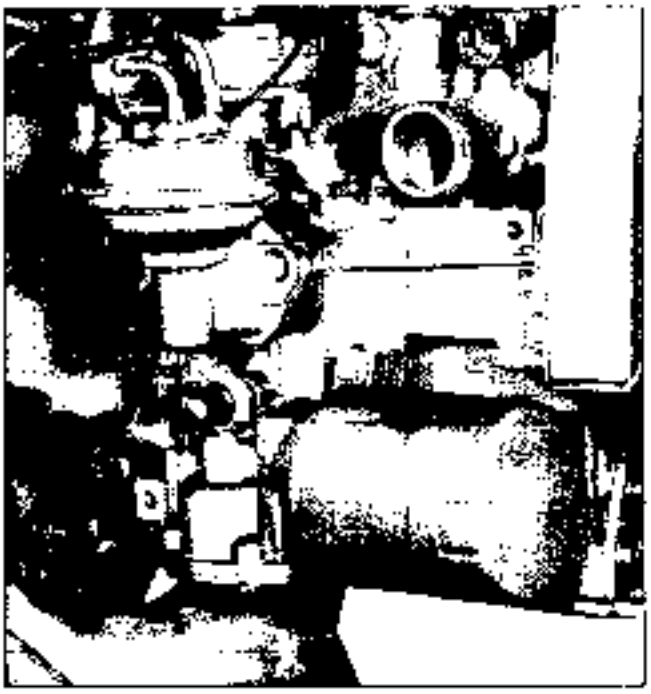


Fig. 6A-4 6 Cylinder Oil Filter Location

Fig. 6A-5 8 Cylinder Oil Filter Location

REMOVE AND REPLACE (400 RAM-AIR ONLY)

1. Place new filter cartridge in engine compartment near filter location.

2. Raise vehicle.

3. Disconnect old filter cartridge using filter wrench J 22775.

4. Hand tighten filter until gasket contacts filter base, then tighten a further 2/3 of a turn using J 22775 for convenience. Do not over-tighten.

5. Lower vehicle.

6. Remove old cartridge from engine compartment.

DRIVE BELTS FOR PONTIAC, TEMPEST & FIREBIRD ENGINE AND ACCESSORY DRIVE COMBINATIONS

Belt Width	Belt Name	Borroughs Gauge	
		New	Used
3/8"	Water Pump and Generator Belt (All 8 Cyl. and 6 Cyl.)	120 Lbs.	75 Lbs.
15/32"	Power Steering Pump Belt (6 Cyl. w/o A.C.)	145 Lbs.	105 Lbs.
15/32"	Power Steering Pump Belt (All 8 Cyl. and 6 Cyl. with A.C.)	145 Lbs.	105 Lbs.
3/8"	Generator to Power Steering Belt (6 Cyl.)	60 Lbs.	50 Lbs.
15/32"	A.C. Compressor Belt (All 8 Cyl. and 8 Cyl.)	145 Lbs.	105 Lbs.

TORQUE SPECIFICATIONS

(Torque in lb. ft. unless otherwise specified.)

Torque (Lb. Ft.)	Application	Torque (Lb. Ft.)	Application
	Oil Pan		Timing Chain Cover
15	Bolt—Oil Baffle to Bearing Cap	30	Bolt—Cylinder Block
12	Bolt—Pan to Cylinder Block	*	Stud—Block (Block End)
15	Bolt—Pan to Cyl. Blk. & Clutch Hsg. Shield	30	Nut—Block (Stud)
			Engine Fan and Pulley
22	Screw—Pan Drain	20	Bolt—Fan and Pulley to Water Pump
15	Bolt—Oil Pump Cover	*	Stud—Timing Chain Cover
13	Retainer—Oil Pump Reg. Spring	15	Nut—Timing Chain Cover
30	Bolt—Oil Pump Assy. to Block	30	Bolt—Intake Man. Water Outlet Fit.
30	Bolt—Oil Filter Pad Cover		
3.5	Bolt—Push Rod Cover		

(*) Checked for alignment, bottoming, height and/or leaks.

COOLING SYSTEM

Type	Pressure with vent
Operating Pressure	14-17 psi
Pump Type	Centrifugal
Pump and Fan Drive	V-Belt
Pump Bearings	Sealed Ball Bearings
Radiator	Tube and Center
Core Area - Pontiac (All)	480 Sq. in.
Core Area - 6-Cyl. Std.	333 Sq. in.
Core Area - 6-Cyl. A/C	480 Sq. in.
Core Area - 350 Std.	480 Sq. in.
Core Area - 400	480 Sq. in.
Thermostat	190°F.
Fan Diameter - V-8 Std.	19 in.
Fan Diameter - 6-Cyl. Std.	17-5/8 in.
Fan Diameter - Power Flex	19 in.
Fan Diameter - 8-Cyl. Clutch Fan	19-1/2 in.
Number of blades - Power Flex	5
Number of blades - Std.	4
Number of blades - Clutch Fan	7
Cooling System Cap. - 400 Pont.-All	18 qts.
Cooling System Cap. - G P	16.8 qts.
Cooling System Cap. - 428	17.2 qts.
*Cooling System Cap. - 400	17.8 qts.
*Cooling System Cap. - 400-A/C	19.4 qts.
*Cooling System Cap. - 350	16.6 qts.
*Cooling System Cap. - 350-A/C	20.2 qts.
Cooling System Cap. - 6-Cyl.	12.1 qts.
Cooling System Cap. - 350-with A/C	12.7 qts.

* Tempest & Firebird V-8

LUBRICATION SYSTEM

Type	Pressure
Oil Pressure - Pontiac exc. H.O.	35 psi above 2600 rpm.
Oil Pressure - Pontiac with H.O.	60 psi above 2600 rpm.
Oil Pressure - 6-Cyl.	30 psi above 2600 rpm.
Oil Pressure - 350	25 psi above 2000 rpm.
Oil Pressure - GTO and Firebird 400	60 psi above 2600 rpm.
Engine Lubricant Capacity When Refilling - 8 Cyl. (6 qts. if filter element is changed)	5 qts.
Engine Lubricant Capacity When Refilling - 6 Cyl. (5 qts. if filter element is changed)	5 qts.
Oil Pump Type	Spur Gear

TRANS-MISSION	SERIES	STANDARD			HEAVY DUTY COOLING			AIR CONDITIONING			SPECIAL ORDER AND TRAILER PROVISION
		ENGINE			ENGINE			ENGINE			ENGINE
		400	428	428 H.O.	400	428	428 H.O.	400	428	428 H.O.	ALL
3 Speed Manual	252, 256, 26239, 45 67, 87, 266	NB	NK	NK	NK	NL	NL	XA	XA	XA	XA
	Police	NB	-	-	NK	-	-	XA	-	-	XA
	26240, 50, 90	NK	-	-	-	-	-	XA	-	-	XA
	Freeway Enforcer & Highway Patrol	-	-	-	NK	NL	NL	XA	XA	XA	XA
4-Speed Manual	252, 256, 262, 266	NB	NK	NK	NK	NL	NL	XA	XA	XA	XA
	Police	NB	-	-	NK	-	-	XA	-	-	XA
	Freeway Enforcer & Highway Patrol	-	-	-	NK	NL	NL	XA	XA	XA	XA
Turbo Hydra-Matic	252, 256, 26239, 45 67, 87	NA	NM	NM	NM	NN	NN	NL	XB	XB	XB
	266	NA	NM	NM	NM	-	NN	NL	XB	XB	XB
	26240, 50, 90	NN	-	-	-	-	-	XB	-	-	XB
	Police	NM	-	-	NN	-	-	XB	-	-	XB
	Freeway Enforcer & Highway Patrol	-	-	-	NN	NG	NG	XB	XB	XB	XB

Fig. 6A-6 Radiator Usage Chart - Pontiac

TRANSMISSION	SERIES	STANDARD					HEAVY DUTY						AIR CONDITIONING						
		ENGINE					ENGINE						ENGINE						
		250	350	400			250	350	400				250	350		400			
		All	All	Std.	Ram-Air	4 Bbl. H.O.	All	All	Std.	2 Bbl.	Ram-Air	4 Bbl. H.O.	All	2 Bbl.	4 Bbl.	Std.	2 Bbl.	Ram-Air	4 Bbl. H.O.
M.T.	230, 235, 237, 239	VA [illegible] VC [illegible]	BC	-	-	-	VE	BL	-	-	-	-	SE	PA	PA	-	-	-	-
	242	-	-	PC	PA	PC	-	-	PA	-	-	PA	-	-	-	PA	-	-	PA
Auto. Trans. (2-Speed)	233, 235, 237, 239	VP	BG	-	-	-	VE	BL	-	-	-	-	SE	BI	PB	-	-	-	-
Auto. Trans. (3-Speed)	242	-	-	BI	PB	PE	-	-	PE	BL	-	PB	-	-	-	PB	PB	-	PB

Fig. 6A-7 Radiator Usage Chart - Tempest

Transmission	Series & R.P.O.	STANDARD ENGINE						HEAVY DUTY ENGINE						AIR CONDITIONING ENGINE					
		350		350		400		350		350		400		350		350		400	
		1 Bbl.	4 Bbl.	2 Bbl.	4 Bbl.	4 Bbl.	4 Bbl. Ram Air	1 Bbl.	4 Bbl.	2 Bbl.	4 Bbl.	4 Bbl.	4 Bbl. Ram Air	1 Bbl.	4 Bbl.	2 Bbl.	4 Bbl.	4 Bbl.	4 Bbl. Ram Air
Manual Trans.	223, 225	JE	UE	-	-	-	-	US	US	-	-	-	-	US	-	-	-	-	-
	224, 226	-	-	UU	UU	UO	JQ	-	-	UX	UX	JQ		-	-	-	-	-	-
2-Speed Auto. Trans.	223, 225	ZA	ZA	-	-	-	-	UF	UF	-	-	-	-	UR	-	-	-	-	-
2 & 3 Speed Auto Trans.	224, 226	-	-	UW	UW	UX	UP	-	-	UX	UX	UP	-	-	-	UP	UP	UP	-

Fig. 6A-8 Rocker Usage Chart - Firebird

ENGINE FUEL

CONTENTS OF THIS SECTION

CARBURETOR AIR CLEANER AND SILENCER

A combined air cleaner-silencer and air preheater, with an oil wetted paper element as standard on all models.

An optional heavy duty dual stage air cleaner is available on all models except the 428 H.O. engine, GTO, and Tempest Sprint.

This air cleaner consists of a replaceable oil wetted paper inner filter surrounded by a glycol wetted polyurethane foam outer filter.

The polyurethane element and crankcase ventilation filter should be washed in solvent and re-oiled using SAE 30 engine oil at 12,000 miles or 12 months.

NOTE: Clean and re-oil after each occasion of driving under severe dust conditions. Allow excess oil to drain out of filter prior to installation.

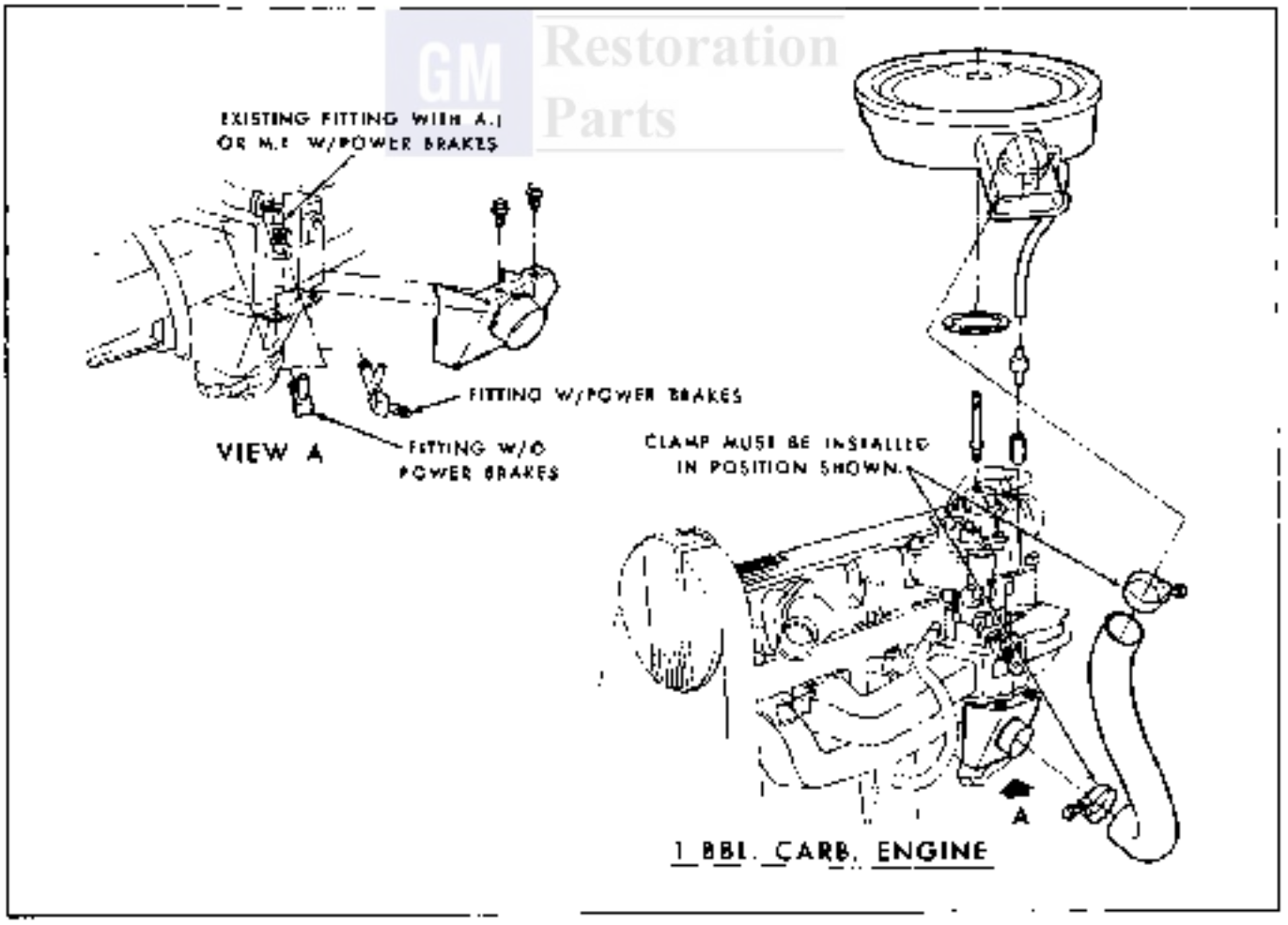


Fig. 6B-1 Air Cleaner Installation—6 Cy.

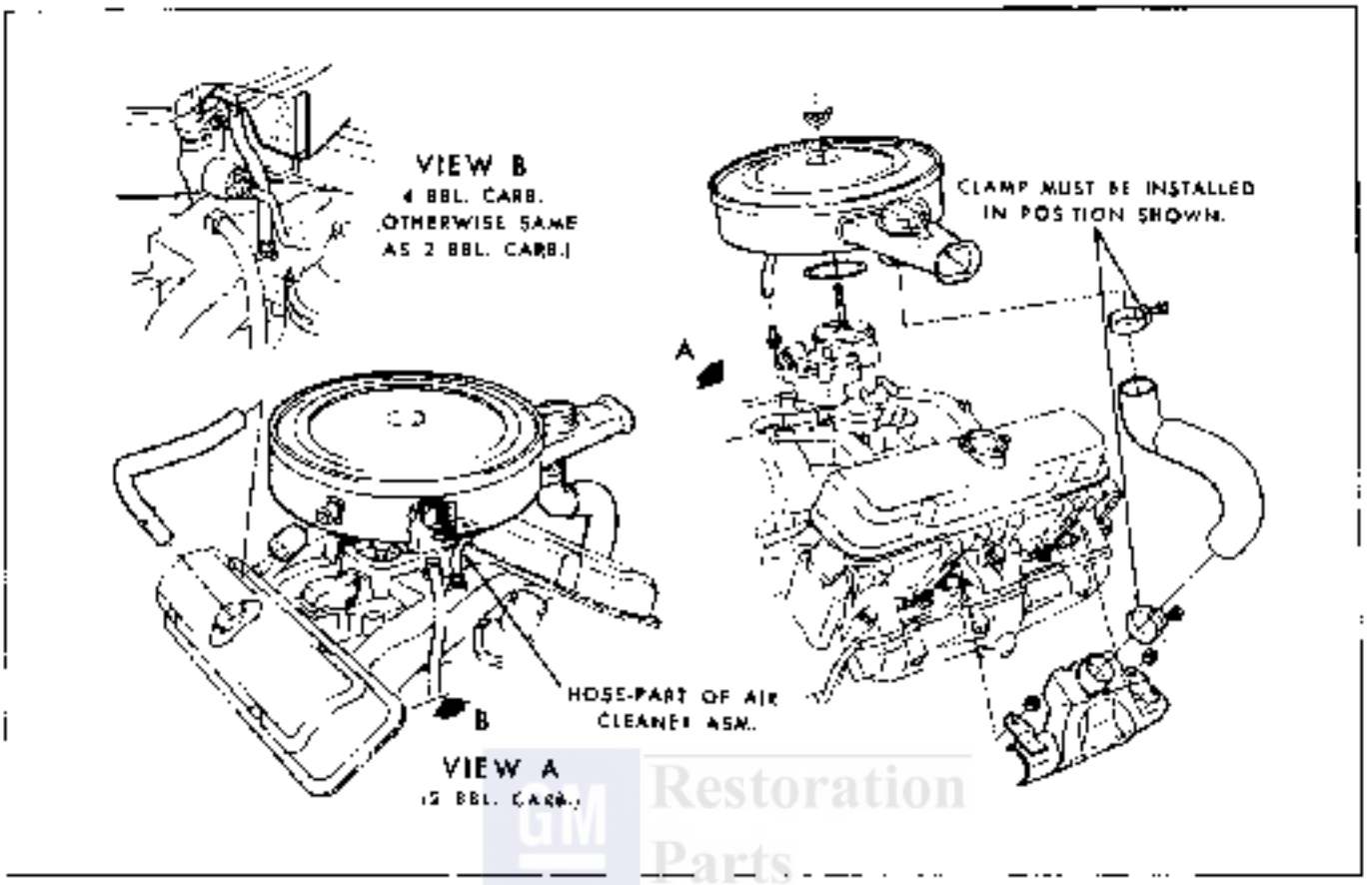


Fig. 6B-2 Air Cleaner Installation—8 Cyl.

IDLE STOP SOLENOID (Fig. 6B-3)

ADJUSTMENT

Adjust plunger to obtain specified engine speed (see idle specification chart, section 6D). Observe operation of solenoid by disconnecting lead. With engine running at specified hot idle speed, the plunger should drop back allowing the carburetor idle screw to contact the idle cam. In this position the engine speed should drop to the specified lower "solenoid inactive" speed.

ACCELERATOR LINKAGE ADJUSTMENT

TEMPEST

There are no throttle linkage adjustments. A reference dimension of 1 9/16" between the bottom of the accelerator pedal roller and floor pan (Fig. 6B-4) should be used only as a check for bent bracket assemblies.

PONTIAC

With carburetor set at hot idle position, line up throttle rod socket with attaching ball stud on carburetor extension lever, turn rod counterclockwise five turns and snap into place (Fig. 6B-5).

FIREBIRD

The throttle control system is of the rod and lever type. The throttle control rod which is threaded at the carburetor end is attached to the carburetor linkage by means of a threaded trunnion (Fig. 5B-6).

Check linkage adjustment with carburetor set at hot idle position and also check for full throttle

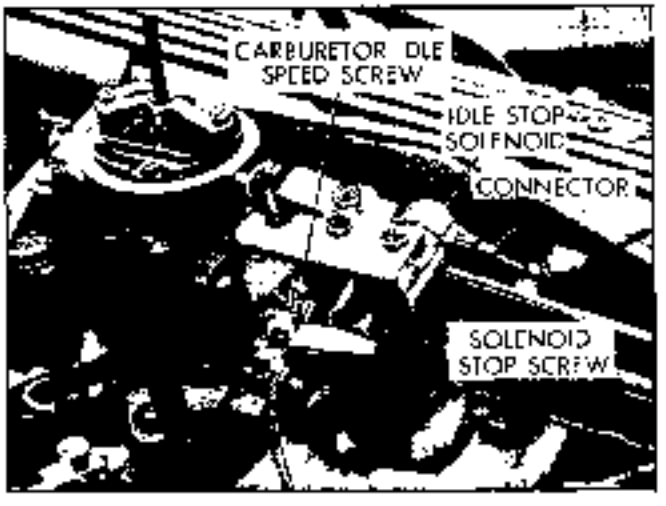


Fig. 6B-3 Idle Stop Solenoid—V-8 Cyl. Shown

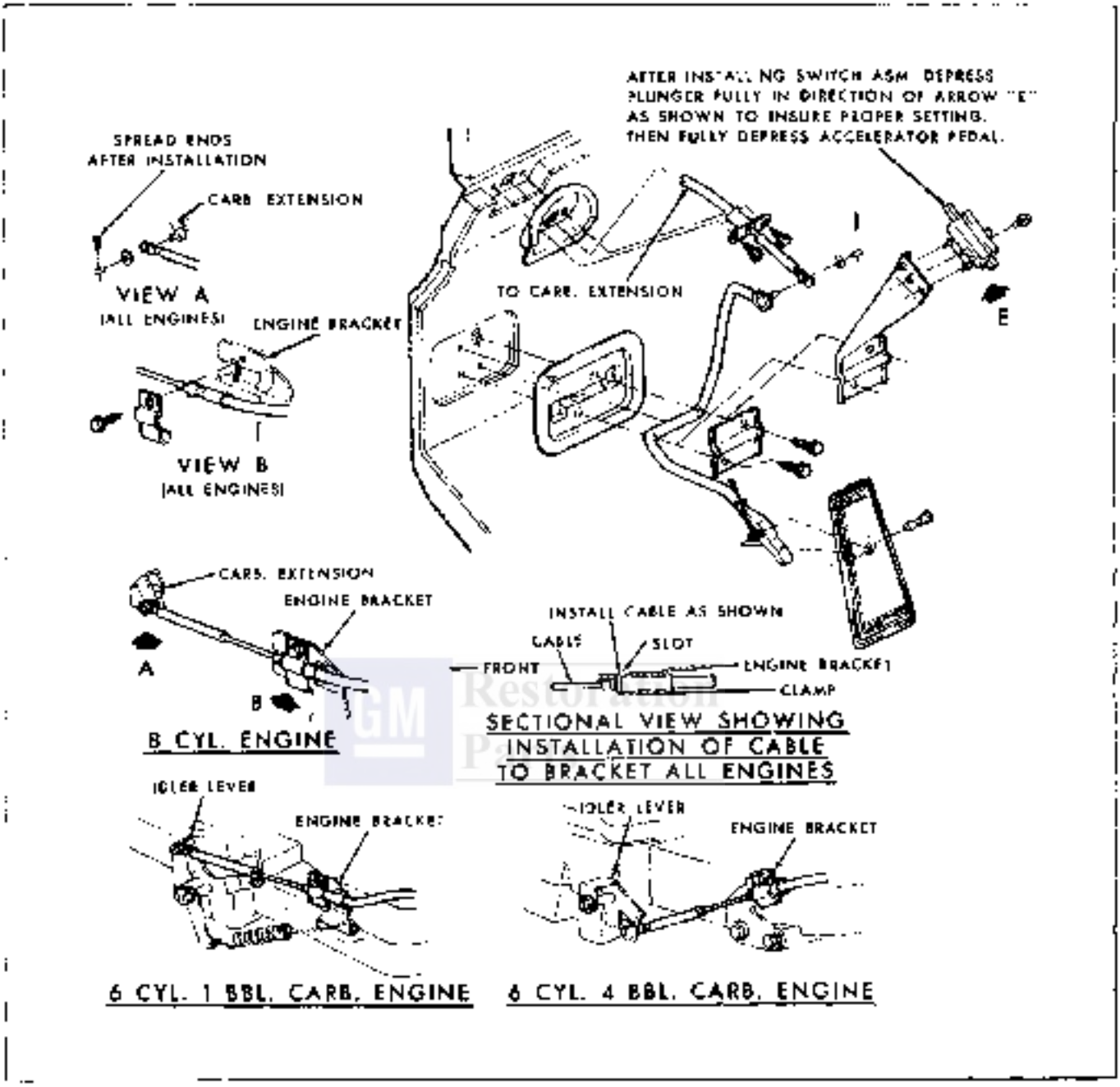


Fig. 6B-4 Accelerator Linkage—Tempest

opening with accelerator fully depressed. Adjust as necessary by removing cotter pin and turning trunnion to obtain the correct open and closed positions.

NOTE: No binding should be felt in linkage

VAPOR DIVERTER

The vapor diverter is incorporated in the fuel pump on all 1968 models, where applicable. Air conditioning is not available on 4Bbl, 8 cylinder engines, therefore no vapor diverters are used with 8 cylinder engines.

ROCHESTER BV CARBURETOR

Carburetor No.	Used On
7028166	6-Cyl, Automatic Transmission

The Rochester Model BV carburetor is a single barrel, downdraft model with provision for automatic choke mounted on the exhaust manifold, and is used on the 1968 250-cu. in. engine, with automatic transmission.

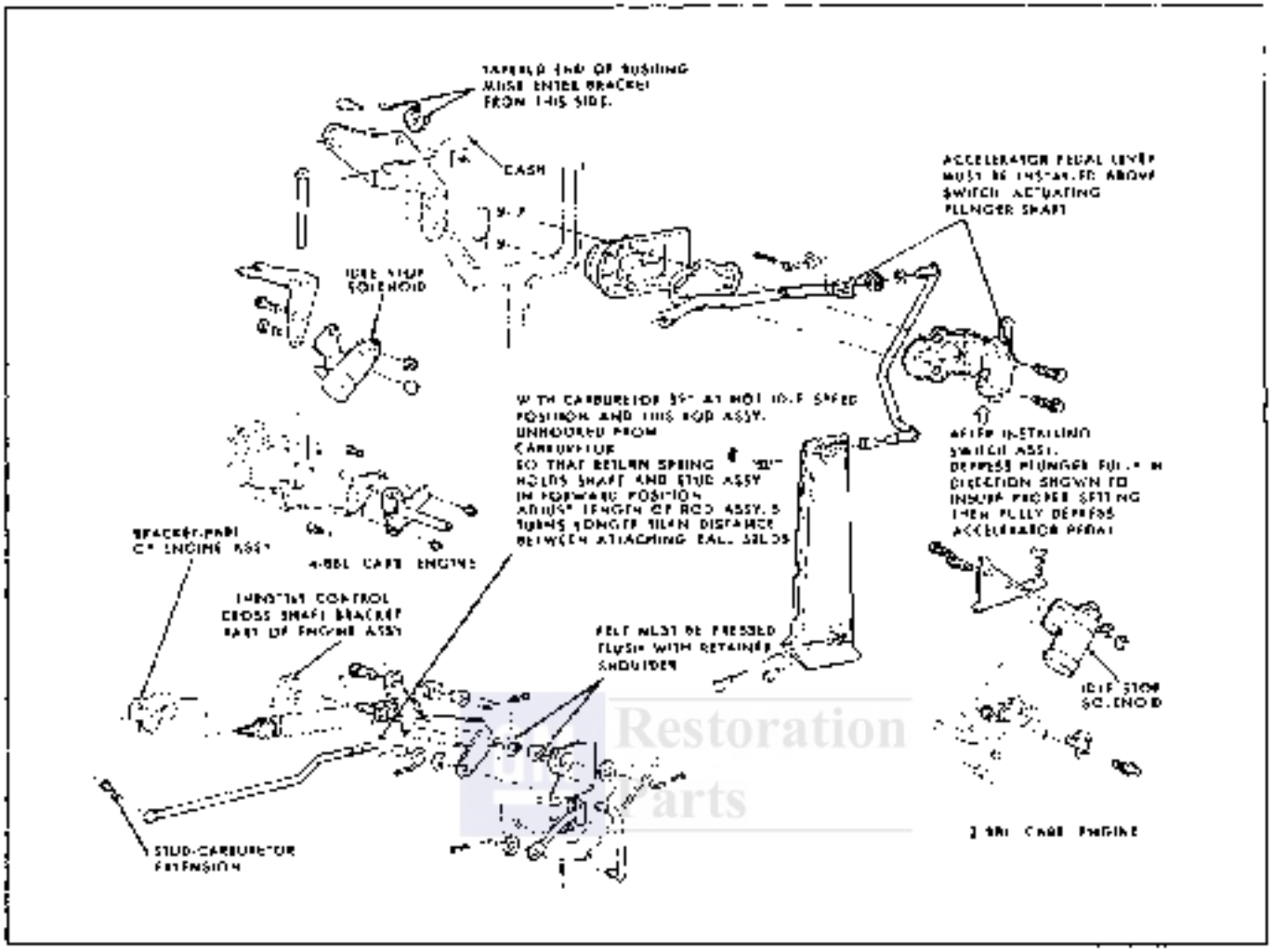


Fig. 6R-5 Accelerator Linkage—Partial

ADJUSTMENTS ON CAR

All Rochester BV adjustments can be performed on the car. With the exception of the idle speed and mixture adjustment, all adjustments are included in the Overhaul and Adjustments procedure.

IDLE SPEED AND MIXTURE ADJUSTMENT

With the engine at operating temperature, adjust idle speed following the procedure at the end of section 6D.

OVERHAUL AND ADJUSTMENT

DISASSEMBLY OF CHOKE

1. Disconnect choke vacuum break hose at diaphragm nipple and from pipe in throttle body.

2. Remove choke shaft lever screw (diaphragm side). Remove two diaphragm bracket screws and remove vacuum break diaphragm assembly.

3. Remove fast idle cam attaching screw. Then fast idle cam and choke rod can be removed from upper choke lever by carefully rotating assembly upward and sliding end of rod out of upper choke lever. The choke rod can now be removed from fast idle cam by rotating cam over end of rod.

4. To remove choke valve, remove choke on out of choke valve screws. Then remove two choke valve attaching screws from choke shaft and pull upward on choke valve to remove from shaft. Choke shaft and lever assembly can now be removed from air horn.

Note position of choke trip lever in relation to upper choke lever tang for ease in reassembly.

DISASSEMBLY OF AIR HORN

1. Remove fuel filter inlet nut and gasket with 1" wrench. Then remove filter, filter spring and gasket between filter element and back side of inlet nut.

NOTE: Large open end of filter element always faces fuel inlet nut.

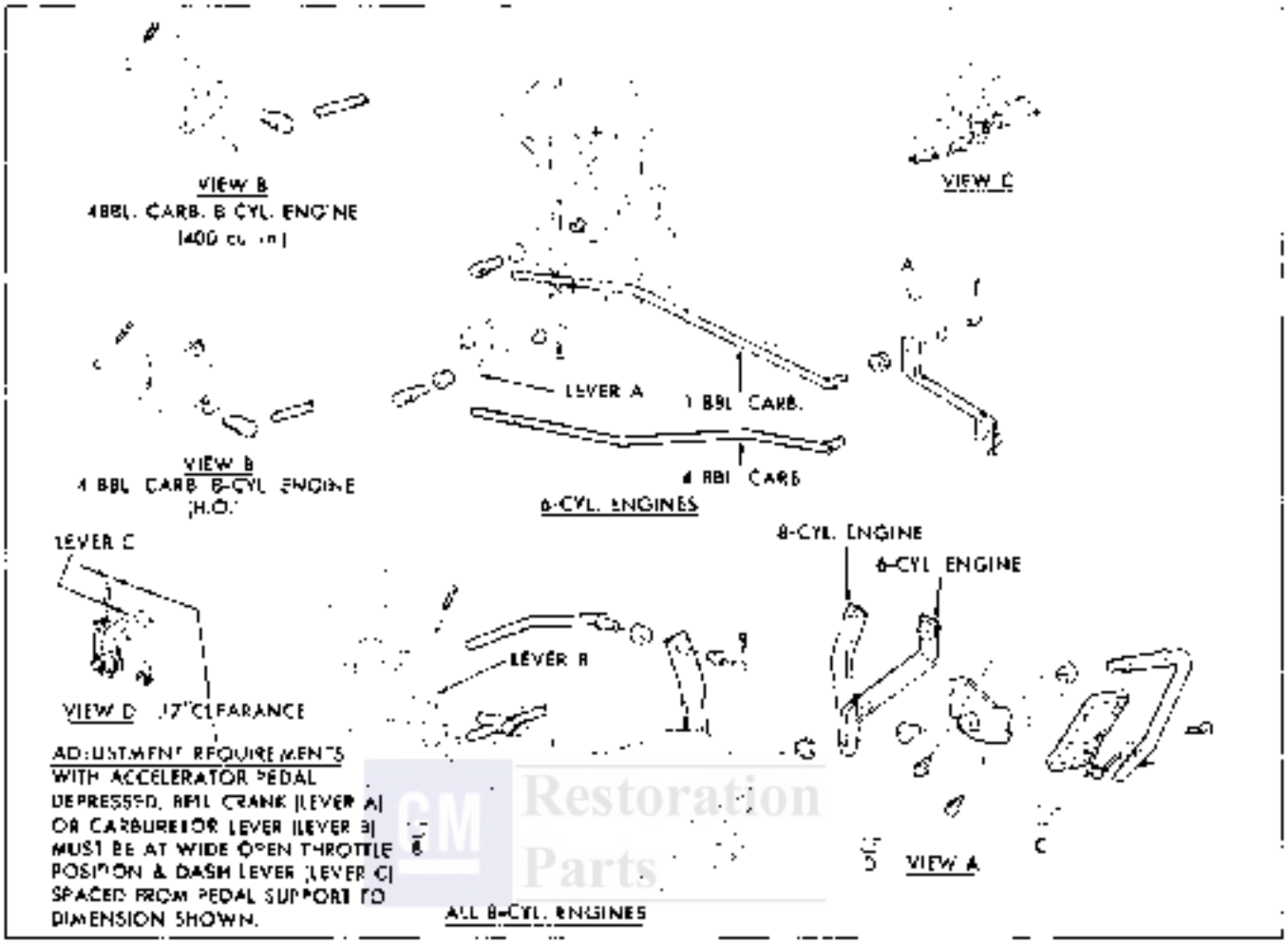


Fig. 6B-6 Accelerator Linkage—Firebird

2. Remove four air horn attaching screws. Lift air horn straight up from bowl so as not to damage float (Fig. 6B-7). Place air horn, inverted, on flat surface.

3. Remove float hinge pin and lift float from air horn (Fig. 6B-8). Float needle may now be removed.

4. Remove float needle and gasket with 1/2" bit screwdriver or special needle gasket-removing tool (Fig. 6B-9).

5. Remove main metering jet from bottom of main well support (Fig. 6B-10).

6. Remove hex head power valve check ball retainer from bottom of support, then remove power valve spring and ball (Fig. 6B-11).

NOTE: Use care when removing power valve so as not to lose small spring and ball.

7. Remove screw at base of main well support, then remove the main well support from air horn.

Fig. 6B-7 Removing Air Horn

Fig. 6B-8 Removing Float Hinge Pin

8. Remove power piston and power piston spring from air horn.

NOTE: Do not remove idle pick-up tube from air horn as it is pressed in place. The anti-bubble screen located inside the main well should not be removed. Clean and blow out dry with compressed air only.

9. Remove air horn gasket.

DISASSEMBLY OF FLOAT BOWL

1. Using pair of long nosed pliers, remove pump discharge guide (Fig. 6B-12). Pump discharge spring and ball may now be removed by inverting bowl and shaking into palm of hand.

2. Remove two hair pin clips from pump link and then remove pump link from throttle lever and pump plunger rod.

Fig. 6B-9 Removing Float Needle Seat

Fig. 6B-10 Removing Main Metering Jet

3. Remove pump plunger from float bowl by pulling straight upward (Fig. 6B-13).

4. Remove pump return spring from bottom of pump well (Fig. 6B-14).

NOTE: Do not remove vacuum break suction tube from throttle body.

5. Place carburetor bowl with suction tube projected over edge of flat surface and remove two throttle body attaching screws. Throttle body and gasket may now be removed.

DISASSEMBLY OF THROTTLE BODY

1. Remove idle mixture adjusting needle and spring.

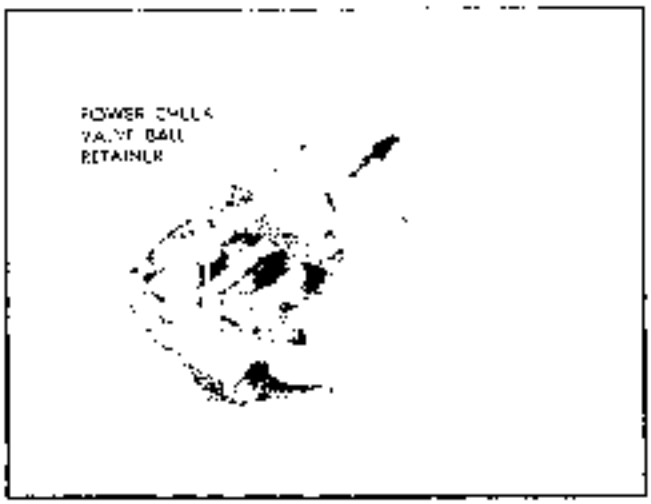


Fig. 6B-11 Removing Power Check Valve Ball Retainer

Fig. 6B-12 Removing Pump Discharge Guide

2. Remove idle screw from throttle lever if necessary to replace.

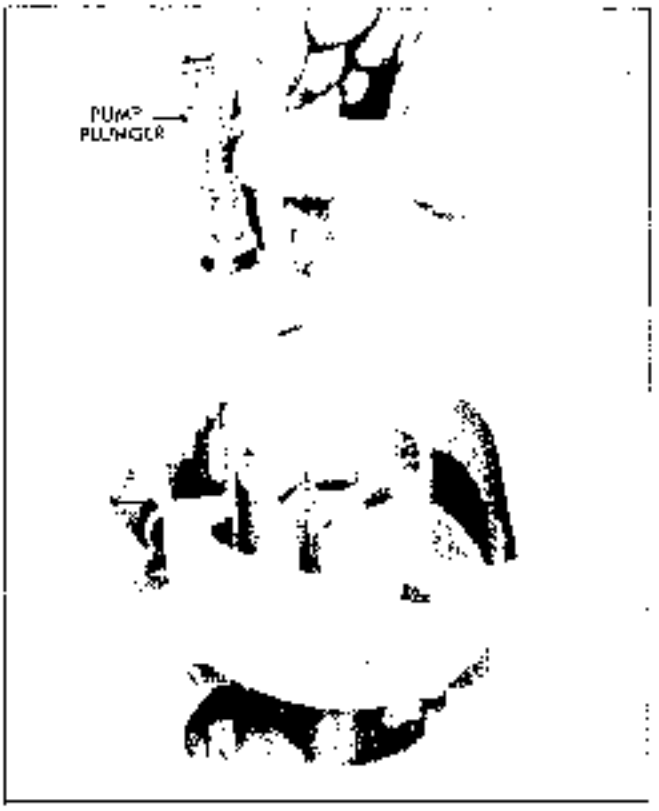


Fig. 6B-13 Removing Pump Plunger

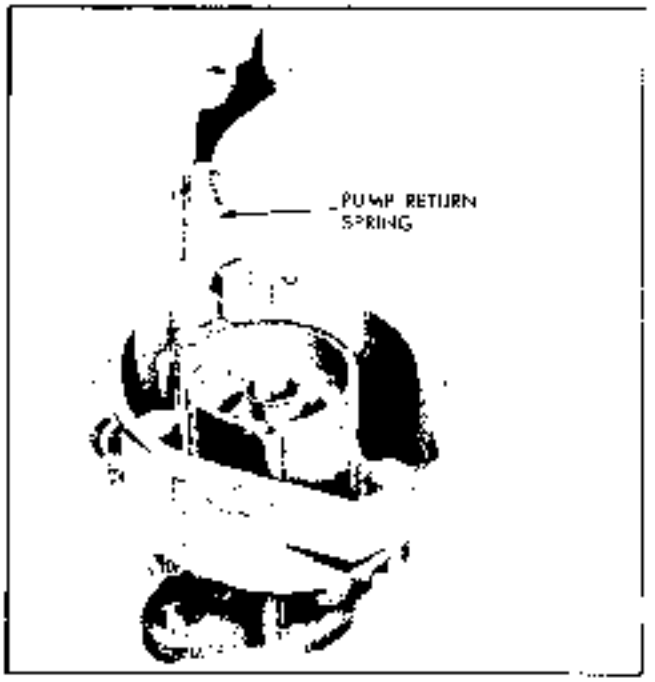


Fig. 6B-14 Removing Pump Return Spring

NOTE: Due to close tolerances fit of throttle valve in bore of throttle body, do not remove throttle valve or shaft from throttle body.

CLEANING AND INSPECTION

1. Thoroughly clean carburetor castings and metal parts in carburetor cleaning solvent.

CAUTION: Pump plunger and any synthetic or plastic parts should not be immersed in commercial carburetor cleaner. Clean in clean solvent or equivalent. Plastic vacuum break diaphragm and should not be immersed in any cleaner.

2. After cleaning, blow all passages and castings with compressed air and blow out all parts until dry.

CAUTION: Do not press drills or wires through calibrated jets or orifices as this may enlarge orifice and seriously affect carburetor calibration.

3. Check all parts for wear. If wear is noted, defective part must be replaced.

NOTE: Especially the following:

a. Check float needle and seat for wear.

b. Check tang on float arm above float needle for wear and floats for dents. Check floats for leaks by shaking.

c. Check throttle and choke shaft bores in throttle body and air horn castings for wear or out of round.

d. Check idle mixture needle for burrs or ridges.

e. If wear is noted on steps of fast idle cam, it should be replaced as it may upset engine idle during engine warm-up period.

f. Inspect pump plunger. Replace plunger if synthetic rubber is scored, hardened or damaged.

g. Inspect for burrs on power piston or a disturbed power piston stem or spring.

4. Always use new gaskets in reassembly.

5. Clean all dirt or lint out of fuel inlet filter. If filter remains plugged, replace it. Check relief spring for distortion, replace if necessary.

6. Thoroughly clean anti-bubble screen in main well. If screen remains plugged, replace main well support.

THROTTLE BODY ASSEMBLY

1. Install idle screw in throttle lever, if removed.

2. Screw idle mixture adjusting needle and spring into throttle body until it is finger tight. Back needle out five turns as a temporary idle mixture adjustment.

3. Using new gasket, attach throttle body to bowl, using two screws and lockwashers. Tighten screws evenly and securely.

FLOAT BOWL ASSEMBLY

1. Install 3/16" steel ball into pump discharge cavity. Carefully insert pump discharge spring and guide on top of ball. Tap discharge guide lightly to seat flush with float bowl casting.

NOTE: The pump discharge guide is installed correctly when it is at right angles with pump discharge jet.

2. Place pump return spring in pump well and bottom spring in well by forcing downward with index finger.

3. Install pump plunger assembly in bowl, making sure not to curl rubber during installation.

4. Attach pump link to pump plunger rod and throttle lever, using two hair pin clips.

NOTE: Dog leg in pump link will face away from throttle shaft when installed correctly. Ends of link will both make outward turns away from throttle body.

AIR HORN ASSEMBLY

1. Install float needle seat and new gasket, using special tool or screwdriver with 1/2" bit.

2. Place new air horn gasket on air horn, check to be sure that all air horn and gasket holes are in line.

3. Install power piston spring and power piston in vacuum cavity.

NOTE: Piston should ride free in cavity.

4. Install power valve ball (small steel ball), power valve spring, and retainer in main well support. Tighten retainer securely.

5. Attach main well support to air horn assembly and tighten attaching screw securely.

NOTE: Check for free motion of power piston.

6. Install main metering jet in main well support.

7. Place float needle in float needle seat.

8. Place float carefully in position with drop tang pointing downward towards air horn and install float hinge pin.

FLOAT LEVEL ADJUSTMENT (Fig. 6B-15)

With air horn inverted and gasket in place, measure the distance from air horn gasket to bottom of each float, as shown. Bend adjustment tang on float arm which contacts float needle, as necessary, to obtain specified dimension.

Align floats by making sure they are parallel and centered in air horn gasket cut-out. Recheck float level adjustment if float alignment is necessary.

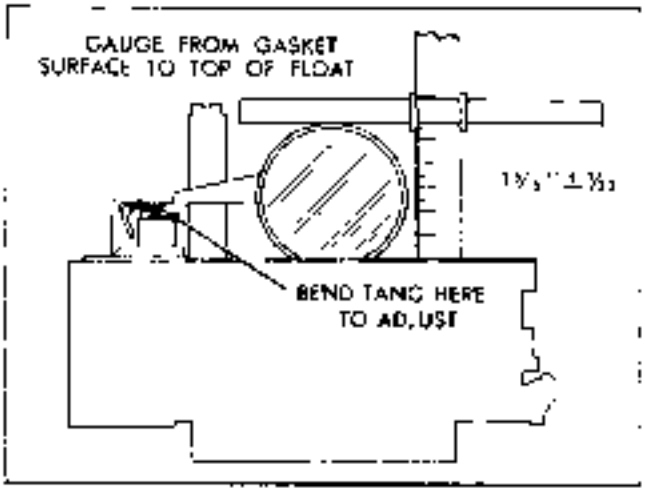


Fig. 6B-15 Float Level Adjustment

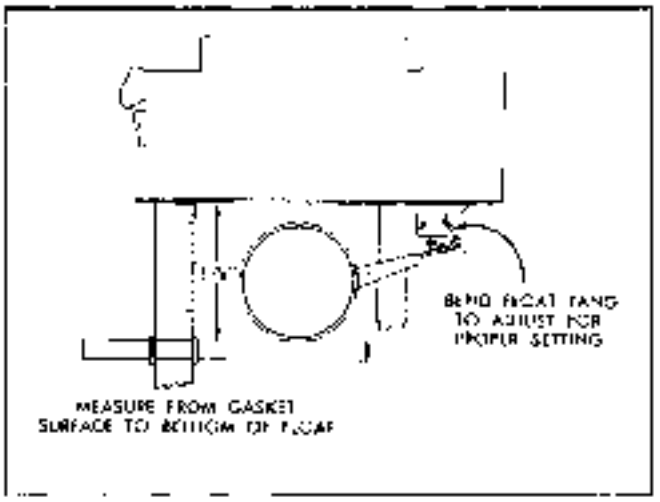


Fig. 68-16 Float Drop Adjustment

FLOAT DROP ADJUSTMENT (Fig. 68-16)

Bend float tang at rear of float arm, next to needle seat, as necessary to obtain a distance of 1 3/4" from gasket surface to bottom of floats with air horn held in upright position and floats hanging free. Measure with scale.

9. Install air horn to bowl assembly, being careful to lower air horn straight down so that floats will not be bent during installation.

10. Install four air-horn-to-float-bowl attaching screws and tighten evenly and securely.

11. Install filter gasket inside fuel inlet nut, filter relief spring, filter element, retaining in place with fuel inlet nut and gasket, and tighten nut to 25 lb. ft.

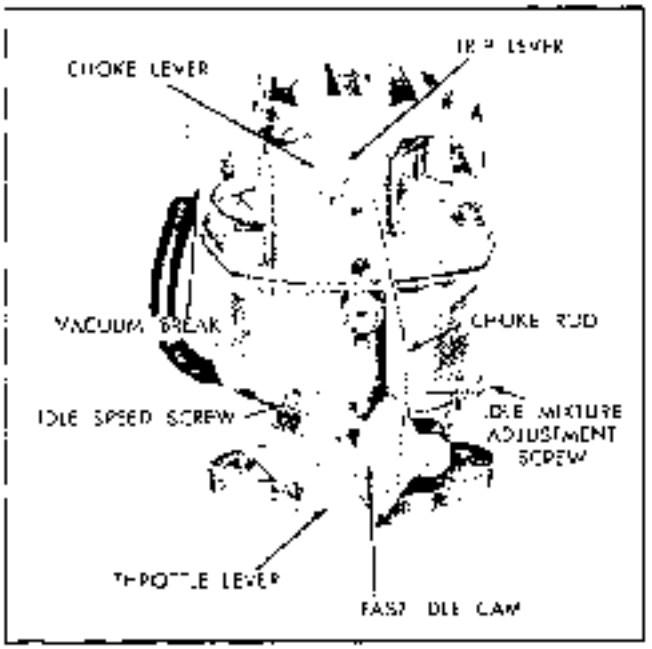


Fig. 68-17 Trip Lever and Choke Rod Lever

Fig. 68-18 Trip Lever and Choke Rod Lever Clearance

CHOKE ASSEMBLY

1. Install upper choke rod lever on choke shaft. Tang of the choke lever should point towards air horn casting.

2. Assemble choke shaft into air horn from throttle lever side. Tang on trip lever should be above tang on choke lever (Fig. 68-17).

3. Install choke valve into slot in choke shaft, BP trade mark should face upward. Install two choke valve attaching screws.

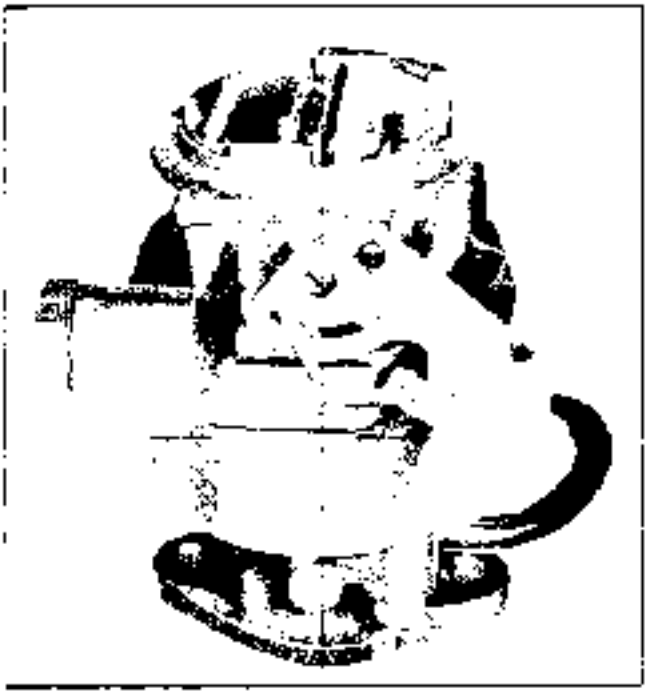


Fig. 68-19 Choke Shaft Lever Installed

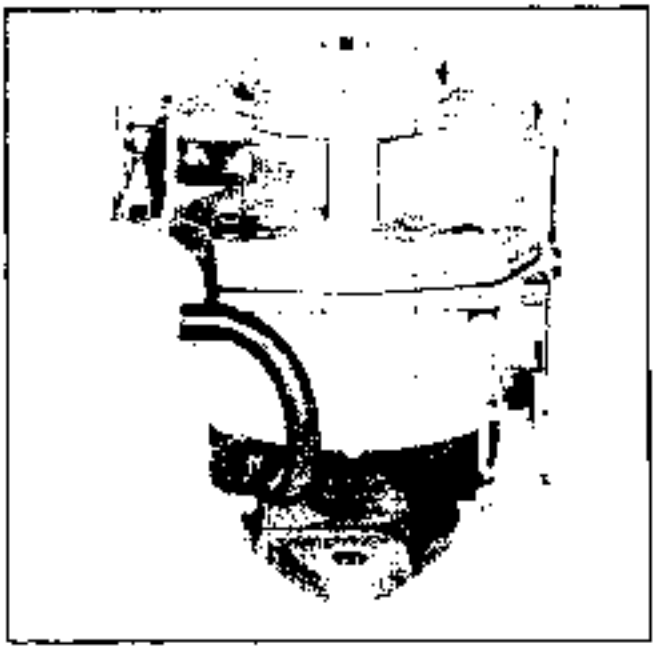


Fig. 6B-20 Vacuum Break Diaphragm Installed

4. To insure proper rod clearance between choke trip lever and choke rod lever, move choke shaft horizontally to obtain .020" clearance between the two levers (Fig. 6B-18). Then tighten two choke valve attaching screws securely and stake in place.

5. Install vacuum diaphragm unit and bracket to side of air horn, retaining with two attaching screws. Tighten securely.

6. Install choke shaft lever to end of choke shaft (diaphragm side), aligning flats on lever with flats on choke shaft. Large side of lever will hang downward and part number identification faces outward (Fig. 6B-19) and tighten securely.

7. Install connecting rod to vacuum break diaphragm plunger by rotating end of rod so rod enters notch in plunger, ends of rod face inward (Fig. 6B-20). Install other end of rod into slot in choke lever. Install nonsticking clip to groove in rod end and pinch together.

8. Install choke rod to fast idle cam as shown, then carefully insert upper end of choke rod into upper choke lever (Fig. 6B-21). The dog leg in rod must face towards idle mixture adjusting needle.

9. Attach fast idle cam to throttle body assembly with fast idle cam screw and tighten securely. The steps on fast idle cam should face towards idle speed screw (Fig. 6B-21).

IDLE VENT ADJUSTMENT (Fig. 6B-21)

With idle rpm set to specification, and screw on low step of cam, the idle vent valve should be open .050". Adjust by turning valve on top of air horn, as needed.

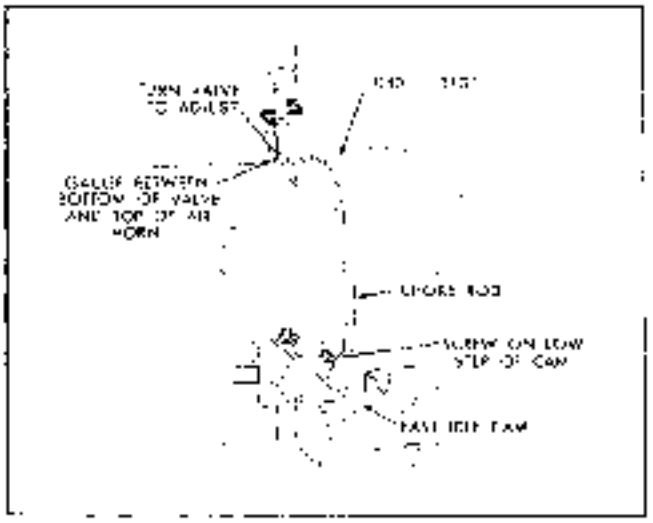


Fig. 6B-21 Idle Vent Adjustment

VACUUM BREAK ADJUSTMENT (Fig. 6B-22)

To insure correct initial choke valve opening, just after engine starting, adjust vacuum break as follows.

Push vacuum break diaphragm plunger in until seated, make sure choke valve is held toward closed position so that connecting rod is at end of slot. In this position, adjust rod so that gauge will fit between lower edge of choke valve and inside of air horn casting, to give a clearance of .165".

To adjust, bend connecting rod at point shown.

CHOKE ROD ADJUSTMENT (Fig. 6B-23)

With idle screw resting on second step of fast idle cam and against shoulder of high step, bend choke

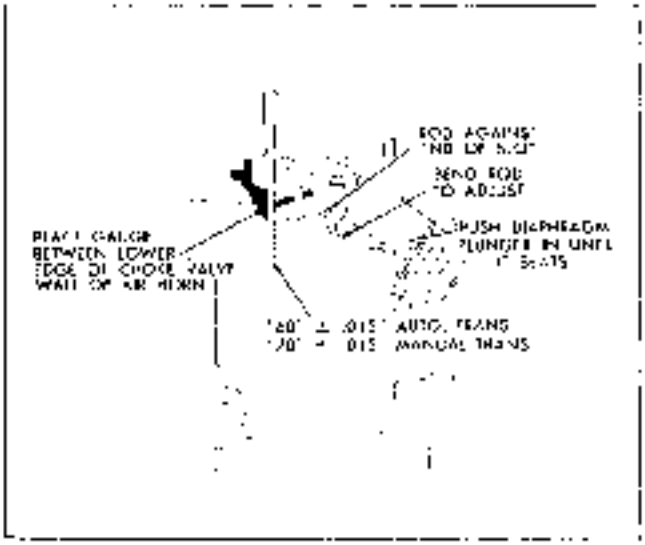


Fig. 6B-22 Vacuum Break Adjustment

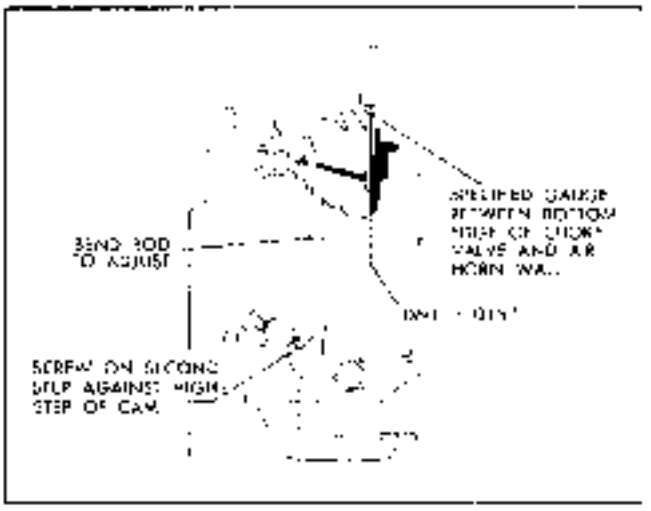


Fig. 6B-23 Choke Rod Adjustment

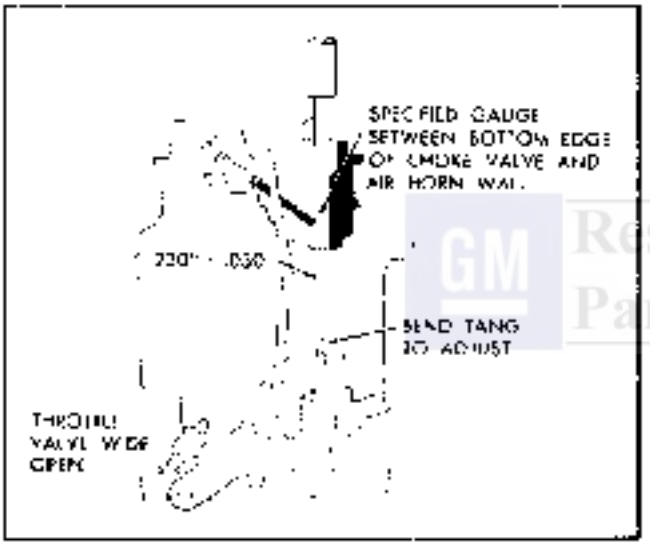


Fig. 6B-24 Unloader Adjustment

rod as shown to obtain sufficient clearance to allow the insertion of an .080" gauge between lower edge of choke valve and dividing wall of air horn.

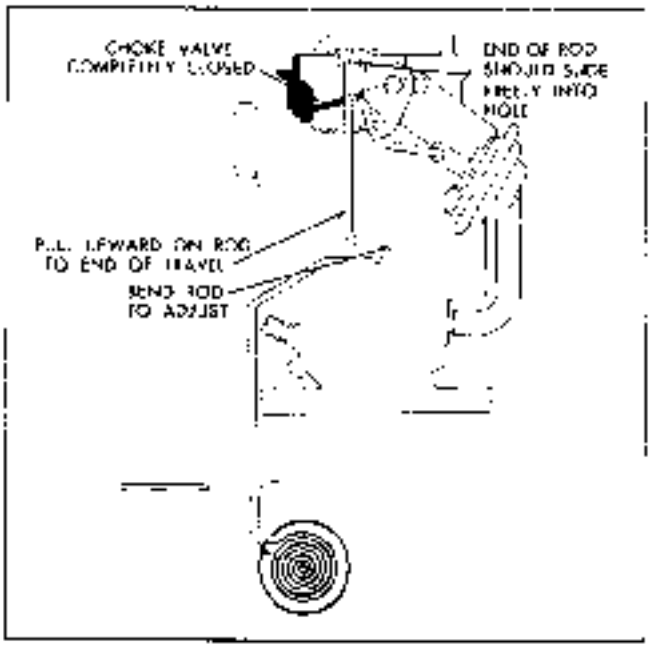


Fig. 6B-25 Choke Coil Rod Adjustment

UNLOADER ADJUSTMENT (Fig. 6B-24)

Bend unloader tang on throttle lever as necessary to allow insertion of a .230" - .030" gauge between the lower edge of choke valve and dividing wall of air horn, with throttle valves held wide open.

CAUTION: Make sure unloader arm does not interfere with fast idle cam screw after this adjustment.

AUTOMATIC CHOKE ADJUSTMENT (Fig. 6B-25)

Disconnect upper end of choke thermostatic coil rod from choke lever. Hold the choke valve completely closed and pull up on thermostatic coil rod to the limit of its travel. The lower edge of rod should be even with top edge of hole in choke shaft lever for maximum rod length, while the rod should just line up with hole for minimum rod length.

To adjust, bend rod as shown.

ROCHESTER MV "MONOJET" CARBURETOR

Carburetor Model Number	Usage
*7028075	250 - M.T.
7028087	250 - M.T. - A/C

* *NOTE: Early production units use model number 7028075 which incorporates a different metering rod setting as noted on page 6B-15.*

All Rochester M.V. adjustments can be performed on the car. With the exception of idle speed and mixture adjustments, outlined in Section 6D, all adjustments are included in the Overhaul and Adjustments procedure.

OVERHAUL AND ADJUSTMENTS

AIR HORN REMOVAL (Fig. 6B-26)

1. Remove upper choke lever retaining screw at end of choke shaft. Then remove choke lever from shaft.

2. Remove choke rod from slot in fast idle cam by rotating rod. Remove upper lever from other end of choke rod. Note position of rod in relation to levers for ease in reassembly.

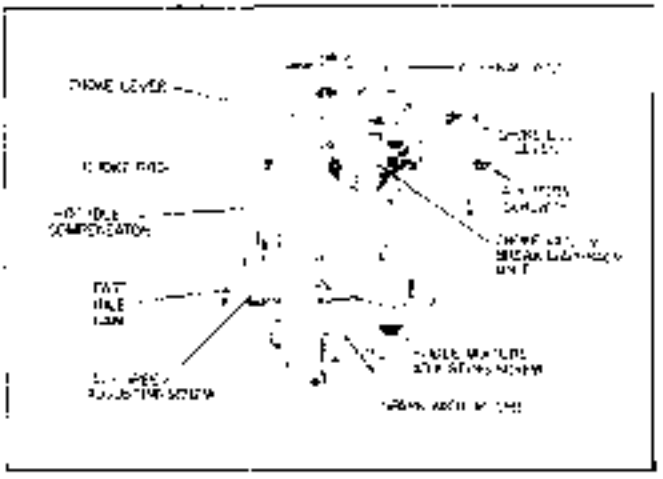


Fig. 6B-26 Air Horn Removal

3. Remove six air horn to float bowl attaching screws (three long and three short screws).

4. Remove air horn by lifting straight up, invert and place on clean bench. Air horn to bowl gasket can remain on bowl for removal later.

AIR HORN DISASSEMBLY (Fig. 6B-27)

1. Remove two vacuum break diaphragm cover screws. Then carefully remove diaphragm rivet retainer.

2. To remove vacuum break diaphragm and plunger rod, hold choke valve open. Then push upward on diaphragm rod until the looped end of rod slides out off of wire lever attached to choke valve. Then remove diaphragm plunger rod through hole in air horn.

3. If desired, the choke valve, vacuum break lever and choke shaft can be removed from air horn by removing two choke valve screws. Staking on choke valve screws should be filed off before removing so as not to ruin threads and distort choke shaft.

4. No further disassembly of the air horn is necessary. The idle vent valve can be removed by turning screw head out of plastic guide. A repair kit is available if replacement parts are needed.

NOTE: The emulsion parchment tube is not removable. Make sure after cleaning that cleaning solution is completely removed from tube cavity and bleed hole in tube retainer is open.

FLOAT BOWL DISASSEMBLY (Fig. 6B-28)

1. Remove air horn to float bowl gasket. Gasket is slit next to metering rod lever so that it can be slid over lever for ease in removal.

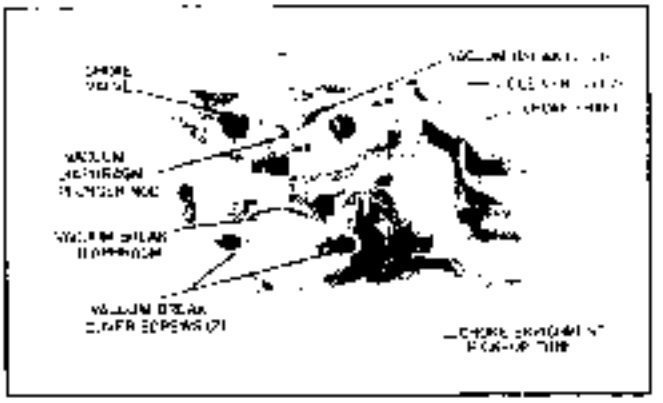


Fig. 6B-27 Air Horn Disassembly

2. Remove float from float bowl by lifting upward on float hinge pin. Remove hinge pin from float arm.

3. Remove float needle, then remove float needle seat and gasket.

4. Remove fuel inlet nut and gasket, then remove filter element and pressure relief spring.

5. Using long nosed pliers, remove 2 pump discharge guide. Pump discharge spring and ball may be removed by inverting bowl.

6. The idle tube can be removed at same time by inverting bowl.

7. To remove accelerating pump plunger and power piston - metering rod assemblies, remove actuating lever on throttle shaft by removing attaching screw in end of shaft.

8. Hold the power piston down in float bowl, then remove power piston drive link by sliding out of hole in power piston plunger rod. The power piston - metering rod can now be removed from float bowl.

NOTE: The metering rod can be removed from holder on power piston by pushing downward on end of rod against spring tension. Then slide narrow neck of rod out of slot in rod holder.

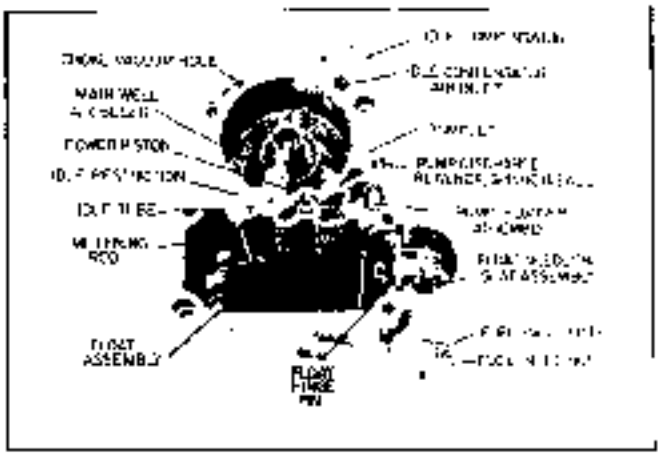


Fig. 6B-28 Float Bowl Disassembly

9. Remove power piston spring from power piston cavity.

10. Remove power piston drive link from throttle actuating lever by aligning tip on rod and notch in lever.

11. Remove actuating lever from accelerator pump drive link in same manner. Note position of actuating lever for ease in reassembly.

12. Hold the pump plunger down in bowl cavity and remove drive link from pump plunger shaft by rotating link until tip on link aligns with notch in plunger shaft.

13. Remove pump plunger from float bowl.

14. Remove pump return spring from pump well.

15. Remove main metering jet from bottom of float bowl.

16. Remove two screws from idle compensator cover. Then remove cover, jet idle compensator and seal from recess in bowl beneath compensator.

17. Idle screw and fast idle cam can be removed at this time if desired.

No further disassembly of the float bowl is required.

THROTTLE BODY REMOVAL AND DISASSEMBLY (Fig. 6B-29)

1. Invert carburetor bowl on bench and remove two throttle body to bowl attaching screws. Throttle body and insulator gasket may now be removed.

2. Remove idle mixture needle and spring.

NOTE: Due to the close tolerance fit of the throttle valve in the bore of the throttle body, do not remove the throttle valve or shaft.

CLEANING AND INSPECTION

The carburetor should be cleaned in a cold immersion type cleaner.

1. Thoroughly clean carburetor castings and metal parts in an approved carburetor cleaner such as carbon-X (X-55) or its equivalent.

CAUTION: Any rubber parts, plastic parts, diaphragms, pump plungers, should not be immersed in carburetor cleaner. However, the air horn which has the plastic vent valve guide and metering enrichment valve will withstand normal cleaning in carburetor cleaner. Make sure the cleaner is thoroughly removed from choke enrichment valve cavity.

2. Blow out all passages in castings with compressed air. Do not pass drills through jets or passages.

3. Inspect idle mixture needle for damage.

4. Examine float needle and seat assembly for wear. Install a new factory matched set if worn.

5. Inspect upper and lower gasket sealing surfaces for damage.

6. Inspect holes in levers for excessive wear or out of round condition. If levers or rods are worn they should be replaced.

7. Examine fast idle cam for excessive wear or damage.

8. Check throttle and choke levers and valves for binds and other damage.

9. Check all spring for distortion or loss in tension, replace as necessary.

CARBURETOR ASSEMBLY AND ADJUSTMENT PROCEDURES

THROTTLE BODY ASSEMBLY AND INSTALLATION (Fig. 6B-29)

1. Install idle mixture needle and spring until lightly seated. Back out five turns as a preliminary idle adjustment.

2. Invert float bowl and install new throttle body to bowl insulator gasket making sure all holes in gasket align with holes in float bowl.

3. Install throttle body on bowl gasket so that all holes in throttle body are aligned with holes in gasket.

4. Install two throttle body to bowl attaching screws. Tighten evenly and securely (12 - 15 lb. ft.)

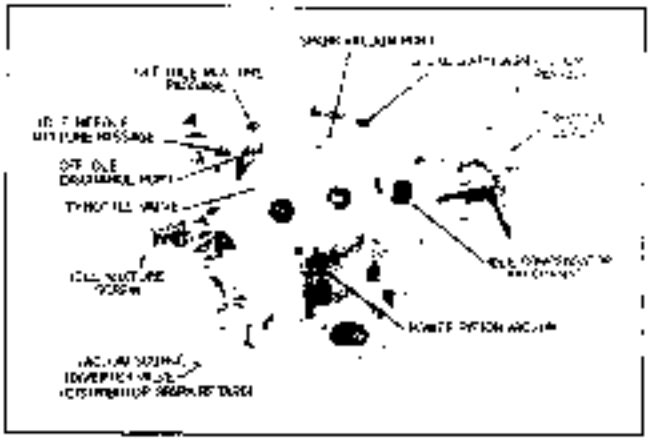


Fig. 6B-29 Throttle Body Disassembly

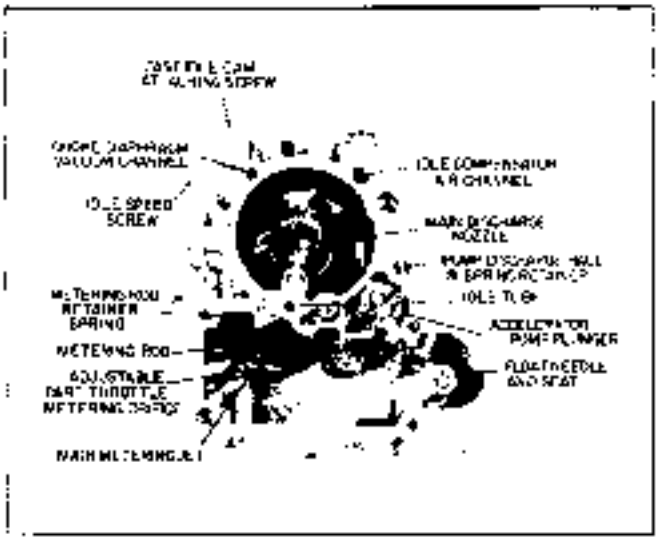


Fig. 6B-30 Float Bowl Assembly

FLOAT BOWL ASSEMBLY (Fig. 6B-30)

1. Install fast idle cam to boss on float bowl, attaching with fast idle cam screw. Tighten securely. Part number on cam faces outward.

2. Install slow idle adjustment screw, if removed.

3. Install seal into recess in idle compensator cavity in float bowl, then install idle compensator.

4. Install idle compensator cover, retaining with two attaching screws. Tighten securely.

5. Install main metering jet into bottom of float bowl. Tighten securely.

6. Install pump return spring into pump well. Make sure spring is properly seated in bottom of well.

7. Install pump plunger into pump well with actuating shaft protruding through bottom of bowl casting. Push downward on pump plunger and install pump drive link into hole in lower end of plunger shaft. Ends of drive link point toward carburetor bore. Lip at upper end of link retains link to pump shaft.

8. Install pump actuating lever to lower end of pump drive link by aligning lip on rod with notch in lever. Projection on actuating lever points downward. Install power piston actuating link into opposite end of actuating lever. Lower end of link has retaining lip and faces outward (away from throttle bore).

9. Install end of power piston actuating rod into groove on side of power piston. Then install power piston spring, power piston, metering rod assembly and actuating rod into float bowl. End of metering rod must enter jet orifice.

10. Hold complete assembly downward in bowl, then install power piston drive link into hole in lower end of power piston actuating rod (beneath bowl). Align D hole in actuating lever with flats on throttle shaft and install lever on end of throttle shaft. Install retaining screw in end of throttle shaft and tighten securely.

11. Install idle tube into cavity in float bowl.

12. Install pump discharge ball, spring and spring retainer. Make sure spring retainer is in flush with top of bowl casting.

13. Install fuel filter relief spring, fuel inlet filter, filter nut and gasket. Tighten to 25 lb. ft.

NOTE: Open end of filter should face hole in fuel inlet nut.

14. Install float needle seat and gasket and tighten securely using care not to damage needle seat.

15. Install float needle valve into needle seat.

16. Insert float hinge pin into float arm. Then install float and hinge pin into float bowl.

17. FLOAT LEVEL ADJUSTMENT (Fig. 6B-31)

a. Hold float retaining pin firmly in place and float arm against top of float needle, by pushing downward on float arm at point between needle seat and hinge pin, as shown.

b. With adjustable T-scale, measure distance from top of float at toe to float bowl gasket surface (gasket removed). Measurement should be made at point 1/16" in from end of flat surface at float toe (not on radius).

18. METERING ROD ADJUSTMENT (Fig. 6B-32)

a. Remove metering rod by holding throttle valve wide open. Push downward on metering rod

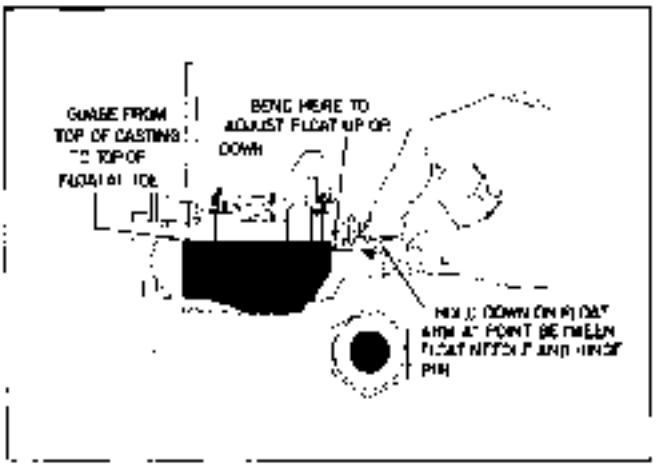


Fig. 6B-31 Float Level Adjustment

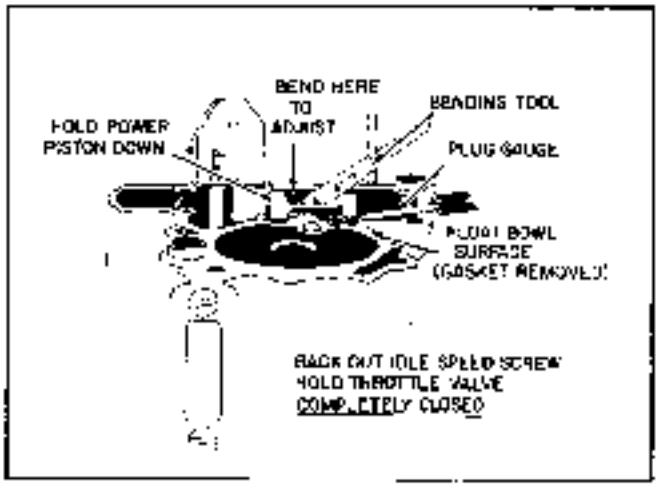


Fig. 6B-32 Metering Rod Adjustment

against spring tension, then slide metering rod out of slot in holder and remove from main metering jet.

b. To check adjustment back out slow idle screw and rotate fast idle cam so that fast idle cam follower is not contacting steps on cam.

c. With throttle valve completely closed, apply pressure to top of power piston and hold piston down against its stop.

d. Holding downward pressure on power piston, swing metering rod holder over flat surface of bowl casting next to carburetor bore

e. Use specified gauge and insert between bowl casting sealing bead (gasket removed) and lower surface of metering rod holder. Gauge should have a slide fit between both surfaces, as shown. (Use gauge .015" for 7028065 carburetor, .085" for remaining two.)

f. To adjust, carefully bend metering rod holder up or down at point shown.

g. After adjustment install metering rod and tension spring

19. Install air horn gasket on float bowl by carefully sliding slot portion of gasket over metering rod holder. Then align gasket with dowels provided on top of bowl casting and press gasket firmly in place.

AIR HORN ASSEMBLY AND INSTALLATION (Fig. 6B-27)

1. Install idle vent valve, if removed.

2. Install choke shaft, choke valve and vacuum break lever, if removed. Align choke valve, tighten two retaining screws and stake securely.

3. Install vacuum break diaphragm and plunger into cavity at side of air horn. With choke valve in the open position, slide eyelit of plunger rod over end of vacuum break lever on choke valve.

4. Seat vacuum break diaphragm over sealing bead on air horn casting. With diaphragm held in place, carefully install diaphragm cover and two retaining screws. Tighten screws securely.

5. Install air horn to float bowl by lowering gently on to float bowl until seated. Install three long and three short air horn to float bowl attaching screws and tighten securely.

6. Assemble choke rod to the choke shaft lever. End of rod points away from air horn casting when installed properly. Lower end of rod has 45 degree bend.

7. Install lower end of choke rod into curved slot in fast idle cam. Steps on fast idle cam should face fast idle lug on throttle lever.

8. Install upper choke lever to choke shaft. Flat of lever faces towards vacuum break diaphragm. (See Fig. 6B-28). Install choke lever screw. Tighten securely.

IDLE VENT ADJUSTMENT (Fig. 6B-33)

Set engine idle rpm to specification (solenoid inactive) and hold choke valve wide open so that the fast idle cam follower is not hitting the fast idle cam. Initial idle setting can be made by turning idle screw in 1 1/2 turns from closed throttle position.

With throttle lever held against the idle screw, the idle vent valve should be open as specified. To measure insert plug gauge between top of air horn casting and bottom of vent valve.

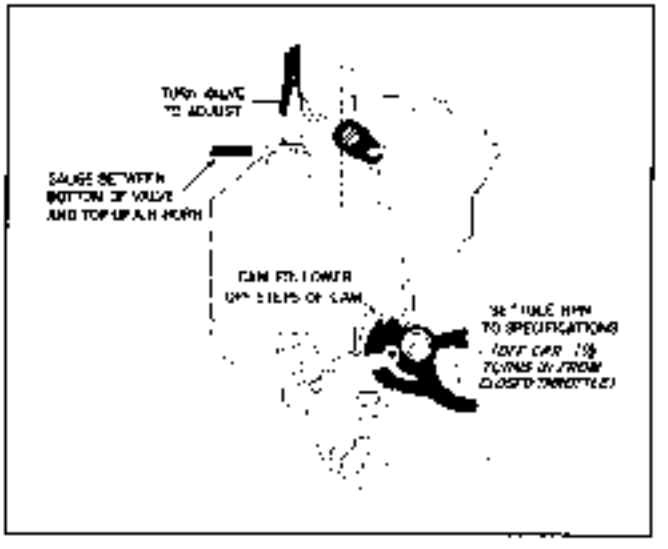


Fig. 6B-33 Idle Vent Adjustment

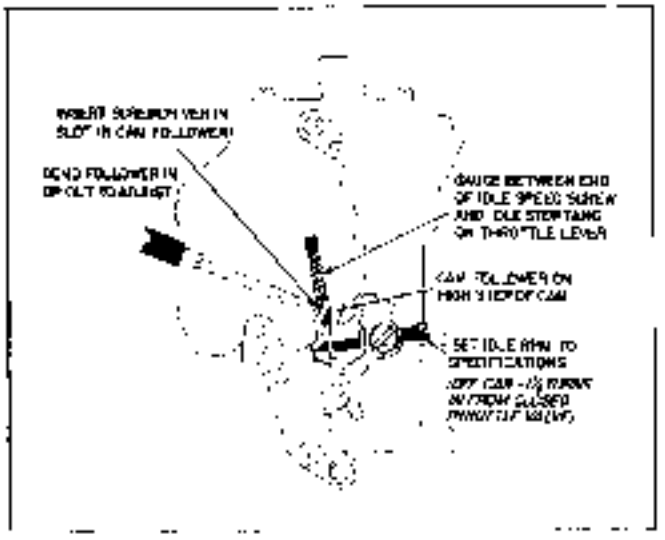


Fig. 6B-34 Fast Idle Adjustment

To adjust, turn slotted vent valve bead with screw driver, clockwise (inward) to decrease clearance and counterclockwise (outward) to increase clearance as needed.

FAST IDLE ADJUSTMENT (Fig. 6B-34)

1. Set normal engine idle speed. (Initial idle speed setting off car is 1 1/2 turns in on idle speed screw from closed throttle valve position).

2. Place fast idle cam follower tang on highest step of cam.

3. With tang held against cam check clearance between end of slow idle screw and idle stop tang on throttle lever. It should be as specified: (.390").

4. To adjust insert end of screw driver in slot provided in fast idle cam follower tang and bend inward (towards cam) or outward (away from cam) to obtain specified dimension.

CHOKE ROD ADJUSTMENT

With fast idle adjustment made (Fig. 6B-35)

1. Place fast idle cam follower on second step of the fast idle cam and hold firmly against the rise to the high step.

2. Rotate choke valve towards direction of closed choke by applying force to choke coil lever.

3. Bend choke rod at point shown to give specified opening between the lower edge of choke valve (at center of valve) and inside air horn wall.

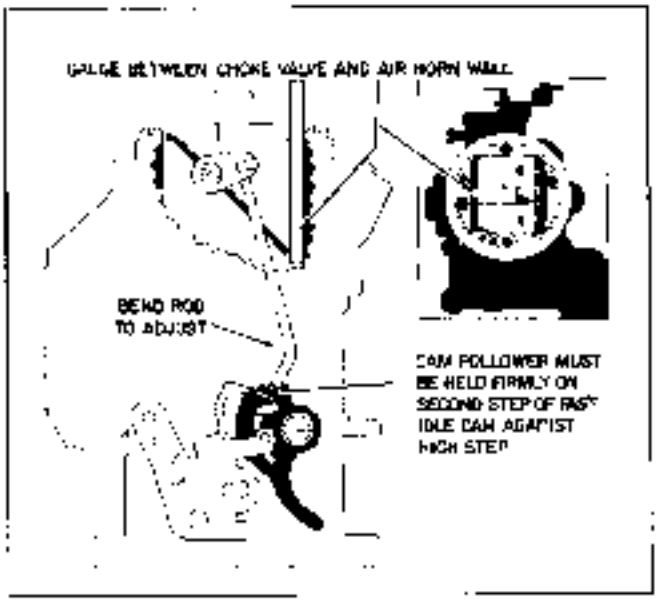


Fig. 6B-35 Choke Rod Adjustment

VACUUM BREAK ADJUSTMENT (Fig. 6B-36)

1. Open throttle valve so that cam follower on throttle lever will clear highest step on fast idle cam.

2. Rotate choke valve to closed position. If thermostatic coil is warm, hold choke valve closed with rubber band or spring attached between choke shaft lever and stationary part of carburetor.

3. Grasp vacuum break plunger rod with needle nose pliers and push straight inward until diaphragm seats.

4. With specified plug gauge, measure clearance between lower edge of choke valve and inside air horn wall at center of valve as shown.

5. Bend end of vacuum break lever at point shown to adjust.

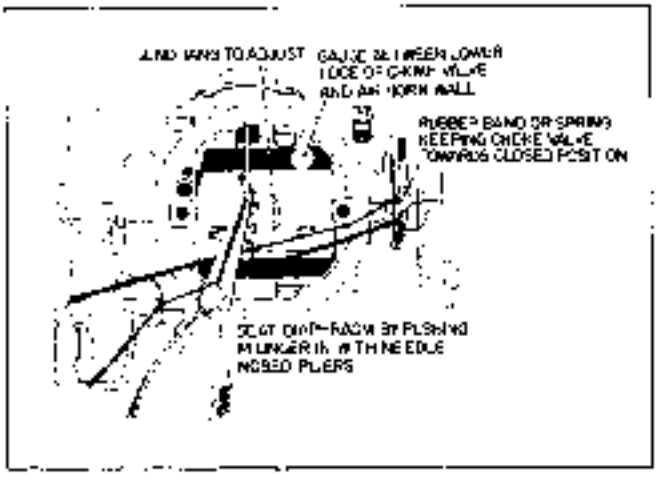


Fig. 6B-36 Vacuum Break Adjustment

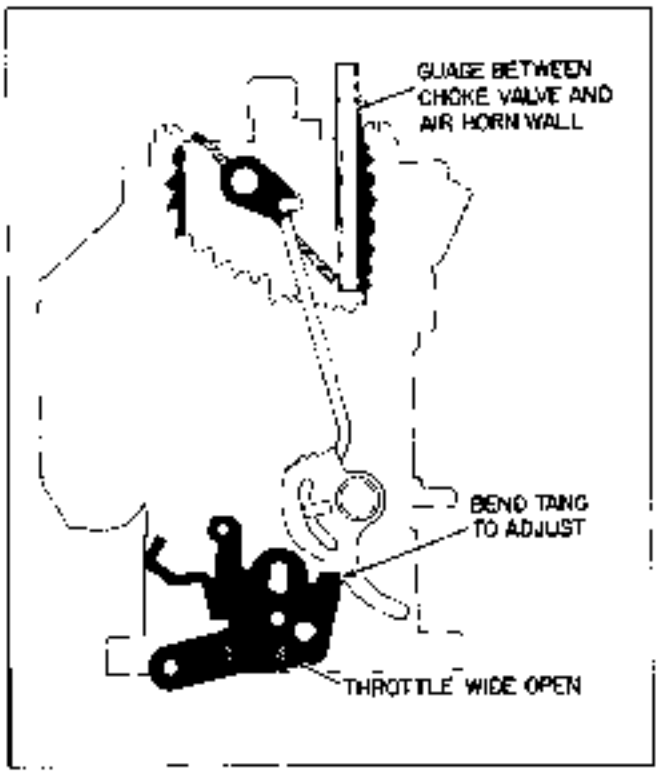


Fig. 6B-37 Unloader Adjustment

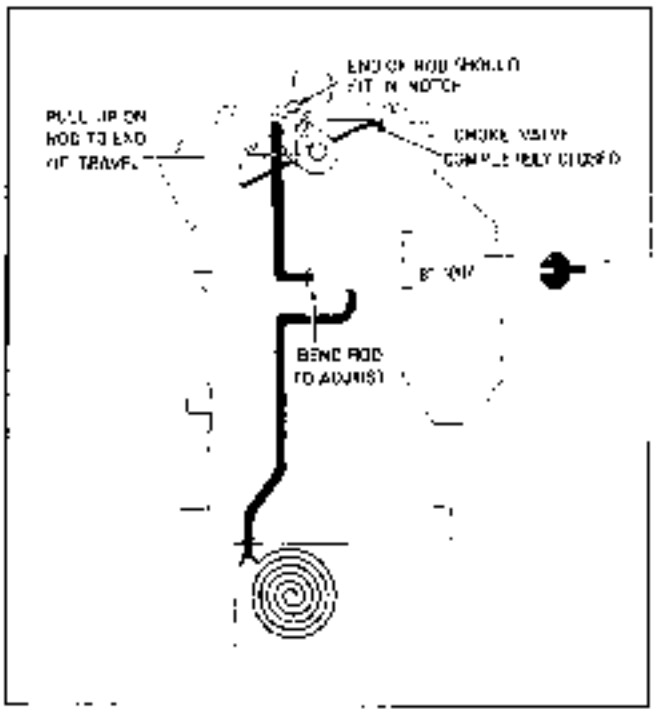


Fig. 6B-38 Choke Coil Rod Adjustment

UNLOADER (Fig. 6B-37)

1. Hold choke valve in closed position by applying a light force to the choke coil lever.

2. Rotate throttle lever to wide open throttle valve position.

3. Bend unloader tang on throttle lever to obtain specified dimension between lower edge of choke valve (at center) and air horn wall.

CHOKE COIL ROD ADJUSTMENT (Fig. 6B-38)

1. Hold choke valve closed.

2. Pull upward on coil rod to end of travel.

3. Bottom of rod end which slides into lever in choke lever should lay freely in notch on the choke lever.

4. Bend choke coil rod at point shown to adjust.

5. Connect coil rod to choke lever and install retaining clip.

FAST IDLE ADJUSTMENT ON CAR

1. Warm up engine.

2. Place fast idle cam follower on top step of fast idle cam.

3. With cam follower held against top step, insert screw driver or adjustment tool and bend tang towards or away from cam to obtain specified rpm.

ROCHESTER 2GV CARBURETOR

V-8 ENGINE

Carburetor Model Number	Usage
7028060	400 Automatic Trans.
7028062	350 Automatic Trans.
7028068	400 Manual Trans.
7028071	350 Manual Trans.

ADJUSTMENTS ON CAR

All Rochester 2GV adjustments can be performed on the car. With the exception of idle speed and mixture adjustment all adjustments are included in the OVERHAUL AND ADJUSTMENTS procedure. Following are idle speed and mixture adjustments.

IDLE SPEED AND MIXTURE ADJUSTMENT

With engine at operating temperature adjust idle speed following the procedure at the end of Section 6D.

Whenever solenoid screw is turned to adjust idle, the throttle should be opened slightly, then closed to seat throttle lever extension on the screw.

The idle mixture should be adjusted to give best lean idle at specified idle speed. Missing is a sign of too lean an idle mixture while rolling or loping indicates too rich a mixture. Turning idle mixture screw in, leans out mixture; four turns out from lightly seated position may be used as a preliminary setting of mixture screws; mixture to be leaned out from this setting to achieve best lean idle.

PERIODIC SERVICE

There are no periodic services required on the Rochester 2GV carburetor, however, choke linkage, choke valve and levers and pump linkage should be kept free of dirt and gum so that they will operate freely. DO NOT OIL CHOKE VALVE SHAFT OR ANY PART OF THE LINKAGE.

OVERHAUL AND ADJUSTMENT

Flooding, stumble on acceleration and other performance complaints are, in many instances, caused by presence of dirt, water or other foreign matter in carburetor. To aid in diagnosing the cause of complaint, the carburetor should be carefully removed from engine without draining fuel from bowl. The contents of fuel bowl may then be examined for contamination as carburetor is disassembled.

The following is a step-by-step sequence by which the Rochester 2GV carburetor may be completely disassembled and reassembled. Adjustments may be made and various parts of the carburetor may be serviced without completely disassembling the entire unit.

DISASSEMBLY OF BOWL COVER

1. Remove fuel inlet filter retainer nut and gasket and remove filter.

2. Disconnect pump link (Fig. 6B-40) from pump lever by removing spring clip. Remove lower end of pump rod from throttle lever by removing clip.

3. Detach choke intermediate rod (Fig. 6B-39) at lower end by removing clip, then detach choke intermediate rod from choke shaft by rotating until tang on rod clears slot in lever.

4. Remove retaining screw at end of choke shaft and remove choke trip lever and fast idle link and lever (Fig. 6B-40). Lever can be removed from link by turning until slot in lever will pass over tang on link. The link and fast idle cam are retained by a Truarc washer. Disassembly of these pieces will destroy Truarc washer.

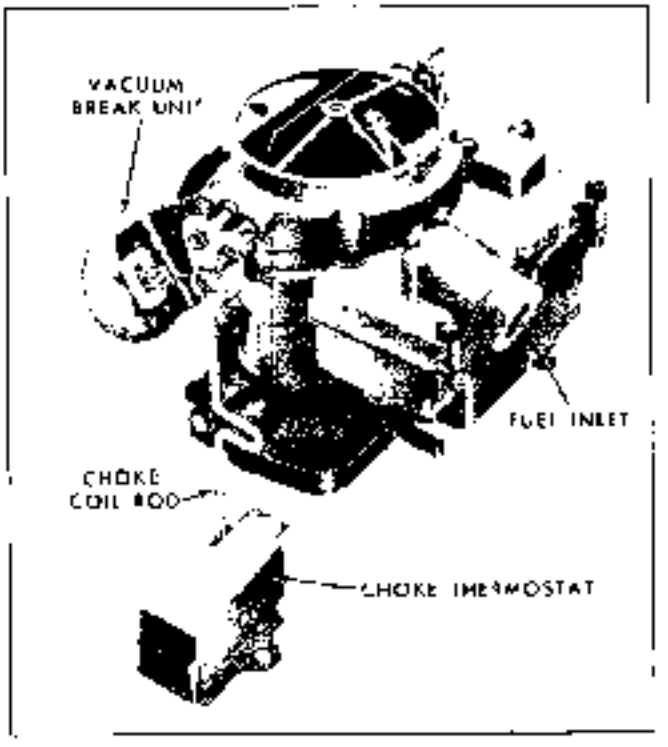


Fig. 6B-39 Rochester 2GV Carburetor

5. Remove eight cover screws and lift cover from bowl (Fig. 6B-41).

6. Remove vacuum break unit and hose.

7. Place unbolted cover on flat surface. Remove float hinge pin and lift float from cover (Fig. 6B-42). Float needle may now be removed from seat.

8. Remove float needle seat, screen (Fig. 6B-42) and gasket with wide blade screwdriver.

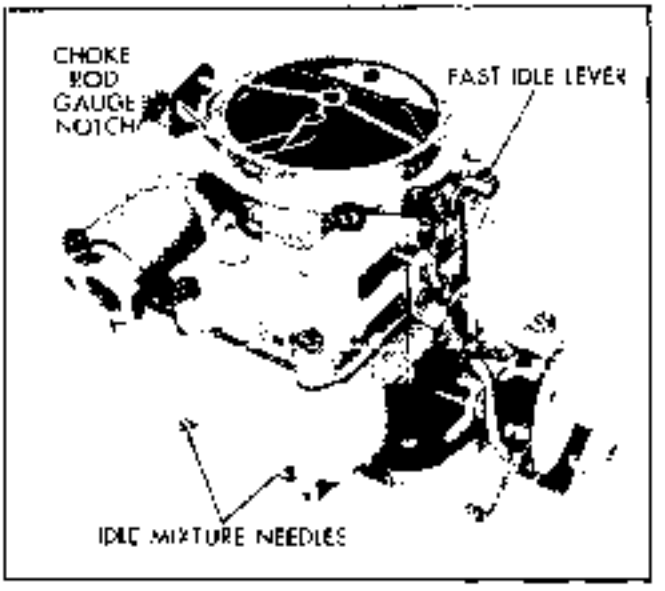


Fig. 6B-40 Rochester 2GV Carburetor

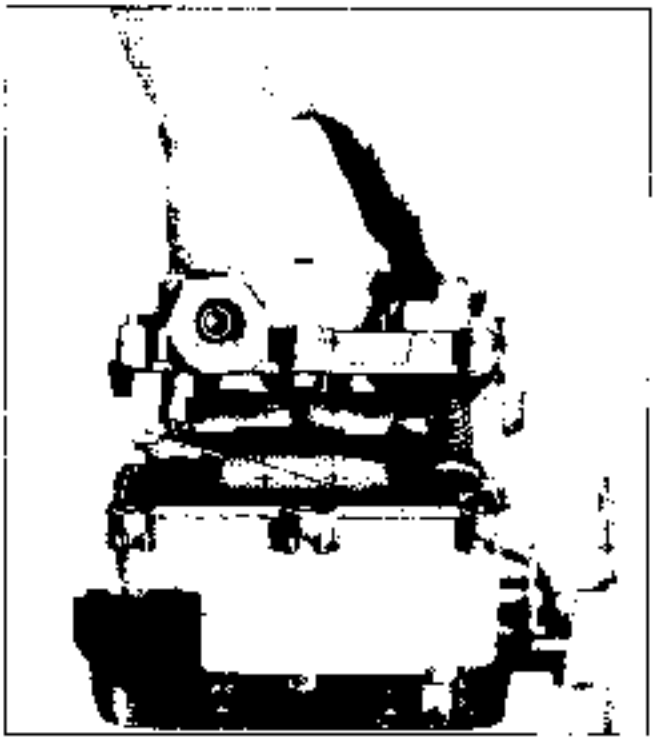


Fig. 6B-41 Air Horn Removal

8. Remove power piston (Fig. 6B-42) by depressing piston stem and allowing it to snap free or by holding stem and tapping lightly on air horn with a nonmetallic object. Use care not to bend piston stem.

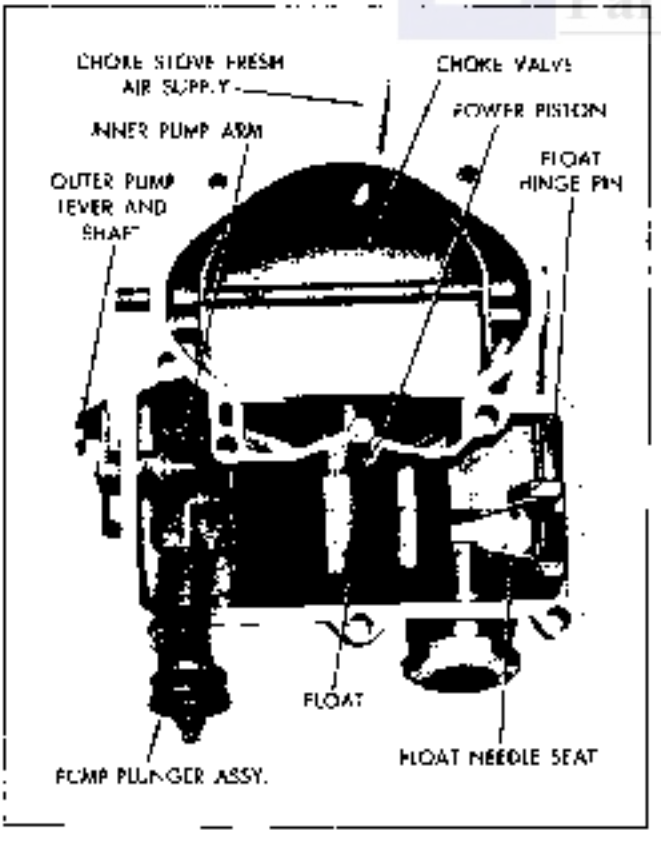


Fig. 6B-42 Bowl Cover Attaching Parts

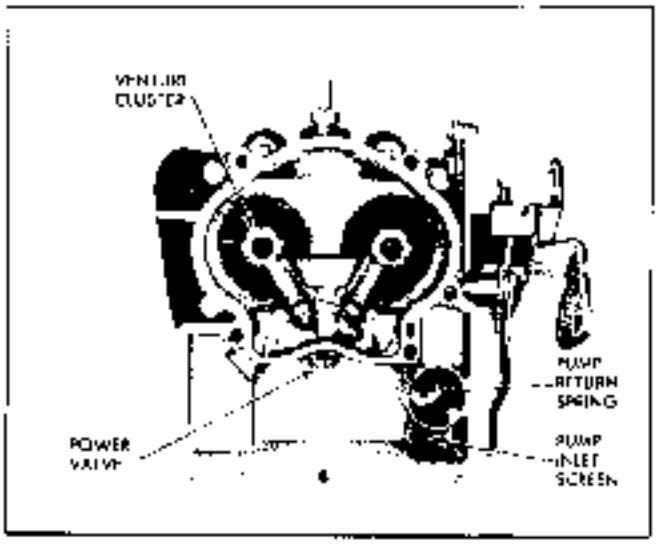


Fig. 6B-43 Carburetor Body Details

9. Remove retainer on pump plunger shaft, remove plunger assembly from pump arm. The pump lever and shaft may be removed by loosening set screw on inner arm and removing outer lever and shaft.

10. The cover gasket may now be removed.

11. Remove two choke valve attaching screws, then remove choke valve.

12. Remove choke valve shaft from bowl cover.

DISASSEMBLY OF BOWL

1. Remove pump inlet filter screen and pump plunger return spring, and remove aluminum check ball from bottom pump well (Fig. 6B-43).

2. Remove main metering jets and power valve (Fig. 6B-43).

3. Remove three screws holding cluster to bowl and remove cluster and gasket.

4. Using a pair of long nose pliers, remove pump discharge spring retainer (Fig. 6B-44). Then spring and check ball may also be removed.

5. Invert carburetor and remove three large bowl to throttle body attaching screws. Throttle body and gasket may now be removed.

6. Remove fast idle cam and fast idle link as an assembly. DO NOT disassemble.

DISASSEMBLY OF THROTTLE BODY

1. Remove idle adjusting needles and springs.

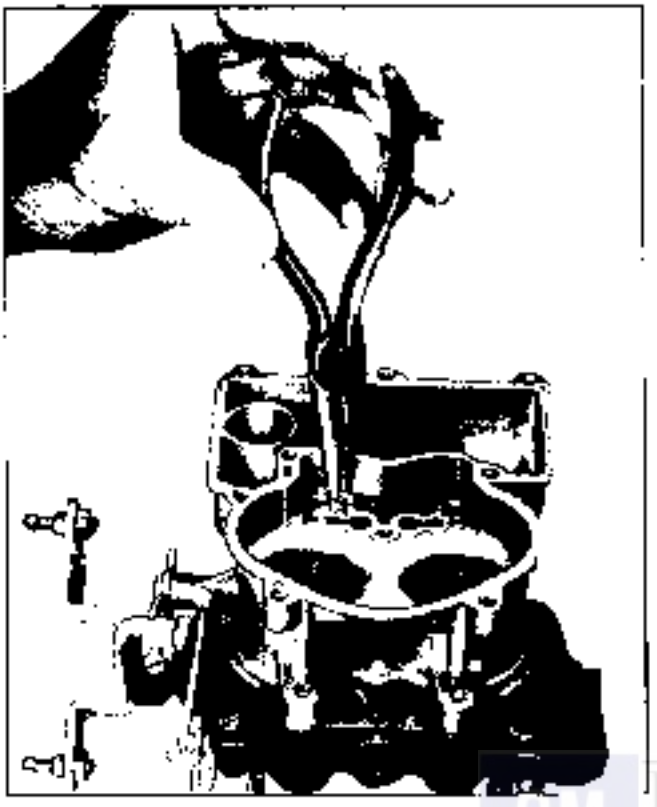


Fig. 6B-44 Removing Pump Discharge Spring Retainer

2. Remove fast idle screw from throttle lever if necessary to replace.

CLEANING AND INSPECTION

Dirt, gum, water or carbon contamination in or on exterior moving parts of a carburetor are often responsible for unsatisfactory performance. For this reason, efficient carburetion depends upon careful cleaning and inspection while servicing.

1. Thoroughly clean carburetor casting and metal parts in clean cleaning solvent.

CAUTION: Vacuum break unit, gaskets, and pump plunger should not be immersed in solvent. Clean pump plunger in clean gasoline only.

2. Blow all passages in castings (Fig. 6B-45) through 6B-49) dry with compressed air and blow off all parts until they are dry.

CAUTION: Do not pass drills or wires through calibrated jets or passages as they may enlarge orifices and seriously affect carburetor calibration.

3. Check all parts for wear. If wear is noted, defective parts must be replaced. Note especially the following:

a. Check float needle and seat for wear. If wear is noted the assembly must be replaced.

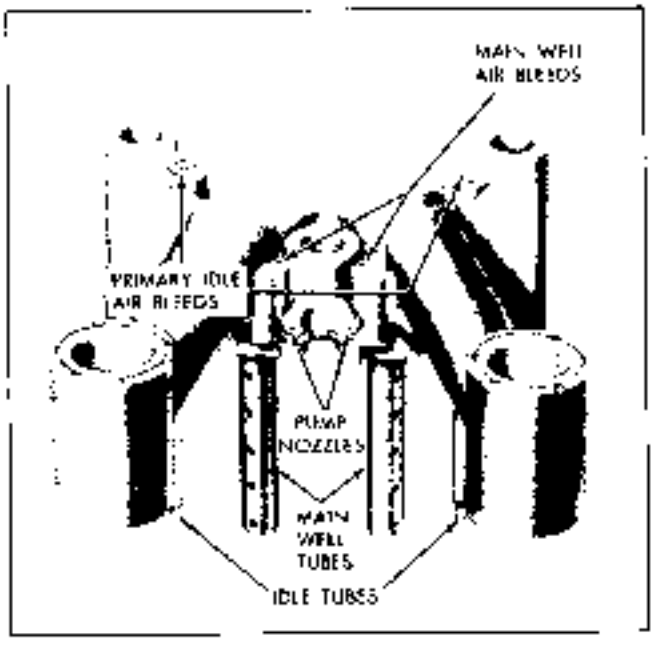


Fig. 6B-45 Venturi Cluster Passage Identification

b. Check float lip for wear and float for damage.

c. Check throttle and choke shaft bores in throttle body and cover castings for wear or out of round.

d. Inspect idle adjusting needle for burrs or ridges. Such a condition requires replacement.

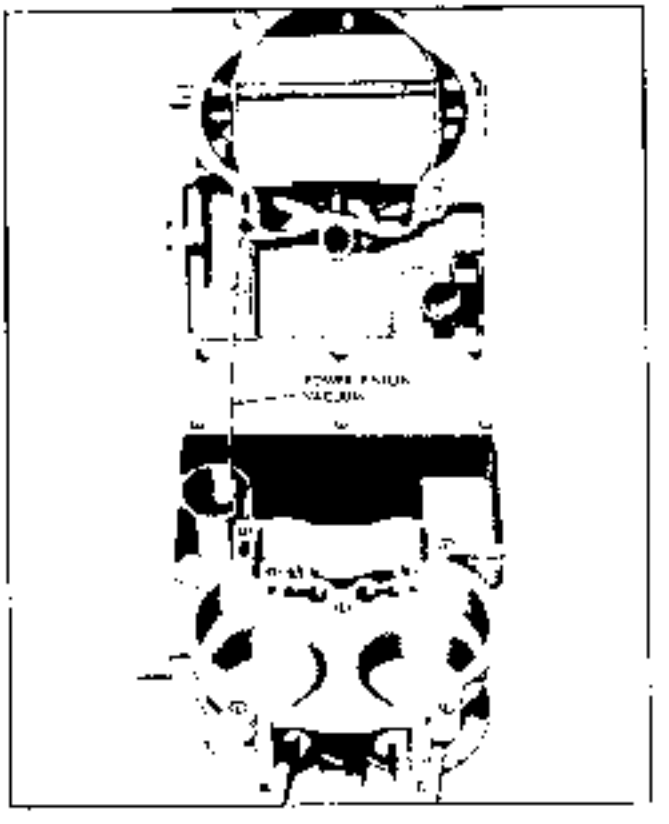


Fig. 6B-46 Body to Bowl Cover Passage Identification

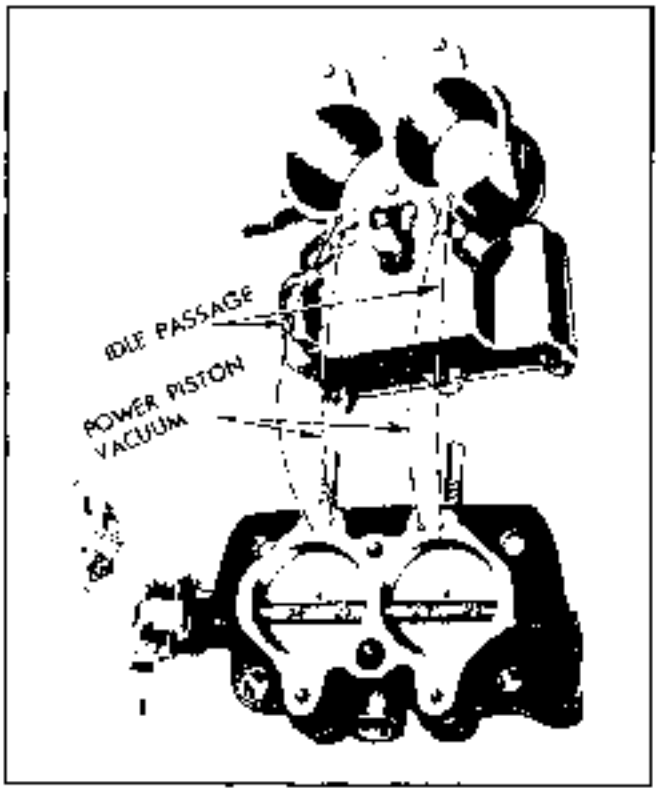


Fig. 6B-47 Flange—Bowl Passage Identification

e. Inspect fast idle cam. If wear is noted on steps of cam, it should be replaced as it may upset engine idle speed during the warm-up period.

f. Inspect pump plunger cup. Replace plunger if cup is damaged.

g. Inspect power piston and spring for burrs or distortion. Replace if necessary.

4. Check all filter screens for dirt or lint. Clean and, if they are distorted or plugged, replace with new parts.

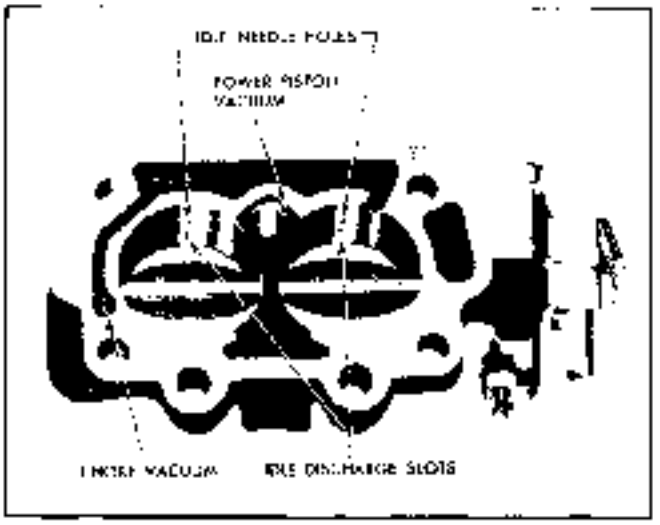


Fig. 6B-48 Throttle Flange Passage Identification

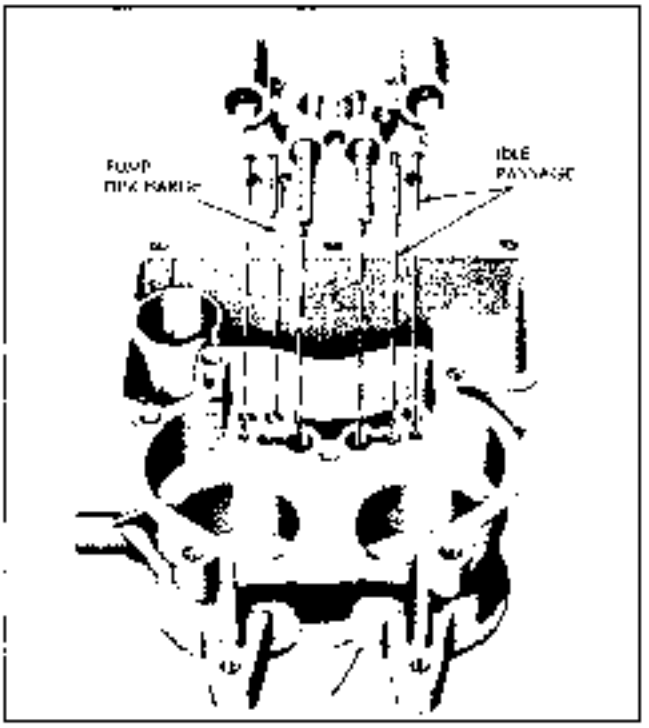


Fig. 6B-49 Body to Cluster Passage Identification

5. Inspect cluster casting. If any parts in castings are loose or damaged, cluster assembly must be replaced.

6. Use new gaskets in reassembly.

ASSEMBLY OF THROTTLE BODY

1. Install idle screw in throttle lever if removed.

2. Screw idle mixture adjusting needles and springs into throttle body until finger tight. Back out screw 4 turns as a preliminary idle adjustment.

3. Upend bowl, place new throttle body gasket in position and attach throttle body. Tighten screws evenly and securely.

ASSEMBLY OF BOWL

1. Drop steel pump discharge check ball into pump discharge hole. Ball is 3/16" diameter (do not confuse with aluminum intake ball). Install pump discharge spring and retainer.

2. Replace cluster and gasket, tighten screws evenly and securely. Make certain center screw is fitted with gasket to prevent pump discharge leakage.

3. Replace main metering jets and power valve.

4. Drop aluminum pump intake ball check into hole in pump well. Install pump return spring, pressing with finger to center it in pump well.

5. Replace pump inlet strainer, pressing carefully into position.

ASSEMBLY OF BOWL COVER

1. Install choke shaft in air horn, then install choke valve on choke shaft, using two attaching screws. Letters RP on choke valve should face towards top of air horn. Center choke valve before tightening screws, by installing the fast idle lever and choke trip lever. Maintain approximately .020" clearance between the fast idle lever and air horn casting. Then tighten choke valve screws and stake lightly. Then install choke trip lever and fast idle lever. Choke valve should move freely in housing.

2. Replace pump outer lever and shaft assembly and inner lever, tighten retaining screw on inner lever.

3. Install small fuel screen on needle seat.

4. Install float needle seat screen and gasket, using wide blade screwdriver.

5. Drop aluminum pump intake ball check into shaft end pointing inward towards center of air horn casting.

6. Install cover gasket.

7. Insert needle in seat, carefully position float and insert hinge pin.

8. Check float level and drop adjustments.

FLOAT LEVEL ADJUSTMENT (Fig. 6B-50)

With air horn inverted, gasket in place and needle seated, there should be 9/16" ± 1/32" clearance between the lip of the float at toe end and air horn gasket.

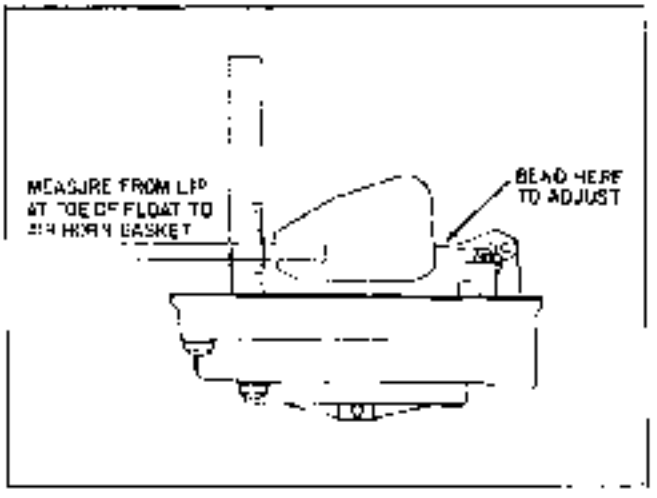


Fig. 6B-50 Float Level Adjustment

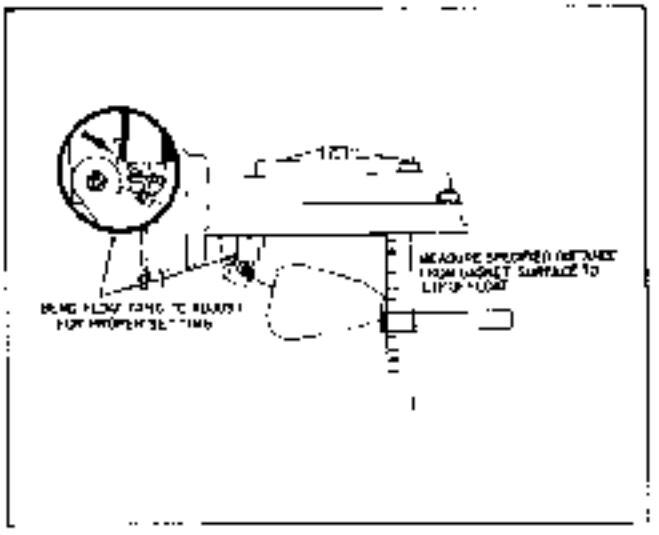


Fig. 6B-51 Float Drop Adjustment

Use gauge set J 9556. To adjust, bend float arm at rear of float. Visually check float alignment after adjusting float.

FLOAT DROP ADJUSTMENT (Fig. 6B-51)

With air horn right side up so that float can hang free, the distance from gasket surface to lip of float should be a minimum of 1 3/4". Maximum drop can be any amount that will retain needle for installation. Needle must not wedge at maximum drop. To adjust, bend tang at rear of float towards needle seat to decrease float drop and away from needle seat to increase float drop.

1. Install power piston in vacuum cavity; piston should travel freely in cavity. Stake vacuum piston retainer washer.

2. Place cover on bowl, making certain that accelerator pump plunger is correctly positioned and will move freely.

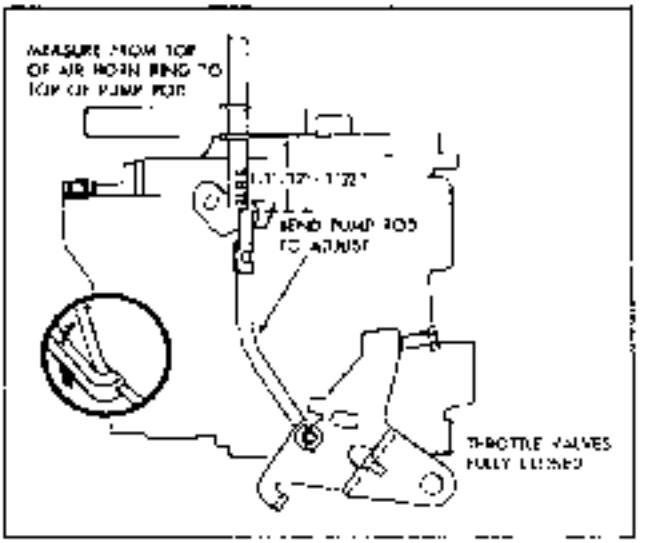


Fig. 6B-52 Pump Rod Adjustment

Fig. 6B-53 Fast Idle Cam Installed

3. Install and tighten eight cover screws evenly and securely.

4. Install inlet filter, pressure relief spring and tighten nut to 25 lb. ft.

5. Install pump link and retainer.

6. Check pump rod adjustment.

PUMP ROD ADJUSTMENT (Fig. 6B-52)

Place tool on top of cleaner mounting ring as shown. Then with throttle valves fully closed the top surface of pump rod should just touch the end of gauge. Measurement should be 1 11/32" ± 1/32". Bend pump rod to adjust.

1. Install fast idle link and fast idle cam as an assembly and install fast idle lever on other end of fast idle link. Place fast idle lever on choke shaft with the tang facing outward and toward the pump lever. Install trip lever so that tang of trip lever is under tang of choke lever, and install retaining screw (Fig. 6B-53).

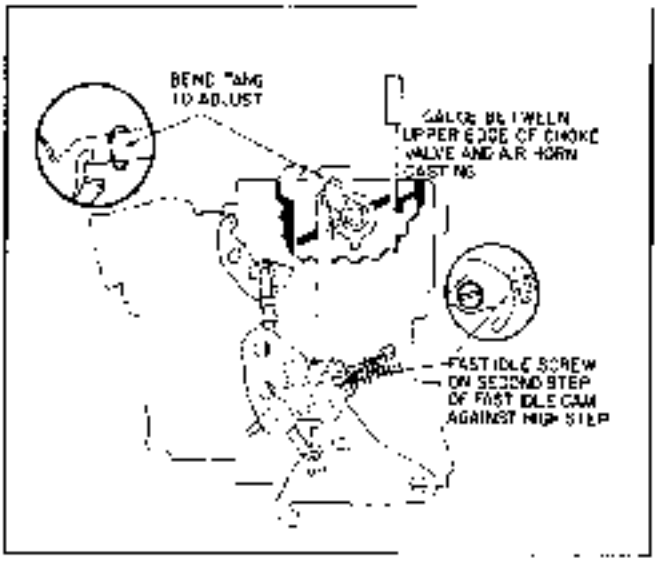


Fig. 6B-54 Choke Rod Adjustment

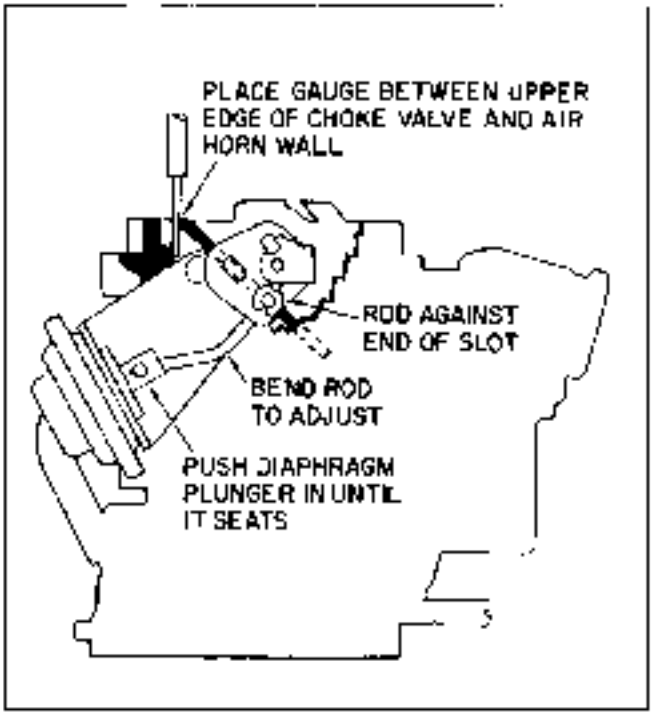


Fig. 6B-55 Vacuum Break Adjustment

2. Connect vacuum hose at flange, and at vacuum break unit.

3. Check choke rod adjustment.

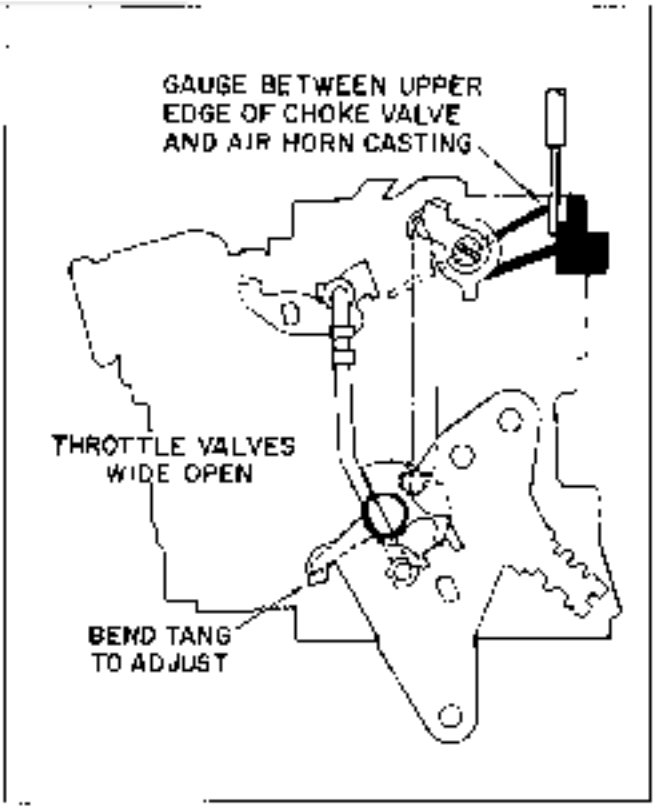


Fig. 6B-56 Unloader Adjustment

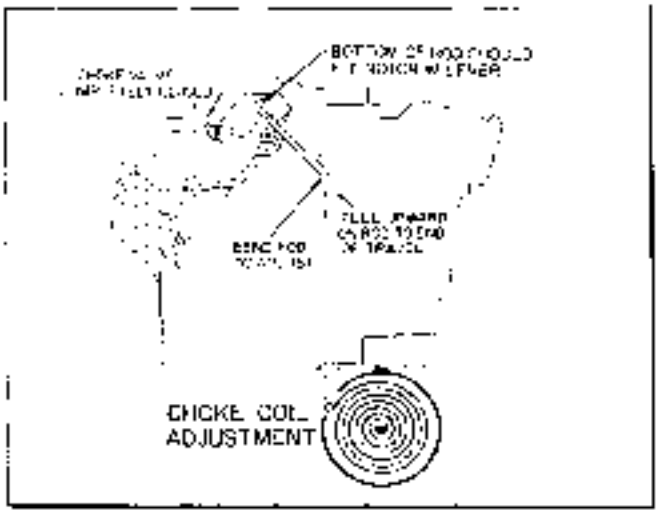


Fig. 6B-57 Choke Coil Rod Adjustment

CHOKE ROD ADJUSTMENT (Fig. 6B-54)

Place idle screw on second step of fast idle cam against shoulder of high step. While holding screw in this position, gauge between upper edge of choke valve and air horn wall. Adjust to specified dimension by bending long on choke lever and collar assembly.

After the carburetor is assembled the following adjustments must be checked.

VACUUM BREAK ADJUSTMENT (Fig. 6B-55)

With vacuum break diaphragm seated and choke valve closed so the vacuum break rod is at the end of the slot in the choke shaft lever, gauge between the upper edge of the choke valve and inside wall of the air horn casting. To adjust, bend the vacuum break rod.

UNLOADER ADJUSTMENT (Fig. 6B-56)

With the throttle valves held wide open the choke valve should be open enough to admit the specified gauge between the upper edge of the choke valve and inner air horn wall. Bend long on throttle lever to adjust.

CHOKE COIL ROD ADJUSTMENT (Fig. 6B-57)

To adjust, disconnect the upper end of the choke coil rod from the choke lever. With choke valve completely closed, pull upward on the choke coil rod to the limit of its travel. The end of the rod should fit the gauge notch on the choke lever.

To adjust, bend rod as shown.

ROCHESTER 4MV QUADRAJET CARBURETOR

Carburetor Model Number	Engine and Transmission Usage	Car Model
7026260	350 A.T.	A & F
7026261	350 M.T.	A & F
7026262	400 A.T.	B
7026263	400 & 428 M.T.	A & B
7026264	400 & 400 H.O. A.T.	F
7026265	400 M.T.	F
7026266	350 A.T.	A & F
7026267	400 H.O. & 428 H.O. M.T.	A & B
7026268	400 & 400 H.O. A.T.	A
	428 & 428 H.O. A.T.	B
7026269	350 M.T.	A & F
7026271	400 H.O. M.T.	F
7026274	400 Ram-Air A.T.	A
7026275	400 Ram-Air M.T.	A
7026276	400 Ram-Air A.T.	F
7026277	400 Ram-Air M.T.	F

Car Model Code:
A - Tempest B - Pontiac F - Firebird

Carburetor identification and change code is stamped on the throttle lever side of the float bowl.

ADJUSTMENTS ON CAR

All Rochester 4MV adjustments can be performed on the car. With the exception of the idle speed and mixture adjustment and the unloader adjustment, all adjustments are included in the OVERHAUL AND ADJUSTMENTS procedure.

Whenever the idle speed screw is turned, the throttle should be opened slightly, then closed to seat screw properly on cam (with solenoid disconnected).

The idle mixture should be adjusted to give a smooth idle at the specified idle speed. Missing is a sign of too lean an idle mixture while rolling or loping indicates too rich a mixture. Turning the idle mixture screw in leans out the mixture; five turns out from the lightly seated position may be used as a preliminary setting of the mixture screws on six-cylinder engine, and six turns out on V-8 engines. The mixture is to be leaned out from this initial setting to achieve the best lean idle.

PERIODIC SERVICE ROCHESTER 4MV CARBURETOR

There are no periodic services required on the Rochester 4MV carburetor; however, choke linkage, choke valve and levers and pump linkage should be kept free of dirt and gum so that they will operate freely. DO NOT OIL LINKAGE.

OVERHAUL AND ADJUSTMENT

Flooding, stumble on acceleration and other performance complaints are, in many instances, caused by the presence of dirt, water or other foreign matter in the carburetor. To aid in diagnosing the cause of the complaint, the carburetor should be carefully removed from the engine without draining the fuel from the bowl. The contents of the fuel bowl may then be examined for contamination as the carburetor is disassembled.

The following is a step-by-step sequence by which the Rochester 4MV carburetor may be completely disassembled and reassembled. Adjustments may be made and various parts of the carburetor may be serviced without completely disassembling the entire unit.

NOTE: Place carburetor on proper holding fixture.

DISASSEMBLY

AIR HORN REMOVAL (Fig. 6B-58)

1. Remove idle vent valve attaching screw then remove idle vent valve assembly.

2. Remove clip from upper end of choke rod, disconnect choke rod from upper choke shaft lever and remove choke rod from bowl.

3. Remove spring clip from upper end of pump rod then disconnect pump rod from pump lever.

4. Disconnect clip from vacuum break rod and remove rod.

5. Remove metering rods and hanger by removing screw from metering rod hanger located between air valves and lift out.

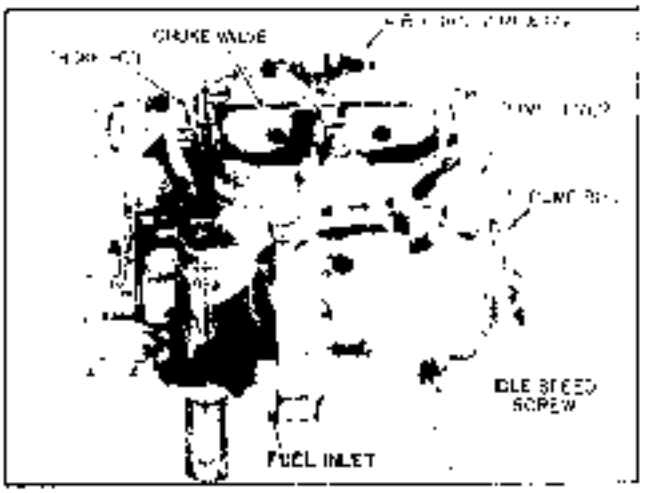


Fig. 6B-58 Rochester 4MV Carburetor

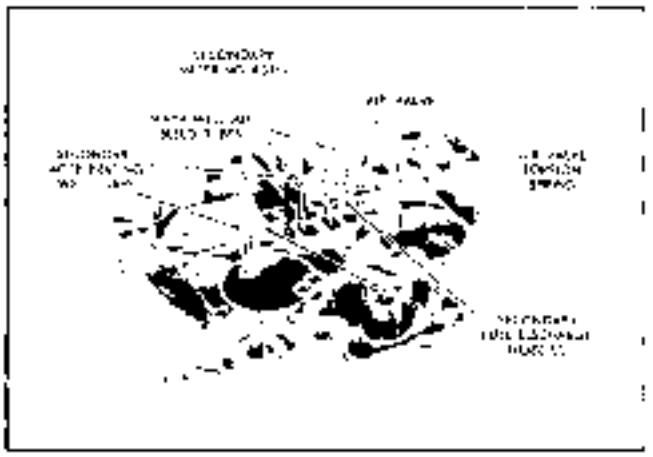


Fig. 6B-59 Air Horn Assy.

6. Remove nine air horn to bowl attaching screws (two attaching screws are located next to primary venturi, [Four long screws, three short screws, two counter-sunk screws]).

7. Remove air horn by lifting straight up. Air horn gasket should remain on bowl for removal later.

CAUTION: Care must be taken not to bend two small main well air bleed tubes protruding from air horn. These are permanently pressed into casting. DO NOT REMOVE.

AIR HORN DISASSEMBLY (Fig. 6B-59)

NOTE: Disassembly of air horn is not required for cleaning purposes. If part replacement is required, proceed as follows:

1. Remove choke valve attaching screws then remove choke valve and shaft.

2. Remove pump lever roll pin then pump lever.

CAUTION: Air valves and air valve shaft should not be removed.

FLOAT BOWL DISASSEMBLY (Fig. 6B-60)

1. Remove pump plunger from pump well.

2. Remove air horn gasket from dowels on secondary side of bowl, then remove gasket from around power piston and primary metering rods.

3. Remove pump return spring from pump well.

4. Remove plastic filler over float valve.

5. Remove power piston and primary metering rods, using needle nosed pliers to pull straight up on metering rod hanger directly over power piston

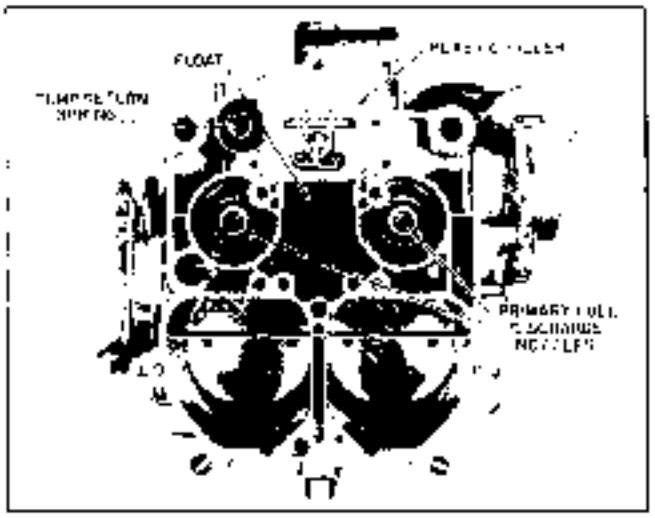


Fig. 6B-60 Float Bowl Assy.

(Fig. 6B-61). Remove power piston spring from well.

6. Remove metering rods from power piston by disconnecting tension spring from top of each rod then rotating rod to remove from hanger.

7. Remove float and float needle by pulling up on retaining pin.

8. Remove float needle seat and gasket.

9. Remove primary metering jets. No attempt should be made to remove secondary metering discs.

10. Remove pump discharge check ball retainer and check ball.

11. Remove baffle from secondary side of bowl.

12. Remove vacuum hose from vacuum break assembly and from tube connection on bowl.

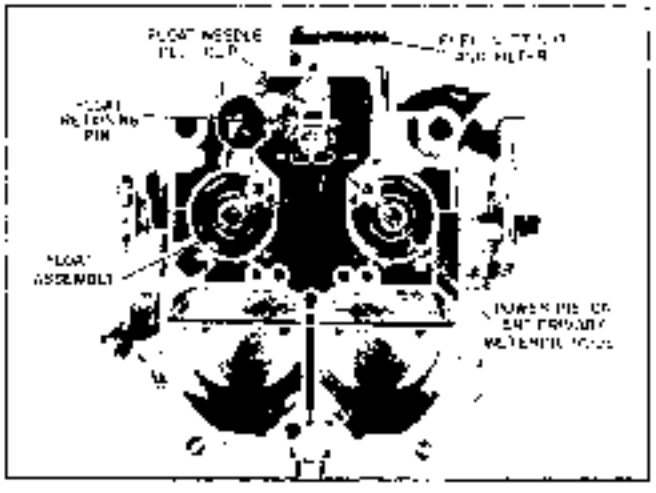


Fig. 6B-61 Float Bowl Assy.

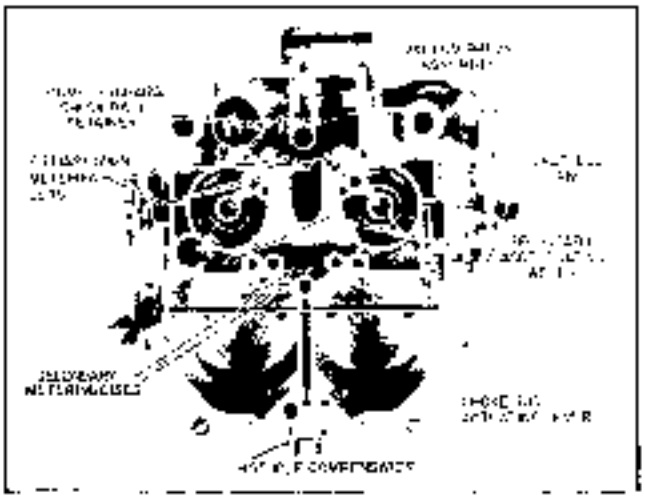


Fig. 6B-62 Float Bowl Assy.

13. Remove retaining screw from choke and remove assembly from float bowl.

NOTE: If further disassembly of choke is necessary, spread the retaining ears on bracket next to vacuum break assembly, then remove vacuum break assembly from bracket.

14. Remove fast idle cam from choke assembly.

CAUTION: Do not place vacuum break assembly in carburetor cleaner.

15. Remove choke rod actuating lever from inside of float bowl well.

16. Remove fuel inlet filter nut, gasket, filter and spring.

17. Remove throttle body by removing throttle body to bowl attaching screws.

18. Remove throttle body to bowl insulator gaskets.

THROTTLE BODY DISASSEMBLY (Fig. 6B-63)

1. Remove pump rod from throttle lever by rotating rod out of primary throttle lever.

2. Remove idle mixture screws and springs.

CAUTION: Extreme care must be taken to avoid damaging secondary throttle valves.

NOTE: No further disassembly of the throttle body is required.

CLEANING AND INSPECTION

NOTE: The carburetor should be cleaned in a cold immersion type cleaner.

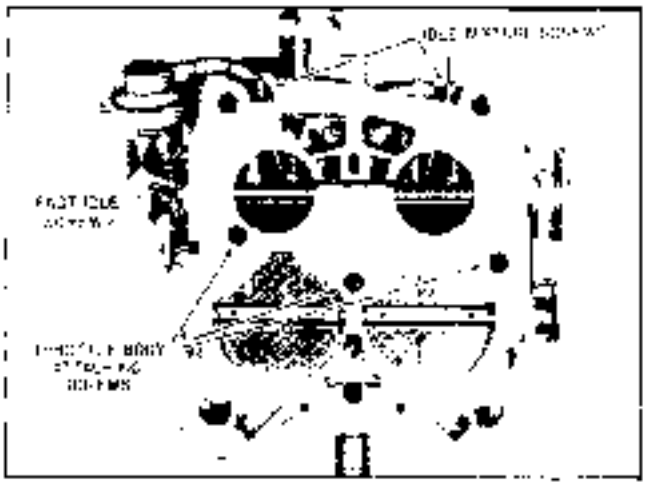


Fig. 6B-63 Throttle Body Assy.

1. Thoroughly clean carburetor castings and metal parts in an approved carburetor cleaner such as Carbon-X (X-55) or its equivalent.

CAUTION: Any rubber parts, plastic parts, diaphragms, pump plungers, should not be immersed in carburetor cleaner. However, the nylon cam on the air valve shaft will withstand normal cleaning in carburetor cleaner.

2. Blow out all passages in castings with compressed air. Do not pass drills through jets or passages.

3. Inspect idle mixture needles for damage.

4. Examine float needle and diaphragm for wear. Replace if necessary with new float needle assembly.

5. Inspect upper and lower surfaces of carburetor castings for damage.

6. Inspect holes in levers for excessive wear or out-of-round conditions. If worn, levers should be replaced.

7. Examine fast idle cam for wear or damage.

8. Check air valve for binding conditions. If air valve is damaged, air horn assembly must be replaced.

9. Check all throttle levers and valves for binds or other damage.

ASSEMBLY AND ADJUSTMENT PROCEDURES

THROTTLE BODY ASSEMBLY (Fig. 6B-63)

1. Install idle mixture needles and springs until seated. Back out needles five turns as a preliminary idle adjustment.

2. Install pump rod in lower hole of throttle lever by rotating rod.

FLOAT BOWL ASSEMBLY (Figs. 6B-60, 61, and 62)

1. Install new throttle body to bowl insulator gasket being certain gasket is properly installed over two locating dowels on bowl.

2. Install throttle body making certain throttle body is properly located over dowels on float bowl then install throttle body to bowl screws and tighten evenly and securely.

Place carburetor on proper holding fixture.

3. Install fuel inlet filter spring, filter, new gasket and inlet nut and tighten nut to 25 lb. ft.

NOTE: If vacuum break diaphragm was removed from bracket, slide vacuum break diaphragm between retaining ears to hold securely.

4. Install fast idle cam on vacuum break assembly. Be sure fast idle cam actuating pin on intermediate choke shaft is located in cut out area of fast idle cam.

5. Connect choke rod to choke rod actuating lever (plain end) then holding choke rod, with grooved end pointing inward, position choke rod actuating lever in well of float bowl and install choke assembly engaging shaft with hole in actuating lever. Install retaining screw and tighten securely. Remove choke rod from lever for installation later.

6. Install vacuum hose at tube connection on bowl to vacuum break assembly.

7. Install air deflector in secondary side of bowl with notches towards top.

8. Install pump discharge check ball and retainer in passage next to pump well.

9. Install primary main metering jets.

10. Insert new needle and seat assembly.

11. Install float by sliding float lever under pull clip from front to back. With float lever in pull clip, hold float at toe and install retaining pin from pump well side. Be careful not to distort pull clip (Fig. 6B-61).

12. Adjust float level.

FLOAT LEVEL ADJUSTMENT (Fig. 6B-64)

a. With adjustable T-scale, measure from top of float bowl gasket surface (gasket removed) to top of float at toe (locate gaging point 1/16" back from toe).

NOTE: Make sure retaining pin is held firmly in place and long of float is seated on float needle.

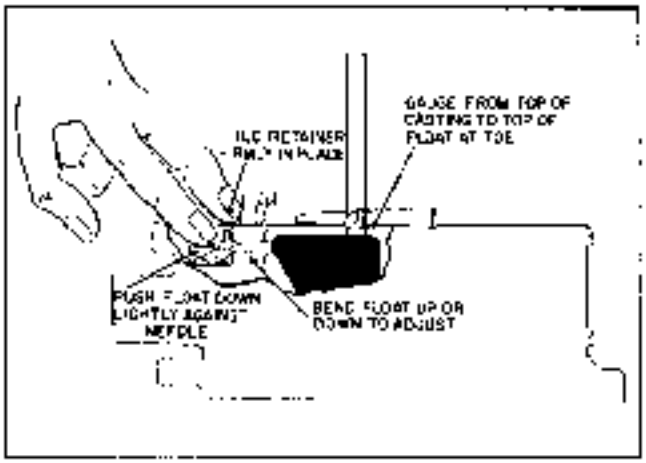


Fig. 6B-64 Float Level Adjustment

b. Remove float and bend up or down for adjustment as specified.

c. Visually check float alignment after adjustment.

13. Install power piston spring in power piston well. If primary main metering rods were removed from hanger reinstall making sure that tension spring is connected to top of each metering rod. Install power piston assembly in well with metering rods properly positioned in metering jets. Press down firmly on power piston to insure the retainer is properly positioned in the bore.

14. Install plastic filler over float needle, pressing downward until seated properly (Fig. 6B-60).

15. Install pump return spring in pump well.

16. Install air horn gasket around primary metering rods and piston. Position gasket over two dowels on secondary side of bowl.

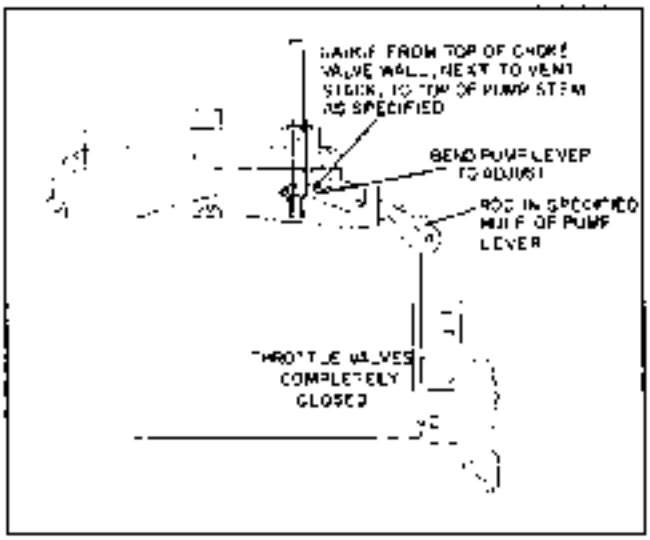


Fig. 6B-65 Pump Adjustment

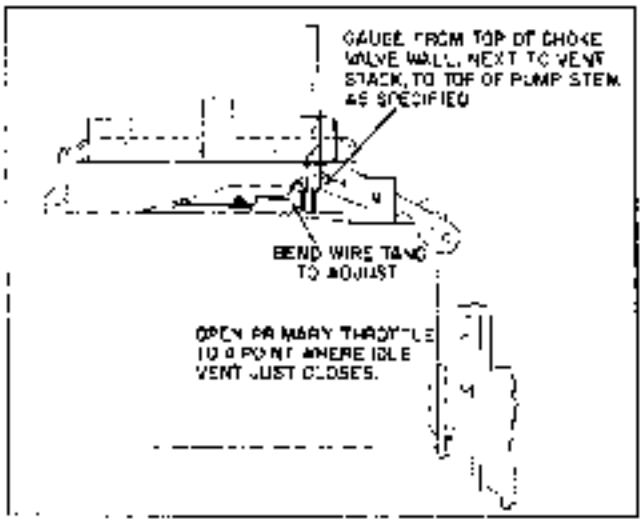


Fig. 6B-66 Idle Vent Adjustment

17. Install pump plunger in pump well.

AIR HORN ASSEMBLY (Fig. 6B-59)

1. Install the following, if removed:

a. Install pump lever and retain with roll pin.

b. Install choke shaft, choke valve, and two attaching screws.

AIR HORN TO BOWL INSTALLATION

1. Place air horn on bowl carefully, positioning vent tubes, and accelerating well tubes through air horn gasket. Do not force air horn on to float bowl.

2. Install two long air horn screws, five short screws and two counter-sunk screws in primary

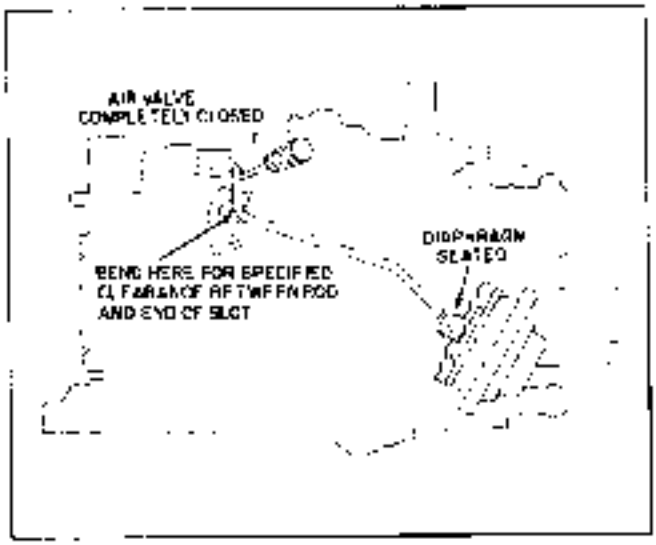


Fig. 6B-67 Air Valve Dashpot Adjustment

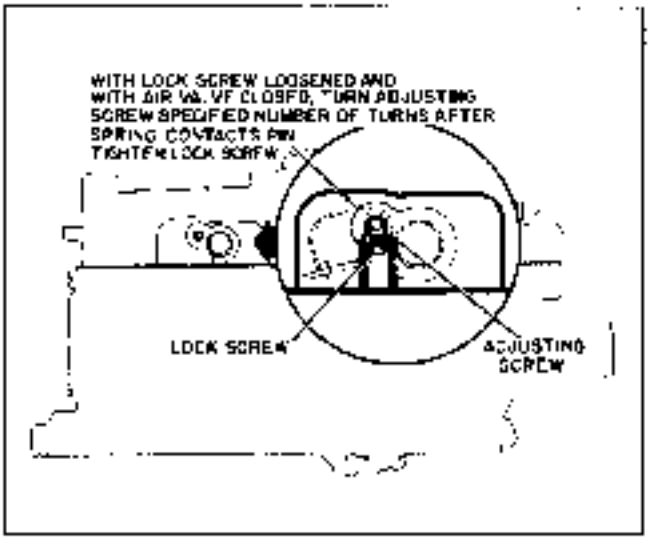


Fig. 6B-68 Air Valve Spring Adjustment

venturi area. All screws must be tightened evenly and securely.

3. Install idle vent actuating rod in pump lever (Fig. 6B-66).

4. Connect pump rod in pump lever and retain with spring clip.

5. Install secondary metering rods and hanger in locating holes in air horn and replace screw. Check for free operation of air valve and metering rods in orifice plates.

6. Connect choke rod in lower choke lever and retain in upper lever with spring clip.

7. Install vacuum break rod and clip.

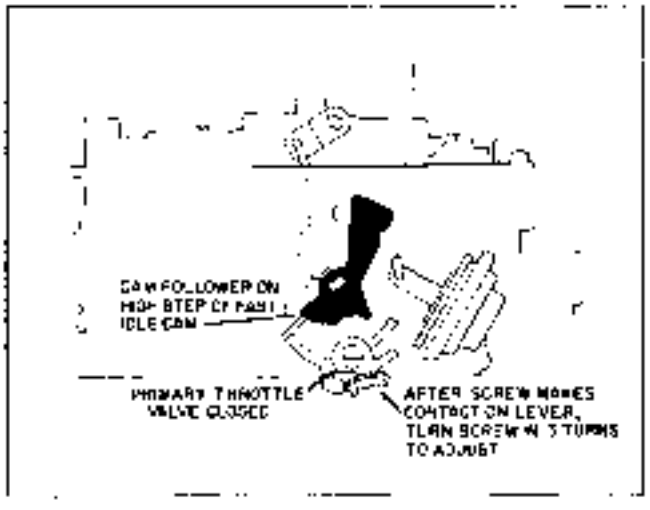


Fig. 6B-69 Fast Idle Adjustment

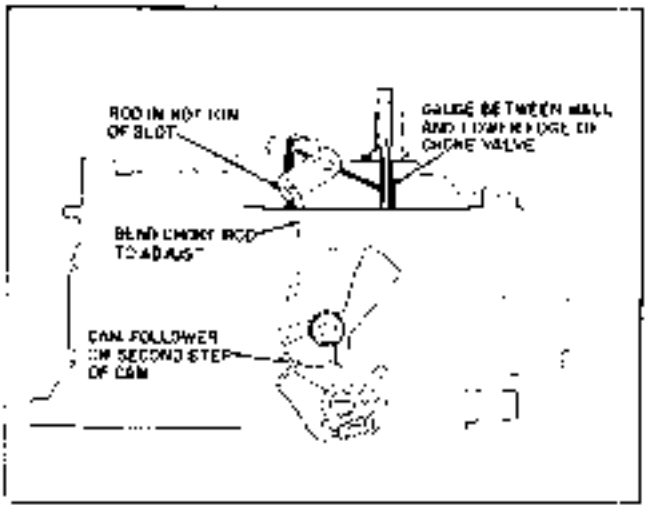


Fig. 6B-70 Choke Rod Adjustment

PUMP ADJUSTMENT (Fig. 6B-65)

Disconnect link between primary and secondary throttle levers so throttle valves are completely closed. With pump rod in specified hole of pump lever, measure from top of choke valve wall, next to vent stack, to top of pump stem with adjustable T-scale. Dimension should be 9/32".

Bend pump lever to adjust.

IDLE VENT ADJUSTMENT (Fig. 6B-66)

After pump rod adjustment has been made open primary throttle to a point where, using an adjustable T-scale, the distance from the top of the choke valve

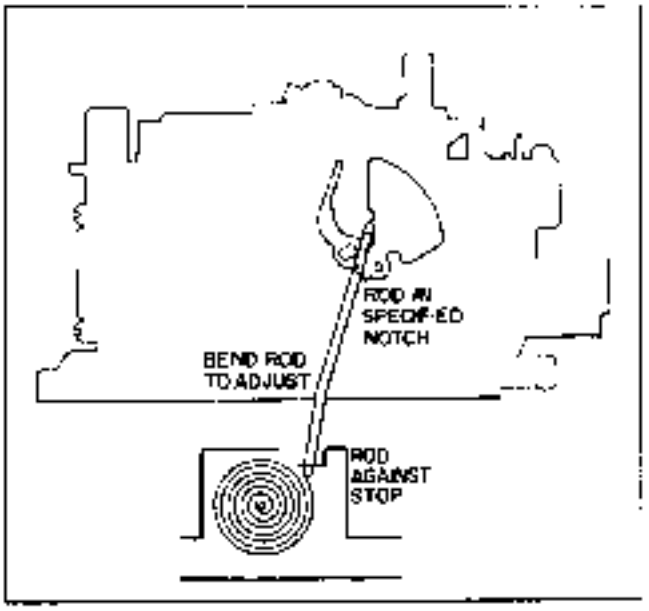


Fig. 6B-71 Choke Coil Rod Adjustment

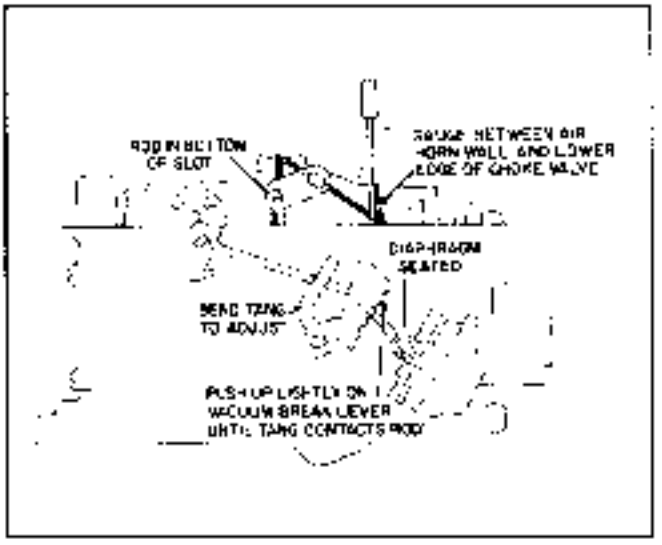


Fig. 6B-72 Vacuum Break Adjustment

wall next to the vent stack, to the top of the pump plunger stem is 3/8". At this point the idle vent should just close.

Bend wire tang on pump lever to adjust.

AIR VALVE DASHPOT ADJUSTMENT (Fig. 6B-67)

Using an external vacuum source to seal the vacuum break diaphragm, and with the air valve closed the clearance between the dash pot rod and end of slot in air valve lever should be as specified.

AIR VALVE SPRING ADJUSTMENT (Fig. 6B-68)

Loosen lock screw and turn adjusting screw counterclockwise to remove spring tension. With air valve closed, turn adjusting screw clockwise 1/2 turn after the torsion spring contacts pin and tighten lockscrew.

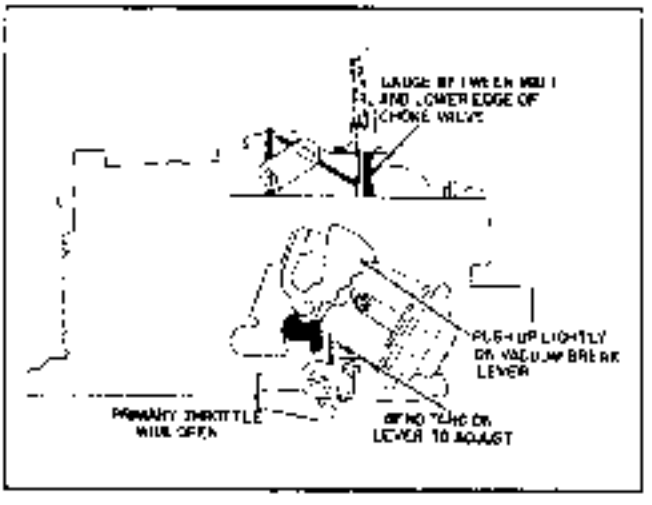


Fig. 6B-73 Unloader Adjustment

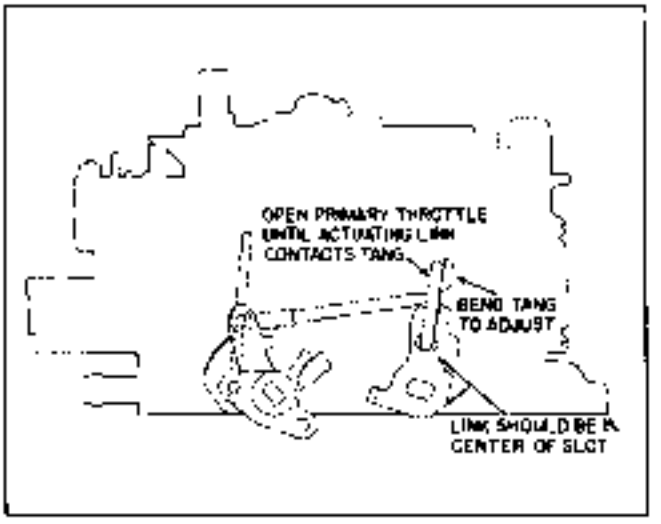


Fig. 6B-74 Secondary Opening Adjustment

FAST IDLE ADJUSTMENT (Fig. 6B-69)

With primary throttle valves completely closed and cam follower over high step of fast idle cam, turn fast idle screw in 2 turns after screw makes contact on lever. Adjust to rpm with cam follower on high step and choke valve open to obtain rpm as specified.

CHOKE ROD ADJUSTMENT (Fig. 6B-70)

With fast idle adjustment made, and cam follower on second step of fast idle cam and against the high step, rotate the choke valve toward the closed position by pushing up on the vacuum break tang. Dimension between the lower edge of choke valve, at choke lever rod, should be as specified. Bend rod to adjust.

CHOKE COIL ROD ADJUSTMENT (Fig. 6B-71)

With choke valve closed by pushing up on vacuum break tang and fast idle cam released from choke,

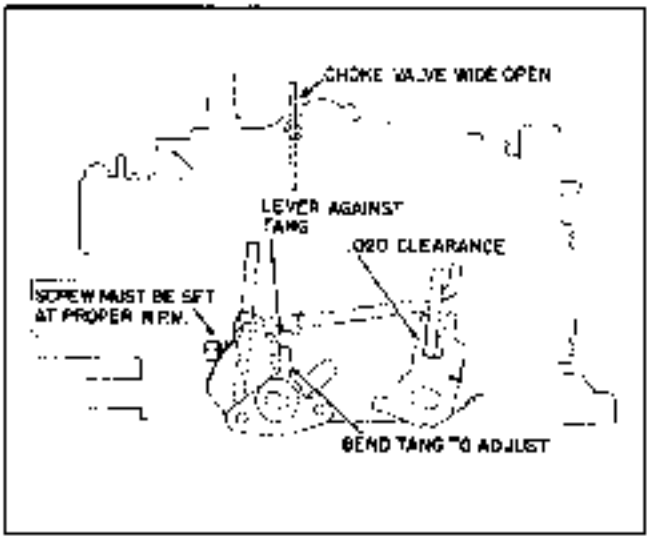


Fig. 6B-75 Secondary Closing Adjustment

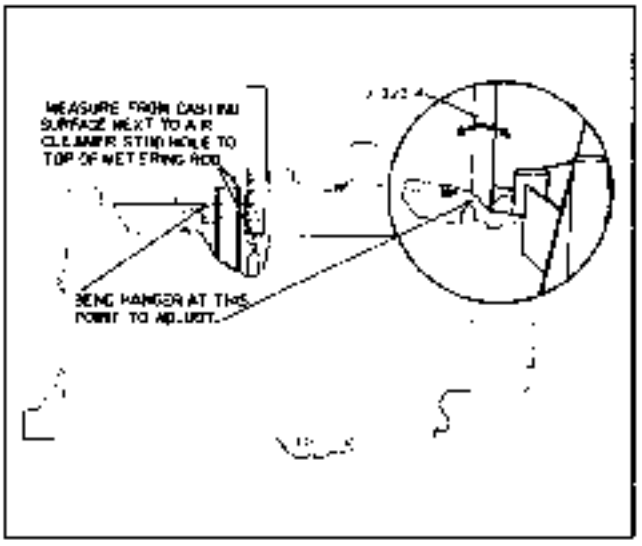


Fig. 6B-76 Secondary Metering Rod Adjustment

hold choke coil rod against stop in thermostat housing. Choke coil rod should fit in center notch in counterweight lever as shown. Bend choke coil rod to adjust.

VACUUM BREAK ADJUSTMENT (Fig. 6B-72)

Using an external vacuum source to seat the vacuum break diaphragm, and with choke valve held toward the closed position, the dimension between the lower edge of choke valve and air horn should be as specified.

UNLOADER ADJUSTMENT (Fig. 6B-73)

With choke valve held in closed position, open primary throttle to wide open position. With valves in this position, the dimension between lower edge of choke valve and air horn should be .300". Bend tang on fast idle lever to adjust.

SECONDARY OPENING ADJUSTMENT (Fig. 6B-74)

Open primary throttle valves until actuating link contacts tang on secondary lever. With the valves in this position the bottom of the link should be in the center of the slot in the secondary lever.

Bend tang on secondary lever if necessary to adjust.

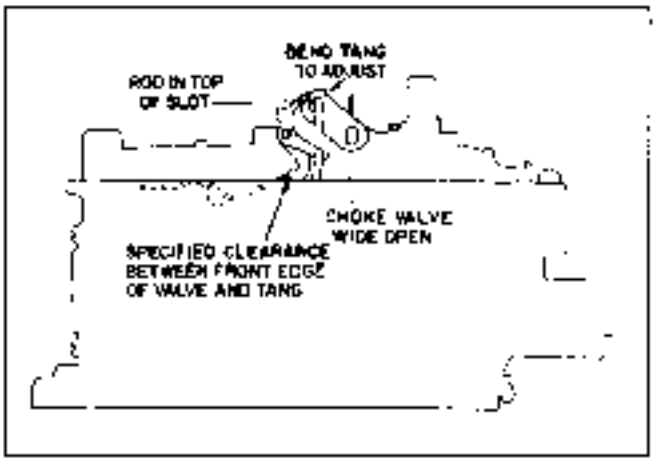


Fig. 6B-77 Air Valve Lockout Adjustment

SECONDARY CLOSING ADJUSTMENT (Fig. 6B-75)

Set idle screw to recommended rpm making sure cam follower is not resting on fast idle cam. The clearance between actuating link and front of slot in secondary lever when tang of actuating lever on primary shaft is against pin should be .020".

Bend tang on primary actuating lever if necessary to adjust.

SECONDARY METERING ROD ADJUSTMENT (Fig. 6B-76)

Measure from the top of the metering rod to the top of the air horn casting next to air cleaner stud hole, dimension should be 53/64". To adjust, bend metering rod hanger at point shown, making sure both rods are adjusted evenly.

AIR VALVE LOCKOUT ADJUSTMENT (Fig. 6B-77)

With the choke valve open, apply sufficient force to thermostat tang to move choke rod to top of slot in choke lever. Move air valve in direction of open valve. Bend upper end of air valve lockout lever, if necessary to given an opening of .015" between lockout tang and front edge of air valve.

SERVICE SPECIFICATIONS

CARBURETOR MODEL	APPLICATION	FLOAT LEVER	FLOAT DROP	PUMP ROD	CHOKE ROD	IDLE VENT	VACUUM BREAK	AIR VALVE LOCK-OUT	UNLOADER	METERING ROD	CHOKE COIL ROD
Rochester BV 7028168	250-AT	1-19/32"	1-3/4"	--	.060"	.250"	.160"	--	.230"		Refer To Choke Adjustments
Rochester MV 7028075 7028367	250-MT 250-MT-A/C	3/16"	--	--	.200"	.040"	.290"	--	.245"	.085"	Refer To Choke Adjustment
Rochester 2 GV 7028360 7028362 7028366 7028367	400-AT 250-AT 400-MT 350-MT	9/16"	1-3/4"	1-11/32"	.085"	--	.50" .50" .70" .60"	--	.180"	--	Refer To Choke Adjustments
Rochester 4 MV 7028260	250-AT	5/16"			.085"		.245"				
7028261	250-MT	5/16"			.085"		.245"				
7028262	400-Econ-AT						.230"				
7028263	400-428-MT						.245"			Secondary	
7028264	400/400 HO F'Bird AT						.230"				
7028265	400-MT						.245"				
7028266	350-AT						.230"				
7028267	400 HO/428 HO MT						.245"				
7028268	400/400 HO AT 428/428 HO AT	1/4"	--	9/32"	.100"	3/8"	.230"	.015"	.330"	.300"	23/64" Center Notch
7028269	350-MT						.245"				
7028271	400 HO F'Bird-MT						.245"				
7028274	400-Ram Air-AT						.230"				
7028275	400 Ram Air-MT						.245"				
7028276	400 Ram Air F'Bird AT						.230"				
7028277	400 Ram Air F'Bird MT						.245"				

Fig. 6B-70 Service Specifications

ENGINE TUNE-UP

TUNE-UP SEQUENCE INDEX

INTRODUCTION

Engine tune-up is diagnosis and preventive maintenance performed at regular intervals to restore maximum performance and economy in an engine.

It is advisable to follow a definite and thorough procedure of analysis and correction as suggested by the sequence-index above.

A quality tune-up is recommended every 12 months or 12,000 miles in order to assure proper engine performance and complete effectiveness of exhaust emission systems.

SPARK PLUG REMOVAL

Remove any foreign matter from around spark plugs by blowing out with compressed air, then disconnect wires and remove plugs.

COMPRESSION TEST

Test compression with engine warm, all spark plugs removed and throttle and choke wide open. Crank engine through at least five compression strokes to obtain highest possible reading. No cylinder should be less than 80% of the highest cylinder (see examples). Excessive variation between cylinders, accompanied by low speed missing of the cylinder or cylinders which are low, usually indicates a valve not properly seating, a burned valve or broken piston ring. Low pressures, even though uniform, may indicate worn rings. This will usually be accompanied by excessive oil consumption.

NOTE: Low compression pressures on remote, 400 H.O. or 428 H.O. engines are not a valid indication of engine condition. Due to the long valve overlap period with camshafts used in these engines compression readings (at cranking speeds) as low as 120 psi are considered normal.

6 CYL.

Example 1

Cyl.	1	2	3	4	5	6
Press.	129	127	130	121	116	102

80% of 130 (highest) is 104. Thus cylinder No. 6 is less than 80% of No. 3. This condition, accompanied by low speed missing, indicates a burned valve or broken piston ring.

Example 2

Cyl.	1	2	3	4	5	6
Press.	85	96	90	67	85	91

80% of 96 is 77. While all cylinders are well above 77, they are all excessively low. This indicates all poor valves or, if accompanied by oil consumption, worn rings or low cranking speed.

If compression is subnormal, tune-up will probably not be satisfactory.

V-8

Example 1

Cyl.	1	2	3	4	5	6	7	8
Press.	135	138	135	144	102	137	140	141

80% of 144 (highest) is 115. Thus cylinder No. 5 is less than 80% of No. 4. This condition, accompanied by low speed missing, indicates a burned valve or broken piston ring.

Example 2

Cyl.	1	2	3	4	5	6	7	8
Press.	85	91	90	87	96	93	87	89

80% or 66 is 77. While all cylinders are well above 77, they are all excessively low. This indicates all poor valves or, if accompanied by oil consumption, worn rings or low crank speed. If compression is subnormal, tune-up will probably not be satisfactory. (See specifications at end of section 6 for correct compression pressures.)

NOTE: The compression check is important because an engine with low or uneven compression cannot be tuned successfully to give peak performance. Therefore, it is essential that improper compression be corrected before proceeding with an engine tune-up.

CLEAN, TEST AND INSTALL SPARK PLUGS

1. Inspect each plug individually for badly worn electrodes, glazed, broken or blistered porcelains and replace plugs where necessary. Refer to spark plug diagnosis information presented in Engine Electrical for an analysis of plug conditions.

2. Clean serviceable spark plugs thoroughly, using an abrasive-type cleaner. File the center electrode flat.

3. Inspect each spark plug for make and heat range. All plugs must be of the same make and number or heat range. (See section 6F for correct spark plug usage.)

4. Adjust spark plug gaps to .035" using a round feeler gauge.

CAUTION: Never bend the center electrode to adjust gap. Always adjust by bending ground or side electrode.

5. If available, test plugs with a spark plug tester.

6. Inspect spark plug hole threads and clean before installing plugs. Corrosion deposits can be removed with a 14 mm. x 1.25 SAE spark plug tap (available through local jobbers) or by using a small wire brush in an electric drill. Use plenty of grease on tap to catch any chips.

CAUTION: Use extreme care when using tap to prevent cross threading. Also crank engine several times to blow out any material dislodged during cleaning operation.

7. Install spark plugs to engine with new gaskets and tighten to 25 lb. ft. torque.

Improper installation is one of the greatest single causes of unsatisfactory spark plug performance. Improper installation is the result of one or more of the following practices:

- Installation of plugs with insufficient torque to fully seat the gasket.
- Installation of the plugs using excessive torque which changes gap settings.
- Installation of plugs on dirty gasket seat.
- Installation of plugs to corroded spark plug hole threads.

Failure to install plugs properly will cause them to operate at excessively high temperatures and result in reduced operating life under mild operation or complete destruction under severe operation where the intense heat cannot be dissipated rapidly enough.

Always remove corrosion deposits in hole threads before installing plugs. When corrosion is present in threads, normal torque is not sufficient to compress the plug gasket and early failure from overheating will result.

Always use a new gasket and wipe seats in head clean. The gasket must be fully compressed on clean seats to complete heat transfer and provide a gas tight seal in the cylinder. For this reason as well as the necessity of maintaining correct plug gap, the use of correct torque is extremely important during installation.

IGNITION SYSTEM SERVICE AND REPAIRS

1. Replace brittle or damaged spark plug wires. Install all wires to proper spark plug. Proper positioning of spark plug wires in supports is important on V-8 engines to prevent cross-firing.

2. Tighten all ignition system connections.

3. Replace or repair any wires that are frayed, loose or damaged.

4. Remove distributor cap, clean cap and inspect for cracks, carbon tracks and burned or corroded terminals. Replace cap where necessary.

5. Clean rotor and inspect for damage or deterioration. Replace rotor where necessary.

6. Check the distributor centrifugal advance mechanism by turning the distributor rotor as far as possible, then releasing the rotor to see if the springs return it to its original position. If the rotor does not return readily, the distributor must be disassembled and the cause of the trouble corrected.

7. Check to see that the vacuum advance control operates freely by turning the movable breaker plate to see if the spring returns to its original position. Any stiffness in the operation of the spark control will affect the ignition timing. Correct any interference or binding condition noted.

8. Examine distributor points and clean or replace if necessary.

- Contact points with an overall gray color and only slight roughness or pitting need not be replaced.

- Dirty points should be cleaned with a clean point file.

  Use only a few strokes of a clean, fine-cut contact file. The file should not be used on other metals and should not be allowed to become greasy or dirty. Never use emery cloth or sandpaper to clean contact points since particles will embed and cause arcing and rapid burning of points. Do not attempt to remove all roughness nor dress the point surfaces down smooth. Merely remove scale or dirt.

- Replace points that are burned or badly pitted.

  Where burned or badly pitted points are encountered, the ignition system and engine should be checked to determine the cause of trouble so it can be eliminated. Unless the condition causing point burning or pitting is corrected, new points will provide no better service than the old. See section 6E for condenser check.

- On 6 cyl. engines, adjust distributor point gap to .019" (new points) or .016" (used points), using a flat feeler gauge. Breaker arm rubbing block must be on high point of lobe during adjustment.

NOTE: Used contact points should be cleaned before adjusting with a feeler gauge.

9. Lubricate distributor breaker cam sparingly with distributor cam lubricant.

10. Install rotor and distributor cap. Press all wires firmly into cap towers.

SERVICE BATTERY AND BATTERY CABLES

State of Charge Test

1. Measure the specific gravity of the electrolyte in each cell. If it is below 1.230 (corrected to 80°F.), recharge with a slow rate charger, and recheck battery.

2. Connect a voltmeter across the battery terminals and measure the terminal voltage of the battery during cranking (remove the coil secondary lead during this check to prevent engine from firing). If the terminal voltage is less than 9.0 volts at room temperature, approx. 80°F.), the battery should be further checked. See section 12 for battery checking procedure using the "621" Tester.

Inspect for signs of corrosion on battery, cables and surrounding area, loose or broken carriers, cracked or bulged cases, dirt and acid, electrolyte leakage and low electrolyte level. Fill cells to proper level with distilled water or water passed through a demineralizer.

The top of the battery should be clean and the battery hold-down bolts properly tightened. Particular care should be taken to see that the top of the battery is kept clean of acid film and dirt because of the high voltage between the battery terminals. For best results when cleaning batteries, wash first with a dilute ammonia or soda solution to neutralize any acid present and then flush off with clean water. Care must be taken to keep vent plugs tight so that the neutralizing solution does not enter the cell. The hold-down clamp should be kept tight enough to prevent the battery from shaking around on its holder, but it should not be tightened to the point where the battery case will be placed under a severe strain.

To insure good contact, the battery cables should be tight on the battery posts. If the battery posts or cable terminals are corroded, the cables should be cleaned separately with a soda solution and a wire brush. After cleaning and before installing clamps, apply a thin coating of petrolatum to the posts and cable clamps to help retard corrosion.

If the battery has remained undercharged, see Charging Circuit – Preliminary Checks, section 6Z.

If the battery has been using too much water, the voltage regulator setting is too high.

GENERATOR AND REGULATOR

Unsatisfactory results obtained during battery testing may indicate further tests and adjustments to the generator and regulator as outlined in Engine Electrical.

FAN BELT

1. Inspect fan belt condition.

2. Check and adjust if necessary for correct tension of belt, as follows:

   a. Using a Burroughs tension gauge check the fan belt midway between the water pump pulley and generator pulley.

   b. Adjust generator on its mounting bracket to proper fan belt tension. See section 6A.

CHECK OPERATION OF MANIFOLD HEAT VALVE

Check manifold heat control valve for freedom of operation. If shaft is sticking, free it up with heat valve lubricant Pt. No. 1050422 or equivalent.

CHECK INTAKE MANIFOLD BOLTS

To check for a possible leak at the intake mani-

fold, apply some heavy oil around the suspected area. Tighten all bolts to specification and sequence as outlined in section 6. If gasket is bad, replace.

AIR CLEANER ELEMENT

Wash polyurethane element (heavy duty) in solvent and re-oil with SAE 30 engine oil. Paper element should be replaced if clogged. Do not attempt to clean with an air hose.

NOTE: Air cleaner should be serviced after each occasion of driving under severe dust conditions.

CHECK FUEL LINES AND SERVICE FUEL FILTER

1. Inspect fuel lines for kinks, bends or leaks and correct any defects found. If necessary to replace fuel line, use only steel double flared end lines.

2. Replace filter in carburetor inlet.

NOTE: If a complaint of poor high speed performance exists on the vehicle, fuel pump tests described in section 6J (Diagnosis manual) should be performed.

INSPECT AND SERVICE COOLING SYSTEM

Inspect cooling system for leaks, weak hoses, loose hose clamps and correct coolant level, and service as required.

NOTE: A cooling system pressure test, as described in section 6J (Diagnosis manual) may be performed to detect internal or external leaks within the cooling system.

CHECK LUBRICANT LEVEL AND INSPECT FOR OIL LEAKS

Check level of lubricant in crankcase and inspect engine for oil leaks.

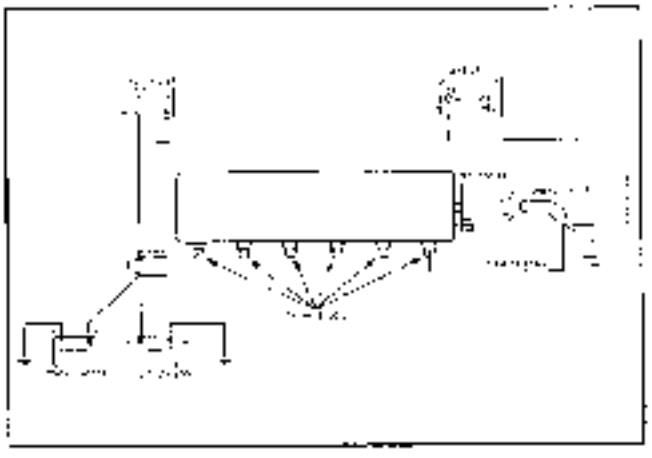


Fig. 6C-1 Schematic of Tune-Up Instrumentation

CHECK CARBURETOR CHOKE AND UNLOADER OPERATION AND ADJUSTMENT

The specified choke setting provides ideal choke operation in all climates. No seasonal changes are necessary. For setting, see ENGINE FUEL, section 6B.

Choke linkage and fast idle cam must operate freely. *Do not lubricate linkage since this will collect dust and cause sticking.*

Check unloader adjustment, see section 6B.

IDLE STOP SOLENOID

Adjust idle stop solenoid to obtain correct idle speed (solenoid active speed). Observe operation of idle stop solenoid by disconnecting lead, with engine running at specified hot idle speed, the plunger should drop back allowing the idle screw to contact the carburetor idle cam. In this position the engine speed should drop to the specified lower solenoid inactive idle speed. (See Section 6D for proper idle setting and procedures.)

CONNECT TUNE-UP EQUIPMENT

Follow manufacturers recommendations for the use of testing equipment. Fig. 6C-1 shows a basic schematic for instrumentation which will apply to many types of test equipment and may be used as a rough guide if equipment manufacturer's instructions are not available.

Connections shown in Fig. 6C-1 are made as follows:

1. Timing light
   a. Positive lead to positive battery terminal.
   b. Negative lead to ground.
   c. Trigger lead to number 1 spark plug.
2. Tachometer
   a. Positive lead to distributor side of coil.
   b. Negative lead to ground.
3. Dwell Meter
   a. Positive lead to distributor side of coil.
   b. Negative lead to ground.

TEST DWELL AND DWELL VARIATION

Two methods are offered for dwell or point gap

adjustment on the vehicle. Whenever possible, a dwell meter should be used for better accuracy.

V-8

1. With engine running at idle, raise the adjusting screw window and insert an Allen wrench in the socket of the adjusting screw.

2. With dwell meter connected, adjust dwell angle to 30 degrees for all V-8 engines. A 2-degree variation is allowable for wear. If a dwell meter is not available, turn adjusting screw clockwise until engine starts to misfire, then turn screw one-half turn in the opposite direction to complete adjustment.

3. Close access cover fully to prevent the entry of dirt into the distributor.

6 CYL.

On 6 cyl., adjust point gap with a flat feeler gauge to .018" (new) or .016" (used).

TEST IGNITION TIMING AND ADVANCE

1. Attach a timing light and tachometer as shown in Fig. 6C-1.

NOTE: Disconnect both hoses from dual acting vacuum control unit.

2. Set parking brake, start engine and run at slow idle speed (solenoid inactive).

3. Aim timing light at marks on lower timing chain cover and harmonic balancer.

4. Adjust timing as required by loosening clamp bolt and rotating distributor until correct timing is indicated, then tighten clamp bolt.

5. Disconnect timing light.

6. Reconnect distributor spark advance and retard hoses, then perform idle speed and mixture adjustment. (See Section 6D)

8 Cyl, 4 Bbl.	5 BTDC
6 Cyl, 1 Bbl.	0°TDC
V-8 (All)	9°BTDC

IDLE SPEED AND MIXTURE

1. Connect tachometer to engine. Set parking brake. Start engine, allow to idle.

2. With a thoroughly warmed-up engine, check to see that choke is fully open and carburetor is on slow idle.

3. Adjust idle speed and mixture screws to give proper idle speed.

NOTE: Depress or plug hot idle compensator valve while adjusting all engines so equipped (6 cyl. 1 bbl. with A/C and 8 cyl. 4 bbl. only.)

Follow procedures outlined in EXHAUST EMISSIONS SECTION and adjust idle speeds to settings given at end of that section.

POSITIVE CRANKCASE VENTILATION

All 1968 engines have the closed positive ventilation systems utilizing manifold vacuum to draw fumes and contaminating vapors into the combustion chamber where they are burned. The crankcase ventilation system has an important function and should be understood and serviced properly.

In the closed crankcase ventilation system, air is drawn through the engine, through a regulating valve and into the manifold, drawing crankcase vapors and fumes with it to be burned. The closed positive ventilation system draws the clean air from the carburetor air cleaner and has a non-vented oil filler cap.

The P.C.V. valves are designed specifically for each engine to control the amount of flow from the crankcase to manifold. VALVES SHOULD NEVER BE INTERCHANGED BETWEEN 6 AND 8 CYLINDER ENGINES.

The crankcase ventilation valve should be checked at regular intervals otherwise it will become plugged and ineffective.

The P.C.V. system should be serviced as follows:

1. Disconnect all hoses and blow them out with compressed air. If any hose cannot be freed of obstructions, replace with new hose.

2. Remove crankcase ventilation valve assembly from rubber grommet, and discard.

3. Clean crankcase and intake manifold connectors; using care not to allow dirt to enter openings.

4. Clean and re-oil ventilation filter in air cleaner.

5. Reinstall Crankcase Ventilation System, using a new P.C.V. valve.

6. Adjust carburetor idle to specifications, section 6D.

ROAD TEST

TEST PERFORMANCE OF CAR

Observe performance of engine at low speed, during acceleration, and at constant speed. Check for

miseing, stalling, surging, poor acceleration or flat spots on acceleration. If any irregularity is found a complete diagnosis should be conducted to find and correct trouble. This diagnosis should also include carburetor checks outlined in section 6H (Diagnosis manual).

TEST OPERATION OF:

BRAKES—Pedal should not go closer than 2" from floor mat (1" with power brakes) and car should not pull to either side. Fluid level in master cylinder should be as shown in Fig. 5-5 (Brake section).

PARKING BRAKE—Should hold the car without excessive movement of parking brake pedal.

AUTOMATIC TRANSMISSION—Observe shift pattern at minimum and full throttle and test forced downshifts. Watch for any indications of slipping or unusual shift characteristics that may indicate need for adjustment.

STEERING GEAR—See that steering operates normally and that steering wheel does not have excessive play. Also observe for alignment of steering wheel, pull, wander, or other irregularity that might indicate need for front end alignment.

WINDSHIELD WIPER—Wiper operation should be tested with windshield wet in order to properly judge the action.

CLUTCH—See that clutch engages smoothly and that lash is correct. Follow procedure for adjusting clutch pedal height and lash in the clutch section. Hard pedal or lack of pedal return may indicate need for overcenter spring adjustment.

LIGHTS AND HORNS—Test operation of headlights, tail lights, stop lights, parking lights, direction signals, hazard flasher and all other lights, as well as the horns.

INSTRUMENTS—Observe operation of all instruments. Observe especially for possible abnormal reading which may indicate trouble.

ACCESSORIES—Test operation of radio, heater, defroster, cigar lighter, other accessories.

EMISSION CONTROL SYSTEMS

CONTENTS OF THIS SECTION

PERIODIC SERVICE

CLOSED P.C.V. SYSTEM

Once a year or at 12,000 miles, the Closed Positive Crankcase Ventilation System should be serviced as follows:

1. Disconnect all hoses and blow them out with compressed air. If any hose cannot be freed of obstructions, replace with new hose.

2. Remove crankcase ventilation valve.

3. All engines are equipped with a crimped-type valve, thus no further disassembly is possible and a new valve should be installed.

4. Clean crankcase and intake manifold connections using care not to allow dirt to enter openings.

5. Clean and re-oil ventilation filter in air cleaner.

6. Reinstall positive crankcase ventilation system.

7. Adjust carburetor idle to specifications.

CONTROLLED COMBUSTION SYSTEM

In order to provide efficient engine operation of cars equipped with the Controlled Combustion System, all normal tune-up items should receive careful and thorough attention every 12 months or 12,000 miles. Adherence to these items will assure that exhaust emissions are kept to the desired level.

Essential services included in the tune-up items are:

1. Check engine idle speed.

2. Check ignition timing (both hoses disconnected and plugged and idle stop solenoid inactive).

3. Check operation of dual acting distributor advance/retard unit.

NOTE: Engine idle speed must be set following the correct procedure.

VACUUM ADVANCE VALVE

No adjustments are necessary to the vacuum advance valve.

THERMOSTATIC VACUUM SWITCH

No maintenance is necessary on the thermostatic vacuum switch.

AUTO-THERM AC AIR CLEANER

MOTOR REPLACEMENT -

Remove

1. Drill out two spot welds initially with a 1/16" drill, then enlarge as required to remove the retaining strap. Do not damage snorkel tube. (Fig. 6D-1)

2. Raise motor strap retainer.

3. Lift motor, cocking it to one side to unhook linkage at the control damper.

Install

1. Assemble in reverse order adhering to the following notes.

a. Drill a 7/64" hole in snorkel tube at point A as shown in Fig. 6D-1.

b. Use motor strap retainer and sheet metal screw provided in the motor service package to secure the retainer and motor to snorkel tube.

c. If screw interferes with operation of the damper, shorten screw.

SENSOR REPLACEMENT -

Remove

1. Detach hoses at sensor.

2. Pry up tabs of sensor retaining clip.

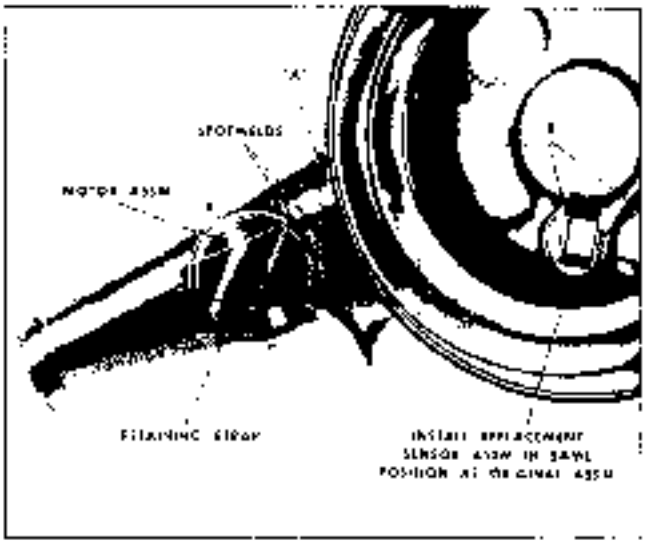


Fig. 6D-1 Therm-AC Motor and Sensor

3. Remove clip and sensor from air cleaner, after noting the installed position of the sensor.

Install

1. Install sensor and gasket assembly in original holes in air cleaner.

2. Support sensor at position B as shown in Fig. 6D-1 and press clip on sensor being careful not to install sensor.

3. Install hoses and connections.

V-8 IDLE PROCEDURE

PONTIAC ENGINE IDLE SPEEDS

Engine	Trans.	Curb Idle RPM Solenoid		Fast Idle RPM
		Active	Inactive	
400 2 Bbl.	M.T.	800	500	-
400 2 Bbl.	A.T.	600	500	-
400 4 Bbl.	A.T.	600	500	2500
All 4 Bbl.	M.T.	850	650	2500
428 4 Bbl.	A.T.	650	500	2500

CURB IDLE SETTING PROCEDURE V-8

1. Back out idle mixture screws four turns (2 Bbl.) or six turns (4 Bbl.) from lightly seated position.

2. With idle stop solenoid energized, adjust mixture screws to best lean carburetor setting using solenoid stop screw for idle speed adjustment. (Fig. 6D-2).

3. With idle stop solenoid disconnected adjust idle speed screw on carburetor to attain the lower solenoid inactive idle speed. Do not re-adjust carburetor mixture screws.

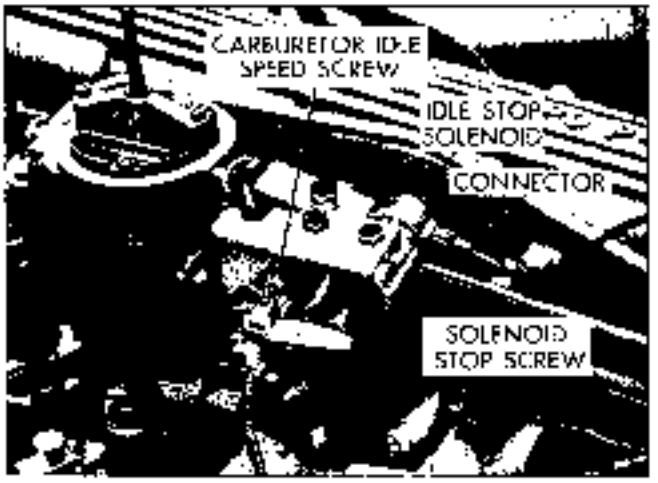


Fig. 6D-2 Idle Stop Solenoid (6 Cyl. Shown)

TEMPEST & FIREBIRD ENGINE IDLE SPEEDS

Engine	Trans.	Curb Idle RPM Solenoid		Fast Idle RPM
		Active	Inactive	
350 2 Bbl.	M.T.	700	500	-
All 2 Bbl.	A.T.	600	500	-
350 4 Bbl.	A.T.	650	500	2500
All 4 Bbl. Exc. L67	M.T.	850	650	2500
400 4 Bbl. Exc. Ram Air	A.T.	650	500	2500
Ram Air 4 Bbl.	M.T.	1000	850	2800
Ram Air 4 Bbl.	A.T.	650	500	2800

To set fast idle speed run engine in neutral, choke valve full open and fast idle lever on top step of fast idle cam, and adjust fast idle speed screw for proper speed setting.

NOTE: Curb idle on automatic transmission cars to be set in drive with air conditioning turned off.

6-CYL. IDLE PROCEDURE

SIX CYLINDER ENGINE IDLE SPEEDS

Engine	Trans.	All Values Are Given In RPM			
		A	B	C	Fast Idle
1 Bbl.	M.T.	730	700	500	2400
1 Bbl.	A.T.	610	600	500	-
4 Bbl.	M.T.	830	800	600	2600
4 Bbl.	A.T.	610	600	500	2500

CURB IDLE SETTING PROCEDURE 6 CYL.

Choke fully open, and hot idle compensator closed on one barrels with air conditioning and all four barrels.

1. With carburetor mixture screws backed out 3 turns and idle stop solenoid active set the idle stop solenoid screw to obtain 'A' rpm. (Fig. 6D-3)

2. Turn mixture screws clockwise to obtain 'B' rpm, idle stop solenoid still active. Do not readjust idle stop solenoid screw.

3. With idle stop solenoid inactive, adjust the idle speed screw on the carburetor to obtain 'C' rpm. (solenoid inactive speed). Do not readjust mixture or solenoid screws.

Procedure for setting fast idle - with transmission in neutral, choke valve fully open and fast idle lever on the top step of the fast idle cam.

1. Bend fast idle tang on throttle lever of one barrel manual transmission carburetor.

2. Adjust fast idle screw on four barrel carburetor.

NOTE: Curb idle on automatic transmission cars to be set in drive with A/C turned off (where fitted).

NOTE: It is important that the idle and timing specifications are strictly adhered to in order to assure proper control of exhaust emissions.

The accuracy of the tachometer used for idle adjustments should be checked periodically by an authorized representative.

DWELL AND IGNITION TIMING SPECIFICATIONS

	Dwell	Point Gap	Ignition Timing
6 Cyl (1 Bbl)	38°	All engines	0° TDC
6 Cyl (4 Bbl)	38°	.019" New	5° BTDC
All V-8	30°	.016" Used	9° BTDC

NOTE: Ignition timing to be checked with both hoses to distributor vacuum unit disconnected and idle stop solenoid disconnected (solenoid inactive speed).

ENGINE ELECTRICAL

NOTE: Information pertaining to chassis electrical will be found in Section 12.

CONTENTS OF THIS SECTION

CRANKING CIRCUIT

STARTING MOTOR

PERIODIC SERVICE

No periodic lubrication of the starting motor or solenoid required. The motor and brushes cannot be inspected without disassembling the unit, so no service is required on the motor or solenoid between overhaul periods.

CHECKS AND ADJUSTMENTS ON CAR

Although the starting motor cannot be checked against specifications on the car, a check can be made for excessive resistance in the cranking circuit. To check for excessive resistance in the cranking circuit, measure:

1. The voltage drop, during cranking, between the positive battery post and battery terminal of solenoid.

2. The voltage drop, during cranking, between the battery terminal of solenoid and the motor terminal of solenoid.

3. The voltage drop, during cranking, between the negative battery post and the starting motor frame.

CAUTION: To prevent the engine from firing during the above checks, disconnect the primary lead to the distributor at the coil.

If the voltage drop for any one of the above three checks exceeds 0.2 volt, excessive resistance is indicated in that portion of the cranking circuit being checked. Locate and eliminate the cause for any excessive voltage drop in these circuits in order to obtain maximum efficiency of the cranking system.

When the solenoid fails to pull in, the trouble may be due to excessive voltage drop in the solenoid control circuit. To check for this condition, close the starting switch and measure the voltage drop between the battery terminal of the solenoid and the switch terminal of the solenoid. Excessive resistance in the solenoid control circuit is indicated and should be corrected if the voltage drop exceeds 3.5 volts.

If the voltage drop does not exceed 3.5 volts and the solenoid does not pull in, measure the voltage available at the switch terminal of the solenoid. If the solenoid does not feel warm, it should pull in whenever the voltage available at the switch terminal is 7.7 volts or more (when the solenoid feels warm, it will require a somewhat higher voltage to pull in).

REMOVE FROM CAR—6 CYL. ENGINE

1. Disconnect battery ground cable at battery terminal post.

2. Disconnect battery positive cable and wiring harness leads from starting motor solenoid.

3. Remove starting motor.

REMOVE FROM CAR—V-8 ENGINE

1. Disconnect battery to starting motor cable from battery post.

2. Raise front of car and place car stand under front suspension.

3. Pull battery cable and solenoid wire loom down so they hang free of surrounding parts.

4. Remove starting motor mounting screws and remove starting motor with cable and solenoid wire loom.

5. Remove wires from solenoid and cable from clamp or solenoid bracket.

SOLENOID

REMOVE AND REPLACE

1. Disconnect field strap.

2. Remove solenoid to drive housing attaching screws and remove solenoid.

3. Remove solenoid return spring.

4. Remove shift lever pivot pin.

5. Remove shift lever.

6. Replace by reversing above procedures.

CHECK CURRENT DRAW

Check current draw of hold-in winding by connecting a variable source of voltage (in series with an ammeter) to the switch terminal of solenoid and ground. Ammeter should read 14.5-16.5 amps. @ 10 volts. To check the current draw of both windings, ground the solenoid motor terminal and connect a source of voltage (in series with an ammeter) to the switch terminal of solenoid and ground. The ammeter should read 41-47 amps. @ 10 volts.

CAUTION: Either of the above checks must be completed in a minimum length of time to prevent overheating solenoid windings. Heating will cause the current draw readings to be below specifications which are based on a temperature of 80°F.

DISASSEMBLE

1. Remove nuts from motor and switch terminal.

2. Remove two screws securing cover and carefully remove cover.

CAUTION: Terminal studs have welded lead connections; therefore be extremely careful not to twist during removal of nuts.

If solenoid contacts are slightly burned or dirty, contacts should be cleaned. When contacts are badly burned, burned parts should be replaced.

ASSEMBLE

1. When assembling cover on solenoid, make sure the terminal studs are properly positioned in cover. The cover gasket must be centered under cover to insure proper sealing.

2. Secure cover with screws and install nuts on motor and switch terminals.

STARTER MOTOR

DISASSEMBLE

1. Disconnect field straps from terminal on solenoid.

2. Remove through bolts.

3. Remove commutator end frame, field frame and armature from drive housing.

4. Remove overrunning clutch from armature shaft as follows:

a. Slide thrust collar (Fig. 6E-1) off end of armature shaft.

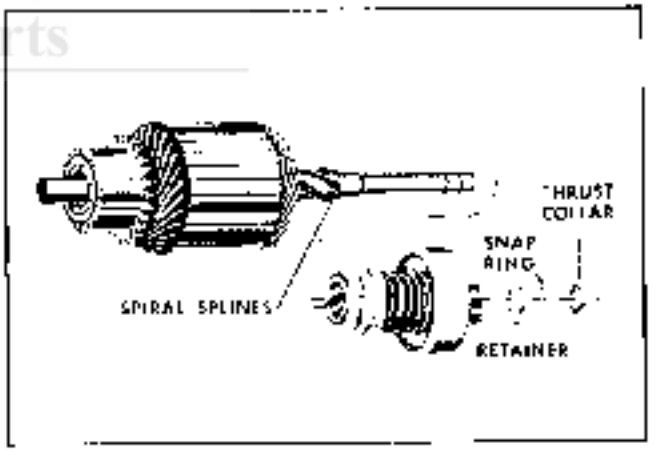


Fig. 6E-1 Armature and Overrunning Clutch Assembly

b. Slide a standard half-inch pipe coupling or other metal cylinder of suitable size (an old pinion of suitable size can be used if available) onto shaft so end of coupling or cylinder butts against edge of retainer (Fig. 6E-2). Tap end of coupling with hammer, driving retainer towards armature and off snap ring.

c. Remove snap ring from groove in shaft, using pliers or other suitable tool. If snap ring is too badly distorted during removal, it will be necessary to use a new one when reassembling clutch.

d. Slide retainer and clutch from armature shaft.

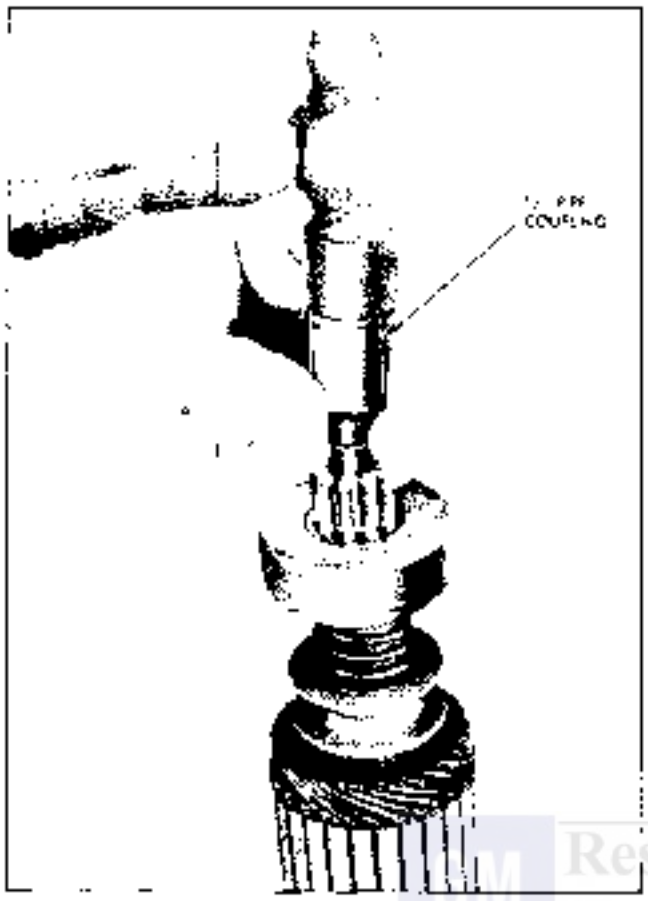


Fig. 6E-2 Driving Retainer Off Snap Ring

CLEAN AND INSPECT

1. Test overrunning clutch action. The pinion should turn freely in the overrunning direction. Check pinion teeth to see that they have not been chipped, cracked, or excessively worn. Replace assembly if necessary. Badly chipped pinion teeth may indicate chipped teeth on the ring gear. This should be checked under such conditions and replaced if necessary.

2. Inspect brushes for wear. Replace if worn to one-half their original length. Check brush holders to see that they are not deformed or bent, so will properly hold brushes against the commutator.

3. Check fit of armature shaft in bushing of drive housing. Shaft should fit snugly in the bushing. If the bushing is worn, it should be replaced.

4. The overrunning clutch, armature and fields should not be cleaned in any degreasing tank, or with grease-dissolving solvents, since these would dissolve the lubricants in the clutch mechanism and would damage the insulation on the armature and field coils. It is suggested that all parts except the clutch, be cleaned with Stoun spirits and a brush. The clutch can be wiped with a clean cloth.

If the commutator is dirty it may be cleaned with No. 00 sandpaper. Never use emery cloth to clean commutator.

SERVICE

ARMATURE

If the armature commutator is worn, dirty, out of round or has high insulation, the armature should be put in a lathe so the commutator can be turned down. The insulation should then be undercut 1/32" wide and 1/32" deep, and the slots cleaned out to remove any trace of dirt or copper dust. As a final step in this procedure, the commutator should be sanded lightly with No. 00 sandpaper to remove any burrs left as a result of the undercutting procedure.

The armature should be checked for opens, short circuits and grounds as follows:

1. Open—The most likely place for an open to occur is at the commutator riser bars as a result of excessively long cranking periods. Inspect the points where the conductors are joined to the commutator bars for loose connections. The poor connections cause arcing and burning of the commutator bars as the starting motor is used. If the bars are not too badly burned, repair can often be effected by resoldering the leads in the riser bars (using rosin flux), and turning down the commutator on a lathe to remove the burned material. The insulation should then be undercut.

2. Short Circuit—Short circuits in the armature are located by use of a growler. When the armature is rotated in the growler with a steel strip such as a hacksaw blade held above it, the blade will vibrate above the area of the armature core in which the short circuit is located. Shorts between bars are sometimes produced by brush dust or copper between the bars. These shorts can be eliminated by cleaning out the slots.

3. Ground—Grounds in the armature can be detected by the use of 110-volt test lamp and test points. If the lamp lights when one test point is placed on the commutator with the other point on the core or shaft (Fig. 6E-3), the armature is grounded. Grounds occur as a result of insulation failure which is often brought about by overheating of the starting motor produced by excessive long cranking periods or by accumulation of brush dust between the commutator bars and the steel commutator ring.

FRAME AND FIELD

The field winding can be checked for an open or a ground by using a test lamp as follows:

1. Using a 110-volt test lamp, place one lead on each end of the field coils connected in series (Fig. 6E-4). If lamp does not light, the field coils are open and must be repaired or replaced.

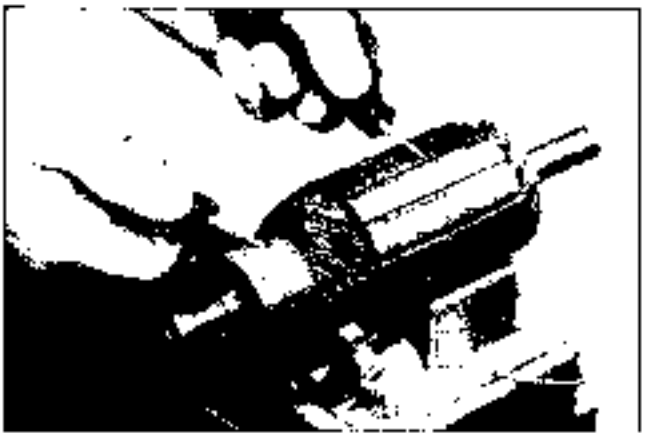


Fig. 6E-3 Testing Armature For Ground

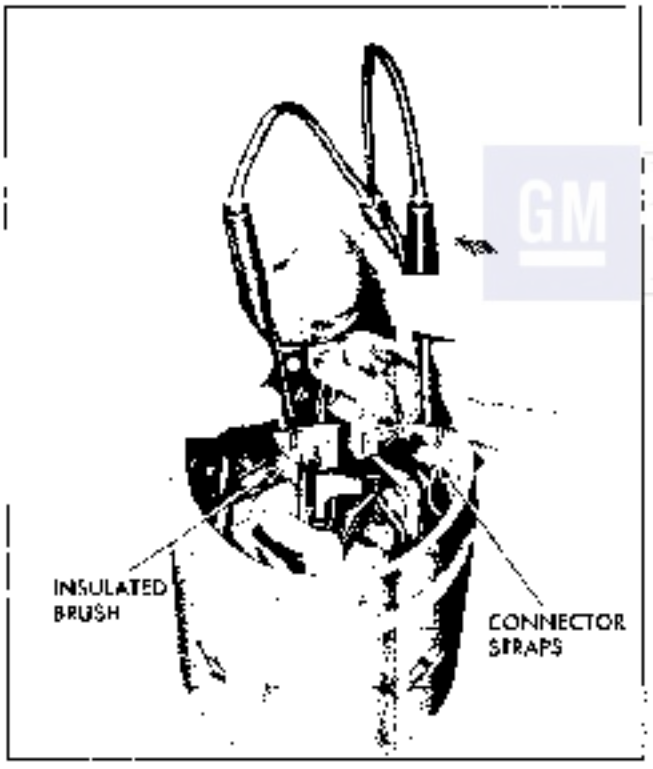


Fig. 6E-4 Testing Field Coils For Open

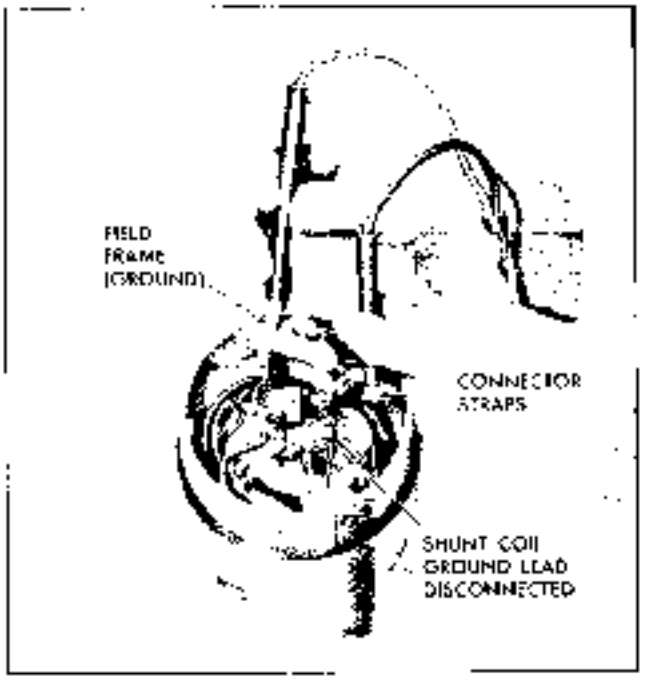


Fig. 6E-5 Testing Field Coils For Ground

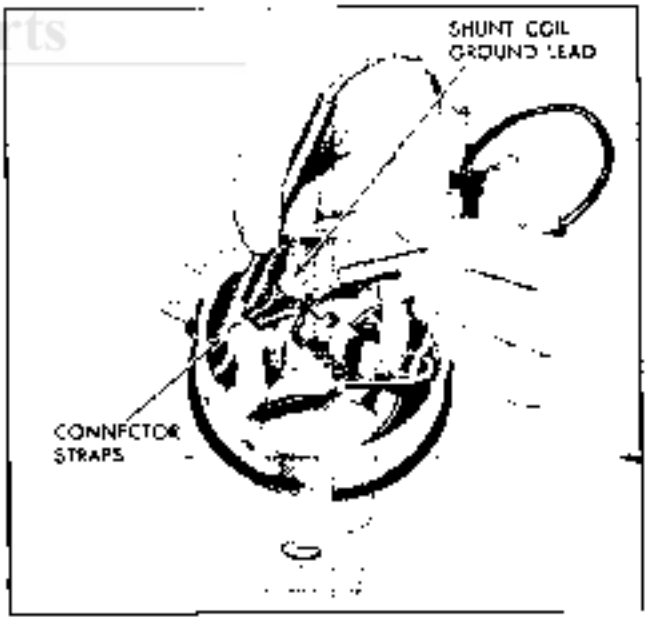


Fig. 6E-6 Testing Shunt Coil For Open

2. Using a 110-volt test lamp, place one lead on the connector strap and the other on the field frame (Fig. 6E-5). Disconnect the shunt coils ground before check is made. If lamp lights, the field coils are grounded and defective coils must be repaired or replaced.

3. Using a 110-volt test lamp, place one lead on each end of shunt coils (Fig. 6E-6). Disconnect shunt coil grounds before check is made. If lamp does not light, the shunt coil is open and must be replaced.

FIELD COIL

Field coils can be removed from the field frame easily by use of a pole shoe screwdriver. A pole shoe spreader should also be used since this prevents distortion of the field frame. Careful installation of field coils is necessary to prevent shorting or grounding of field coils as the pole shoes are tight-

cned into place. Formed insulators are used to prevent the field leads from grounding to frame. These must be replaced on assembly.

REPLACE BRUSHES

1. Remove brush holder pivot pin which positions one insulated and one grounded brush.

2. Remove brush spring.

3. Replace brushes as necessary.

ASSEMBLE STARTER

1. Assemble overrunning clutch to armature shaft as follows:

a. Lubricate drive end of armature shaft with high melting point grease.

b. Slide clutch onto armature shaft with pinion outward.

c. Slide retainer onto shaft with cupped surface facing end of shaft.

d. Stand armature on end on wood surface with commutator down. Position snap ring on upper end of shaft and hold in place with a block of wood. Hit wood block a blow with hammer, forcing snap ring over end of shaft. Slide snap ring past the grease groove to the snap ring groove (Fig. 6E-7).

e. Assemble thrust collar on shaft with shoulder next to snap ring (Fig. 6E-8).

f. Place armature flat on work bench, and position retainer and thrust collar next to snap ring. Then, using two pairs of pliers at same time (one pair on either side of shaft), grip retainer and thrust collar and squeeze until retainer is forced over snap ring (Fig. 6E-8).

2. Place a small amount of high melting point grease in drive housing bushing. Make sure thrust collar is in place against snap ring and retainer and slide armature and clutch into place in drive housing, engaging shift lever with clutch.

3. Position field frame over armature, apply sealing compound between frame and solenoid case. Position frame carefully against drive housing to prevent damage to brushes.

4. Place a small amount of high melting point grease in bushing in commutator end frame. Place leather thrust washer on armature shaft and slide commutator end frame onto shaft.

5. Install through bolts and tighten securely.

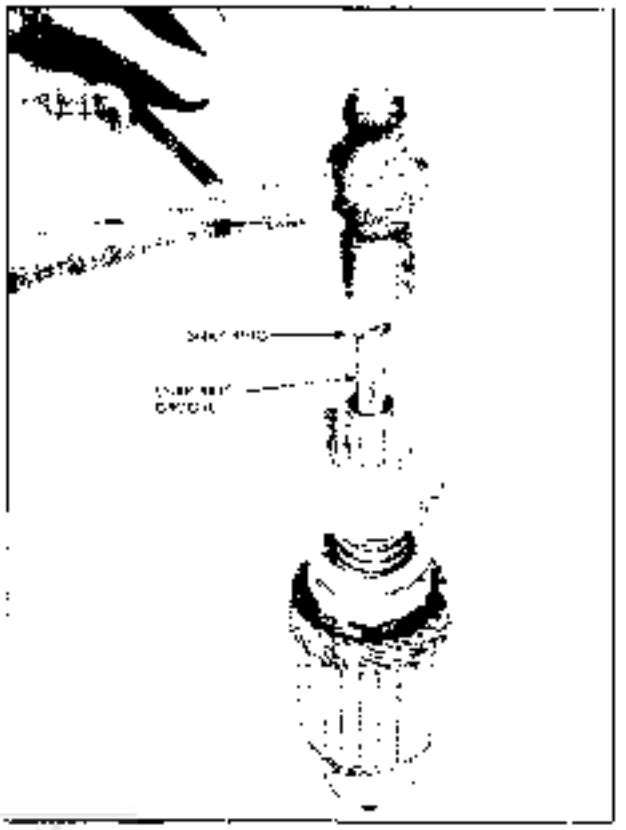


Fig. 6E-7 Forcing Snap Ring Onto Armature Shaft

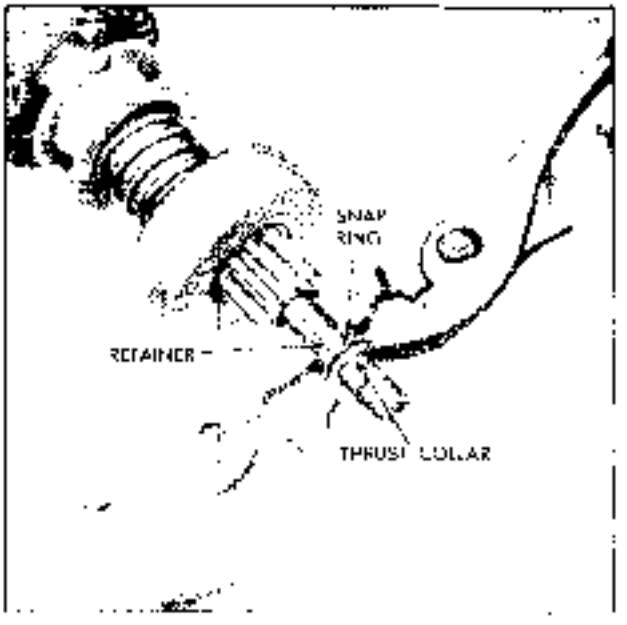


Fig. 6E-8 Forcing Retainer Over Snap Ring

6. Reconnect field coil leads to solenoid terminal.

PINION CLEARANCE CHECK

There is no provision for adjusting pinion clearance on the enclosed shift lever cranking motor. When the shift lever mechanism is correctly reassembled, the pinion clearance should fall within the specified limits (.010"-.140"). When clearance exceeds these limits it may indicate excessive wear of solenoid linkage or shift lever yoke bushing.

Pinion clearance should be checked after motor has been disassembled and reassembled.

Check pinion clearance in following manner:

1. Disconnect the motor field coil connector from the solenoid motor terminal and insulate it carefully.

2. Connect one battery lead to the solenoid switch terminal and the other to the solenoid frame (Fig. 6E-9).

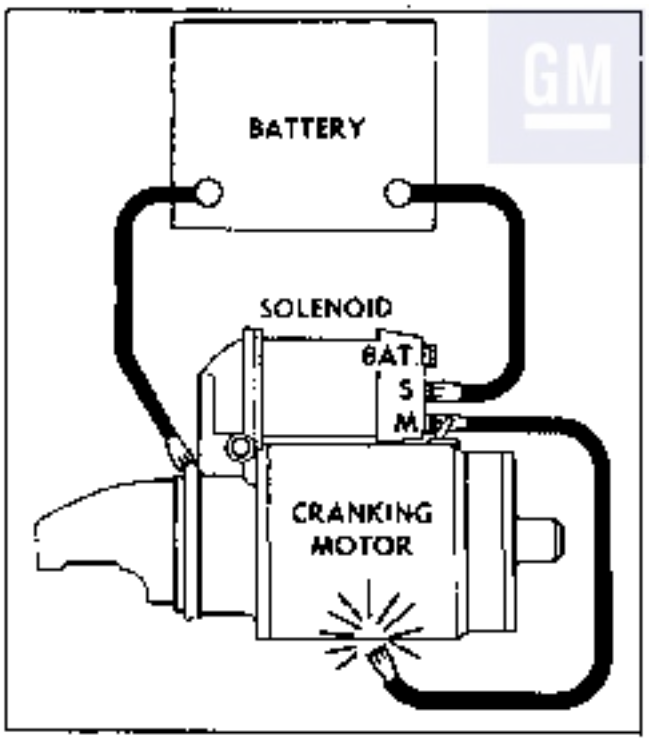


Fig. 6E-9 Circuit To Checking Pinion Clearance

3. Flash a jumper lead momentarily from the solenoid motor terminal to the solenoid frame. This will shift the pinion into cranking position and it will remain so until the battery is disconnected.

4. Push pinion back towards the commutator end to eliminate slack movement.

5. Measure the distance between pinion and pinion stop (Fig. 6E-10).

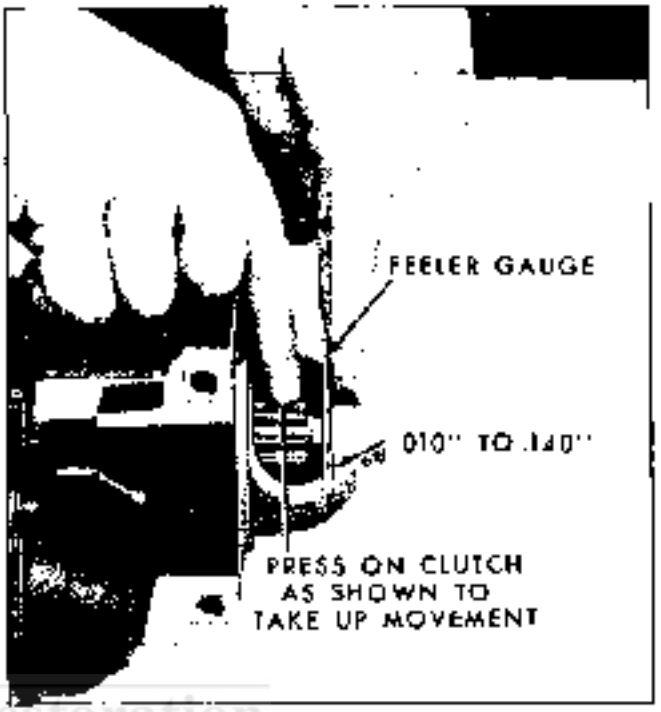


Fig. 6E-10 Measuring Pinion Clearance

INSTALL IN CAR—6-CYL. ENGINE

1. Install starting motor.

NOTE: Make sure that the shim has been installed if this car is equipped with an automatic transmission.

2. Connect battery positive cable and wiring harness leads to starting motor solenoid.

3. Connect battery ground cable at battery terminal post.

INSTALL IN CAR—V-8 ENGINE

1. Connect battery cable and solenoid wires to solenoid.

NOTE: Connect purple (or violet) wire to terminal marked S.

2. Install starting motor on engine and tighten mounting screws securely.

NOTE: Make sure that the shims have been installed if this car is equipped with an automatic transmission.

3. Push cables up where they can be reached from above car, then lower car.

4. Route battery cable and connect cable to battery post.

CHARGING CIRCUIT

GENERATOR

PERIODIC SERVICE

The generator does not require periodic lubrication. The rotor shaft is mounted on ball bearings at drive end and roller bearing at slip ring end, and each has a permanent grease supply which eliminates need for periodic lubrication. At periodic intervals, check mounting bolts for tightness and belt for proper alignment, wear and tension.

CAUTION: When applying belt tension, apply pressure at center of generator, never against either end frame.

SERVICE PRECAUTIONS

Since both the generator and regulator in the standard system and the CSI generator-regulator in the integrated circuit are designed for use on only one polarity system (negative ground) the following precautions must be observed when working on charging circuit. Failure to observe these precautions will result in serious damage to electrical equipment.

1. Do not attempt to polarize generator. It is not necessary since there are no permanent magnets.

2. Do not short across or ground any terminals on generator.

3. Never operate generator on open circuit (with field terminal connected and output terminal disconnected). Make absolutely certain all connections in circuit are secure. If generator is operating on open circuit, extremely high voltages may result that are both dangerous and damaging to generator.

4. When installing battery, make absolutely sure negative post is attached to ground strap.

CAUTION: Never reverse battery leads, even for an instant, as reverse polarity current flow will damage diodes in generator.

5. When connecting booster battery, make certain to connect negative battery terminals together and positive battery terminals together.

6. When connecting charger to battery, connect charger positive lead to battery positive terminal and charger negative lead to battery negative terminal.

CHECK IN CAR

If electrical system is not charging properly, follow the in-car checks outlined in Charging Circuit Preliminary Checks, Figs. 6E-19 and 6E-21 in the Diagnosis Manual, prior to removing generator. Remove generator as follows:

REMOVE FROM CAR

1. Disconnect positive battery terminal.

CAUTION: Failure to observe this step may result in an injury from hot battery lead at generator.

2. Remove two leads at generator.

3. Loosen adjusting bolts.

4. Remove generator drive belt.

5. Remove bolts which retain generator.

6. Remove generator from car.

DISASSEMBLE GENERATOR

1. If rotor, drive end frame bearings or pulley and fan need replacement, remove and replace shaft nut using Allen wrench.

2. Scribe a mark between two halves of generator to help locate parts in same position during assembly.

3. Remove four through bolts.

4. Separate drive end frame and rotor assembly from stator assembly by prying apart with screwdriver at stator slot. The fit between the two is not tight and the two can be separated easily.

NOTE: The separation is to be made between stator assembly and drive end frame.

CAUTION: As rotor and drive end frame assembly is separated from slip ring frame assembly the brushes will fall down onto shaft and come in contact with lubricant. Brushes which come in contact with shaft should be cleaned immediately to avoid contamination by oil, or they will have to be replaced.

INSPECTION AND REPAIR

ROTOR

The rotor may be checked electrically for grounded, open or short-circuited field coils as follows:

1. To check for grounds, connect a 110-volt test lamp or ohmmeter from either slip ring to rotor shaft, or to rotor poles. If lamp lights or ohmmeter reading is low, the field winding is grounded (Fig. 6E-11).

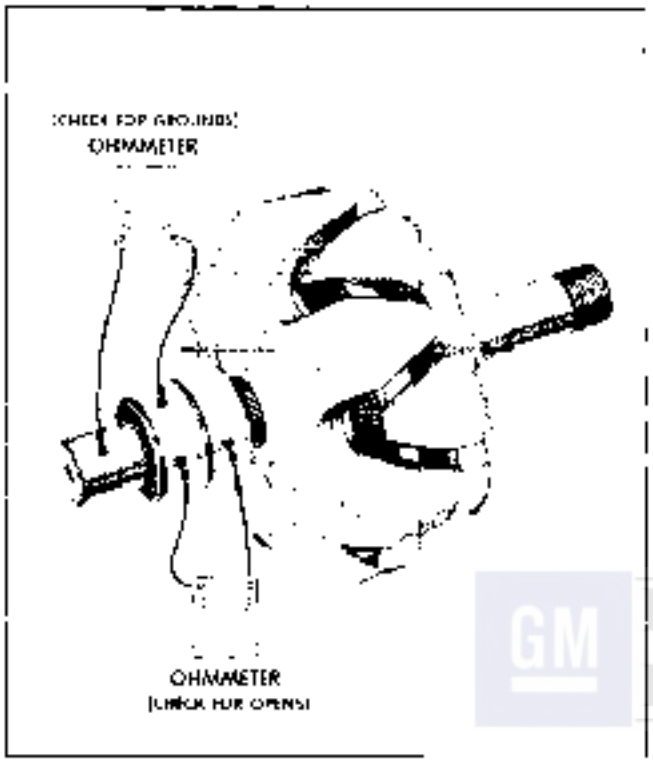


Fig. 6E-11 Checking Rotor

2. To check for opens, connect test lamp or ohmmeter to each slip ring. If lamp fails to light or if the ohmmeter reading is high (infinite), winding is open (Fig. 6E-11).

3. The winding is checked for short circuits by connecting a battery and ammeter in series with two slip rings. The field current at 12 volts and 80°F should be between 3.2 - 3.8 amperes on standard regulator cars and 4.0 - 4.5 on cars equipped with 52 amp alternators. Any ammeter reading above these values indicates shorted windings.

4. Rotor assemblies which fail above test should be replaced.

The rotor may be cleaned and inspected as follows:

a. If magnetic poles of rotor need cleaning, they may be cleaned by brushing with cleaning spirits.

CAUTION: Do not clean with degreasing solvent.

b. Inspect slip rings for dirt and roughness. These may be cleaned with solvent, if necessary. They may also be cleaned and finished with 400 grain or finer polishing cloth. Do not use sandpaper. Spin rotor in lathe or otherwise spin rotor, and hold polishing cloth against slip rings until they are clean.

CAUTION: The rotor must be rotated in order that slip rings will be cleaned evenly. Cleaning slip rings by hand, without spinning rotor, may result in flat spots on slip rings, causing brush noise.

Slip rings which are rough or out of round should be cleaned in lathe to .002" maximum indicator reading. Remove only enough material to make rings smooth and round. Finish with 400 grain or finer polishing cloth and blow away all dust.

DRIVE END FRAME BEARING

1. Remove three screws from retainer plate and remove retainer plate inner collar and gasket.

2. Press out bearing and oil slinger.

3. The bearings in generator are permanently lubricated and require no lubrication during life of bearing. If a dry bearing is encountered, do not attempt to lubricate, as an improper lubricant or excessive amount of lubricant may burn bearing, or be thrown off and contaminate inside of generator. Replace dry, worn or rough bearings with new bearings, which are prepacked with proper amount and type of lubricant.

4. To install, press in bearing and grease slinger with tube or collar that just fits over outer race.

5. Install retainer plate gasket and inner collar with three screws. It is recommended that new retainer plate be installed if felt seal is hardened or excessively worn.

STATOR

If stator is to be checked and/or replaced:

1. Remove 3 stator lead attaching nuts and washers (Figs. 6E-12 or 6E-13).

2. Separate stator from end frame. The fit between stator frame and end frame is not tight, and two can be separated easily.

3. The stator windings may be checked with 110-volt test lamp or ohmmeter as follows:

a. To check for grounded windings, connect lamp or ohmmeter from any stator lead to frame. If lamp lights or ohmmeter reading is low the stator is grounded (see Fig. 6E-14).

b. To test for opens, successively connect 110-

volt test lamp or ohmmeter between stator leads. If lamp fails to light and if ohmmeter reading is high, there is an open in stator windings (see Fig. 6E-14).

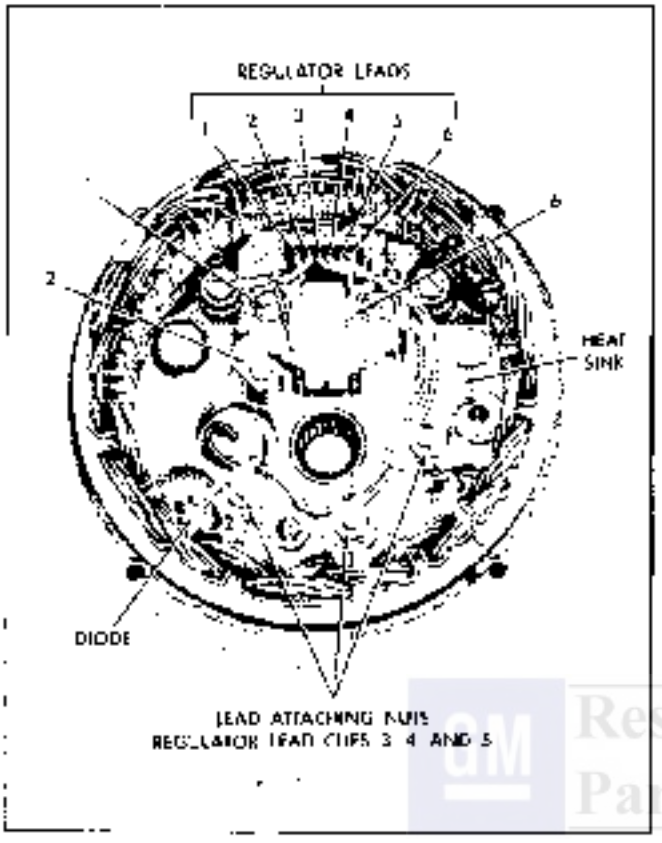


Fig. 6E-12 Slip Ring End Frame and Regulator Leads - C.S.I. Generator

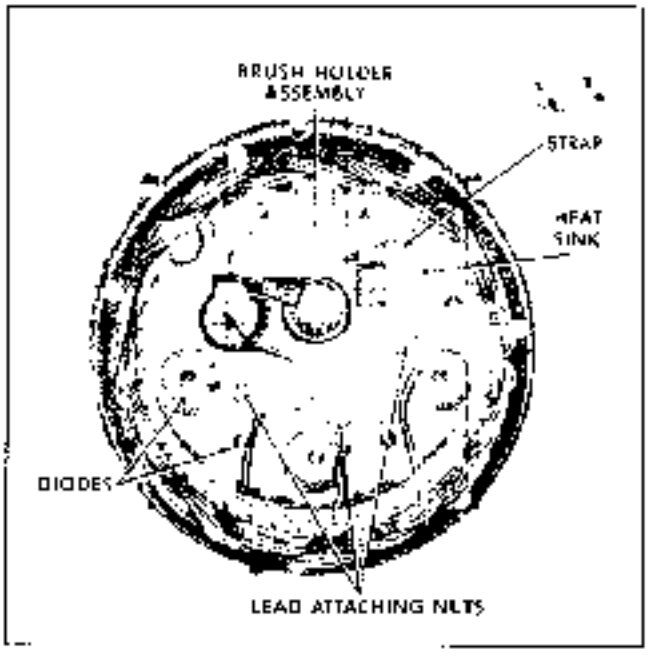


Fig. 6E-13 Slip Ring End Frame - Standard Generator

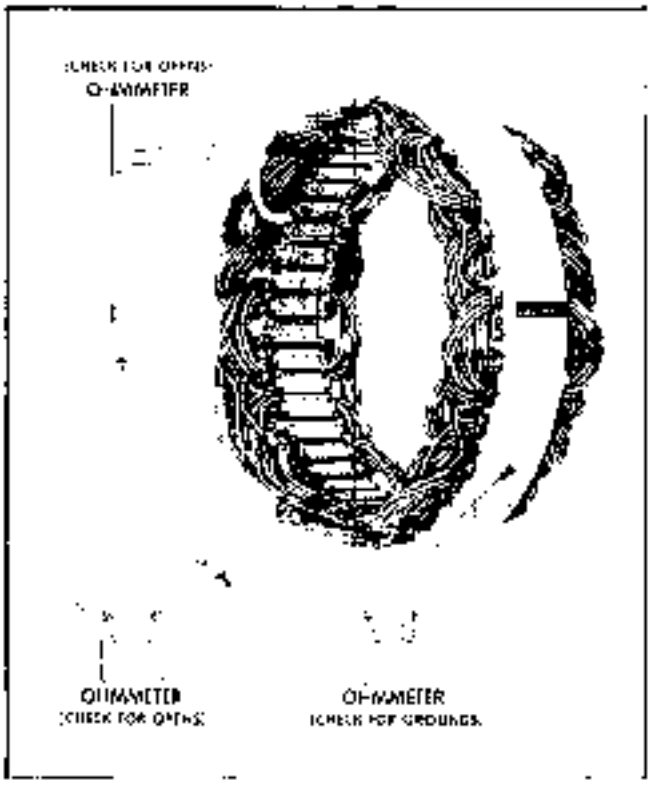


Fig. 6E-14 Checking Stator

c. A short circuit in stator windings is difficult to locate without laboratory test equipment, due to low resistance of windings. However, if all other electrical checks are normal and alternator fails to supply rated output, shorted stator windings are indicated.

3. Stator which fails above test should be replaced.

4. If necessary, stator may be cleaned by brushing with oleum spirits.

CAUTION: Do not clean in solvent.

5. The stator can be installed by reversing steps 1 and 2.

BRUSHES

1. Remove two brush holder screws and stator lead to strap attaching nut and washer (Fig. 6E-12 or 6E-13).

2. Remove brush holder and brushes. Carefully note stack-up of parts (Fig. 6E-15) for reassembly.

3. Inspect brush spring for evidence of damage or corrosion.

4. Inspect brushes for wear or contamination.

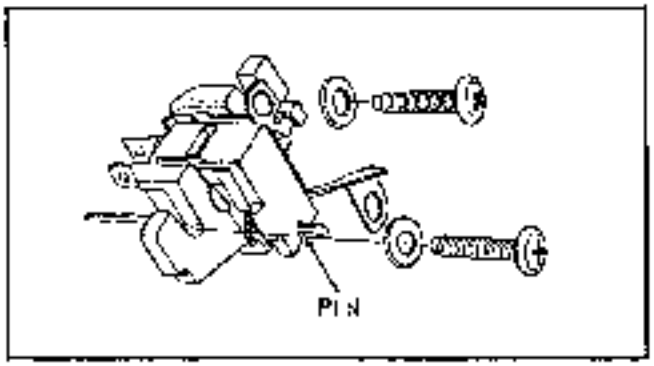


Fig. 6E-15 Brush Holder

5. If old brushes are to be reused, they must be thoroughly cleaned with soft dry cloth and must be completely free of oil.

6. If there is any doubt about condition of brush springs, they should be replaced.

7. Install spring and brushes into brush holder (they should slide in and out without binding). Insert straight wood or plastic toothpick (to prevent scratching brush face) into hole at bottom of holder to retain brushes.

8. Attach brush holder into end frame, noting carefully stack-up of parts as shown in Fig. 6E-15. Allow wood or toothpick to protrude through hole in end frame and install stator lead to strap attaching nut and washer.

SLIP RING END FRAME BEARING AND SEAL

1. With stator removed, press out bearing and seal with rod or collar that just fits inside end frame housing. Press from outside of housing toward inside. Support inside of frame with hollow cylinder to allow seal and bearing to pass through.

2. The bearings in generator are permanently lubricated and require no lubrication during life of bearing. If a dry bearing is encountered, do not attempt to lubricate, as improper lubricant or excessive amount of lubricant may burn bearing, or be thrown off and contaminate inside of generator. Replace dry, worn or rough bearings with a new bearing which will be prepacked with proper amount and type of lubricant.

3. Place flat plate over bearing and press in from outside toward inside of frame until bearing is flush with outside of end frame. Support inside of frame with hollow cylinder to prevent breakage of end frame. Use extreme care to avoid misalignment or otherwise placing undue stress on bearing.

4. From inside of frame, insert seal flush against bearing.

5. Install stator and connect leads.

DIODES

Diodes are checked by making use of their principles of allowing electricity to pass through in only one direction. Two methods are available:

OHMMETER METHOD

The lowest range scale on ohmmeter should be used and it should have 1 1/2 volt cell. To determine cell voltage, turn selector to lowest scale, then connect ohmmeter leads to voltmeter. The voltmeter will indicate cell voltage.

HEAT SINK DIODES

1. With stator disconnected, check a diode in heat sink by connecting one of ohmmeter leads to heat sink, and other ohmmeter lead to diode lead and note reading (Fig. 6E-16).

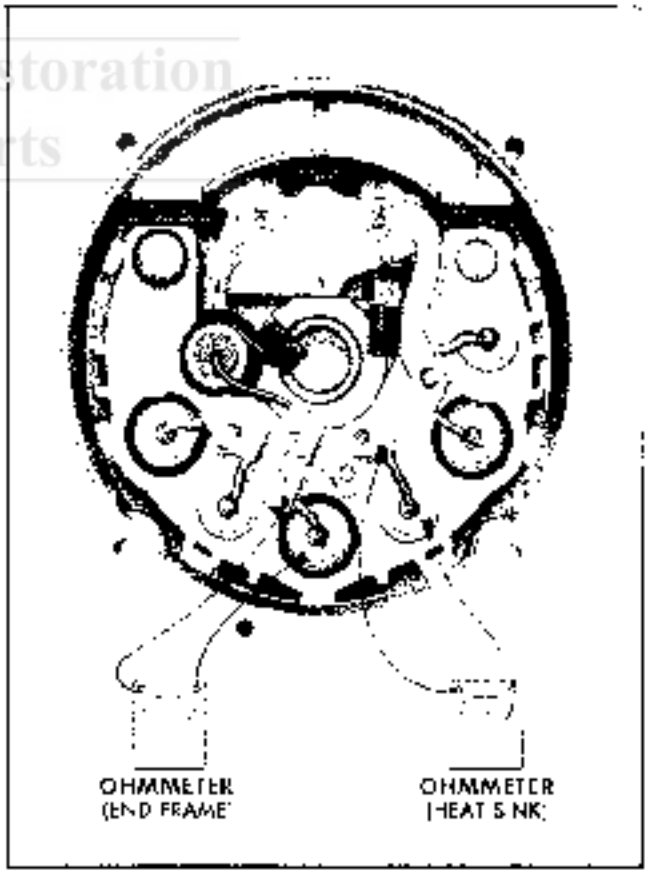


Fig. 6E-16 Checking Diodes

2. Reverse ohmmeter leads and note reading.

3. If both readings are very low or very high (read same), the diode is defective. A good diode will give one low reading and one high reading.

4. Check other two diodes in heat sink in same manner.

END FRAME DIODES

1. To check a diode mounted in end frame, connect one of ohmmeter leads to end frame and other ohmmeter lead to diode lead and note reading (Fig. 6E-16).

2. Reverse ohmmeter leads and note readings.

3. If both readings are very low or very high (read the same), the diode is defective. A good diode will have one low reading and one high reading.

4. Check other two diodes in end frame in same manner.

TEST LAMP METHOD

An alternate method of checking diodes is to use a test lamp of not more than 12 volts in place of ohmmeter.

CAUTION: Do not use 110 volt test lamp to check diodes.

With stator disconnected, connect test lamp across each diode as previously described, first in one direction and then other.

If lamp lights in both checks or fails to light in both checks, the diode is defective. When checking a good diode, the lamp will light in only one of two checks.

Diodes which fail the electrical tests should be replaced. If diodes must be replaced:

1. With stator removed, support slip ring end frame in vise or arbor press with J 9717-2 against casting and position remover J 9717-1 against diode as shown in Fig. 6E-17.

2. Tighten vise to remove diode.

CAUTION: Never attempt to remove diode by striking it, as shock may damage other diodes.

3. To install a diode, place new diode in installer J 9600-2.

4. Place slip ring end frame in vise so that new diode is in position and remover J 9717-1 supports casting (Fig. 6E-18).

5. Tighten vise to install diode.

CAUTION: Never attempt to install diode by striking it, as shock may damage it and other diodes.

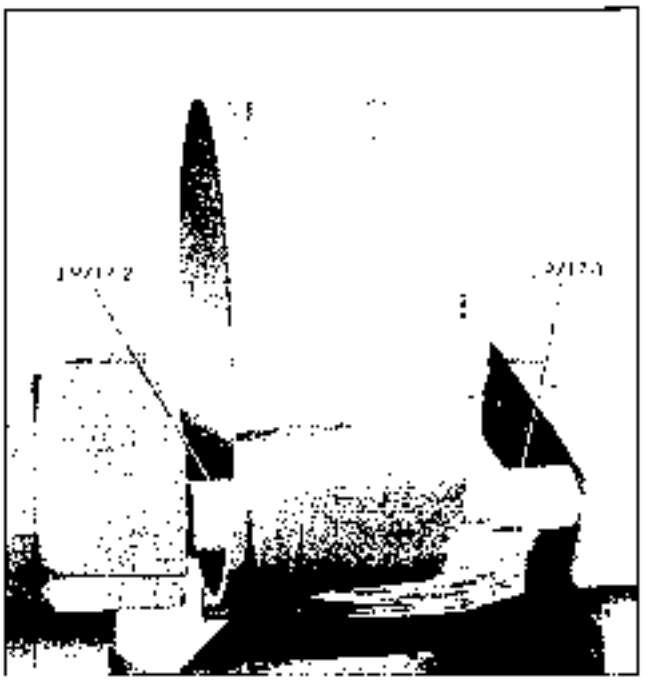


Fig. 6E-17 Removing Diodes

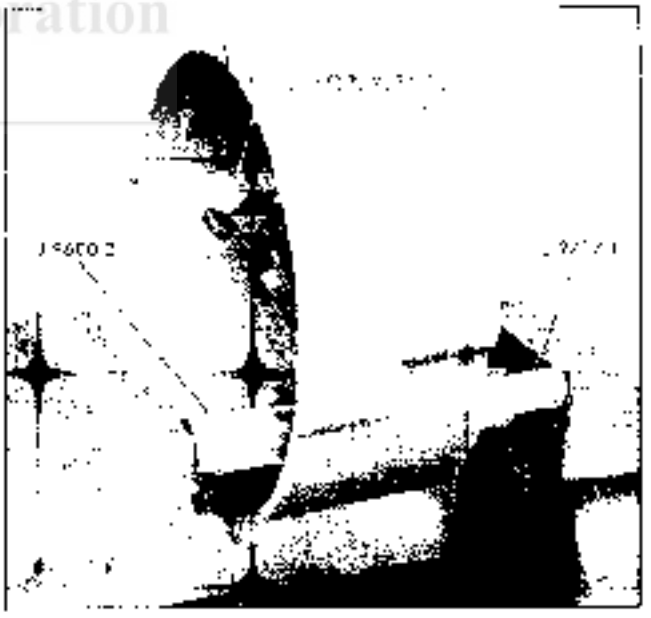


Fig. 6E-18 Installing Diodes

6. Install stator and connect leads.

CSI GENERATOR REGULATOR CHECKS

The regulator assembly of the integrated CSI generator may be checked for defects as follows:

1. Separate the stator assembly from the end

frame by removing the three stator lead attaching nuts (Fig. 6E-12).

2. Remove the numbers 3, 4, and 5 regulator lead clips from the studs as shown in Fig. 6E-19.

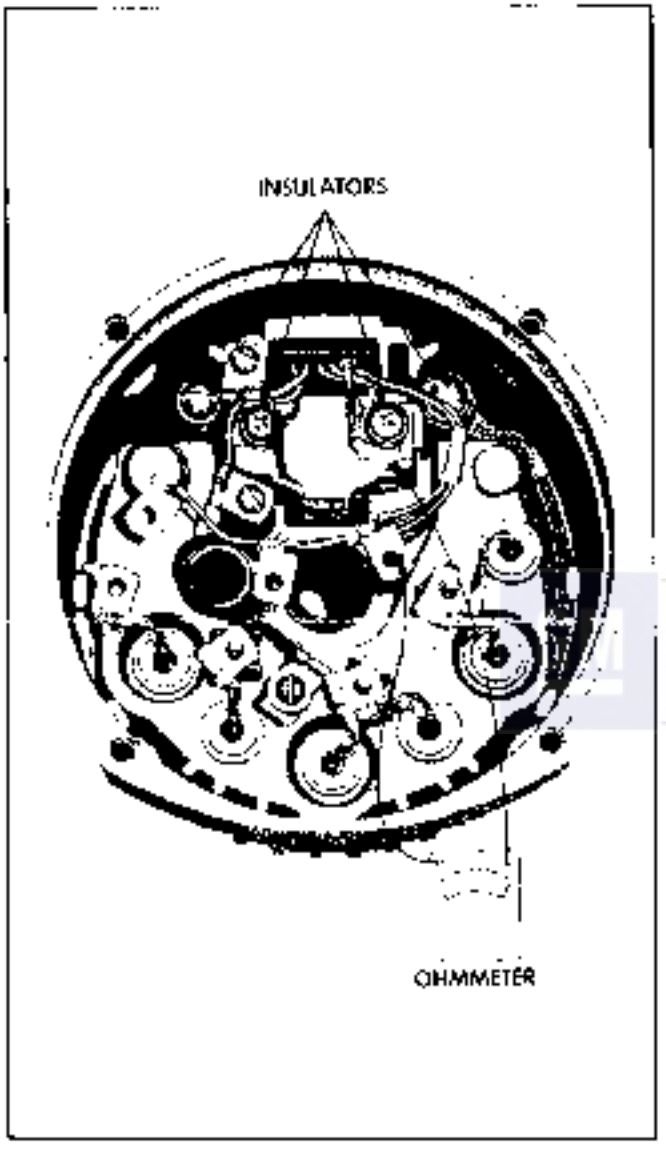


Fig. 6E-19 Regulator Checks - C.S.I. Generator

3. Using lowest range scale on an ohmmeter having a 1 1/2 volt cell, connect to one of the three disconnected regulator leads and to the generator No. 1 terminal as shown in Fig. 6E-19. Note ohmmeter reading.

4. Reverse the ohmmeter lead connections and again note the ohmmeter reading.

If both readings are the same, the regulator is defective and must be replaced. The ohmmeter should give one high and one low reading. Check the other two regulator leads in the same manner.

HEAT SINK

NOTE: Do not disassemble unless absolutely necessary. The heat sink must be completely insulated from end frame.

1. With stator removed, remove screw retaining condenser lockwasher, flat washer, fiber insulator and condenser lead.

2. Remove BAT and GRD terminals and respective washers and insulators from end frame.

3. Remove heat sink and washers.

4. Replace heat sink assembly, noting stack-up of parts shown in Fig. 6E-20.

5. Attach condenser lead to heat sink with washer and screws. Be sure insulating washer is between heat sink and end frame.

6. Install stator and connect leads.

CSI GENERATOR REGULATOR—REPLACEMENT

1. Detach the six regulator lead clips and two regulator heat sink attaching screws, sleeve insulators, and flat washer insulators (Fig. 6E-12).

2. Remove regulator from heat sink by removing regulator mounting screws. Carefully note stackup of parts.

3. Attach negative brush connection to regulator heat sink.

4. Assemble regulator noting carefully proper stackup of parts and being sure all electrical connectors at brush holder mounting screws are located under the flat washer insulators. Also check brush lead positions to insure freedom of brush movement and absence of shorts or grounds.

NOTE: Except for attachment of regulator, stack-up of parts in heat sink assembly is the same in both CSI integrated generator and basic generator (Fig. 6E-20).

ASSEMBLE GENERATOR

1. Before assembling rotor and drive end frame to slip ring end frame, make sure bearing surfaces of shaft are perfectly clean.

2. Join together two end frames, matching scribe marks.

3. Install four through bolts.

4. Remove wood or toothpick from brush holder assembly.

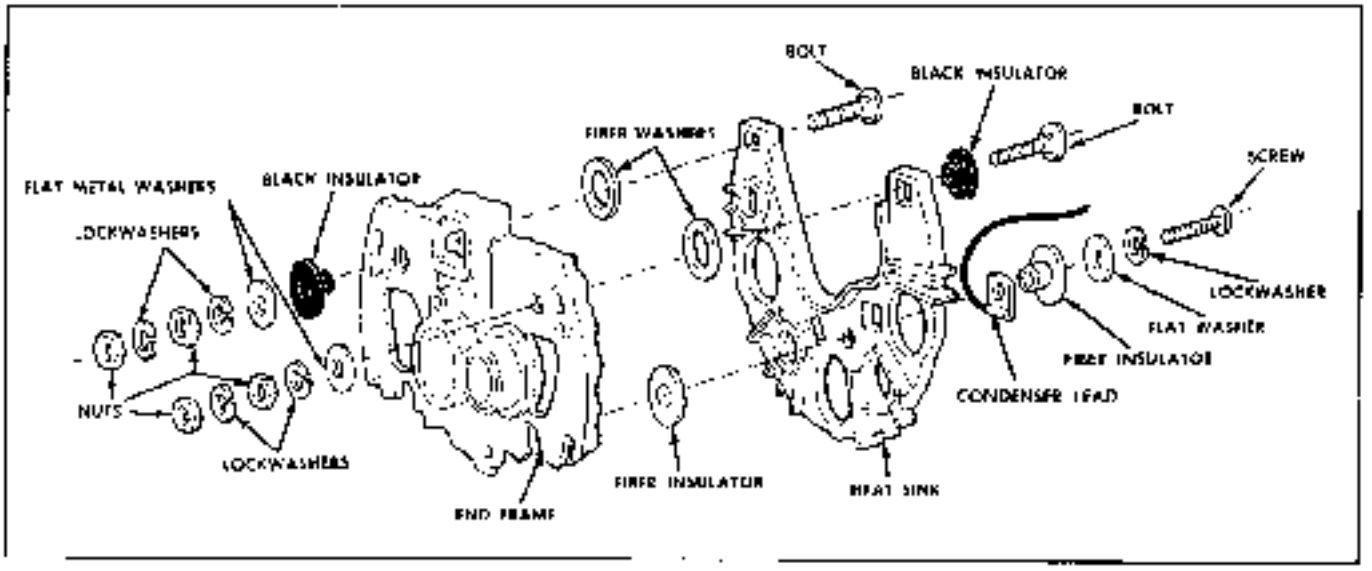


Fig. 6E-20 Heat Sink - Exploded View

INSTALL IN CAR

1. If removed from car, install generator to mounting bracket with bolts, washers, and nuts. Do not tighten.

2. Install generator drive belt.

3. See Section 3A for proper belt tensioning procedures.

4. Tighten bolts to 30 lb. ft., except bolt at sliding slot on bracket used for other than air conditioned cars, which is 20 lb. ft.

5. Install field and battery leads to generator.

6. Connect positive battery terminal.

CAUTION: Take care not to reverse polarity.

STANDARD AND TRANSISTOR REGULATORS

See Diagnosis Manual for servicing and checks of standard and transistor voltage regulators.

IGNITION CIRCUIT

DISTRIBUTOR—6 CYLINDER ENGINE

CHECKS AND ADJUSTMENTS ON VEHICLE

REPLACING CONTACT SET

The contact set is replaced as a complete assembly. To remove contact set, merely lift condenser lead clip and primary lead clip from between breaker lever spring and insulator, and then remove the contact set attaching screw (Fig. 6E-21). The service replacement contact set has breaker lever spring and point alignment preadjusted at factory. Only point opening requires adjusting after replacement.

ADJUSTING POINT OPENING

Loosen distributor clamp bolt and turn distributor until point set fiber block is on high point of cam. Measure point opening with feeler gauge. To change setting, loosen contact set attaching screw (Fig. 6E-21), insert screwdriver in adjusting screw slot, and pry to adjust to .016" with used points and .019" with new. Retighten screw securely after setting is

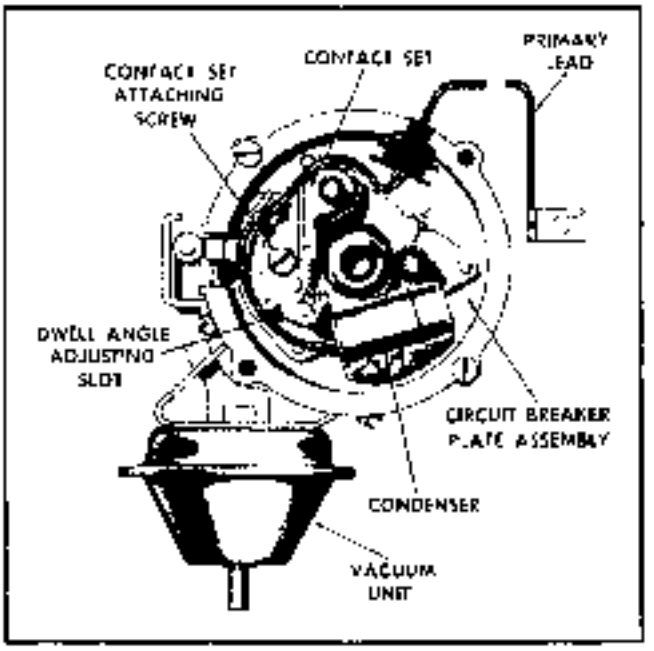


Fig. 6E-21 Top View of Distributor (Cap and Rotor Removed)

made. Reset timing and tighten distributor clamp bolt.

CHECKS AND ADJUSTMENTS OFF VEHICLE

REMOVE

1. Disconnect distributor-to-coil primary wire.

2. Remove distributor cap.

3. Crank engine so rotor is in position to fire No. 1 cylinder and timing mark on harmonic balancer is indexed with the proper mark on the lower timing belt cover (Fig. 6E-20).

4. Remove vacuum line s from distributor.

5. Remove distributor clamping nut and holddown clamp from stud.

6. Remove distributor. It will be noted that rotor will rotate as distributor is pulled out of block. Note relationship of rotor and distributor housing after removal so that rotor can be set in the same position when distributor is being installed.

NOTE: It is NOT necessary to remove compressor mounting bracket in engines equipped with air conditioning.

CAUTION: Always set distributor in upright position so oil from distributor shaft will not run out onto breaker plate and points.

The distributor may be placed in a distributor testing machine or synchroscope to check for variation of spark and centrifugal and vacuum advance.

IMPORTANT: When checking dwell angle, the vacuum advance must be in full retard or no vacuum advance position, since the dwell angle may vary with vacuum advance on these types of distributors.

The procedure for replacing contact set, and adjusting point opening is covered under Checks and Adjustments of Distributor on Vehicle.

DISASSEMBLY AND ASSEMBLY

DISASSEMBLE (Fig. 6E-22)

1. Remove rotor.

2. Disconnect primary and condenser leads from between plastic retainer and breaker set spring. Remove breaker points adjusting the hold-down screw and remove breaker points assembly.

3. Remove primary lead and retainer.

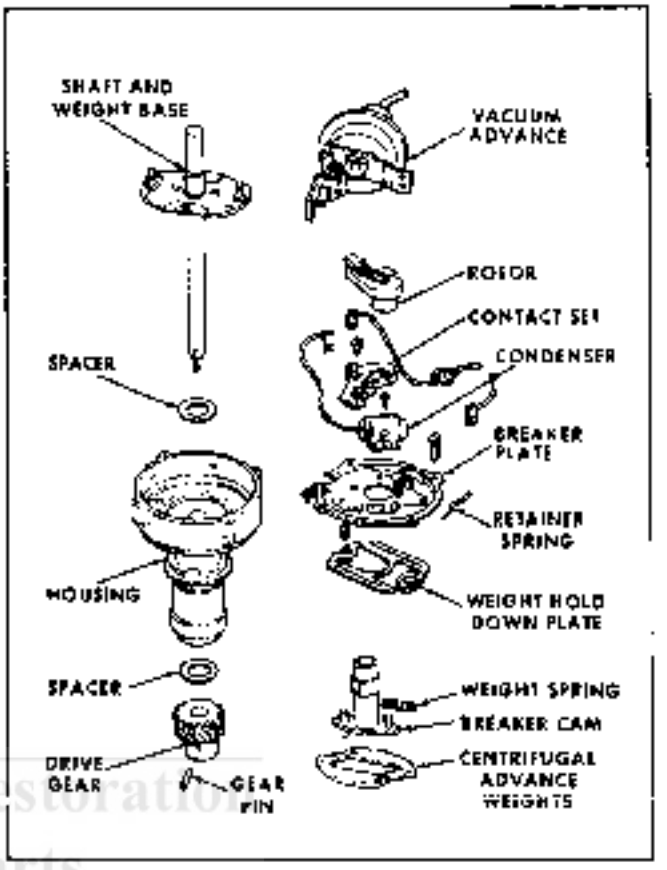


Fig. 6E-22 Exploded View of 6-Cylinder Distributor

4. Remove condenser and bracket.

5. Remove screws from vacuum advance diaphragm bracket. With slight downward pressure to disengage lever, remove vacuum advance assembly.

6. Remove screws securing breaker plate and remove breaker plate.

7. Remove roll pin from driven gear and remove driven gear and washer.

8. Pull shaft and weight base assembly and washer out of distributor housing and remove screws and washers securing centrifugal advance upper plate.

9. Remove weight control springs, weights from base plate and pull breaker cam assembly from main shaft.

ASSEMBLE

Assembly of the distributor is the reverse of the disassembly procedure outlined above. Coat upper end of shaft with grease before installing breaker cam. When installing the gear on shaft, use a new roll pin. The pin must be tight in hole to prevent any movement between gear and shaft.

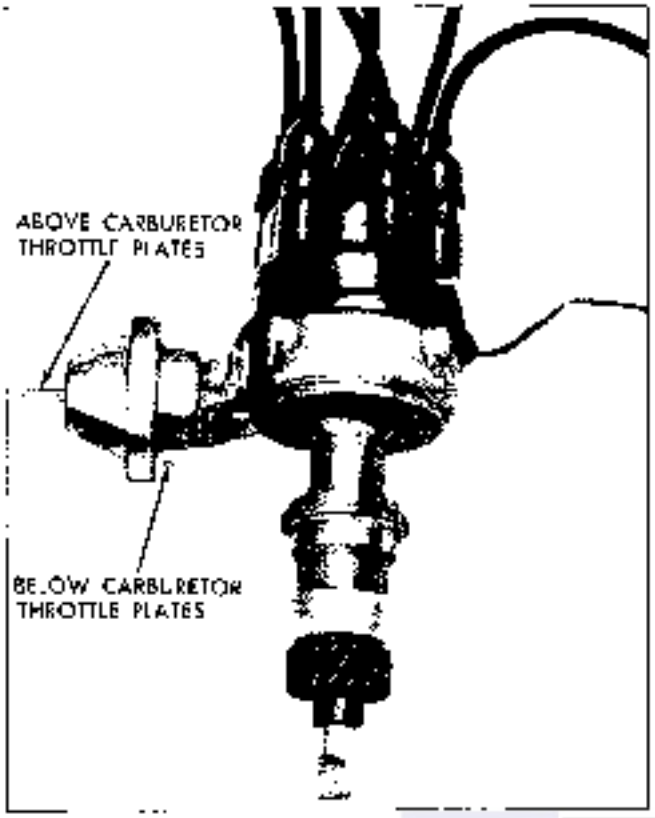


Fig. 6E-23 Positions of Vacuum Hoses - V-8 Distributor

INSTALL

1. Check to see that engine is at firing position for No. 1 cylinder (No. 1 piston at top of compression stroke) and timing mark on harmonic balancer is indexed with the proper mark on the lower timing belt cover (Fig. 6E-29).

2. Position new distributor to block gasket on block.

3. Before installing distributor, index rotor with housing as noted when distributor was removed Fig. 6E-20. This will simplify indexing the distributor shaft and gear with oil pump drive shaft and distributor drive gear. Distributor and rotor will be positioned properly when installed with No. 1 piston in firing position.

4. Replace distributor clamp leaving nut loose enough to allow distributor to be turned for timing adjustment.

5. Attach distributor to coil primary wire.

6. Replace distributor cap.

7. Adjust timing and then tighten distributor clamp nut.

8. Attach vacuum line(s) to distributor.

DISTRIBUTOR—8 CYLINDER ENGINE

PERIODIC SERVICE

A permanent lubricant reservoir is built into the distributor housing to lubricate upper end of shaft. No periodic lubrication is required.

When replacing contact set assembly apply a trace of petrolatum to breaker cam. No other lubrication is required. The movable breaker plate is lubricated by lubricant from the upper shaft bushing.

This distributor also requires periodic inspection of cap and rotor, wiring, and point condition, and a check for correct spark timing. This should be done at each tune-up and at least every spring and fall.

ADJUSTMENT

1. With engine operating, raise window provided in cap.

2. Insert Hex type wrench into head of adjusting screw as shown in Fig. 6E-24.

Fig. 6E-24 Adjusting Dwell Angle

3. Turn screw to adjust point opening by one of the following methods:

Preferred Method

Turn adjusting screw until 30° dwell is obtained as measured by dwell meter. (When using dwell meter be sure to test distributor resistance before testing dwell angle.)

NOTE: Providing dwell meter is accurate and is used correctly, points can be set very accurately. Several design features such as use of upper shaft bushing as a bearing for breaker plate and construction of advance mechanism have made this possible.

Alternate Method

Turn adjusting screw clockwise until engine begins to misfire. Then turn screw one-half turn in opposite direction (counterclockwise). This will give proper dwell angle.

REMOVE

1. Disconnect distributor-to-coil primary wire.

2. Remove distributor cap.

3. Crank engine so rotor is in position to fire No. 1 cylinder and timing mark on harmonic balancer is indexed with the proper mark on the timing chain cover, Fig. 6E-27 and 6E-30.

4. Remove mounting bolts from distributor.

5. Remove distributor clamping screw and hold-down clamp.

6. Remove distributor and distributor to block gasket. It will be noted that rotor will rotate as distributor is pulled out of block. Note relationship of rotor and distributor housing after removal, so that rotor can be set in same position when distributor is being installed.

NOTE: Always set distributor in upright position so oil from distributor shaft will not run out onto breaker plate and points.

INSPECT

With distributor removed from vehicle it is advisable to place distributor in a distributor testing machine or synchroscope. When mounting distributor in tester, first secure gear in drive mechanism, then push distributor housing down toward gear to take up end play between gear and housing, and finally secure housing in tester. Test distributor for variation of spark, correct centrifugal and vacuum advance, and condition of contacts. This test will give valuable information on distributor condition and indicate parts replacement which may be necessary.

REPLACE CONTACT SET

The contact point set is replaced as one complete assembly. The breaker lever spring tension and point alignment of service contact set have been pre-adjusted at factory. Only point opening requires adjusting after replacement.

Replace contact set as follows:

1. Remove two attaching screws which hold base of contact set assembly in place.

2. Remove condenser lead and primary lead from nylon insulated connection (Fig. 6E-25) in contact set.

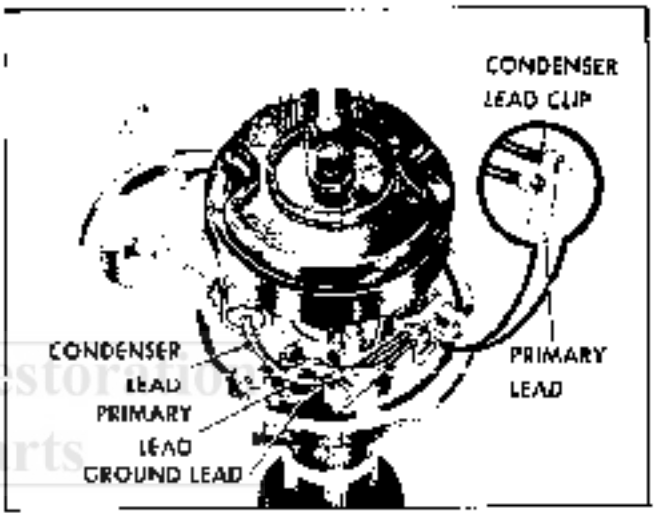


Fig. 6E-25 Arrangement of Leads

3. Replacement is reverse of removal.

CAUTION: Make sure condenser lead and primary lead are located as in Fig. 6E-25. Leads must be properly located to eliminate interference between leads and cap, weight base or breaker plate.

4. Apply trace of petrolatum to breaker cam.

DISASSEMBLE DISTRIBUTOR

1. Remove rotor by removing two attaching screws, lockwashers, and flatwashers (Fig. 6E-26).

NOTE: It will be observed that rotor is doweled to weight base so that it can be installed in only one position.

2. Remove both weight springs and both advance weights.

3. Remove retaining pin from gear by driving it out of gear with a drift and hammer.

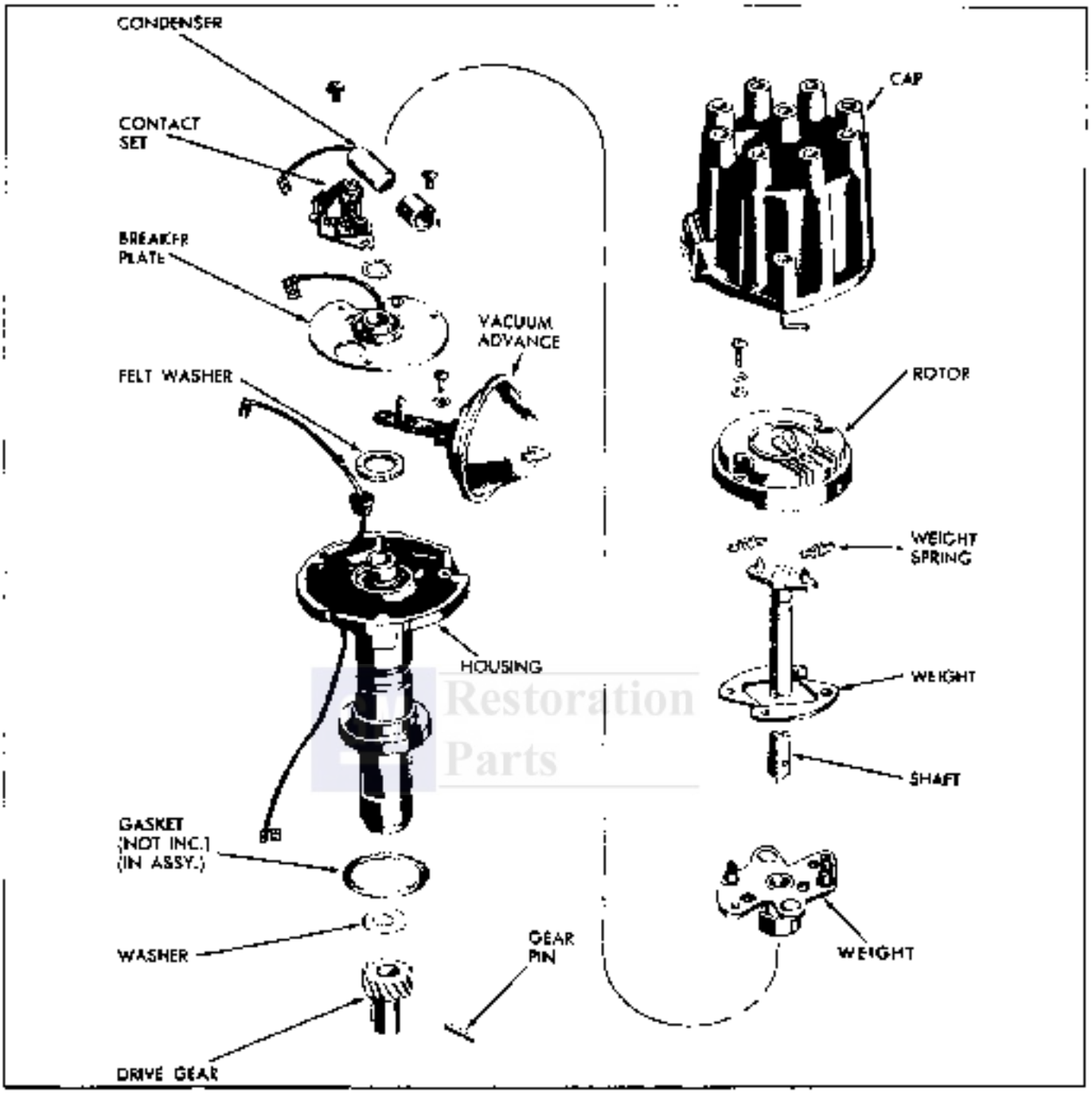


Fig. 6E-26 Exploded View of V-8 Distributor

CAUTION: Distributor should be supported in such a way that distributor shaft will not be damaged when driving pin out.

4. Slide gear and washer off shaft.

5. Pull shaft and cam-weight base assembly from the housing.

6. Remove contact set assembly.

7. Remove condenser hold-down screw, condenser and bracket from the breaker plate.

8. Remove spring retainer and raise plate from housing.

9. Remove two attaching screws and lock washers and plate ground lead, and remove vacuum advance unit.

10. Remove felt washer from around bushing in housing.

NOTE: No attempt should be made to service shaft bushings in housing, as housing and bushings are serviced as a complete assembly.

ASSEMBLE

Assembly of the distributor is reverse of disassembly procedure outlined above. When installing gear on shaft use a new retaining pin. The pin must be tight in hole to prevent any movement between gear and shaft.

Note that rotor can be installed in only one position. It will be broken if an attempt is made to install it backwards.

NOTE: Some G.T.O., Firebird and 428 HO distributors will have cadmium plated, hardened drive gears. Whenever one of these distributors or gears is replaced, an identical replacement part must be used. Engines built with hardened gears have a 90 psi oil pump spring, and early failure will result if a normal gear is used.

INSTALL

1. Check to see that engine is at firing position for No. 1 cylinder (No. 1 piston at top of compression stroke) and timing mark on harmonic balancer is indexed with the proper mark on the timing chain cover (Fig. 6E-30).

2. Position new distributor to block gasket on block.

3. Install distributor in block so that vacuum diaphragm faces left side of engine and rotor points toward contact in cap for No. 1 cylinder. Before installing distributor, index rotor with housing as noted when distributor was removed. This will simplify indexing distributor shaft and gear with oil pump drive shaft and drive gear on camshaft. Distributor and rotor will be positioned as shown in Fig. 6E-27 when properly installed with No. 1 piston in firing position.

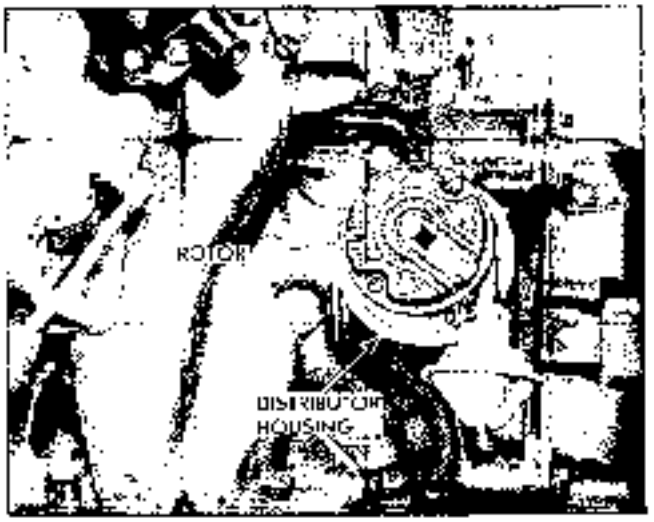


Fig. 6E-27 Rotor in No. 1 Firing Position – V-8

4. Replace distributor clamp, leaving screw loose enough to allow distributor to be turned for timing adjustment.

5. Attach distributor to coil primary wire.

6. Replace distributor cap.

7. Adjust dwell and timing and then tighten distributor clamp screw.

8. Attach vacuum lines to distributor.

If engine was turned with distributor removed and position of rotor was not noted at removal of distributor, it may be installed by the following method.

1. Remove No. 1 spark plug (forward plug on left bank on V-8).

2. Place finger in spark plug hole and turn engine over until timing mark is at index (see Fig. 6E-30).

NOTE: As engine approaches timing mark, a pressure should be felt with the finger in the spark plug hole. If no pressure is felt, it will be necessary to turn the engine one complete revolution and again index with timing marks.

3. Install distributor in position as shown in Figs. 6E-27. It will be necessary to rotate rotor slightly to the right for a V-8 and to the left for a 6-cyl. when attempting installation so that final position will be correct.

NOTE: If distributor does not drop into position fully, hold down on housing and rotate engine until distributor drops into position.

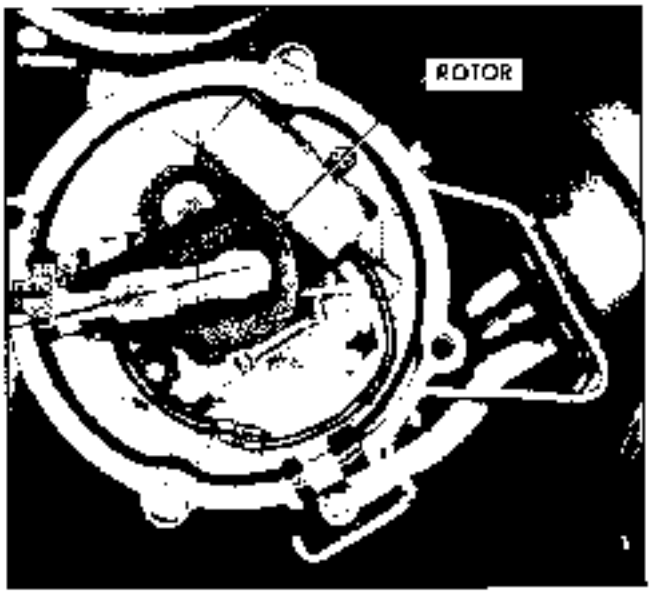


Fig. 6E-28 Rotor in No. 1 Firing Position – 6 Cylinder

IGNITION TIMING

Correct timing marks are on the front engine covers and harmonic balancer (Figs. 6E-29, 6E-30).

Due to vacuum advance at idle, it is inoperative to disconnect distributor vacuum advance line before setting ignition timing.

Fig. 6E-29 Timing Marks on 6 Cylinder Engine

Fig. 6E-30 Timing Marks on V-8 Engine

At time spark is adjusted, the general appearance of breaker points should be observed. If smudge line appears on point support and breaker plate just beneath points, burned points (from oil or crankcase vapor between points) are very probable. Points which have gone several thousand miles will have a rough surface, but this does not mean points are worn out. The roughness between points matches so that a large contact area is maintained and points will continue to provide satisfactory service. If dirt or scale is present, points should be cleaned with a few strokes of a clean, fine-cut, contact file. Do not attempt to remove all roughness or dress point surfaces down smooth. Never use emery cloth or sandpaper to clean points. If points are burned or badly pitted, they should be replaced and cause of this condition found and corrected. If this is not done new points will also burn and pit in a short time.

Adjust ignition timing as follows.

1. Adjust breaker point gap.

2. Connect power timing light.

3. Loosen distributor clamp screw and rotate distributor until power timing light shows that the proper mark on the cover lines up with the mark on the harmonic balancer. Tighten distributor clamp screw. The timing specifications for various engines are listed below.

6-cyl. 4-bbl.	5°BTDC
6-cyl. 1-bbl.	0°TDC
V-8 (All)	9°BTDC

IGNITION AND STARTING SWITCH

The ignition and starting switch is key-operated to close the ignition primary circuit and to energize the starting motor solenoid for cranking.

The ignition switch used on Pontiac and Tempest has four positions, OFF when the key is straight up and down, ACCESSORY when pushed in and turned to the left, ON when turned to the right until spring pressure is felt, and START when turned fully to the right against spring pressure.

With the switch in either ACCESSORY or ON positions the following electrical circuits are activated: stop lights, air conditioning, directional signals, parking brake warning light, radio, back-up lights, heater and defroster, and electric windshield wiper. In the ON position the ignition primary circuit is activated through the resistance.

There are eight terminals on the back of switch (Figs. 6E-31-32). The terminal marked BAT is connected to the battery and supplies power to the switch. The accessory terminal supplies power to the accessories when the switch is in ACC or running positions. The SOL terminal supplies power to the solenoid to activate the starter in start position. The terminal marked GRD completes the feet circuit for the temperature HOT indicator bulb when the switch is turned to start position.

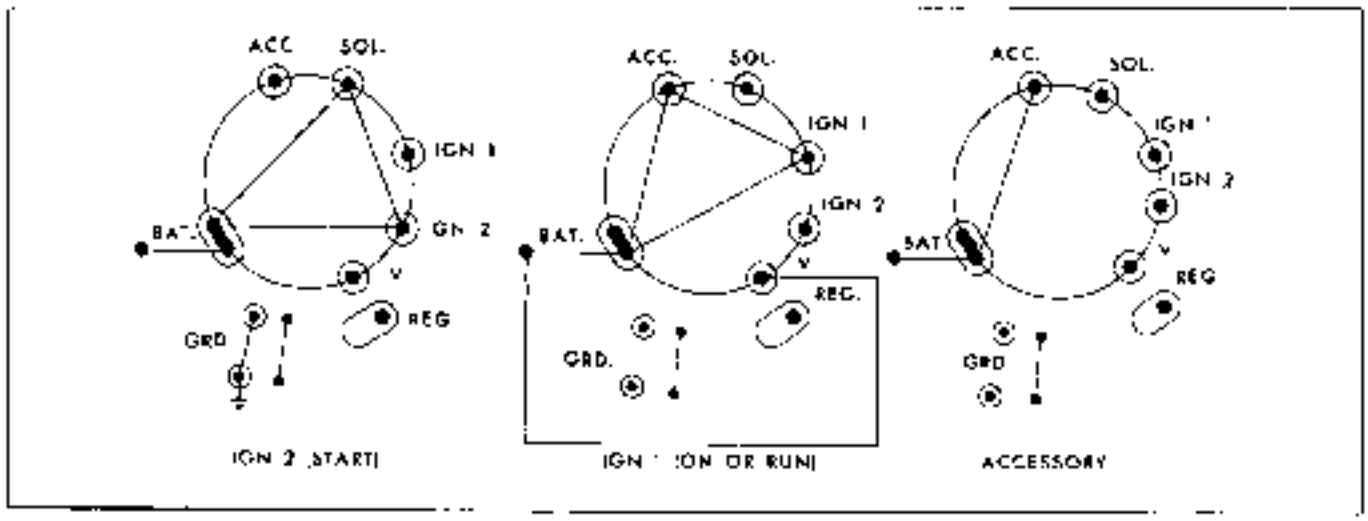


Fig. 8E-31 Pontiac Ignition Switch

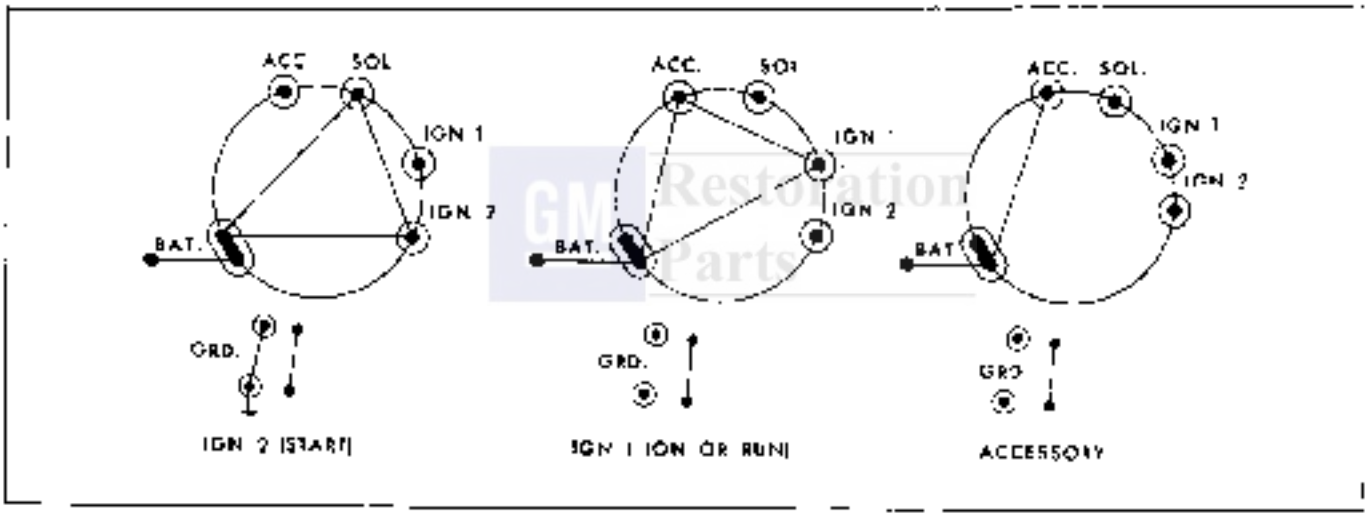


Fig. 8E-32 Tempest Ignition Switch

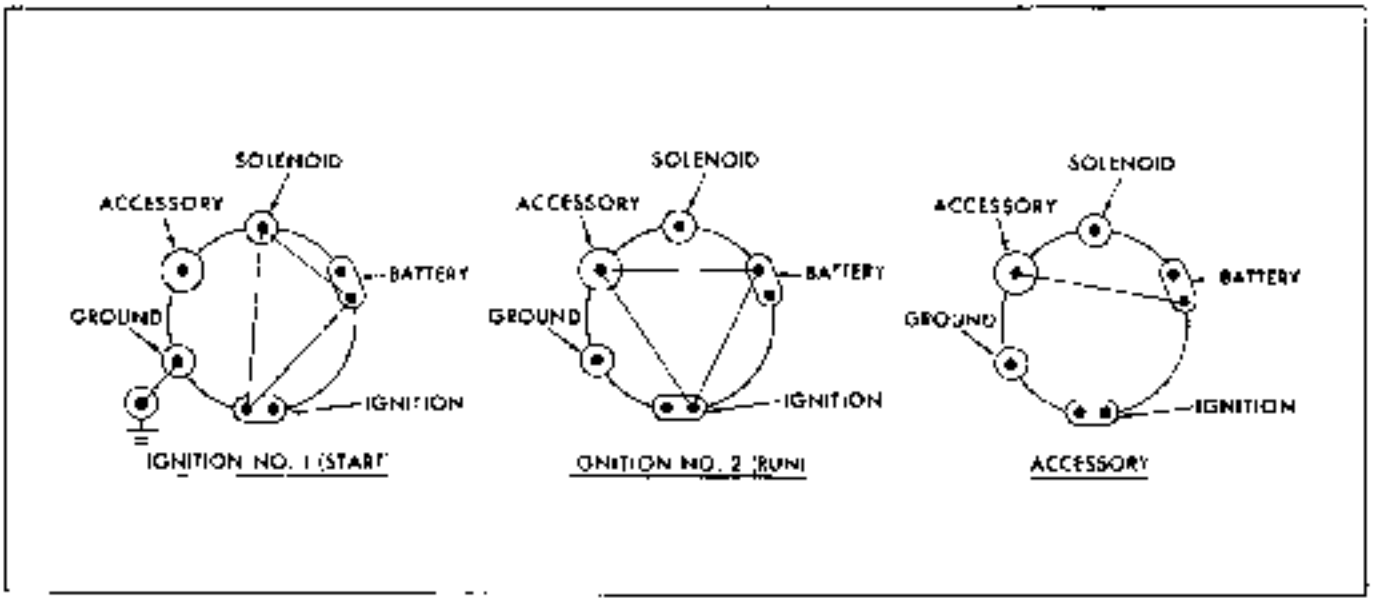


Fig. 8E-33 Firebird Ignition Switch

These circuits are all cut off when the ignition switch is in the OFF or START positions.

When the ignition switch is turned to the start position, the ignition primary circuit is activated directly, by-passing the resistance, and the starting motor circuit is activated to crank the engine.

Two ignition terminals, marked IGN 1 and IGN 2, will be found on the back of switch. The IGN 1 terminal is energized when the ignition switch is in normal operating position. It directs current to the ignition coil through the resistance. The IGN 2 position is energized when the ignition switch is turned to the starting position. It directs current to the coil around the resistance to provide full battery voltage to the coil when starting.

The two terminals V and REG on Pontiac ignition switch are connected to a special set of contacts inside the ignition switch. Externally the V terminal is connected directly to the battery splice and the REG terminal is connected to the No. 3 terminal of voltage regulator. When the ignition switch is in the ON position the special set of contacts is closed and current flow can be traced from the battery, through switch, through voltage regulator to the field terminal of generator, and finally through the rotor field coil windings to ground.

On all models, when the ignition switch is turned to the start position, the ignition primary circuit is activated directly by-passing the resistance, and the starting motor circuit is activated to crank the engine (Figs. 6E-31-32-33).

On Firebird models, one ignition terminal marked IGN 1 will be found on the back of the switch (Fig. 6E-33). The IGN 1 terminal is energized when the ignition switch is in the normal operating position. It directs current to the ignition coil through the resistance. In the START position, the temperature indicator bulb check circuit is activated through the ground.

CAUTION: Due to the presence of the bulb check circuit which is connected to the ignition terminal, never attempt to jumper the cranking motor solenoid with the ignition switch in the OFF position, as this will result in burning of the ignition switch ground spring.

The SOL terminal is energized when the ignition switch is turned to the starting or crank position. Electrical energy from the battery is supplied to the starting motor directly through the solenoid switch contacts to provide full battery voltage to crank the engine.

REPLACE SWITCH

1. Remove positive cable from battery to protect against short circuit.

2. Remove ignition lock cylinder.

3. Remove ignition switch ferrule by unscrewing with special spanner J 7607.

4. Remove ignition switch lamp housing brace screw from bottom flange of instrument panel.

5. Remove switch from back of instrument panel and disconnect wires after unlatching special locking terminal.

6. Replace switch by reversing above steps.

REPLACE SWITCH LOCK CYLINDER

1. Place ignition key in lock and depress lock plunger by inserting small pin through hole in lock cap.

2. While holding plunger in, turn key approximately 20° counterclockwise to release lock cylinder and remove cylinder from switch.

3. To install lock cylinder, insert key in cylinder. Then, with key and cylinder turned about 20° counterclockwise, insert cylinder in lock and rotate clockwise to lock in place.

FREE UP LOCK

Occasionally an ignition lock may stick, making it difficult to insert key and turn lock. In such case blow a very small quantity of powdered graphite into lock key hole and operate lock several times until lock operates freely.

If ignition switch will not free up with lubrication it must be replaced. To remove a stuck lock, use a 5/8" drill bit and drill out center of cylinder as shown in Figure 6E-34. The tumblers must be destroyed before the cylinder can be removed.

SPARK PLUGS

PERIODIC SERVICE

Periodically (actual time depending on operating conditions) plugs should be removed for cleaning, inspection and regapping.

REMOVE

1. Remove spark plug wires.

2. Remove any foreign matter from around spark plugs by blowing out with compressed air.

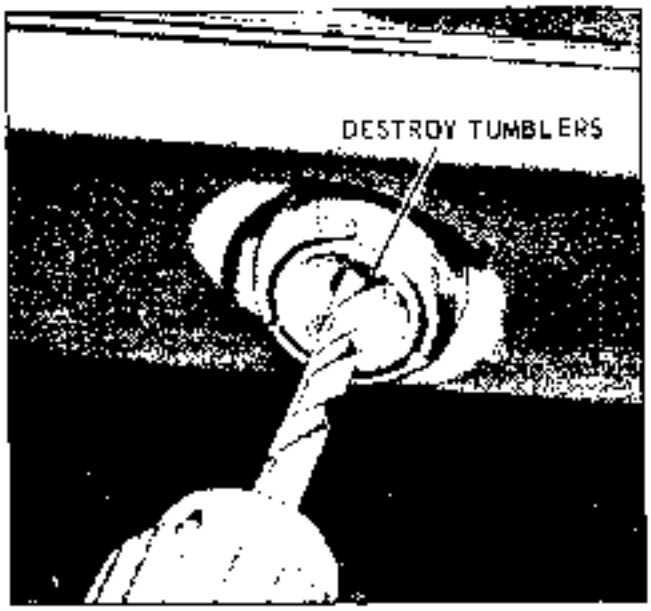


Fig. 6E-34 Drilling Out Ignition Cylinder

3. Using a 13/16" spark plug socket, remove the spark plugs.

INSPECT

Spark plug life is governed to a large extent by operating conditions and plug life varies accordingly. To insure peak performance, spark plugs should be checked, cleaned and regapped every 12 months or 12,000 miles.

Worn or dirty plugs may give satisfactory operation at idling speed, but under operating conditions they frequently fail. Faulty plugs are evident in a number of ways such as wasting gas, power loss, loss of speed, hard starting and general poor engine performance.

Spark plug failure, in addition to normal wear may be due to dirty or leaded plugs, excessive gap or broken insulator.

CLEAN AND REGAP

Clean spark plugs thoroughly using an abrasive-type cleaner. All spark plugs must be of the same make and number or heat range. Use a round feeler gauge to adjust the spark plug gaps to .035" (Fig. 6E-35). Test spark plugs following instructions furnished with Spark Plug Cleaner and Indicator (Fig. 6E-36).

CAUTION: Before adjusting gap, file center electrode flat. In adjusting spark plug gap, never bend center electrode which extends through porcelain center. Always make adjustments by bending ground (side) electrode.

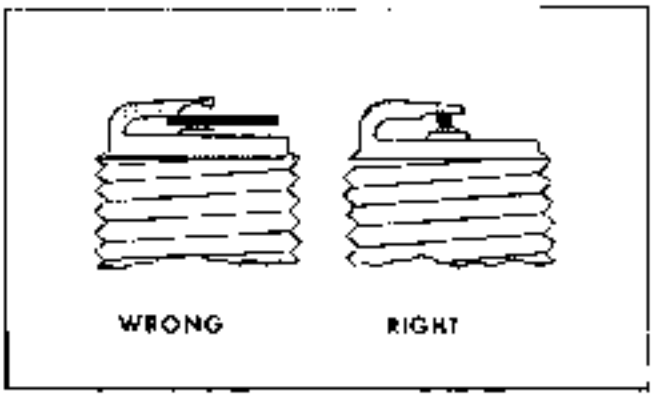


Fig. 6E-35 Measuring Spark Plug Gap

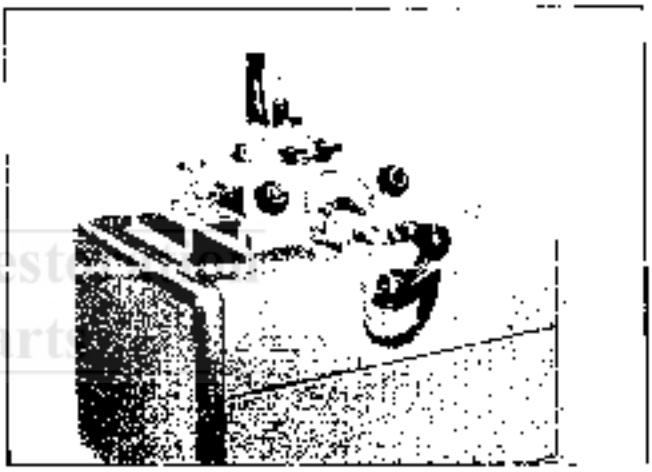


Fig. 6E-36 Spark Plug Cleaner and Indicator

INSTALL

1. Inspect spark plug hole threads and clean before installing plugs. Corrosion deposits can be removed with a 14 mm. x 1.25 SAE spark plug tap (available through local jobbers) or by using a small, soft wire brush on an electric drill. If a tap is used, coat it with plenty of grease to catch any chips.

CAUTION: Use extreme care when using tap to prevent cross threading. Also, crank engine several times to blow out any material dislodged during cleaning operation.

2. Install spark plugs in engine, using new gaskets, and tighten to 23 lb. ft. torque.

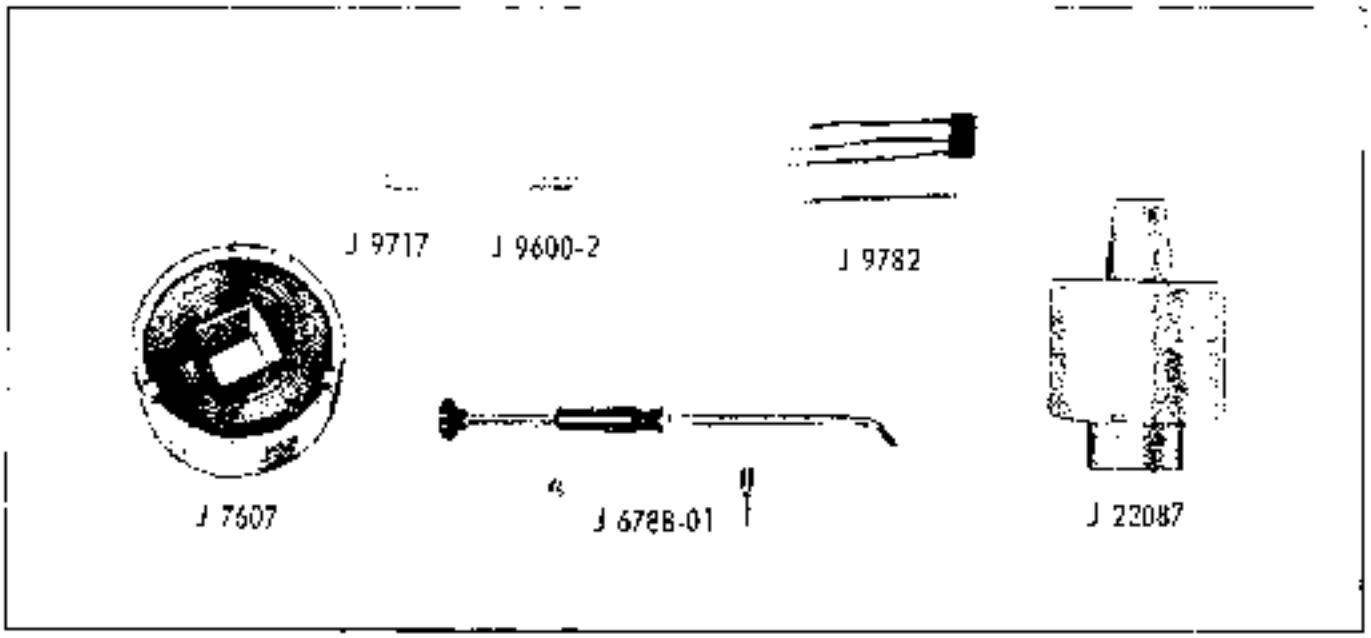


Fig. 6E-37 Special Tools

	PONTIAC							
	STANDARD				HEAVY DUTY			
						OPTIONAL		
	[illegible] FUEL	[illegible] STD	[illegible]	A/C	[illegible]	[illegible]	[illegible]	
BATTERY MODEL	Y59	R59			R59			
Wattage	[illegible]	[illegible]			[illegible]			
Amps @ 20 Hr. Rate	53	61			70			
GENERATOR AMPS Load Rating	37		42	55	55	62	55	
Output @ Eng. R.P.M.	28 @ 770		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Output @ Eng. R.P.M.	40 @ 1825		35 @ 1825	50 @ [illegible]	50 @ 1825	[illegible]	[illegible]	
Field Current Draw	[illegible]			[illegible]	[illegible]	[illegible]		
REGULATOR MODEL	[illegible]		[illegible]	[illegible]			[illegible]	
Normal Range	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]	
STARTER MOTOR MODEL / No. of Shunt Winds	[illegible]	[illegible]						
SOLENOID MODEL / Pull-in Winding AMPS @ 10V / Both Windings AMPS @ 10V	[illegible] / [illegible] / 41-47							

	TEMPEST						
	6-CYL			V-8			
	STD	A/C OR H.D.	AUTO TRANS	350 REG FUEL	STD	A/C OR H.D.	H.D. OR R.A.
BATTERY MODEL	Y55	R59		Y59	R59		
Wattage	[illegible]	[illegible]		[illegible]	[illegible]		
Amps @ 20 Hr. Rate	44	61		53	61		
GENERATOR AMPS Load Rating	37	55		37		55	
Output @ Eng. R.P.M.	[illegible]	[illegible]		[illegible]		[illegible]	
Output @ Eng. R.P.M.	35 @ 1825	50 @ [illegible]		[illegible]		[illegible]	
Field Current Draw	[illegible]	[illegible]		[illegible]		[illegible]	
REGULATOR MODEL	[illegible]						
Normal Range	[illegible]						
STARTER MOTOR MODEL	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	
SOLENOID MODEL	[illegible]			[illegible]			
Pull-in Winding AMPS @ 10V	[illegible]			[illegible]			
Both Windings AMPS @ 10V	41-47			41-47			

	FIREBIRD					
	6-CYL			V-8		
	STD	A/C	H.O. OPT	STD 350	[illegible]	A/C OR H.D.
BATTERY MODEL	Y53	R59		Y59	R59	
Wattage	[illegible]	[illegible]		[illegible]	[illegible]	
Amps @ 20 Hr. Rate	[illegible]	[illegible]		53	61	
GENERATOR AMPS Load Rating	37	55		37		[illegible]
Output @ Eng. R.P.M.	[illegible]	[illegible]		[illegible]		[illegible]
Output @ Eng. R.P.M.	[illegible]	[illegible]		[illegible]		[illegible]
Field Current Draw	[illegible]	[illegible]		[illegible]		[illegible]
REGULATOR MODEL	[illegible]					
Normal Range	[illegible]					
STARTER MOTOR MODEL / No. of Shunt Winds	[illegible] / 0			[illegible] / 1	[illegible] / 0	
SOLENOID MODEL	[illegible]				[illegible]	
Pull-in Winding AMPS @ 10V	[illegible]				TEST NOT RECOMMENDED	
Both Windings AMPS @ 10V	41-47					

IGNITION COIL	MODEL	PRIMARY RESIST. OHMS @ [illegible]	SEC. RESIST. OHMS @ [illegible]
PONTIAC	[illegible]	[illegible]	[illegible]
TEMP. AND FIREBIRD — 6-Cyl.	[illegible]	[illegible]	[illegible]
TEMP. AND FIREBIRD — 8 Cyl.	[illegible]	[illegible]	[illegible]

*Grand Prix Regulator Contained Within Generator Assy.

SPARK PLUGS

6-Cyl. [illegible]
6-Cyl. [illegible]
GTO & [illegible]
[illegible]
Tempest [illegible]
[illegible]

Fig. 6E-30 Engine Electrical Specifications

PONTIAC

MODEL	1101272		1111930		1101448		1111435		1101450		1101270		1111449	
ROTATION VIEWED FROM TOP	C-C		C-C		C-C		C-C		C-C		C-C		C-C	
DWELL SET TO	30		30		30		30		30°		30		30°	
CONDENSOR CAP (MFD)	.18-.23		.18-.23		.18-.23		.18-.23		.18-.23		.18-.23		.18-.23	
CENT. ADV. (DIST. DEG.)	DEG.	RPM	DEG.	RPM	DEG.	RPM	DEG.	RPM	DEG.	RPM	DEG.	RPM	DEG.	RPM
START	1.5-2.5	500	0-2	500	1-3	700	0-2	480	1.5-3.5	700	0-2	500	1-3	700
INTERMEDIATE	7.5-9.5	950	5-7	1000	5-7	1000	6-8	1000	6-8	1000	5-7	1000	5-7	1000
MAXIMUM	15-17	2275	9-11	2300	9-11	2300	10-12	2300	10-12	2300	9-11	2300	9-11	2300
VACUUM CONTROL MODEL	1973411		1973412		1973412		1973412		1973411		1973412		1973411	
IN. HG. TO START ADVANCE	8-10		10-12		10-12		10-12		8-10		10-12		8-10	
IN. HG. FOR FULL ADVANCE	15-17		17-18.5		17-18.5		17-18.5		15-17		17-18.5		15-17	
MAX. ADVANCE (DIST. DEG.)	10		10		10		0		10		10		10	
IN. HG. FOR FULL RETARD														
MAX. RETARD (DIST. DEG.)	4-6		4-6		4-6		4-6		4-6		4-6		4-6	

TEMPEST AND FIREBIRD

MODEL	1116430		1103417		1111281		1111252		1101447		1101272		1101270		1101449	
ROTATION VIEWED FROM TOP	C		C		C-C		C-C		C-C		C-C		C-C		C-C	
DWELL SET TO	32		32		30°		30		30°		30		30°		30	
POINT OPENING	.016		.016													
CONDENSOR CAP (MFD)	.18-.23		.18-.23		.18-.23		.18-.23		.18-.23		.18-.23		.18-.23		.18-.23	
CENT. ADV. (DIST. DEG.)	DEG.	RPM	DEG.	RPM	DEG.	RPM	DEG.	RPM	DEG.	RPM	DEG.	RPM	DEG.	RPM	DEG.	RPM
START	0-4.8	500	0-1.9	500	1-3	350	1.5-3.5	700	0-2	640	1.5-3.5	530	0-2	500	1-3	700
INTERMEDIATE	4.8-9.5	600	6-8	825	6.5-8.5	975	4-6	1000	5.5-8.5	950	7.5-9.5	950	5-7	1000	5-7	1000
MAXIMUM	13-15	2200	12-14	2500	11-13	2400	8-10	2500	8-10	2400	15-17	2275	9-11	2300	9-11	2300
VACUUM CONTROL MODEL	1973412		1973414		1973411		1973411		1973411		1973411		1973412		1973411	
IN. HG. TO START ADVANCE	4-6		4-6		8-10		8-10		8-10		8-10		10-12		8-10	
IN. HG. FOR FULL ADVANCE	9.2-10.2		9.2-10.2		15-17		15-17		15-17		15-17		17-18.5		15-17	
MAX. ADVANCE (DIST. DEG.)	7.5		7.5		10		10		10		10		10		10	
IN. HG. FOR FULL RETARD	11															
MAX. RETARD (DIST. DEG.)	1.75-3.75		4-6		4-6		4-6		4-6		4-6		4-6		4-6	

Fig. 6E-39 Distributor Specifications

CLUTCH, MANUAL TRANSMISSIONS

CONTENTS OF THIS SECTION

GENERAL DESCRIPTION

Several clutches are being used, depending on the engine option. The clutches differ in diaphragm spring design, damper spring calibration and driven disc diameter. Clutch usages are shown in Fig. 1.

PERIODIC SERVICE

LUBRICATION

Every 6,000 miles, lubricate all pivot points with engine oil. Use light grease at push rod to clutch fork pin joint and chassis grease at high pressure lubrication fitting. The ball type release bearing is lubricated and sealed for life and requires no lubrication.

CLUTCH PEDAL ADJUSTMENT (Figs. 7-3, 7-4 and 7-5)

Wear on the clutch parts necessitates occasional lash adjustment. No other adjustment is made. Lash adjustment should be made as follows:

1. Remove the return spring.

2. With clutch pedal against stop, loosen jam nut sufficiently to allow the adjusting rod to be turned out of swivel and rearward against the clutch fork until the release bearing contacts pressure plate fingers lightly.

3. Rotate adjusting rod into swivel 3 1/2 turns and tighten jam nut 10 lb. ft. torque.

4. Reinstall spring. Approximately 1" of lash should be at the pedal.

	Diaphragm Spring Design	Driven Disc Diameter (inches)	Color and number of Damper Springs
PONTIAC			
400 cu. in. 4-Bbl. & 428 cu. in. All	Bent-finger	11.0	5 no paint
400 cu. in. 2-Bbl.	Flat-finger*	10.4	6 red
TEMPEST AND FIREBIRD			
6-cyl. 1-Bbl.	Flat-finger	10.0	6 orange
6-cyl. 4-Bbl.	Bent-finger	10.4	5 dark gray
350 cu. in. 4-Bbl.	Bent-finger	10.4	6 red
400 cu. in. 4-Bbl.	Bent-finger	10.4	5 black
350 cu. in. 2-Bbl.	Flat-finger*	10.4	5 red

*Two Clutch covers used, one made by Borge & Beck and the other by Chevrolet.

Fig. 7-1 Clutch Usage

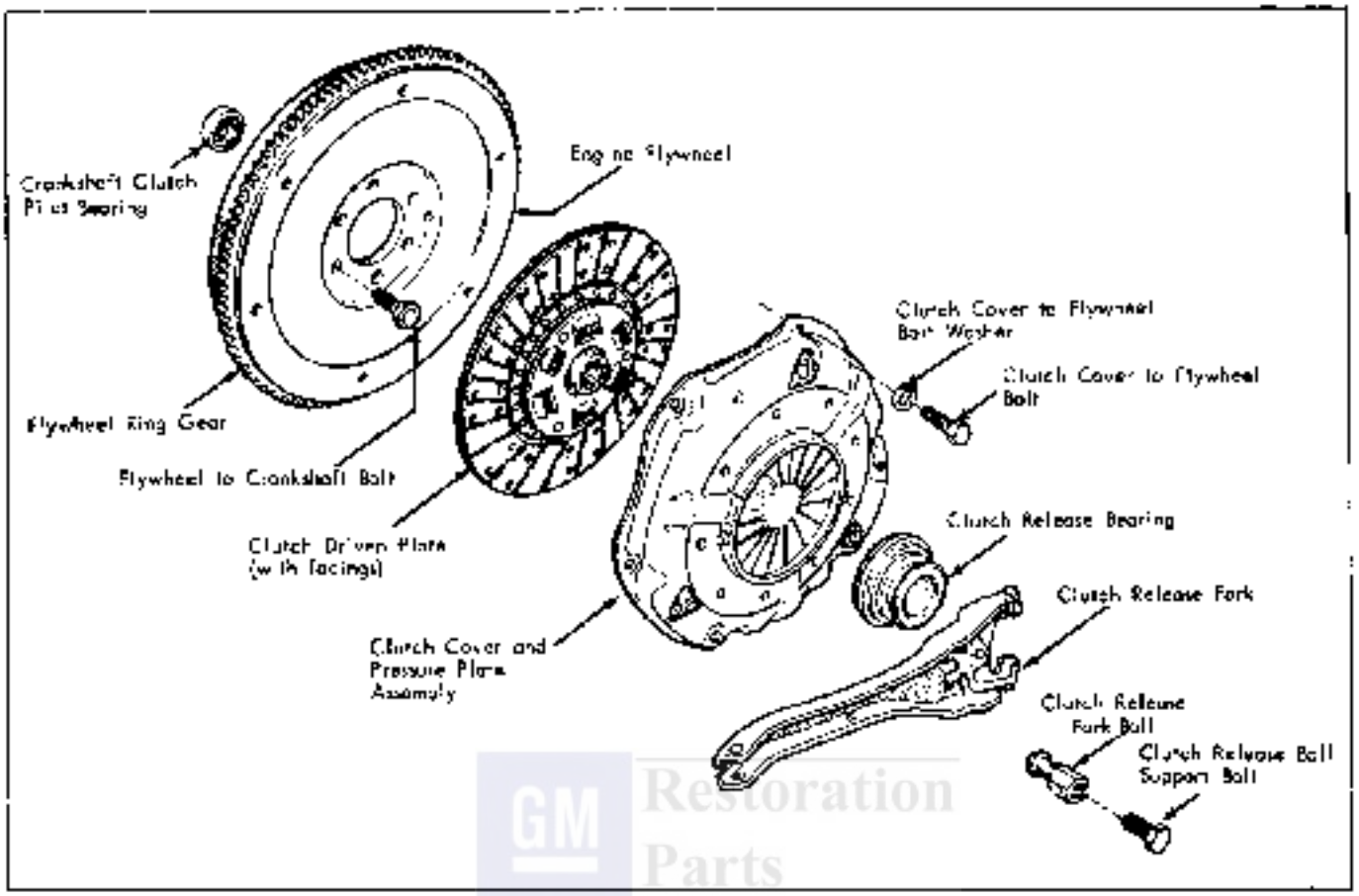


Fig. 7-2 Exploded View of Clutch and Flywheel Assembly

SERVICE AND REPAIRS

CLUTCH CONTROL LINKAGE— REMOVE AND REPLACE

REMOVE

1. Remove return spring and anti-rattle spring.

2. Disconnect retainer from each end of intermediate rod.

3. Loosen nut and lockwasher from ball stud at frame bracket and remove countershaft assembly.

REPLACE

1. Reverse removal steps. Tighten ball stud nut 21 lb. ft. torque.

2. Adjust lash. See Clutch Pedal Adjustment under Periodic Service.

CLUTCH—REMOVE AND REPLACE

REMOVE

1. Disconnect battery to starter lead at battery.

2. Remove propeller shaft and transmission. See TRANSMISSION SECTION. Exercise care to avoid damaging transmission front bearing retainer (release bearing support) when transmission is pulled back to free main drive (clutch) gear from flywheel housing.

3. Remove release bearing through rear opening in clutch housing. Do not place bearing in any degreasing or cleaning solvent.

4. Remove return spring.

5. Remove starter.

6. Remove front flywheel housing shield.

7. Remove flywheel housing bolts and pull housing off of dowels.

8. Remove flywheel housing.

9. Disconnect clutch fork from ball stud by forcing it toward the center of the vehicle. Remove fork through inside of flywheel housing.

10. Mark clutch pressure plate cover and flywheel to insure reassembly in the same position as balanced at factory.

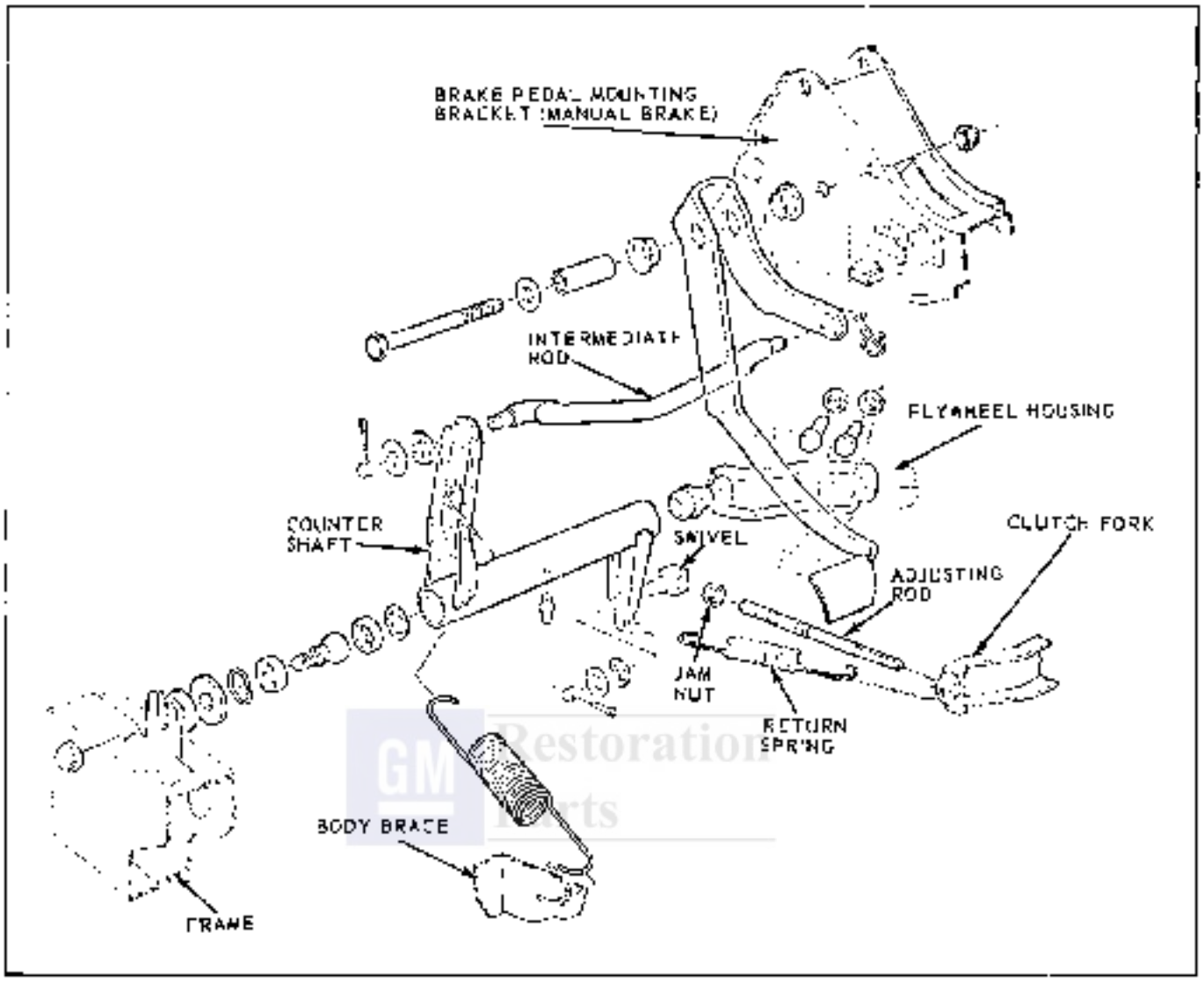


Fig. 7-3 Pontiac Clutch Pedal Adjustment

11. Loosen bolts holding clutch cover to flywheel one turn at a time until tension is relieved.

12. Remove all but top bolt and move clutch assembly away from flywheel at bottom so as to permit removal of clutch driven plate.

13. Remove remaining bolt to remove clutch cover plate assembly.

INSPECTION

1. Inspect clutch driven plate for broken or distorted torsion springs, worn or loose facings, oil on facings and damaged spline which could cause binding. If any of the above defects are present, replace driven plate with new assembly.

2. Inspect pressure plate and cover assembly to see that it is free of oil and grease. Check pressure plate for scores or cracked surface.

NOTE: Servicing of clutch driven plate or pressure plate and cover assembly must be made by replacement of assemblies only.

3. Examine transmission bearing retainer carefully to be certain there are no burrs on outer surface which pilots clutch release bearing.

4. Try release bearing on transmission bearing retainer to make sure no binding exists.

5. Check release bearing by placing thrust load on bearing by hand and turning bearing race. Replace if bearing feels rough or seems noisy when turning.

6. Clean flywheel face with cleaning solvent, sandpaper or steel wool. Inspect pilot bearing in crankshaft for roughness.

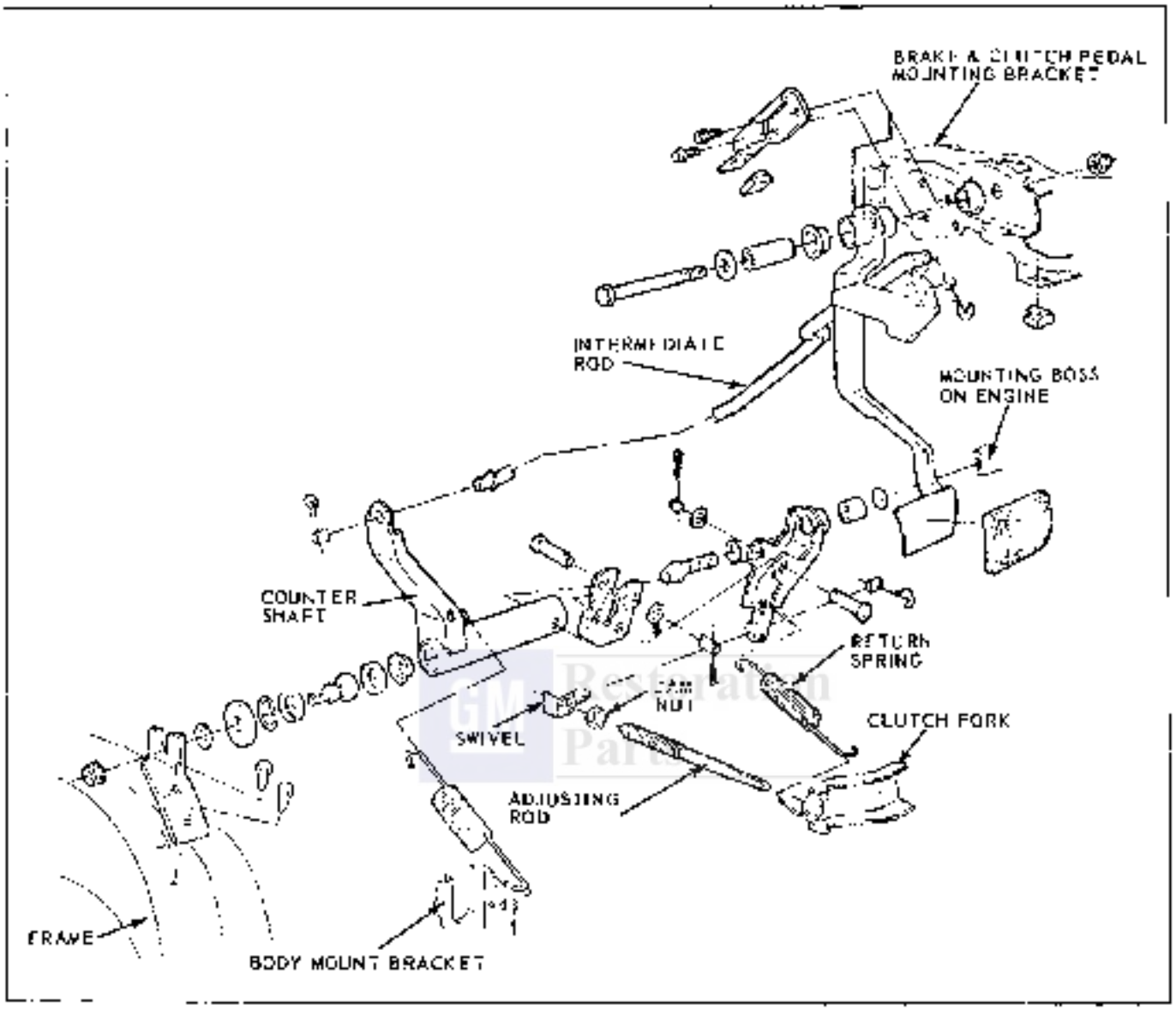


Fig. 7-4 Tempest Clutch Pedal Adjustment

REPLACE

1. Position clutch driven plate on dust long end of hub as in flywheel and install clutch driven plate and cover assembly on flywheel but do not tighten bolts (install lock washer under each cover to flywheel bolt).

NOTE: Align marks placed on flywheel and on cover during disassembly.

2. Use a spare transmission main drive gear, inserted in spline of clutch driven disc, to move disc into correct alignment so pilot on end of drive gear will enter clutch pilot bearing. Tighten clutch cover and pressure plate to flywheel bolts one at a time until snug, then tighten to 25 lb. ft. torque. Remove spare main drive gear used to align clutch disc.

3. Lubricate surface of release fork fingers which contact release bearing, sides of pressure plate lugs protruding through cover plate stamping and release fork ball fulcrum with high melting point wheel bearing lubricant and install release fork.

4. Apply a light coat of grease to inner diameter of clutch release bearing and fill recess in inner diameter of bearing.

5. Install clutch release bearing to fork in flywheel housing.

NOTE: When installing a new bearing, be sure the same length bearing is installed as was removed.

6. Apply a light coat of high melting point wheel bearing lubricant to full length of outer diameter of transmission release bearing support (retainer).

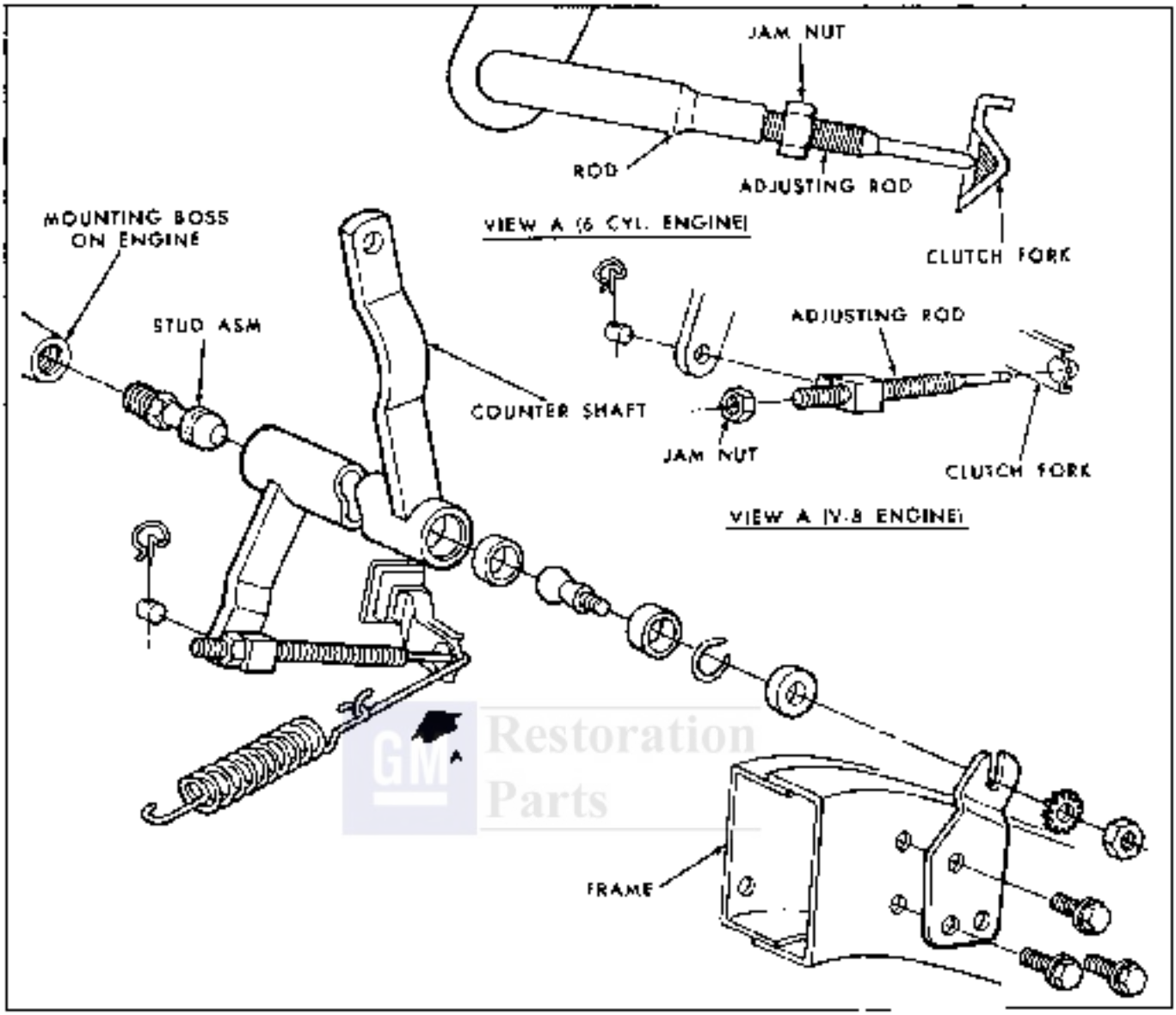


Fig. 7-5 Firebird Clutch Pedal Adjustment

CAUTION: Do not overlubricate.

7. Install flywheel housing and tighten bolts to 40 lb. ft. torque.

8. Install transmission. See TRANSMISSION SECTION.

CAUTION: Use two transmission guide pins in upper holes in clutch housing.

9. Connect clutch linkage to release fork.

10. Adjust pedal lash. See lash adjustment under Periodic Service.

NOTE: If interference is encountered with the clutch fully engaging, the transmission shift linkage should be adjusted as outlined in sections 7A thru 7D, because the shift linkage interlock mechanism is controlled by clutch action.

FLYWHEEL OR CLUTCH PILOT BEARING—REMOVE AND REPLACE

1. Remove transmission.

2. Remove clutch assembly.

3. If clutch pilot bearing is to be replaced, use cold chisel to remove staking in end of crankshaft which keeps bearing in place when transmission is removed (Fig. 7-6). Remove clutch pilot bearing from hole in crankshaft.

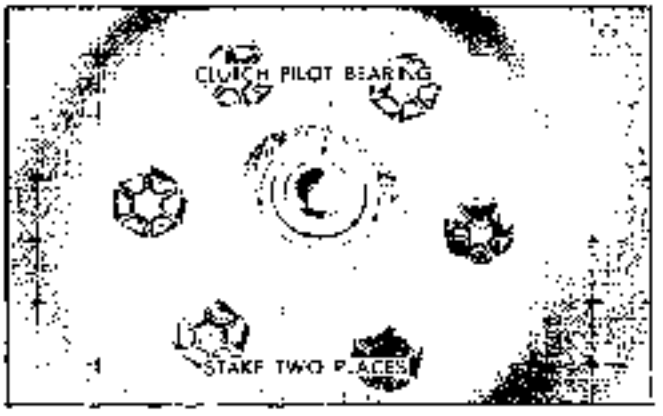


Fig. 7-6 Clutch Pilot Bearing Staked

If bearing is a snug fit in crankshaft, use puller J 4333 and slide hammer J 2619-A to remove bearing. When installing new bearing, see that hole in crankshaft is thoroughly clean. Install new bearing with shielded side toward transmission. Start bearing into hole and tap into place. Stake slightly, as shown in Fig. 7-6, to keep bearing in place in case transmission is removed in the future.

4. If flywheel is to be removed and reinstalled, scribe marks on flywheel and crankshaft flange, remove flywheel to crankshaft bolts and remove flywheel. When reinstalling, clean the mating flanges of flywheel and crankshaft carefully, making sure there are no burrs on either mounting face. Position flywheel on crankshaft flange with scribe marks in alignment and install flywheel to crankshaft bolts and tighten evenly to 95 lb. ft. torque.

NOTE: Flywheel bolts do not require lock washers.

5. Install clutch and transmission.

PROCEDURE FOR REMOVING AND INSTALLING STARTER RING GEAR ON FLYWHEEL

REMOVING RING GEAR FROM FLYWHEEL.

1. Place the flywheel, crankshaft side down, on a solid flat surface or block which is slightly smaller in diameter than the flywheel.

2. Drive the ring gear off the flywheel, using a suitable drift and hammer.

NOTE: Keep working around the circumference of the ring gear to avoid binding the ring gear on the flywheel.

3. Remove all burrs and rough spots from flywheel.

INSTALLING RING GEAR ON FLYWHEEL.

1. Support flywheel in level position with cylinder block side facing up.

2. Support ring gear on metal surface and, using a blowtorch or acetylene torch, heat ring gear uniformly on the inside diameter, keeping the torch moving around the circumference of the ring gear to avoid localizing hot spots. Under no circumstances should the ring gear be heated over 400°F., as excessive heating may destroy the original heat treatment.

3. Pick ring gear up with tongs and place in position on flywheel, with ring gear facing the same direction as the one just removed.

4. Tap ring gear down into place against shoulder on flywheel. If the ring gear can not be tapped into place readily, it may be necessary to remove it and apply additional heat, heeding the caution about overheating given in step 2.

SPECIFICATIONS

CLUTCH

Pedal Lash - 3 1/2 turns of adjusting rod from zero lash position.

Type Disc Facings	Single Plate Dry
Diameter of Disc	Pontiac—Std.-10.4"
	Pontiac—H.D.-11"
	Firebird and Tempest—6 Cyl.-Single Bbl. 10.00"
	Firebird and Tempest—All V-8 & 6 Cyl.-4 Bbl. 10.40"
Release Bearing	Sealed Ball Bearing
Diaphragm Springs	V-8 2 Bbl. & 6-Cyl. 1 Bbl.—Flat-finger disc spring; V-8 4 Bbl. & 6-Cyl. 4 Bbl.—Bent-finger disc spring

TORQUE

	Lb. Ft.
Clutch Pressure Plate to Flywheel Bolts	25
Flywheel Housing to Engine Block Bolts	40
Clutch Fork Ball Stud	40
Transmission to Flywheel Housing Bolts	55
Clutch Fork Rod Adjustment Lock Nut	10
Flywheel to Crankshaft Bolts	95
Countershaft Stud Assembly to Cylinder Block	
Tempest	70
Firebird	27
Countershaft Stud to Side Rail Nut	21

THREE SPEED DEARBORN MANUAL TRANSMISSION

CONTENTS OF THIS SECTION

DESCRIPTION

This transmission is of the fully synchronized type with all gears, except the reverse gear, being in constant mesh.

It is used as the standard 3-speed for Pontiac and a heavy duty 3-speed for Tempest and Firebird.

PERIODIC SERVICE

TRANSMISSION

No periodic service of the transmission is required except checking for leaks and proper lubrication level every 6000 miles.

If there is evidence of leakage, leak should be corrected and lubrication added as needed. Refill capacity is 2 3/4 pints.

Use SAE 90 Multi-purpose Gear lubricant. No special additive to this lubrication is required or recommended.

SHIFT CONTROL

No periodic service of the shift control is required. Certain parts are lubricated on assembly and require further lubrication only when parts become dry and sticky.

ON CAR ADJUSTMENTS

LINKAGE ADJUSTMENT—COLUMN SHIFT (Fig. 7A-1)

1. Align upper and lower gearshift levers on steering column assembly in neutral position by inserting gage pin in hole as shown in View A.

2. Loosen clamp screws at transmission gearshift control rods.

3. Position levers on transmission in neutral.

4. Retorque clamp screws to 20 lb. ft. and check complete shift pattern.

LINKAGE ADJUSTMENT—FLOOR SHIFT (Figs. 7A-2, 7A-3, 7A-4)

1. Position selector lever in neutral position.

2. Loosen trunnion jam nuts on transmission gearshift control rods.

3. Place transmission lever and bracket assembly in neutral position and install gauge pin as illustrated.

4. Position levers on transmission in neutral.

5. Retorque trunnion jam nuts to 30 lb. ft.

6. Remove gauge pin and check complete shift pattern for freeness of operation.

MINOR REPAIRS

EXTENSION HOUSING BUSHING AND OIL SEAL REPLACEMENT

1. Remove drive shaft.

2. Insert tool J 4830-02 over output shaft and tighten set screw.

3. Attach slide hammer J 2619. Using hammer, pull bushing and seal from extension housing.

4. Start new bushing into extension housing.

5. Using tool J 6403-1 and soft hammer, tap bushing into place.

6. Install new seal, using tool J 6403-1 and collar J 6403-2.

7. Reinstall drive shaft.

MAJOR REPAIRS

TRANSMISSION—REMOVE

1. Disconnect speedometer cable.

2. Disconnect shift control rods from transmission.

3. Remove propeller shaft.

4. Support rear of engine and remove transmission mount.

5. Remove four (4) crossmember bolts and slide member rearward.

6. Remove two (2) upper transmission to flywheel housing bolts and insert guide pins.

7. Remove two (2) lower transmission to flywheel housing attaching bolts.

8. Slide transmission straight back on guide pins until the main drive gear splines are free of splines in clutch friction plate.

9. Remove transmission.

INPUT SHAFT SEAL REPLACEMENT

1. Remove transmission from car.

2. Remove input shaft bearing retainer.

3. Remove seal from retainer by prying out with screwdriver.

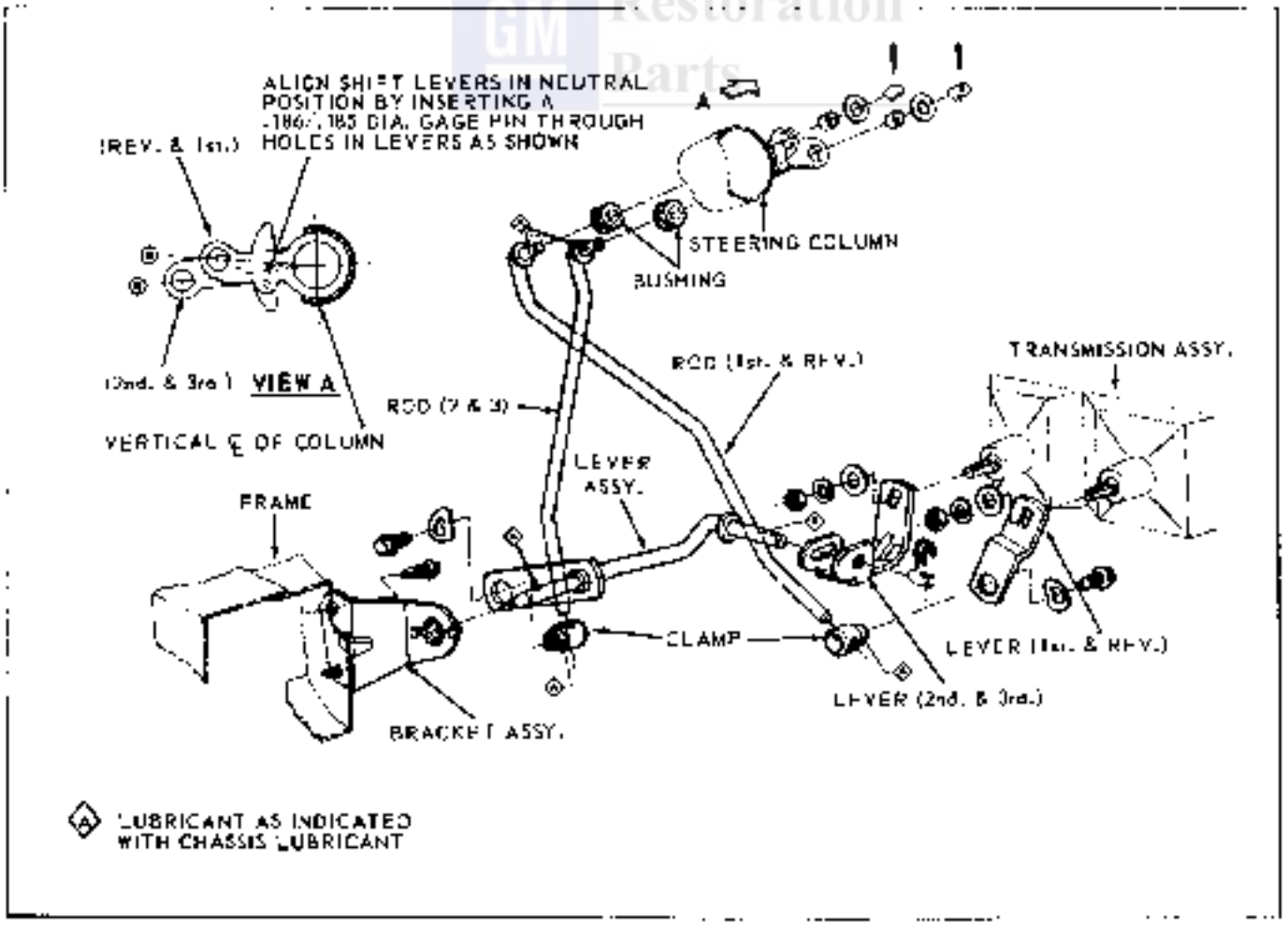


Fig. 7A-1 Pontiac Column Shift Controls

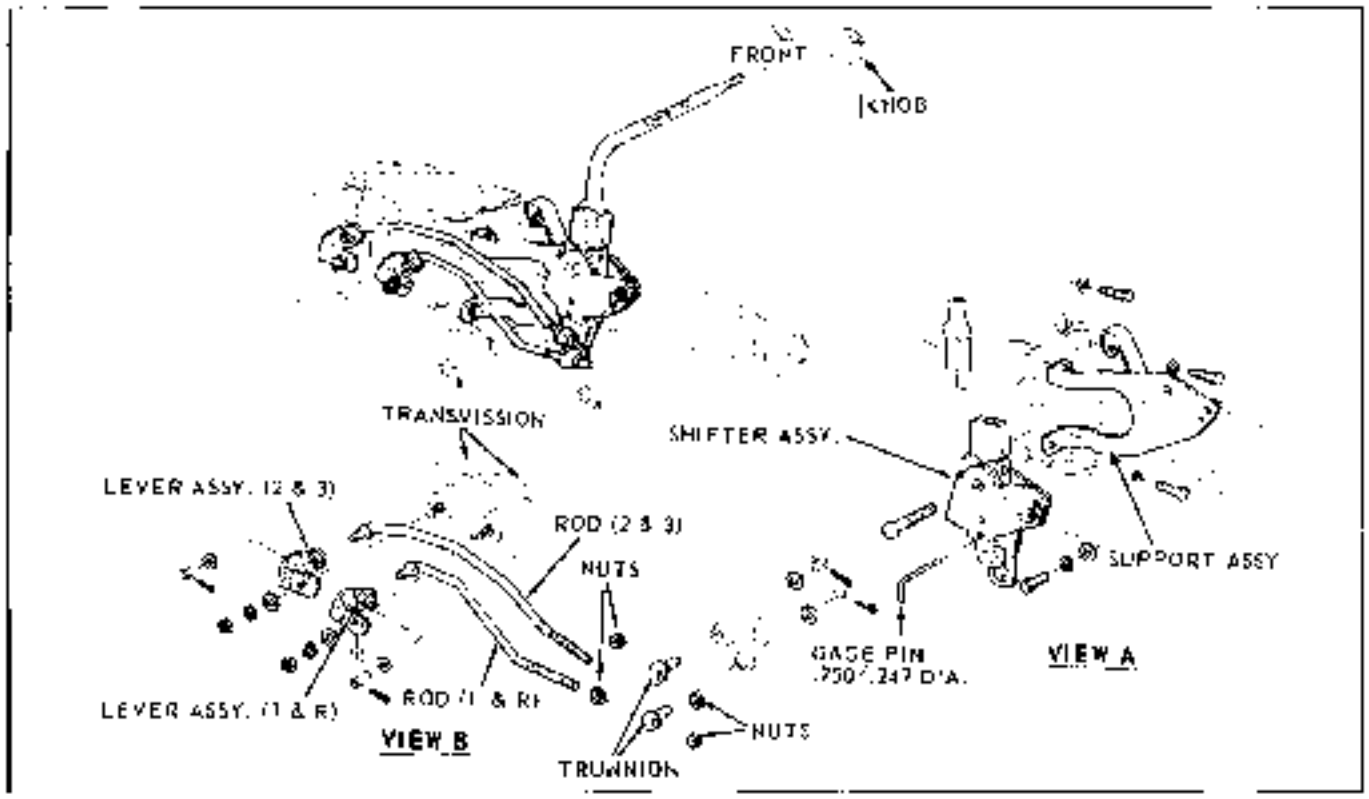


Fig. 7A-2 Pontiac Floor Shift Controls

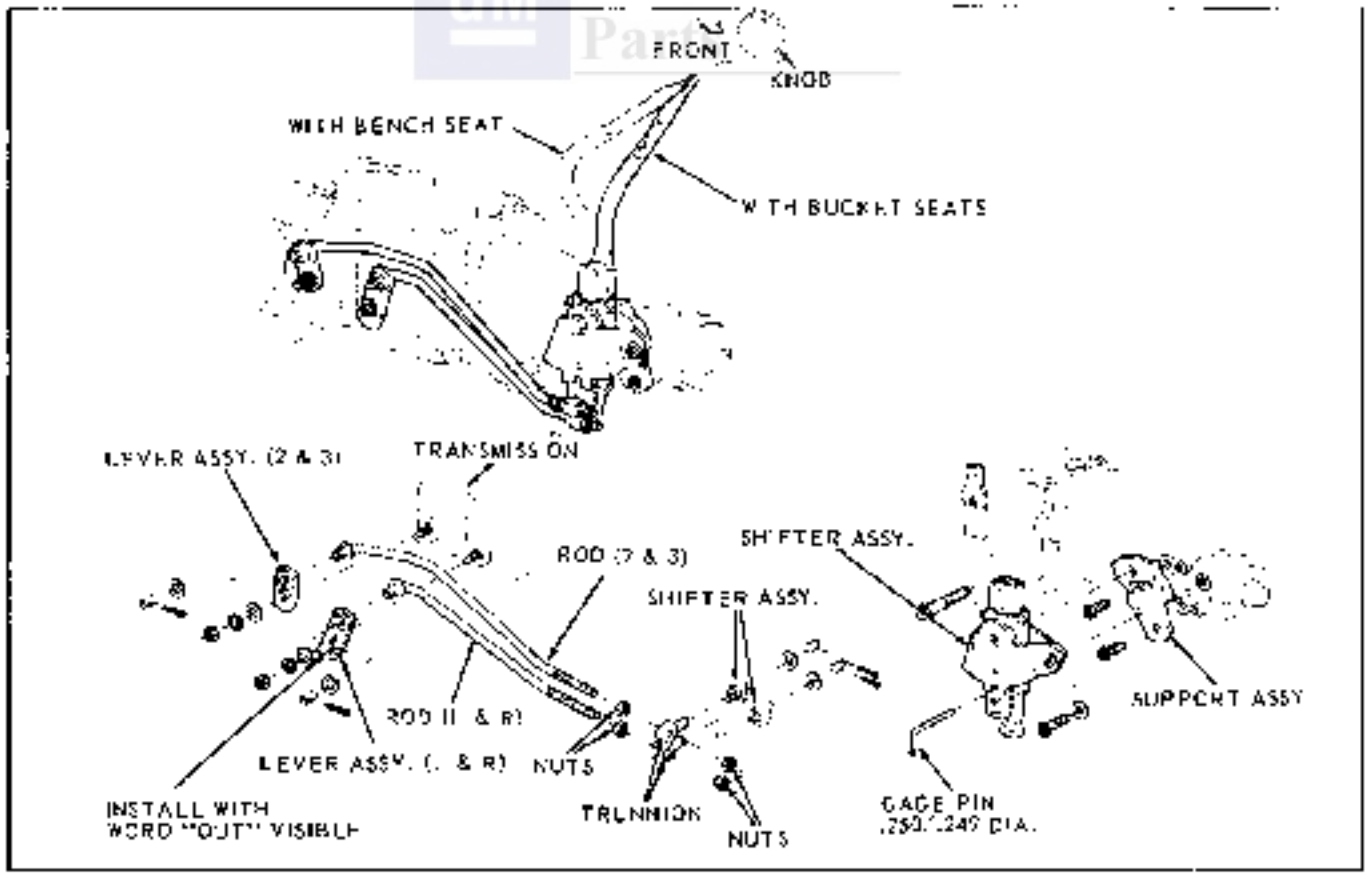


Fig. 7A-3 Tempest Floor Shift Controls

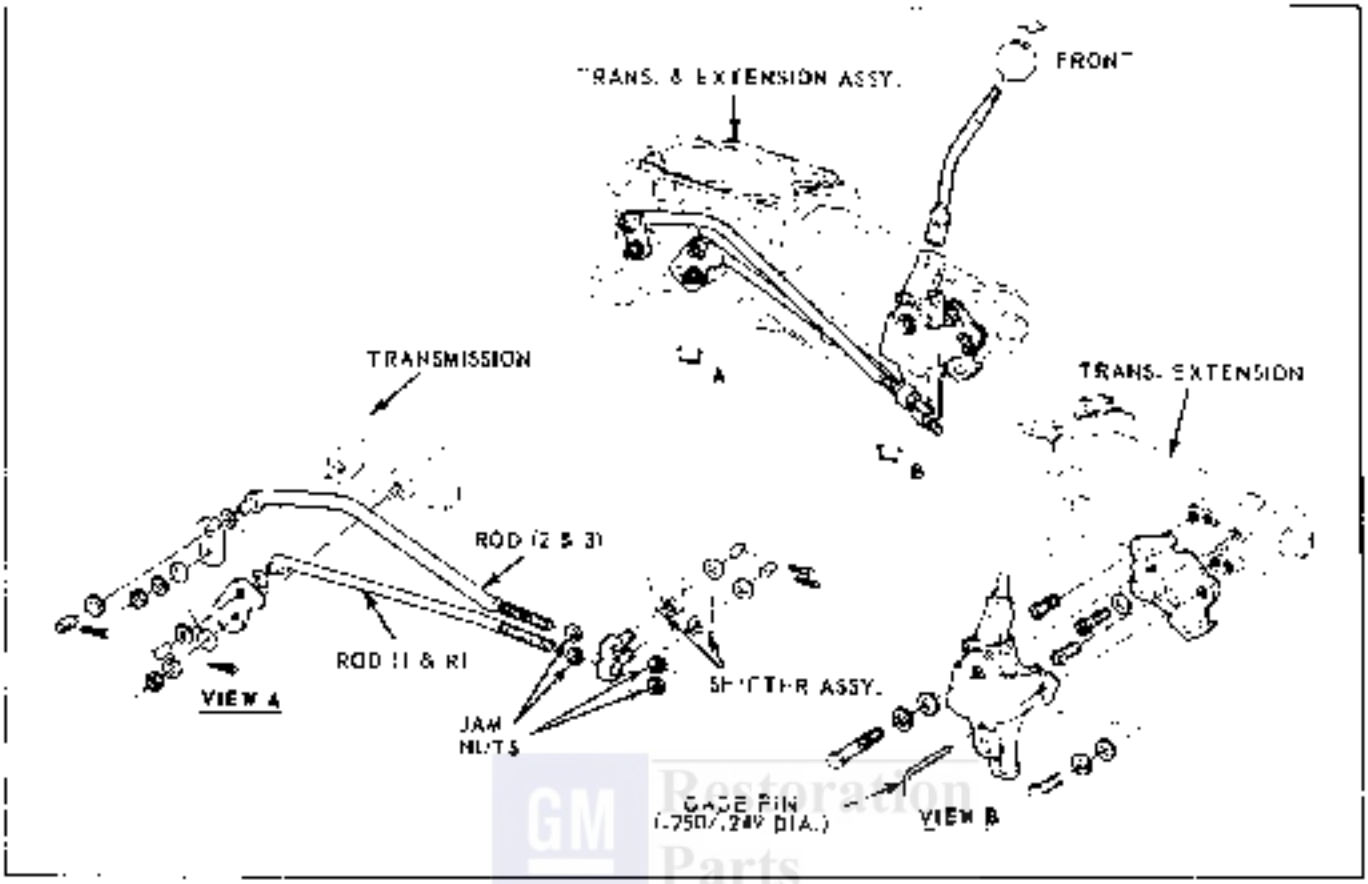


Fig. 7A-4 Firebird Floor Shift Controls

1. Second and Third Gear Shifter Fork
2. Shifter Fork to Rail Set Screw
3. Shift Rail Inter-lock Pin
4. Shift Rail Inter-lock Pin Spring Set Screw
5. Shift Rail Inter-lock Spring
6. First and Reverse Shift Rail
7. Shift Lever
8. Shift Lever Oil Seal
9. First and Reverse Shifter Fork
10. Access Cover Screw
11. Access Cover
12. Access Cover Screw
13. Drive Gear Bearing Retainer Bolt
14. Drive Gear Bearing Retainer
15. Input Shaft Oil Seal
16. Bearing Retainer Gasket
17. Filler Plug
18. Access Cover Gasket
19. Extension Housing Gasket
20. Lock Washer
21. Extension Housing Bolt
22. Extension Housing
23. Extension Housing Bushing
24. Extension Housing Assembly
25. Extension Housing Seal
26. Case
27. Synchronizer Blocking Ring
28. First and Reverse Synchronizer Spring (Front)
29. First and Reverse Sliding Gear
30. Synchronizer Hub Insert
31. First and Reverse Synchronizer Hub
32. First and Reverse Synchronizer Spring (Rear)
33. First and Reverse Synchronizer Assembly
34. Drain Plug
35. Drive Gear Rear Bearing Retaining Snap Ring
36. Drive Gear Rear Bearing to Shaft Snap Ring
37. Drive Gear Rear Bearing
38. Speedometer Drive Gear
39. Front Bearing to Shaft Snap Ring
40. Front Bearing Retaining Snap Ring
41. Front Bearing
42. Input Shaft
43. Input Shaft Roller Bearing
44. Second and Third Synchronizer Blocking Ring
45. Second and Third Synchronizer Spring
46. Second and Third Synchronizer Sleeve
47. Second and Third Synchronizer Insert
48. Second and Third Synchronizer Hub
49. Second and Third Synchronizer Assembly
50. Second Gear
51. First Gear
52. Second and Third Synchronizer Hub to Shaft Snap Ring
53. Synchronizer Blocking Ring to Shaft Snap Ring
54. Low Gear Thrust Washer
55. Speedometer Drive Gear Retaining Ball
56. Output Shaft
57. Main Drive Gear Bearing to Shaft Snap Ring
58. Speedometer Drive Gear to Shaft Snap Ring
59. Retaining Pin
60. Countershaft
61. Thrust Washer
62. Countershaft Washer
63. Roller Bearing
64. Countershaft Gear
65. Idler Gear Bushing
66. Reverse Idler Gear
67. Idler Gear Assembly
68. Idler Gear Thrust Washer
69. Idler Gear Shaft
70. Idler Gear Retainer Pin
71. Second and Third Shift Rail

Fig. 7A-5 Exploded View of Transmission

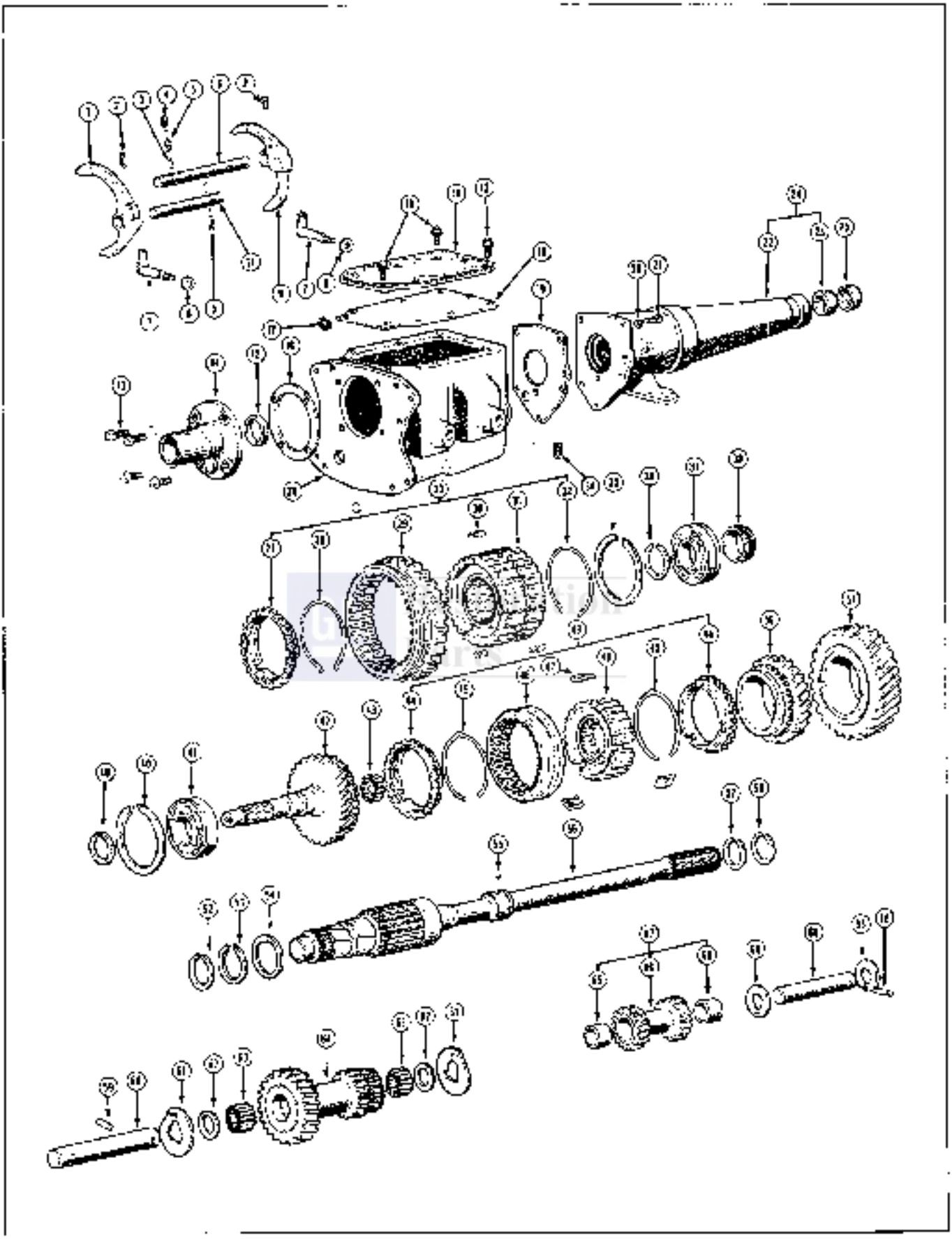


Fig. 7A-5 Exploded View of Transmission

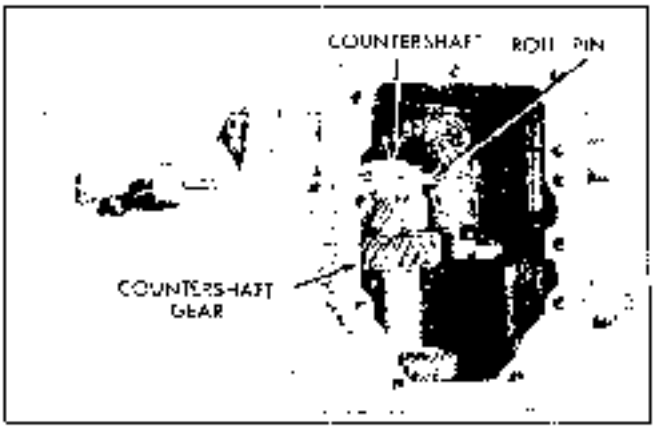


Fig. 7A-6 Removing Countershaft Retaining Pin

4. Center new seal in opening. Place a suitable size socket (approximately 1 1/4") on the seal and, using a soft hammer, tap the seal into place.

5. Reinstall input shaft bearing retainer.

6. Reinstall transmission in car.

TRANSMISSION—DISASSEMBLE

1. Drain lubricant.

2. Remove input shaft bearing retainer and gasket.

3. Remove access cover and gasket.

4. Remove extension housing and gasket.

5. Through filler plug hole, drive out countershaft to case retaining pin (Fig. 7A-6).

6. Remove detent plug retaining set screw, spring and detent plug (Fig. 7A-7).

7. With transmission in neutral, remove shift fork to rail locking set screws.

8. Push first and reverse shift rail out rear of case.

9. Using tool J 3049, rotate 2nd and 3rd shift rail 90° (Fig. 7A-8).

NOTE: Rail must be rotated 90° to disengage detent plug.

10. Using brass drift, drive 2nd and 3rd shift rail and welch plug out front of case.

11. Using countershaft alignment tool J 21775-01, drive countershaft out rear of case (Fig. 7A-9). Hold cluster gear with hook to prevent it from dropping to bottom of case. After removing countershaft, lower countergear to bottom of case.

12. Remove speedometer drive gear snap ring, drive gear and retaining ball.

13. Remove rear bearing retaining snap ring.

14. Remove large snap ring from rear bearing.

15. Slide tool J 21774-1 up over bearing and install snap ring (in tool) in snap ring groove in bearing (Fig. 7A-10).

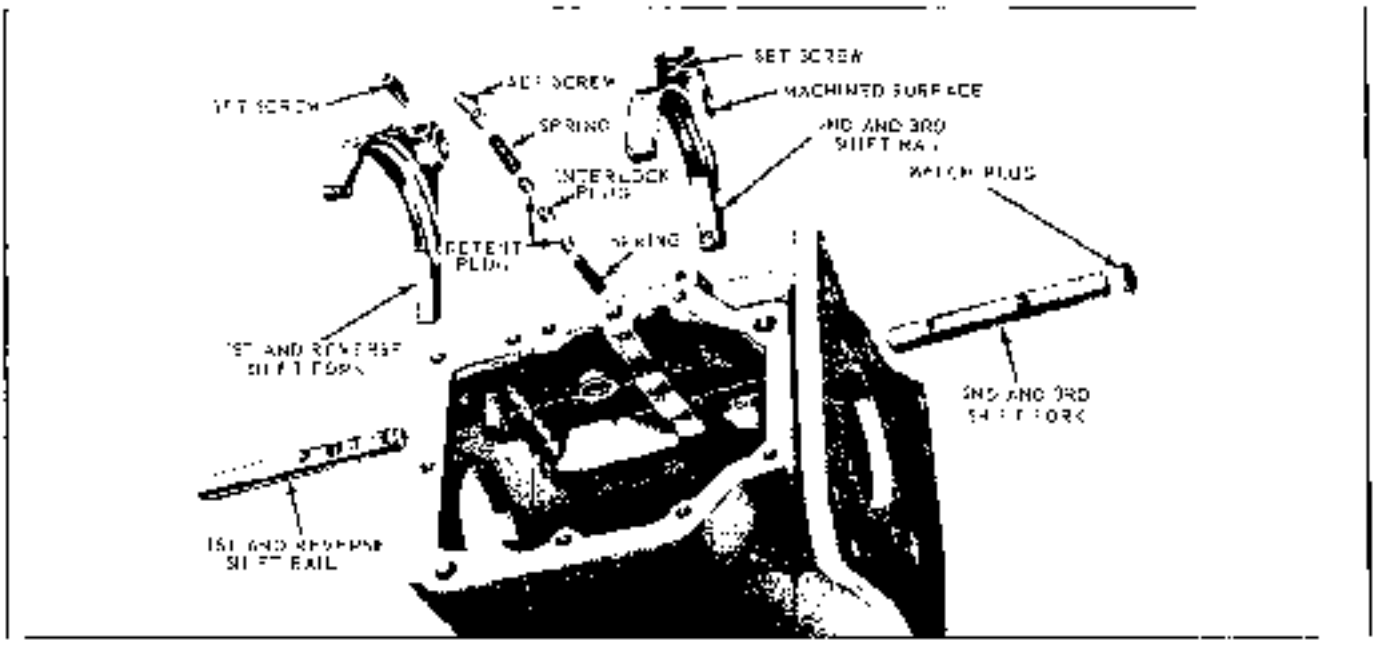


Fig. 7A-7 Shift Rails, Forks, Detent Plugs and Detent Springs

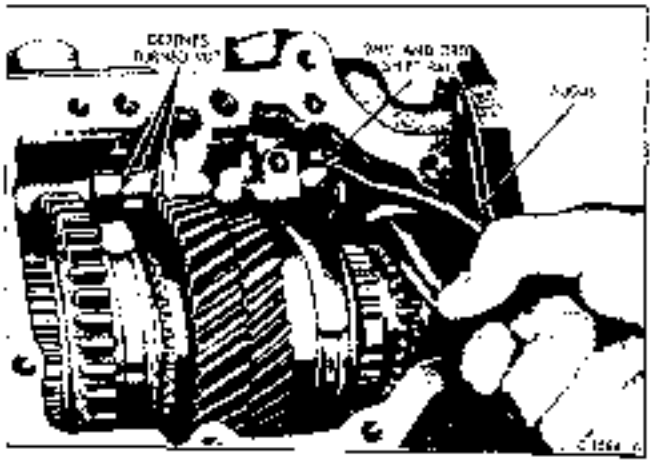


Fig. 7A-8 Rotating Second and Third Shift Rail

16. Install speedometer drive gear snap ring on output shaft.

17. PONTIAC:

a. Slide tool J 21774-2 on to output shaft and thread it into J 21774-1.

b. Thread J 21774-2 into J 21774-1 with handle J 8614-1 until bearing becomes free of output shaft.

TEMPEST OR FIREBIRD:

a. Install tool J 21774-5 over output shaft and position against speedometer drive gear snap ring.

b. Slide tool J 21774-2 onto output shaft and thread it into J 21774-1 until bearing becomes free of output shaft.

18. Remove bearing and tool.

19. Slide input shaft forward until input gear rests against the case.

20. Remove shift forks.

21. Remove main shaft through top of case.

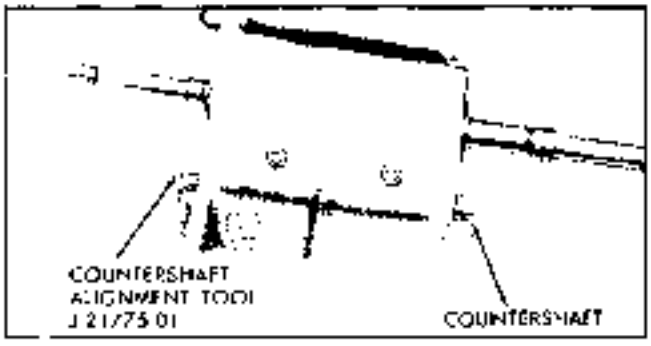


Fig. 7A-9 Removing Countershaft

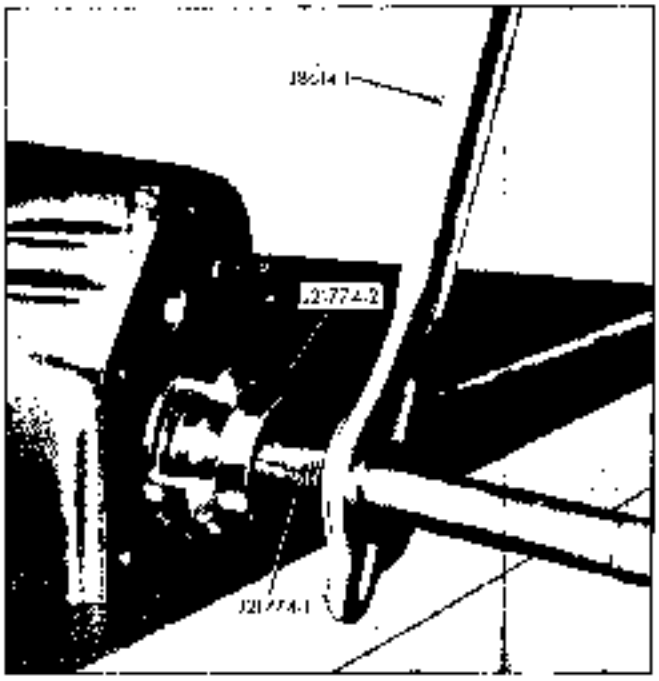


Fig. 7A-10 Removing Rear Bearing

22. Remove large snap ring from input shaft bearing and lift input shaft out through top of case.

23. Remove countergear and thrust washers.

24. Using a brass drift, drive reverse idler gear shaft out of rear of case (Fig. 7A-11) and lift gear and thrust washers from case.

25. Remove intermediate and high detent plunger and spring.

SHIFT LEVER SHAFT OR SEAL REPLACEMENT— MAIN SHAFT REMOVED

1. Remove nut, lockwasher and flat washer.

Fig. 7A-11 Removing Reverse Idler Gear Shaft

2. Remove shift lever.

3. Slide shift lever shaft out of case and discard O-ring seal.

4. Lubricate new seal and slide on shaft.

5. Install shaft in case.

6. Install shift lever and secure with nut, lockwasher and flat washer.

INPUT SHAFT BEARING REPLACEMENT—MAIN SHAFT REMOVED

1. Re-install input shaft in case.

2. Install large snap ring on bearing.

3. Remove bearing to shaft retaining snap ring.

4. Position case in press (Fig. 7A-12) and press input shaft out of bearing.

5. Remove shaft from case.

6. Place new bearing on input shaft.

7. Position input shaft in press (Fig. 7A-13), support the bearing by the inner race and press the shaft into the bearing.

MAINSHAFT—DISASSEMBLE

1. Remove front blocking ring (Fig. 7A-14).

2. Remove synchronizer insert retaining spring.

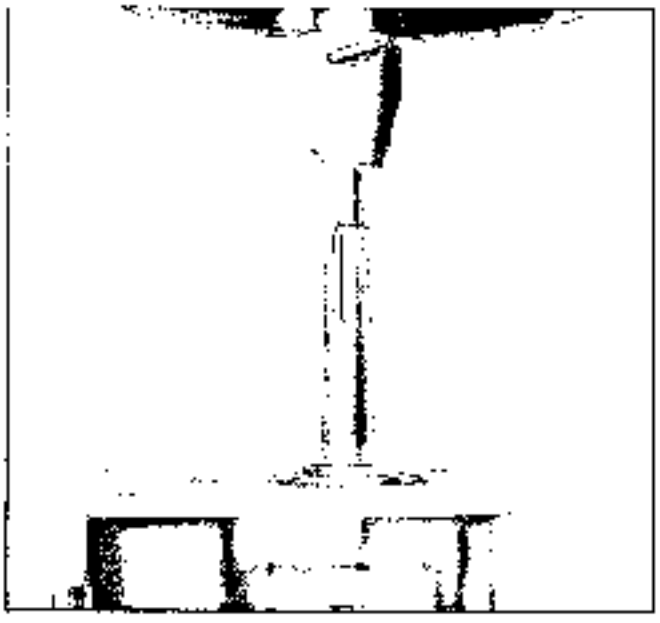


Fig. 7A-12 Pressing Input Shaft Out of Bearing

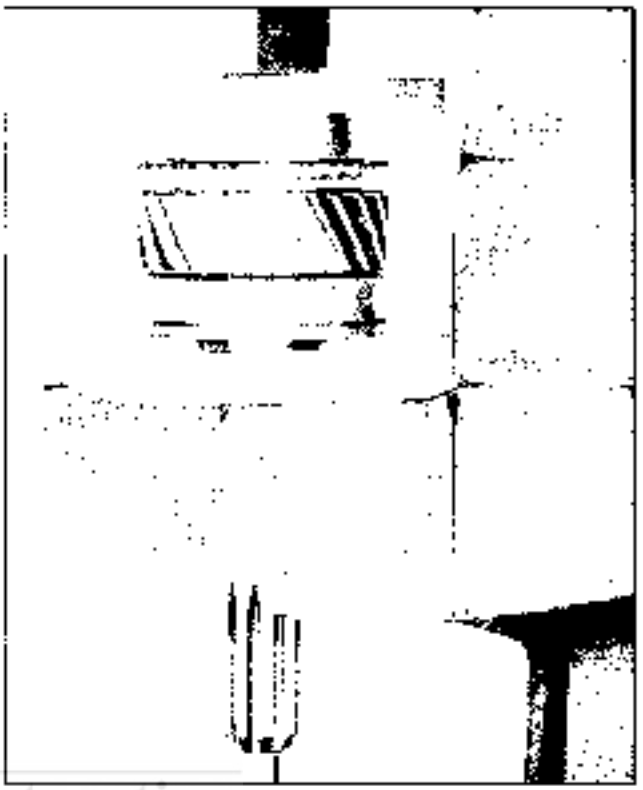


Fig. 7A-13 Installing Input Shaft Bearing

3. Remove 2nd and 3rd gear synchronizer sleeve.

4. Remove synchronizer hub retaining snap ring, hub and blocking ring.

5. Remove 2nd gear (Fig. 7A-15).

6. Remove 1st gear retaining snap ring, thrust washer, 1st gear and blocking ring.

7. Remove reverse gear retaining snap ring.

8. Using an arbor press, as shown in Fig. 7A-16, remove reverse gear synchronizer hub and sliding gear.

TRANSMISSION—ASSEMBLE

MAINSHAFT—ASSEMBLE

1. Install rear insert spring in the groove in 1st and reverse synchronizer hub (Fig. 7A-17). Make sure spring covers all insert grooves.

NOTE: If the tip of rear insert spring is less than 0.120" in length, replace spring.

2. Start hub in the sleeve, making sure alignment marks are indexed.

3. Position the three inserts in the hub with the

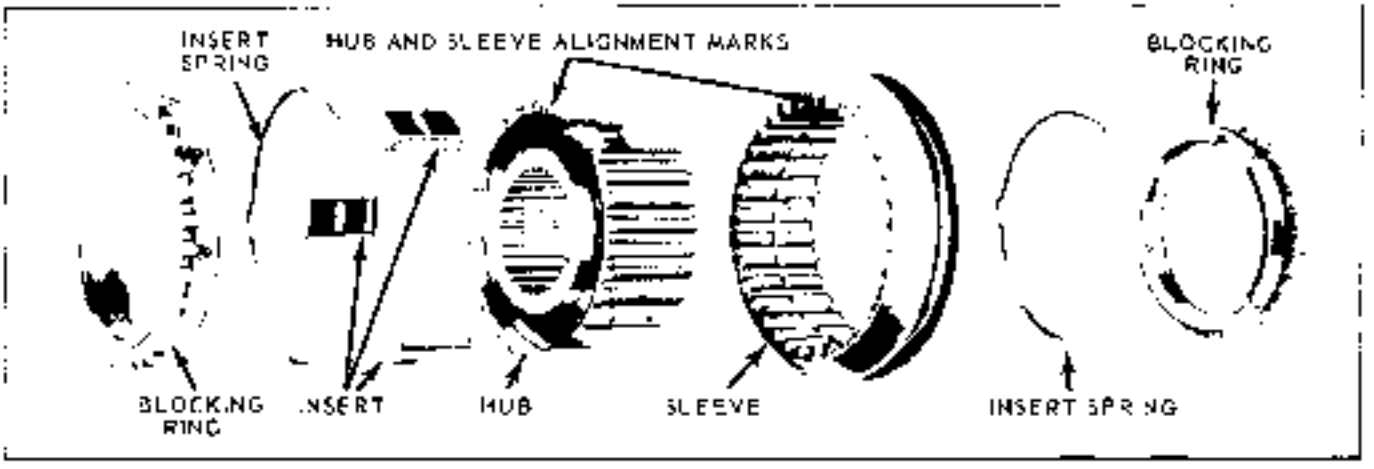


Fig. 7A-14 Exploded View of Second and Third Synchronizer

small end over the spring and the shoulder on the inside of the hub.

4. Slide the sleeve onto the hub until the detent is engaged.

5. Install the front insert spring in the hub.

6. Install one insert spring (Fig. 7A-14) into the groove of the second and third speed synchronizer hub, making sure that all three insert slots are fully covered (Fig. 7A-16).

7. With alignment marks on the hub and sleeve aligned, start the hub into the sleeve.

NOTE: There is a possibility of not having alignment marks on hub and sleeve. If marks are there, they must be aligned

8. Place the three inserts, in the slots, on top of the retaining spring and push the assembly together.

9. Install the remaining insert spring so that the spring ends cover the same slots as does the other spring.

NOTE: Do not stagger the springs.

10. Place a synchronizer blocking ring on each end of the synchronizer sleeve.

11. Lubricate main shaft splines and machined surfaces with transmission lubricant.

12. Using an arbor press, install the first and reverse synchronizer hub and sliding gear onto the mainshaft, with the teeth end of the gear facing toward the rear of the shaft (Fig. 7A-18). When pressed into place, install the snap ring (Fig. 7A-15).

13. Coat the tapered machine surface on the first gear with grease. Place the blocking ring on the greased surface.

14. Slide the first gear onto the main shaft, with the blocking ring toward the rear of the shaft. Rotate the gear as necessary to engage the three notches in the blocking ring with the synchronizer inserts. Secure the first gear with thrust washer and snap ring.

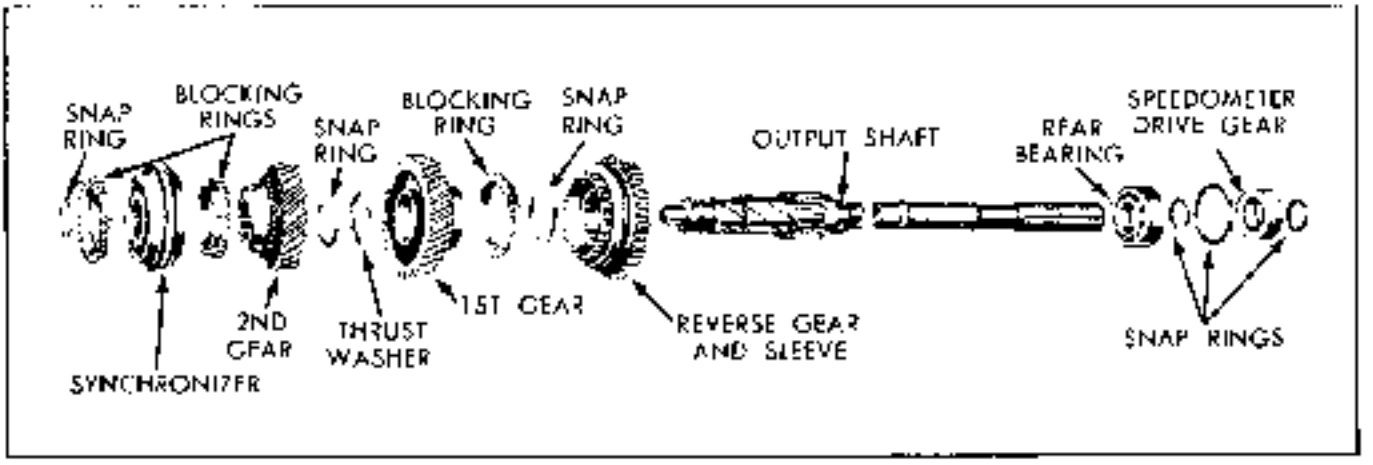


Fig. 7A-15 Exploded View of Mainshaft

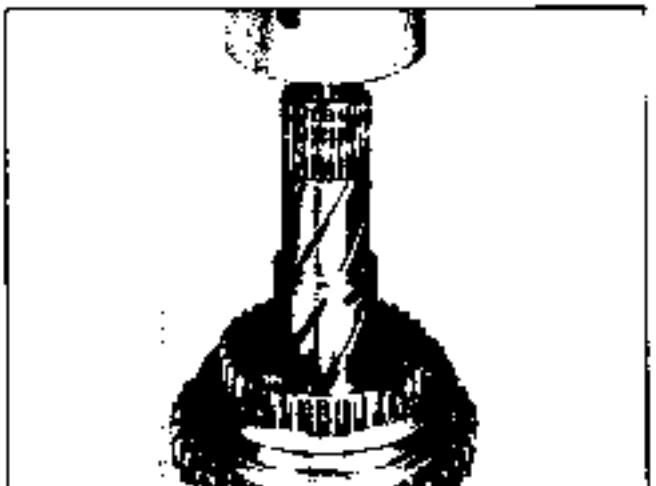


Fig. 7A-16 Removing Reverse Synchronizer Hub and Sliding Gear

15. Coat the tapered machine surface of the second gear with grease and slide the blocking ring onto it.

16. Slide the second gear with blocking ring and the second and third gear synchronizer onto the main shaft. The tapered machined surface of the second gear must be toward the front of the shaft. Make sure the notches in the blocking ring engage the synchronizer inserts. Secure the synchronizer with a snap ring.

TRANSMISSION—ASSEMBLE

1. Install reverse idler gear, with a thrust washer on each end in case. Make sure that roll pin (Fig. 7A-20) is seated in slot in back face of case.

2. Assemble the countergear, countershaft alignment tool, bearings, thrust washers and place in bottom of case. The countergear will remain in the bottom of the case until the main and input shafts have been installed (Fig. 7A-21).

3. Coat the bore of the input shaft and gear (Fig. 7A-22) with a thin film of grease and install the 15 bearings in the bore.

NOTE: A thick film of grease will plug the lubricant holes and prevent lubrication of the bearings.

4. Install the input shaft and bearing through the top of the case into the bore in the front of the case. Install the large snap ring on the bearing.

5. Position the mainshaft assembly in the case.

6. Install the second and third speed shift fork on the second and third speed synchronizer.

7. Place a detent plug spring and detent plug in the case.

NOTE: Detent ping and spring installation can be facilitated by the use of tool J 22239 or a similar tool fabricated from 1/2" round bar stock (Fig. 7A-23)

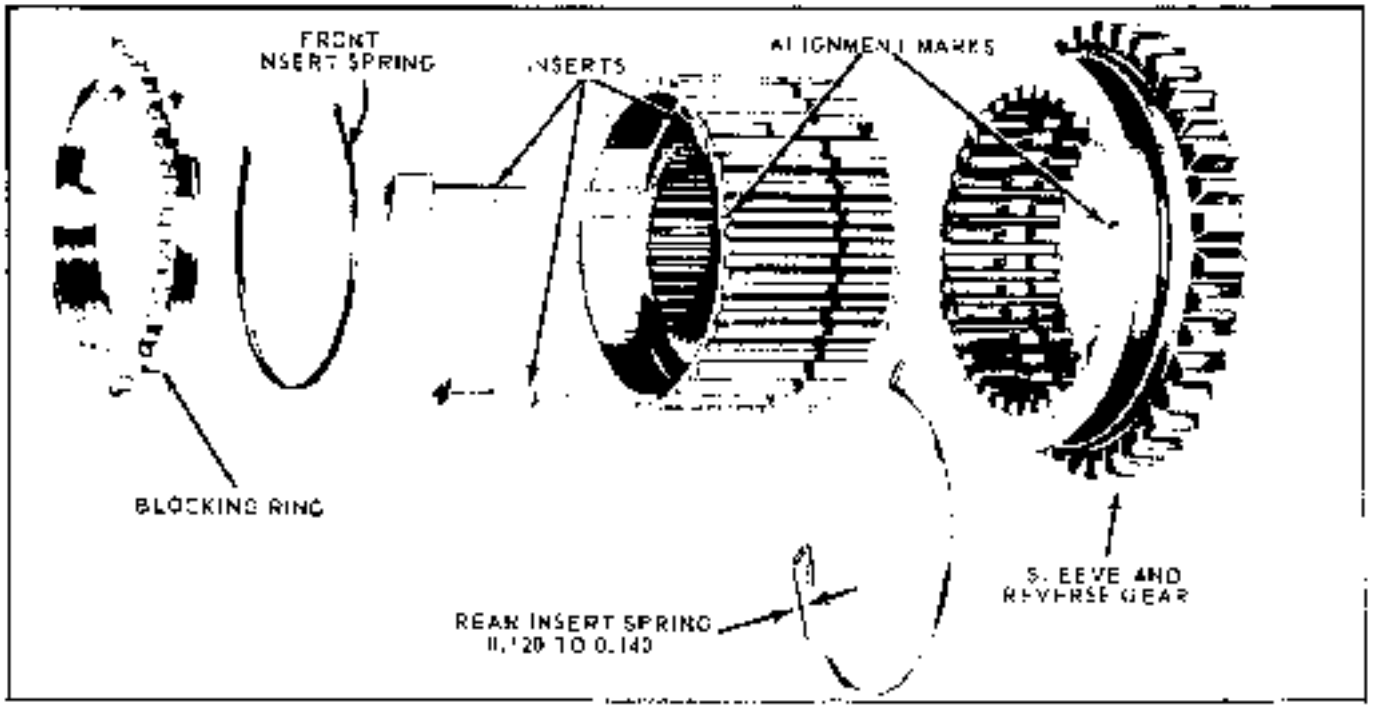


Fig. 7A-17 Exploded View of First and Reverse Synchronizer

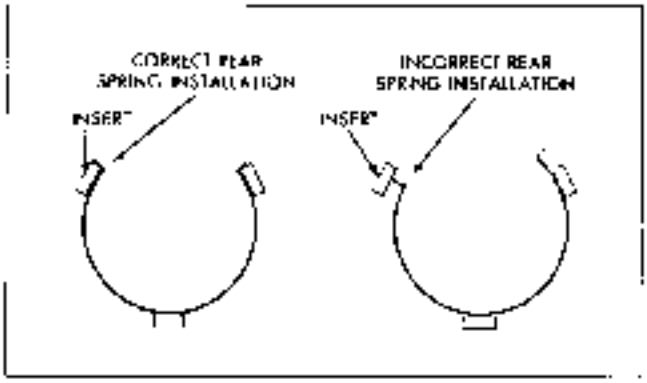


Fig. 7A-18 Synchronizer Insert Spring Installation

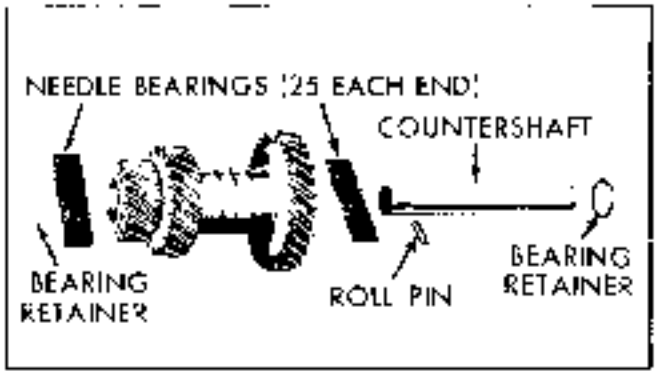


Fig. 7A-21 Exploded View of Countergear

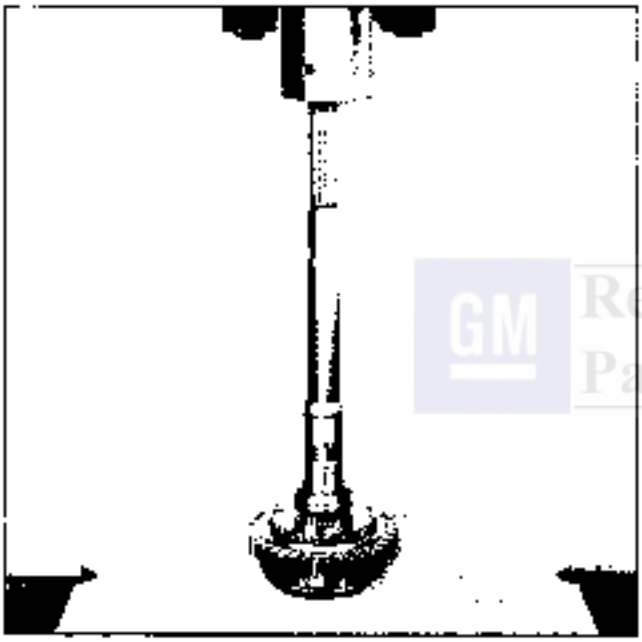


Fig. 7A-19 Installing Reverse Synchronizer Hub

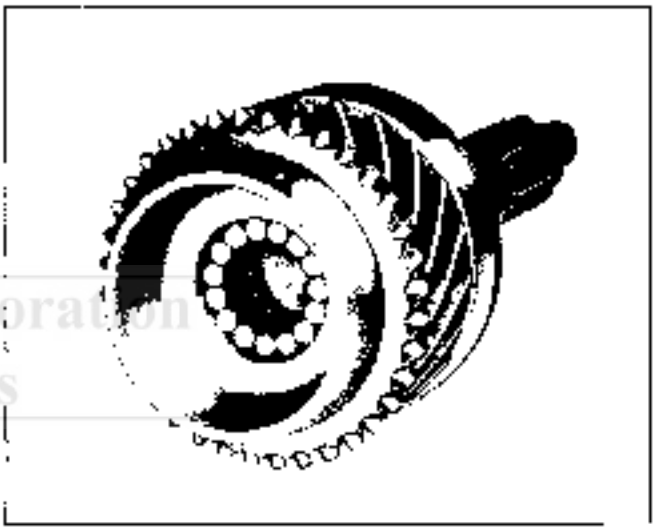


Fig. 7A-22 Input Shaft Roller Bearing Installation

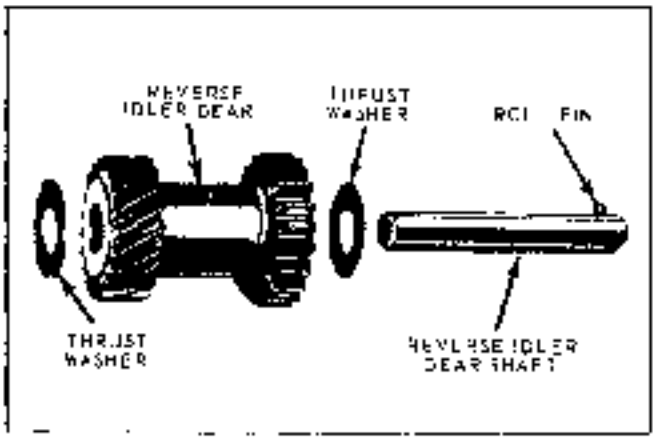


Fig. 7A-20 Exploded View of Reverse Idler

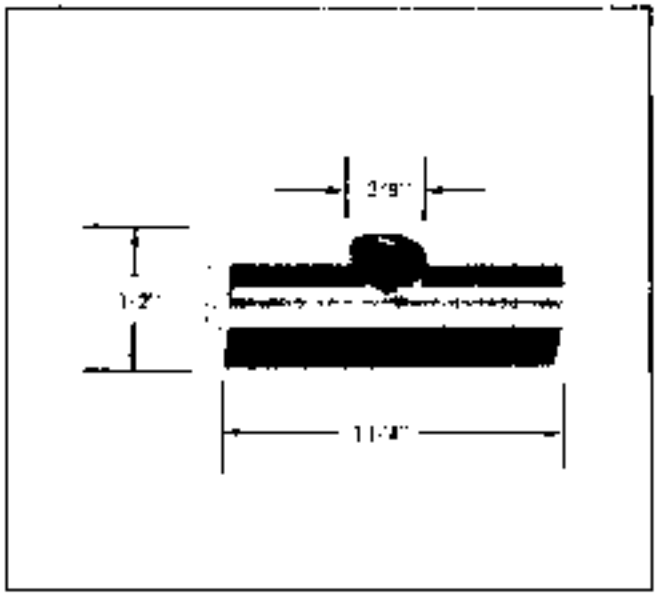


Fig. 7A-23 Detent Pin Installation

8. Place second and third speed synchronizer in second speed position (toward rear of case).

9. Align the shift fork and install second and third speed shift rail.

NOTE: It will be necessary to depress detent plug to install the rail in the bore. Move the rail in until the detent plug engages the forward notch.

10. Secure the shift fork to the shift rail with set screw.

11. Move the synchronizer to the neutral position.

12. Install the interlock plug in the case. If the second and third speed shift rail is in the neutral position, the top of the interlock will be slightly lower than the surface of the first and reverse shift rail bore.

13. Move the first and reverse synchronizer forward and place the first and reverse shift fork in the groove of the synchronizer.

14. Align the shift fork and install the first and reverse shift rail. Move the rail in until the center notch is aligned with the detent bore.

15. Install the remaining detent plug and spring. Secure the spring with the slotted head set screw. Turn screw in until the head is flush to 0.020 inches below the top of the case.

16. Secure the shift fork to the shift rail with set screw.

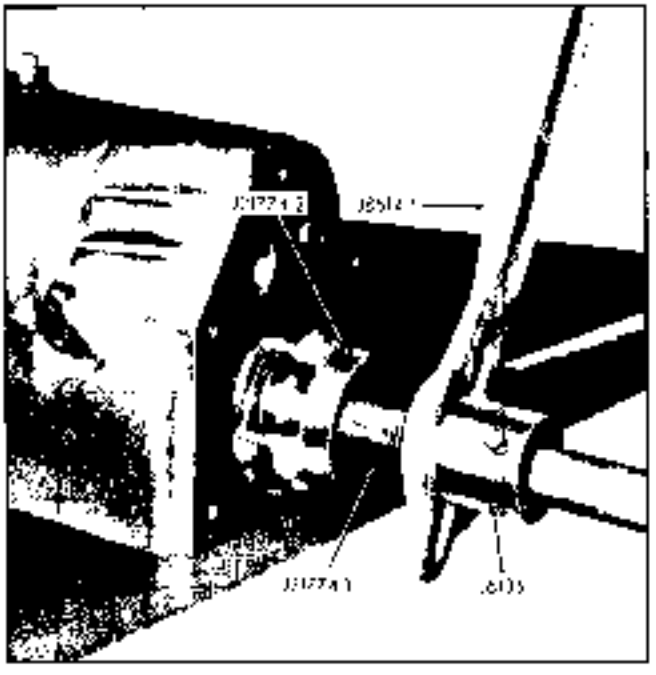


Fig. 7A-24 Installing Tempest Rear Bearing

17. Install a new shift rail expansion plug in front of the case.

18. While holding the input shaft and blocking ring in position, move the main shaft forward to seat the main shaft pilot in the roller bearings of the input shaft.

19. Tap the input shaft bearing into place in the case while holding the main shaft to prevent the roller bearings from dropping out.

20. Install the front bearing retainer and new gasket, making sure the oil return slot is toward bottom of the case. Torque the attaching screws to 22 lb. ft.

21. Install the large snap ring on the rear bearing.

22. Position the bearing on the output shaft, with the snap ring toward the rear of the shaft.

23. Thread tool J 21774-2 all the way into J 21774-1 and place tools on output shaft next to bearing.

24. PONTIAC:

a. Install speedometer driven gear snap ring on output shaft.

b. Back tool J 21774-2 out of J 21774-1, using handle J 8614-1, until bearing is positioned correctly on output shaft.

c. Remove speedometer driven gear snap ring and tools.

TEMPEST OR FIREBIRD

a. Install tool J 8614-1 on lugs of J 21774-2 and place J 6135 on output shaft. Secure J 6135 in position against J 21774-2 and J 8614-1 and lock in place by tightening the set screw against the non-finished surface of the output shaft (Fig. 7A-24).

NOTE. A bench vise may be used in lieu of J 6135.

b. Back tool J 21774-2 out of J 21774-1 until bearing is positioned correctly on output shaft.

c. Loosed J 6135 set screw and remove tools.

25. Place speedometer drive gear locking ball in the detent on the output shaft and slide speedometer drive gear into place. Secure gear with snap ring.

26. Using a hook or your hand, lift the countergear from the bottom of the case and align it and the thrust washers with the bore in the case.

27. Working from the rear of the case, push the countershaft alignment tool out of the countergear

with the countershaft. Before the countershaft is completely inserted, make sure that the locking pin hole in the shaft will line up with the locking pin hole in the case.

28. Drive the shaft into place and insert the locking pin.

29. Coat a new extension housing gasket with sealer and install it on the case.

30. Dip the threads of the extension housing screws in sealer.

31. Install the extension housing. Torque the screws to 48 lb. ft.

32. Install the filler and drain plugs in case, making sure the magnetic plug is installed in bottom of case.

33. Place the transmission in gear and put lubricant over the entire gear train while rotating the input shaft.

34. Coat a new cover gasket with sealer and install it on the case.

35. Install cover. Torque screws to 17 lb. ft.

TRANSMISSION—INSTALL IN VEHICLE

1. Install guide pin in upper right transmission to flywheel housing bolt hole for alignment and place transmission on guide pin. Rotate transmission, as necessary, to start main drive gear splines into clutch friction plate. Slide transmission forward.

NOTE: Make certain splines of clutch friction plate are concentric with pilot bearing in crankshaft and release bearing properly installed.

2. Install two (2) lower transmission mounting bolts. Remove guide pin and install two (2) upper bolts. Torque bolts 55 lb. ft.

3. Slide crossmember forward and install four (4) bolts. Torque 25 lb. ft.

4. Install transmission mount and lower engine. Torque mount bolts 30 lb. ft.

5. Install propeller shaft.

6. Connect linkage and adjust as described in ON CAR ADJUSTMENTS

7. Connect speedometer cable.

8. Refill transmission with recommended lubricant.

SPECIFICATIONS

TRANSMISSION IDENTIFICATION

An identifying code is marked in yellow paint on all three speed manual transmissions. This code consists of two letters, 2 inches high, on the R.H. side of the case. The letters "DA" identify the standard Pontiac three speed manual (Dearborn) transmission and "DB" identifies a heavy duty Tempest or Firebird three speed manual (Dearborn) transmission.

A number derived from the vehicle identification number is also stamped on the transmission case as shown in Fig. 7A-25

GEAR RATIOS

First Speed	2.42:1
Second Speed	1.61:1
Third Speed	1.00:1
Reverse	2.33:1

LUBRICANT

Capacity	2 3/4 pints

CLEARANCES

Countershaft Gear End Play	0.004"-0.018"
Reverse Idler Gear End Play	0.004"-0.018"

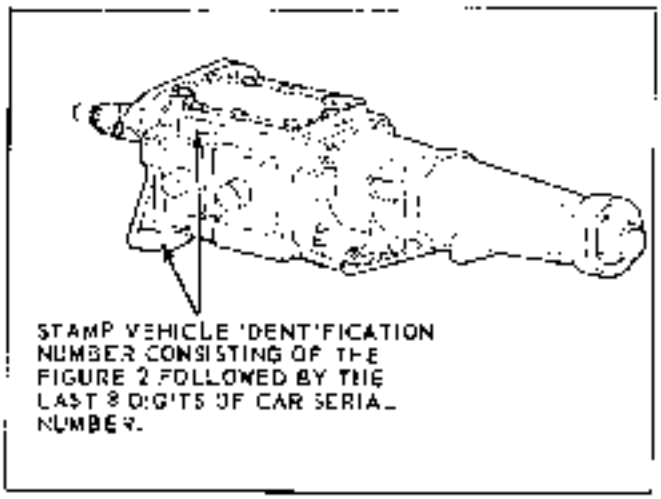


Fig. 7A-25 Vehicle Identification Number Location

TORQUE LIMITS

	Lb. Ft.
Input Shaft Bearing Retainer Bolts	22
Extension Housing to Transmission Bolts	46
Transmission to Flywheel Housing Bolts	40
Access Cover Bolts	17
Shift Fork to Shift Rail Set Screw	14
Filler Plug	25
Drain Plug	25
Trunnion Jam Nuts	30
Clamp Screws	20

SPECIAL TOOLS

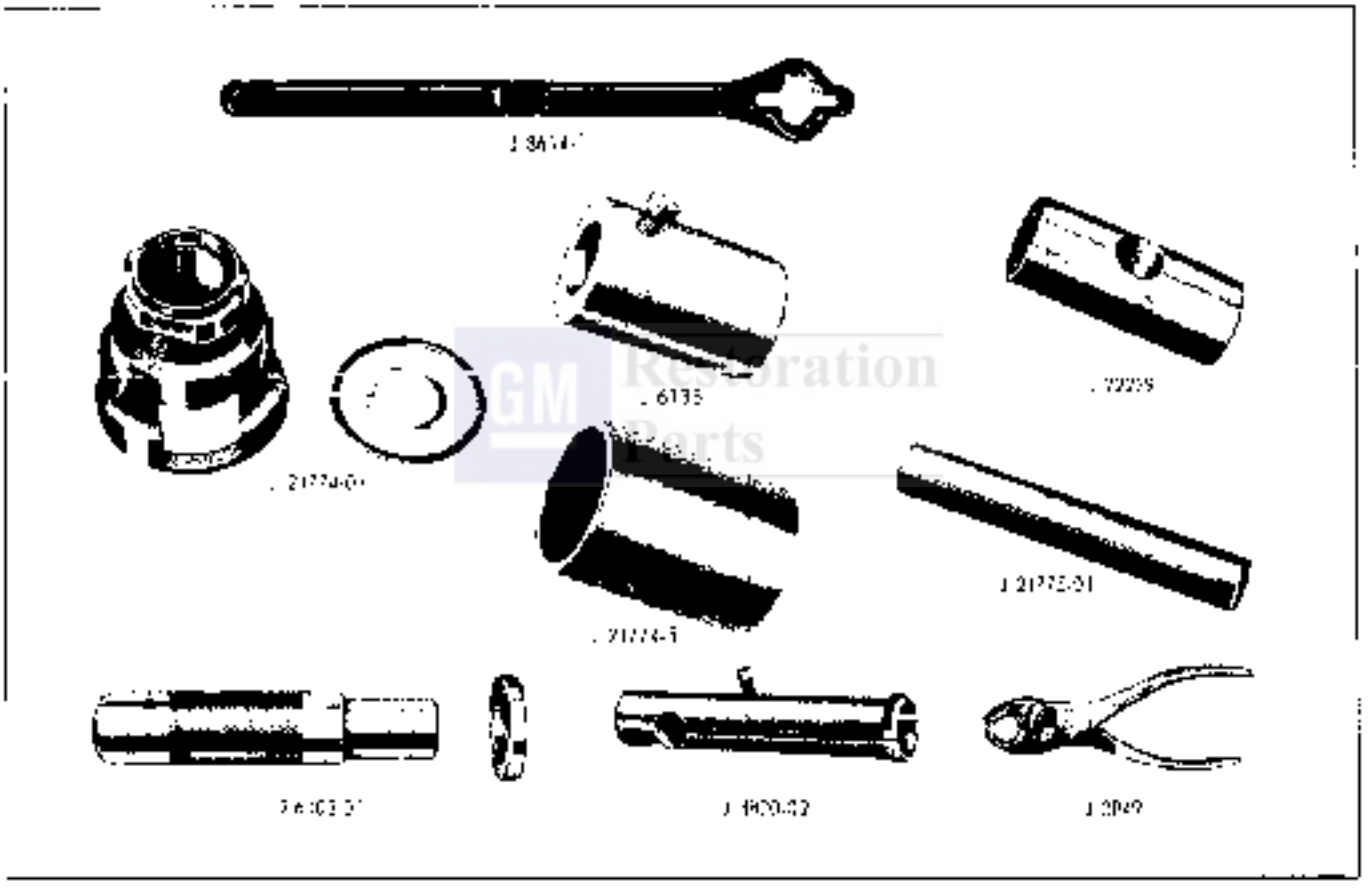


Fig. 7A-26 Special Tools

J 3049	Shift Rail Retaining Pliers	J 9614-1	Companion Flange Holding Tool
J 4830-02	Extension Housing Bushing and Seal Remover	J 21774-01	Transmission Output Shaft Rear Bearing Remover & Replacer
J 6135	Adapter (Rear Unit Clutch Retainer)	J 21774-5	Sleeve
J 6403-01	Extension Housing Bushing and Oil Seal Installer	J 21775-01	Countershaft Alignment Tab
		J 22229	Detent Pin Installer

THREE SPEED SAGINAW MANUAL TRANSMISSION

CONTENTS OF THIS SECTION

DESCRIPTION

The Saginaw three speed manual transmission is used as the standard equipment transmission on all Tempest and Firebird models except those equipped with the 400 cu. in. V-8 engine.

Gear ratios for the 6-cylinder engines are 2.65:1 in first, 1.68:1 in second, 1.00:1 in high and 2.95:1 in reverse. The 8-cylinder engine gear ratios are 2.54:1 in first, 1.60:1 in second, 1.00:1 in high and 2.83:1 in reverse.

PERIODIC SERVICE

TRANSMISSION

No periodic service of the transmission is required except checking for leaks and proper lubrication level every 6000 miles.

If there is evidence of leakage, leak should be corrected and lubrication added as needed. Refill capacity is 3-1/2 pints.

Use SAE 90 multi-purpose Gear Lubricant. No special additive to this lubrication is required or recommended.

SHIFT CONTROL

No periodic service of the shift control is required. Certain parts are lubricated on assembly and require further lubrication only when parts become dry and sticky.

ON CAR ADJUSTMENTS

LINKAGE ADJUSTMENT—COLUMN SHIFT (Fig. 7B-1 and Fig. 7B-2)

1. Set transmission control levers in neutral position (see view A).

NOTE: Align shift levers in neutral position by inserting 1/8" dia. gauge pin through holes in levers as shown.

2. Loosen screw on each adjusting swivel clamp.

3. Set both shift levers on transmission in neutral position.

4. Tighten screws on each adjusting swivel clamp to 20 lb. ft.

5. Remove gauge pin and check complete shift pattern.

LINKAGE ADJUSTMENT—FLOOR SHIFT (Fig. 7B-3 and Fig. 7B-4)

1. Position selector lever in neutral position.

2. Loosen trunnion jam nuts on transmission gear shift control rods.

3. Place transmission lever and bracket assembly in neutral position and install gauge pin as illustrated in view A.

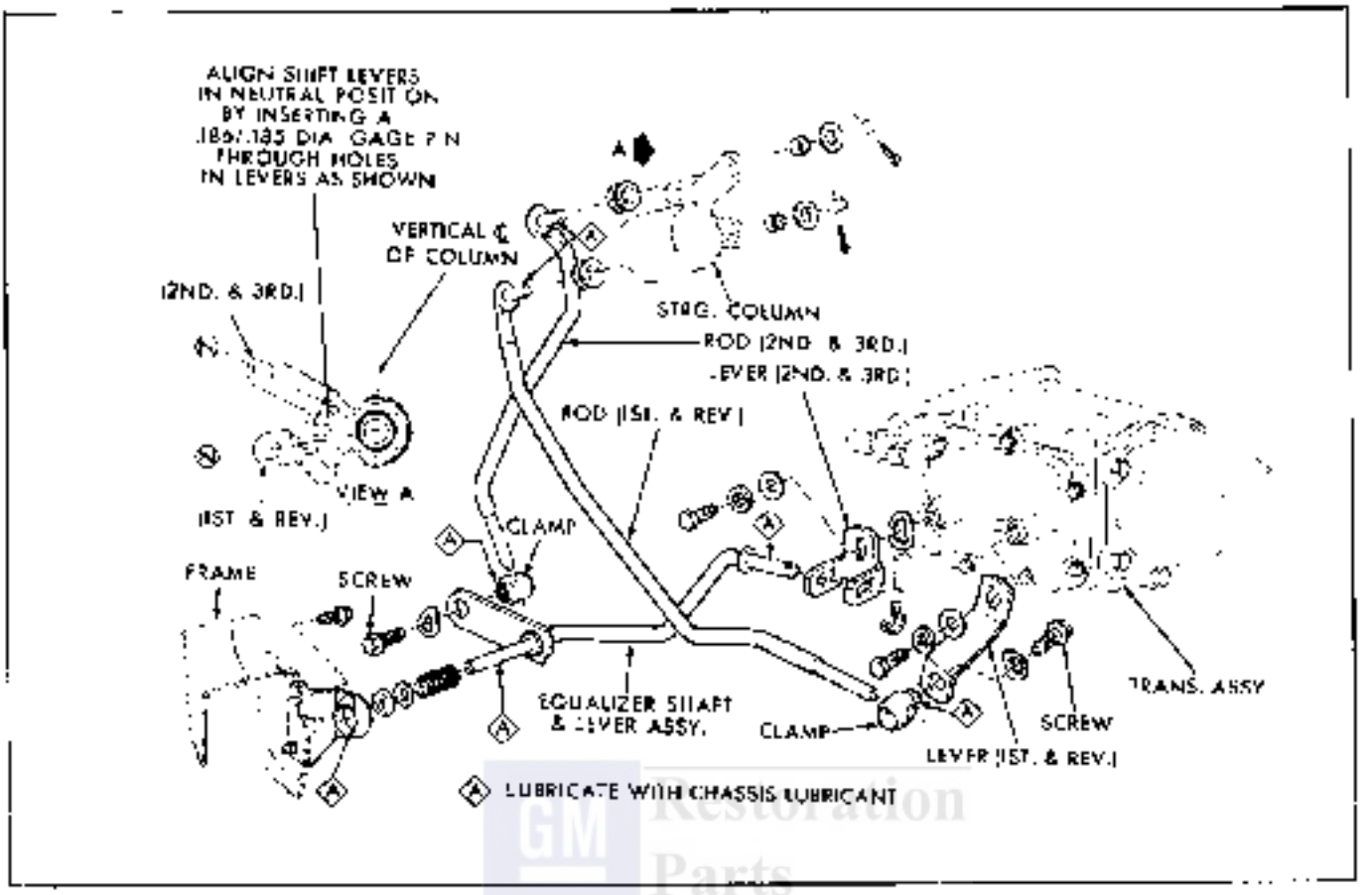


Fig. 7B-1 Tempest Column Shift Controls

4. Position levers on transmission in neutral.

5. Retorque jam nuts to 30 lb. ft.

6. Remove gauge pin and check complete shift pattern.

MINOR REPAIRS

EXTENSION HOUSING SEAL

REMOVE AND REPLACE

1. Remove drive shaft as outlined in Section 4C.

2. Remove seal by prying out with screw driver.

3. Wash counterbore with cleaning solvent and inspect for damage.

4. Inspect propeller shaft yoke for nicks, burrs or scratches which would cut new seal or cause seal to leak or damage bushing.

5. Coat new seal with sealing compound and start new seal in opening.

6. Place collar J 6403-2 onto tool J 6403-1 (Fig. 7B-6).

NOTE: Flat side of J 6403-2 must be toward rear of J 6403-1.

7. Place tool J 6403-1 over end of output shaft.

8 Tap end of tool with soft hammer to seat seal.

9. Reinstall drive shaft.

EXTENSION HOUSING SEAL AND BUSHING

REMOVE AND REPLACE

1. Remove drive shaft.

2. Insert tool J 4830-02 over output shaft and tighten screw.

3 Attach slide hammer J-2619. Using hammer, pull bushing and seal from extension housing (Fig. 7B-6).

4. Start new bushing into extension housing.

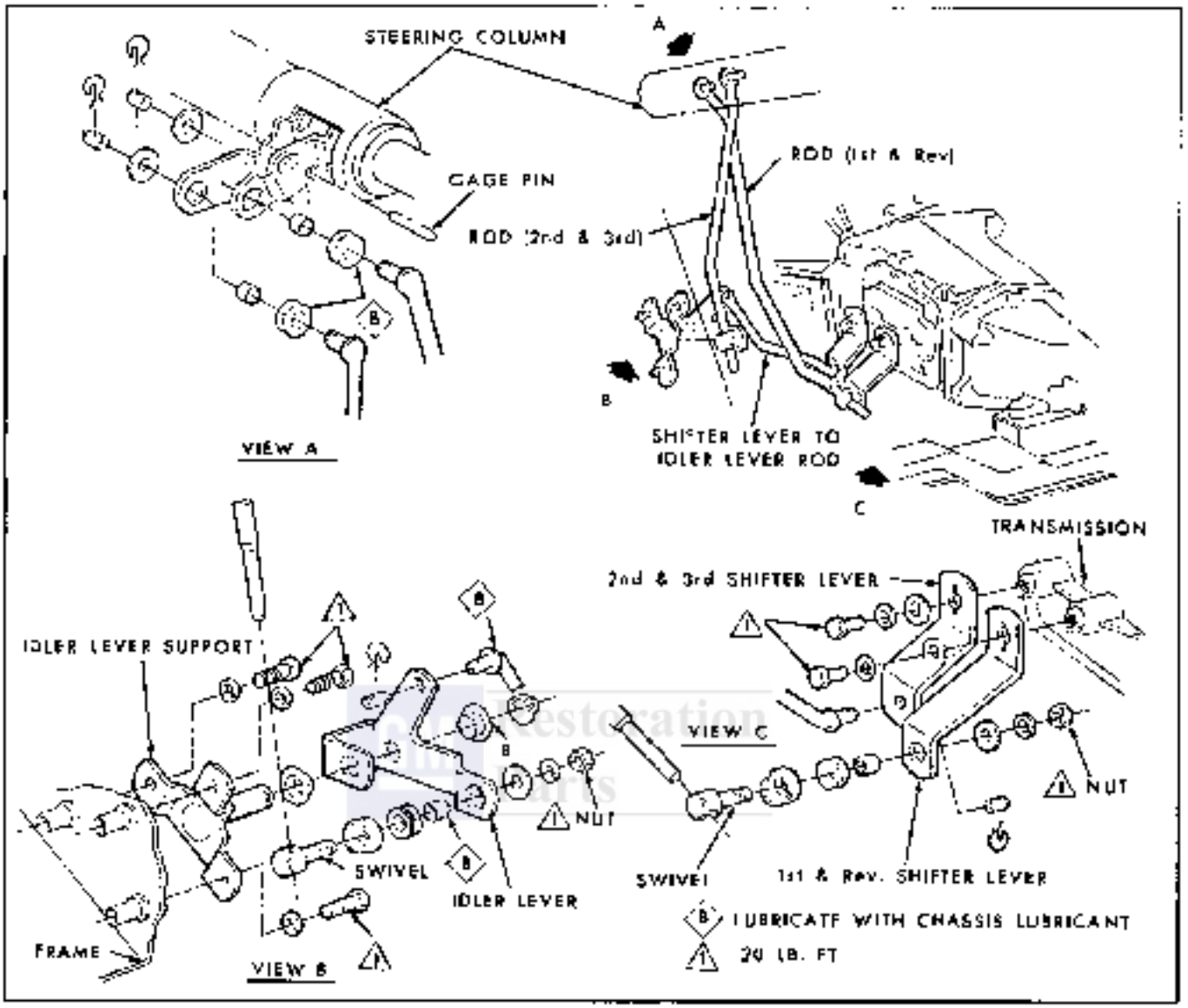


Fig. 7B-2 Firebird Column Shift Controls

5. Using tool J 6403-01 and soft hammer, tap bushing into place (Fig. 7B-7).

6. Install new seal, using tool J 6403-01 and collar J 6403-02 (Fig. 7B-8).

TRANSMISSION SIDE COVER— REMOVE AND DISASSEMBLE

It is not necessary to remove transmission from vehicle for inspection or replacement of parts in transmission side cover assembly, but cover itself must be removed from transmission case (Fig. 7B-9).

1. Loosen side cover bolts to allow transmission fluid to drain.

2. Disconnect control rods from levers.

3. Remove side cover from transmission case.

4. Disassemble side cover by removing detent cam spring, shifter forks and shafts, detent cam retainer and detent cams.

5. Inspect and replace necessary parts.

6. Inspect shifter shaft O-rings and replace if necessary.

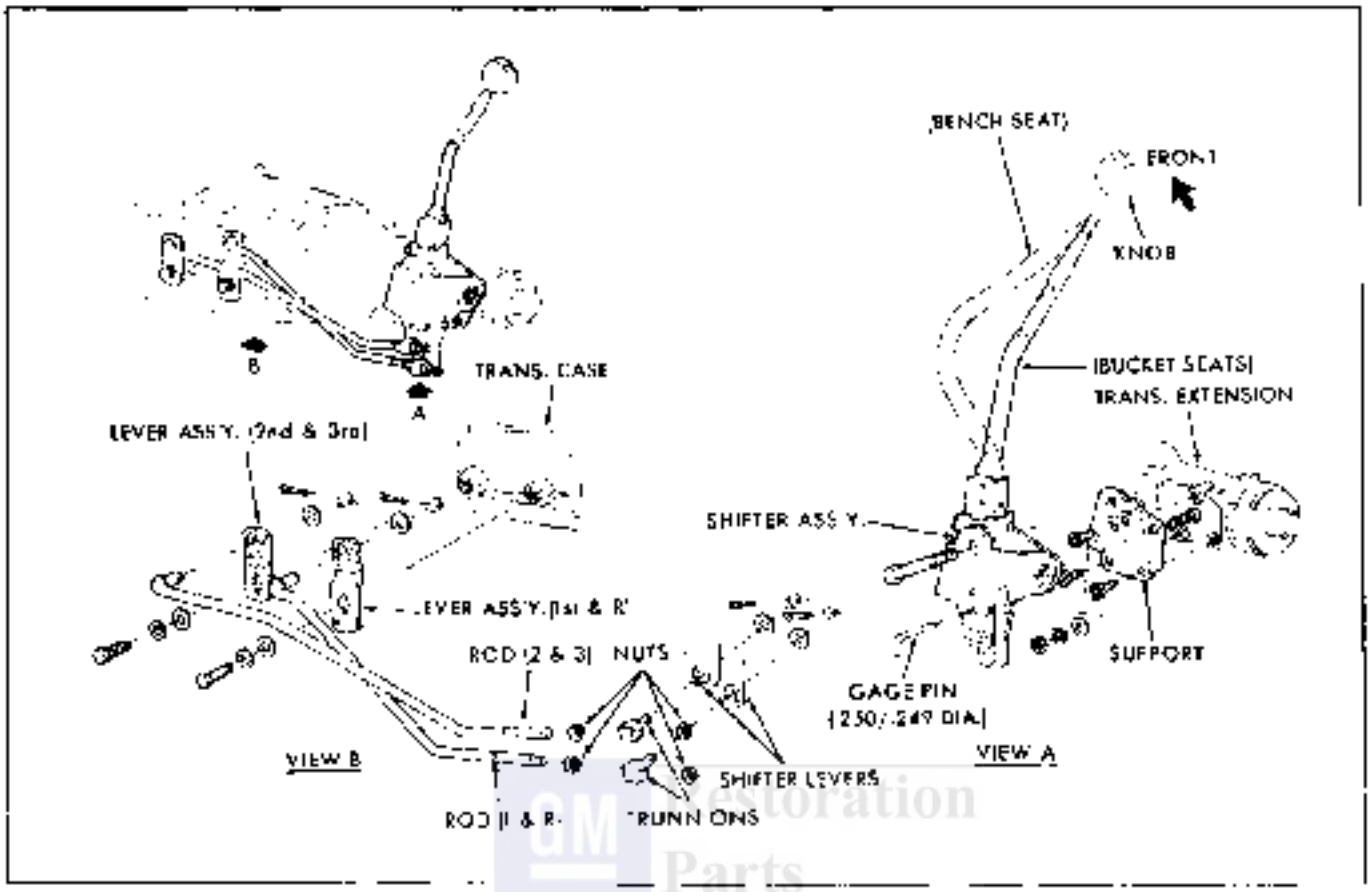


Fig. 7B-3 Tempest Floor Shift Controls

TRANSMISSION SIDE COVER—ASSEMBLE AND INSTALL

1. Install shifter shaft O-rings if removed.

2. Install detent cams, detent cam retainer, shifter shafts and forks and detent cam spring.

3. Attach side cover to transmission case.

4. Connect control rods to levers.

5. Refill transmission.

NOTE: Detent cams, shifter shafts and forks are interchangeable.

MAJOR REPAIRS

TRANSMISSION—REMOVE

1. Disconnect speedometer cable.

2. Disconnect shift control rods from transmission.

3. Scribe a mark on companion flange and shaft yoke to assure proper reassembly and remove propeller shaft.

4. Support rear of engine and remove transmission mount.

NOTE: On Firebird 6-cyl., remove driveline damper (Fig. 7B-26).

5. Remove four (4) crossmember bolts and slide member rearward.

6. Remove two (2) upper transmission to clutch housing bolts and insert guide pins J 1126.

7. Remove two (2) lower transmission to clutch housing bolts.

8. Slide transmission straight back on guide pins until main drive gear splines are free of splines in clutch friction plate.

9. Remove transmission.

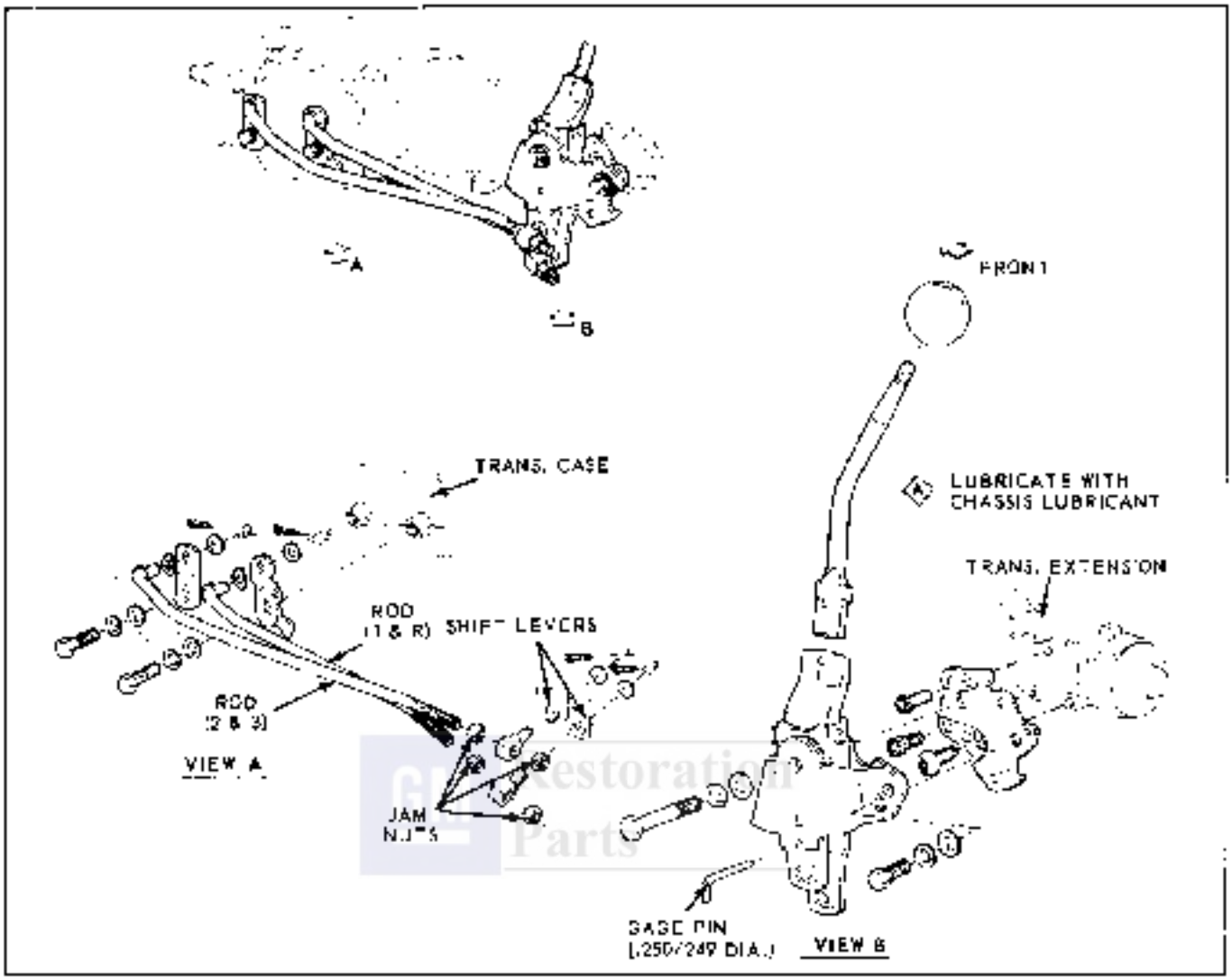


Fig. 7B-4 Firebird Floor Shift Controls

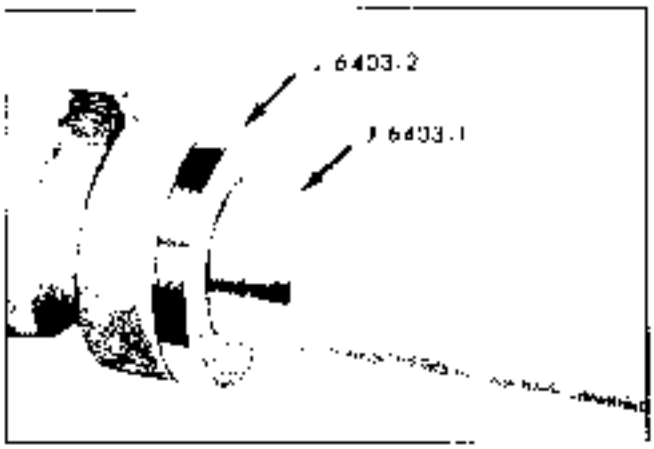


Fig. 7B-5 Installing Extension Housing Seal

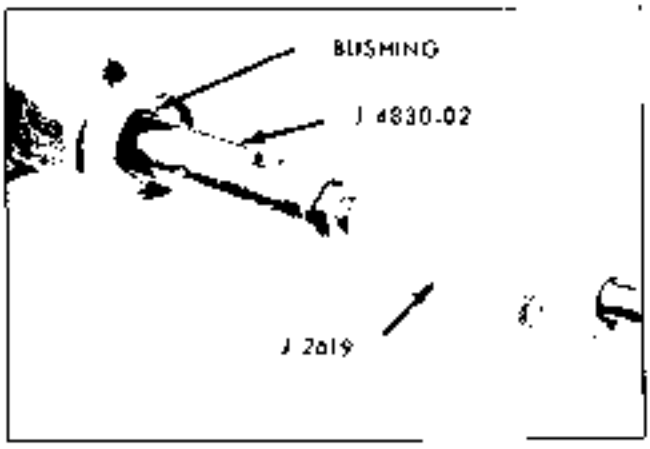


Fig. 7B-6 Removing Extension Housing Bushing

Fig. 7B-7 Installing Extension Housing Bushing

TRANSMISSION—DISASSEMBLE

1. Drain lubricant.

2. Remove side cover attaching bolts. Remove side cover and gasket.

3. Remove front bearing retainer and gasket.

4. Remove front bearing to main drive gear snap ring.

5. Pull main drive gear out of case as far as possible and remove front bearing (Fig. 7B-9).

NOTE: Although front bearing is a slip fit on main drive gear, it may be necessary to pry removal with screwdriver.

6. Remove extension housing to case attaching bolts.

7. Remove reverse idler shaft to gear snap ring (Fig. 7B-10). Slide reverse idler gear forward on shaft.

8. From rear of case, remove extension housing and mainshaft assembly (Fig. 7B-11).

9. Remove main drive gear and third speed blocking ring from inside of case and remove 14 bearing rollers from mainshaft drive gear.

10. Using snap ring pliers, expand snap ring at front of extension housing which retains extension housing to mainshaft (Fig. 7B-12) and remove extension housing.

11. Using countershaft alignment tool J 22246, tap out counter gear shaft and its woodruff key through rear of case (Fig. 7B-13). Remove counter gear and two (2) tanged thrust washers.

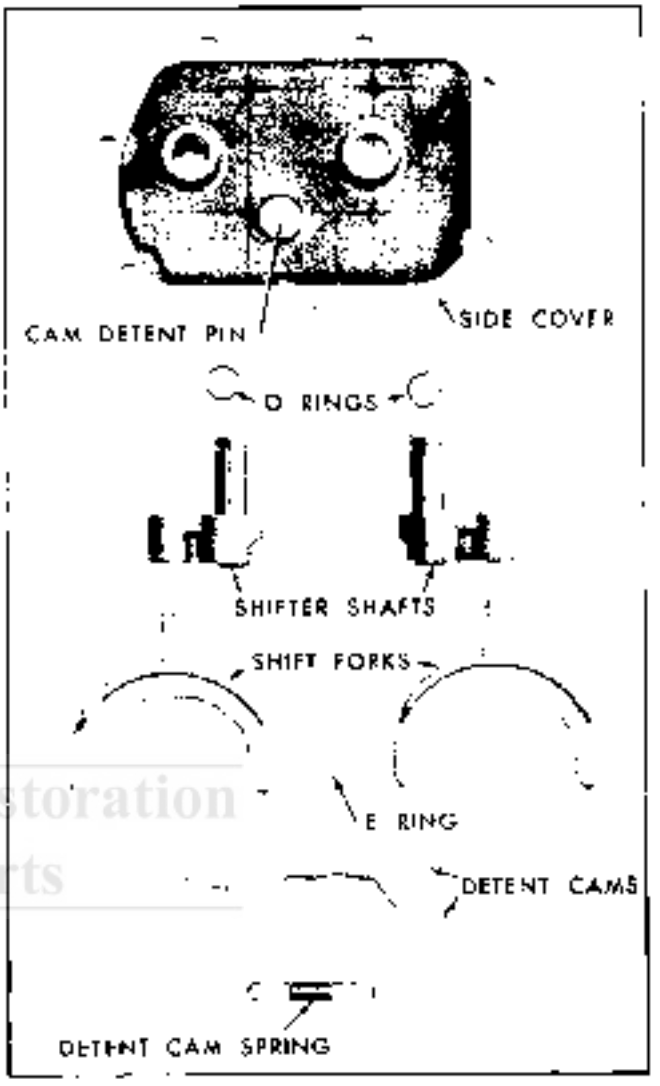


Fig. 7B-8 Exploded View of Transmission Side Cover

12. Remove countershaft alignment tool J 22246.

13. From each end of countershaft, remove spacer and 27 bearing rollers.

14. Using a long brass drift or punch, drive reverse idler shaft and woodruff key through rear of case (Fig. 7B-14).

15. Remove reverse idler gear and tanged steel thrust washer.

16. Remove second-third synchronizer sleeve (Fig. 7B-15).

17. Remove rear bearing snap ring (Fig. 7B-15).

18. Remove speedometer drive gear by depressing retainer clip and sliding off output shaft.

19. Using hydraulic or arbor press, press off rear bearing, spring washer, thrust washer and reverse gear (Fig. 7B-16).

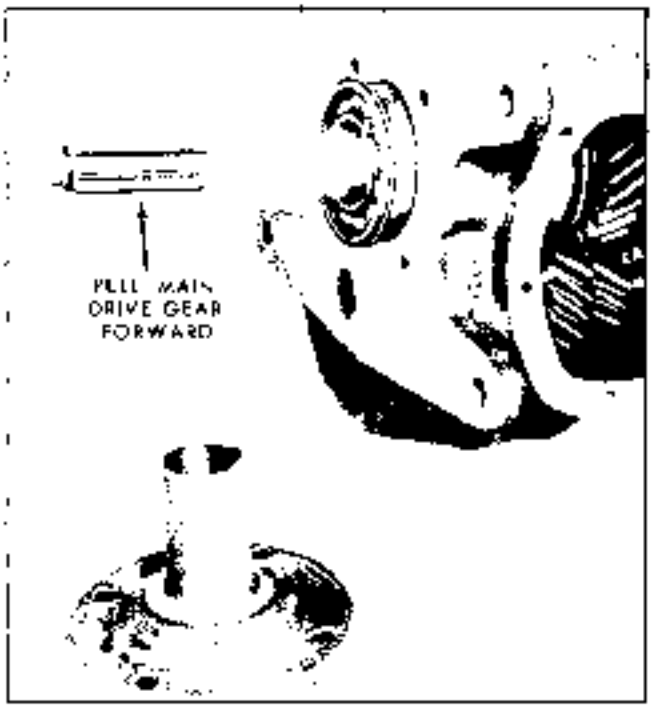


Fig. 7B-9 Removing Front Bearing

20. Remove first speed synchronizer snap ring (Fig. 7B-16).

21. Support first speed gear on press plate, using two (2) pieces of stock 6" x 1-7/8" x 3/4" (Fig. 7B-17). Remove first speed synchronizer assembly and first speed gear.

22. Remove second-third speed synchronizer snap ring (Fig. 7B-15).

23. Support second speed gear on press plate, using two (2) pieces of stock 8" x 1 7/8" x 1/4" (Fig. 7B-18). Remove second-third speed synchronizer assembly and second speed gear.

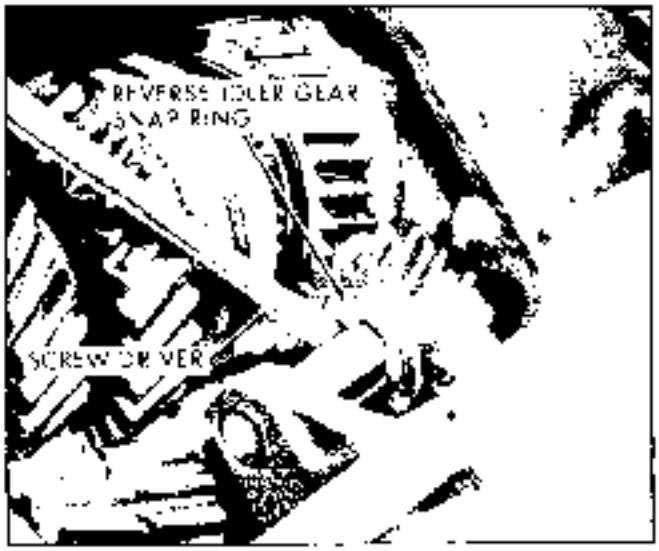


Fig. 7B-10 Removing Reverse Idler Gear Snap Ring

Fig. 7B-11 Removing Mainshaft

CLEANING AND INSPECTION

1. Check synchronizer hubs, sliding keys and springs and, if necessary, replace.

NOTE: The synchronizer hubs and sliding sleeves are a selected assembly and should be kept together as originally assembled.

a. Mark hub and sleeve so they can be reassembled in same position.

b. Remove sliding sleeve from synchronizer hub. Remove keys and springs from hub.

c. Replace the three (3) keys and two (2) springs in position (one on each side of hub) so

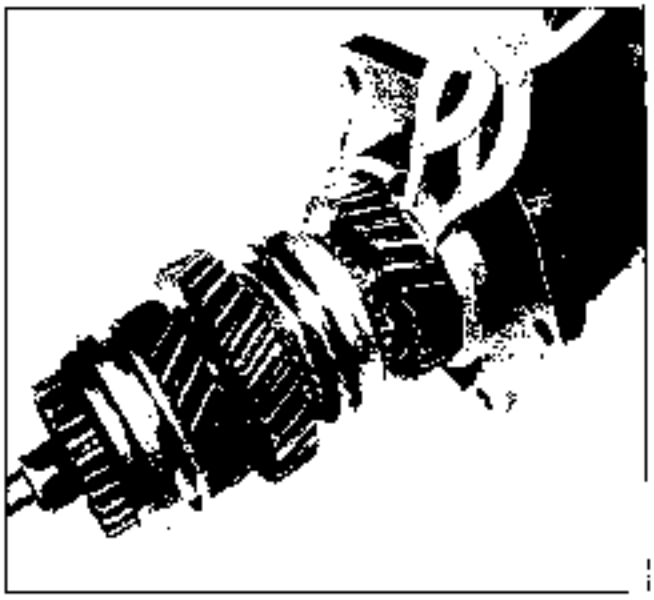


Fig. 7B-12 Expanding Extension Housing Snap Ring

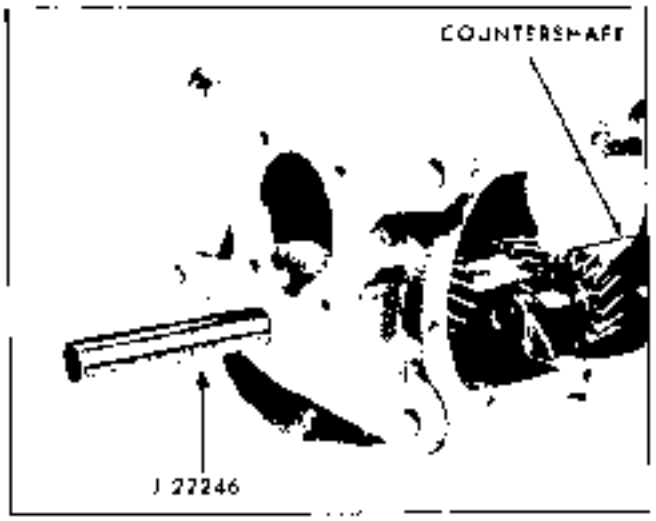


Fig. 7B-13 Removing or Installing Countergear

all three keys are engaged by both springs (Fig. 7B-19).

The tanged end of each synchronizer spring should be installed in different key cavities on either side of hub. Slide sleeve onto hub aligning marks made before disassembly.

NOTE: A groove around the outside of synchronizer hub identifies the end that must be opposite fork slot in sleeve when assembled. This groove indicates the end of the hub with a greater recess.

2. Wash front and rear bearings thoroughly in cleaning solvent. Blow out bearing with compressed air.

CAUTION: Do not allow bearings to spin; turn them slowly by hand. Spinning bearings will damage race and balls. Make certain bearings are clean, then lubricate with light engine oil and check them for roughness by slowly turning race by hand.

3. Check for cracks in blocking rings.

TRANSMISSION CASE

1. Wash transmission case thoroughly inside and outside with suitable cleaning solvent; then inspect case for cracks.

2. Check front and rear case faces for burrs and, if present, remove with a fine mill file.

3. Check and clean magnet in bottom of transmission case.

BEARING ROLLERS

All main drive gear and countergear bearing rollers should be inspected closely and replaced if they show wear.

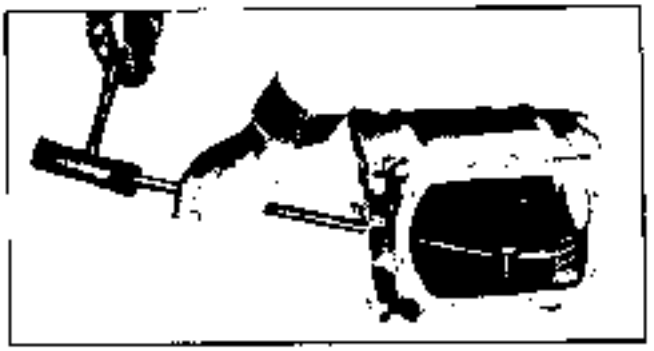


Fig. 7B-14 Removing Reverse Idler Gear Shaft

GEARS

1. Inspect all gears for excessive wear, chips or cracks.

2. Inspect reverse gear bushing and, if worn or damaged, replace entire gear.

NOTE: Reverse gear bushing is not serviced separately.

3. Inspect reverse idler gear bushing and, if worn or damaged, replace entire gear.

COUNTERGEAR ASSEMBLY

1. Check for broken bearing rollers.

2. Inspect anti-rattle plate teeth for wear or other damage.

3. Check for broken anti-rattle springs.

NOTE: The anti-rattle plate is riveted to the countergear in three (3) places. Disassembly is not recommended (Fig. 7B-20).

FRONT BEARING RETAINER OIL SEAL

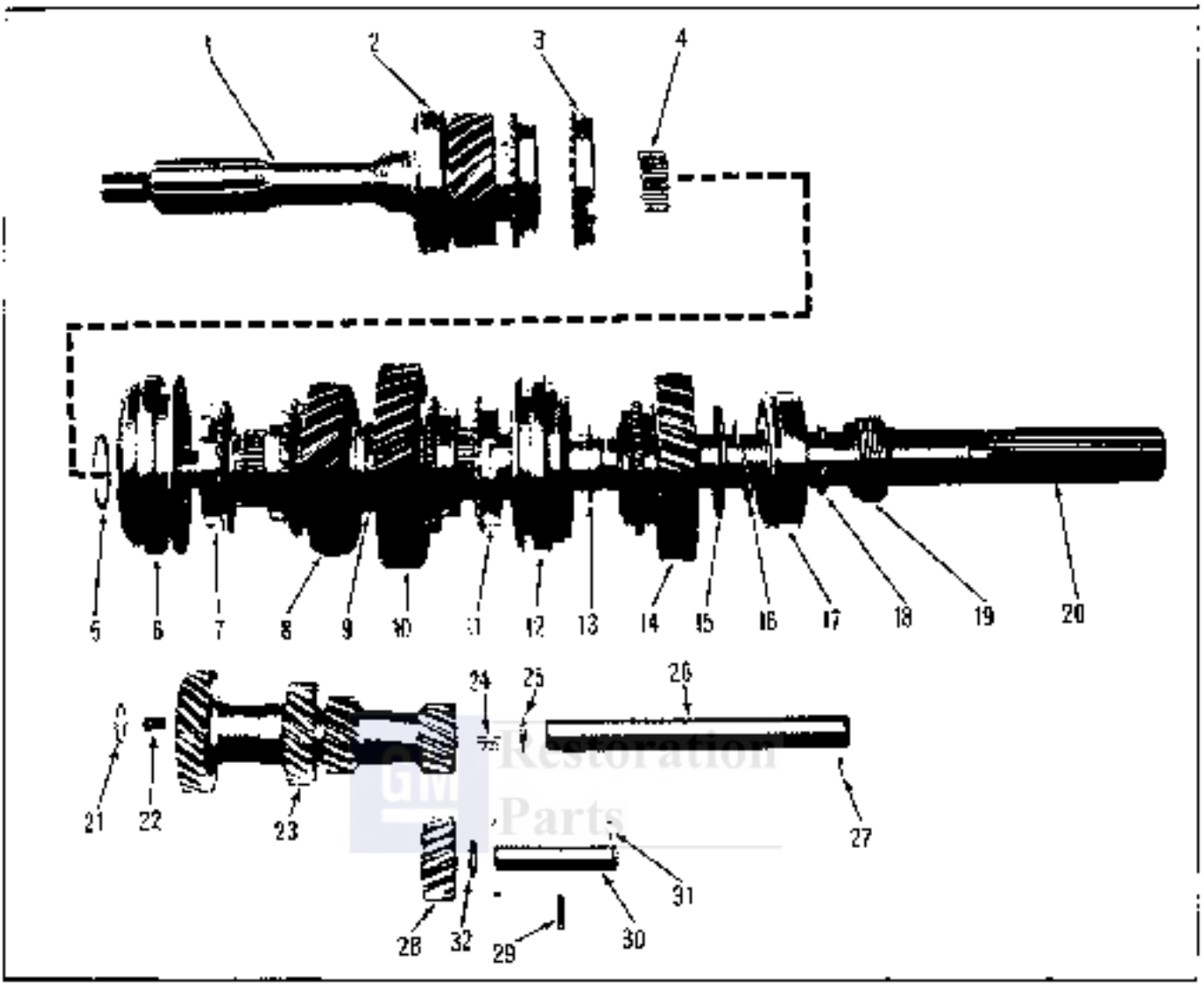
If lip seal in retainer needs replacement, pry out old seal with screwdriver. Replace with new seal, using flat plate, and tap until seal is seated in its bore (Fig. 7B-21).

NOTE: Lip of seal must face rear of bearing retainer.

TRANSMISSION—ASSEMBLE

MAINSHAFT—ASSEMBLE

1. Turn the front of the mainshaft upward and install second speed gear and synchronizer on mainshaft. Using hydraulic or arbor press and press



1. Main Drive Gear
2. Cone Bearing
3. Third Speed Blocking Ring
4. Main Drive Gear Bearing Rollers (14)
5. Second-Third Synchronizer Snap Ring
6. Second-Third Synchronizer Assembly
7. Second Speed Blocking Ring
8. Second Speed Gear
9. Shoulder (Part of Mainshaft)
10. First Speed Gear
11. First Speed Blocking Ring
12. First Speed Synchronizer Assembly
13. First Speed Synchronizer Snap Ring
14. Reverse Gear
15. Reverse Gear Thrust Washer
16. Spring Washer (Reverse Gear)
17. Rear Bearing
18. Rear Bearing Snap Ring
19. Speedometer Drive Gear
20. Mainshaft
21. Thrust Washer - Front
22. Countergear Bearing Rollers (27)
23. Countergear
24. Countergear Bearing Rollers (27)
25. Thrust Washer - Rear
26. Countershaft
27. Woodruff Key
28. Reverse Idler Gear
29. Reverse Idler Gear Snap Ring
30. Reverse Idler Shaft
31. Woodruff Key
32. Reverse Idler Gear Thrust Washer

Fig. 7B-15 Mainshaft, Countergear and Reverse Idler Gear Details

plate J 21858, press second-third speed synchronizer assembly (with chamfer toward rear of transmission) onto mainshaft (Fig. 7B-22). Install retaining snap ring.

CAUTION: Make certain notches in blocking ring align with keys in synchronizer.

2. Install first speed gear and synchronizer on mainshaft (Fig. 7B-23). Using hydraulic or arbor press and press plate J 21858, press first speed synchronizer assembly onto mainshaft. Install retaining snap ring.

CAUTION: Make certain notches in blocking ring align with keys in first speed synchronizer.

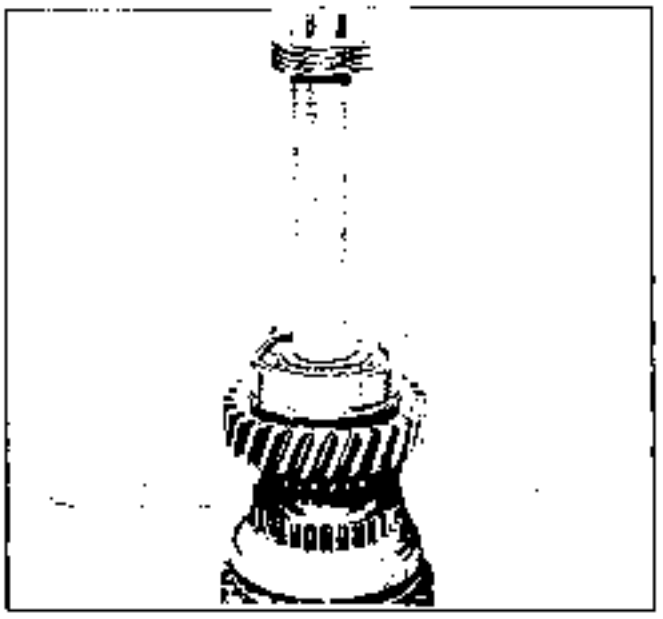


Fig. 7B-16 Removing Rear Bearing

3. Turn the rear of the mainshaft upward and install reverse gear, thrust washer, spring washer and rear bearing (Fig. 7B-16).

NOTE: Groove on bearing must be toward reverse gear. Using hydraulic or arbor press and press plate J 8092, press rear bearing into position (Fig. 7B-24). Install retaining snap ring.

4. Place speedometer gear retainer into hole in output shaft.

5. Align slot in speedometer drive gear with retainer clip and slide gear into place.

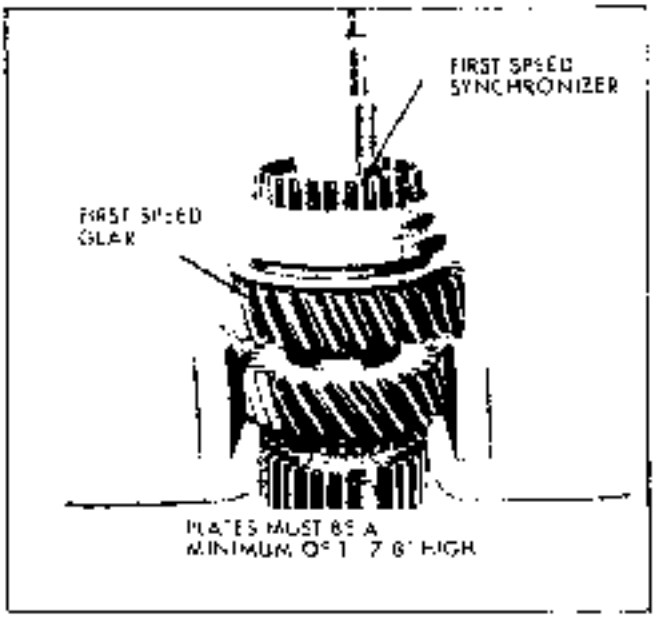


Fig. 7B-17 Removing First Speed Synchronizer and Gear

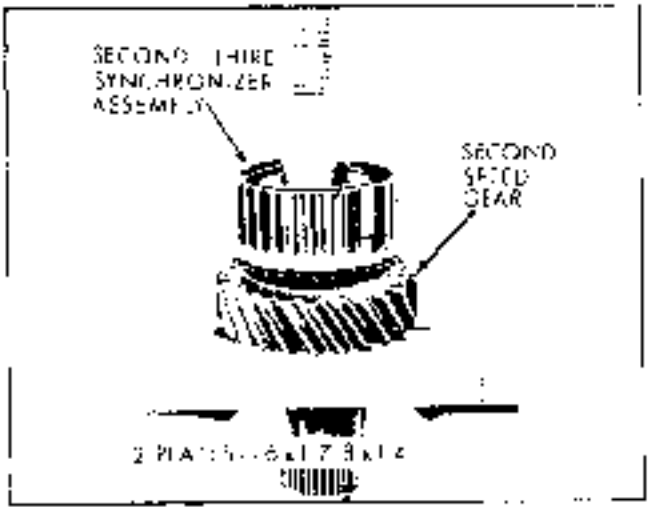


Fig. 7B-18 Removing Second - Third Synchronizer and Gear

6. Install second-third synchronizer sleeve (Fig. 7B-15).

COUNTERGEAR—ASSEMBLE

1. Install countershaft alignment tool J 22240.

2. From each end of countergear, install 27 bearing rollers and spacer (Fig. 7B-20).

NOTE: Coat needle bearings with heavy grease before installing.

TRANSMISSION—ASSEMBLE

1. Install countergear to case bronze thrust washers.

2. Install countergear assembly into case. Install countergear shaft from rear of case. Make certain woodruff key is in position.

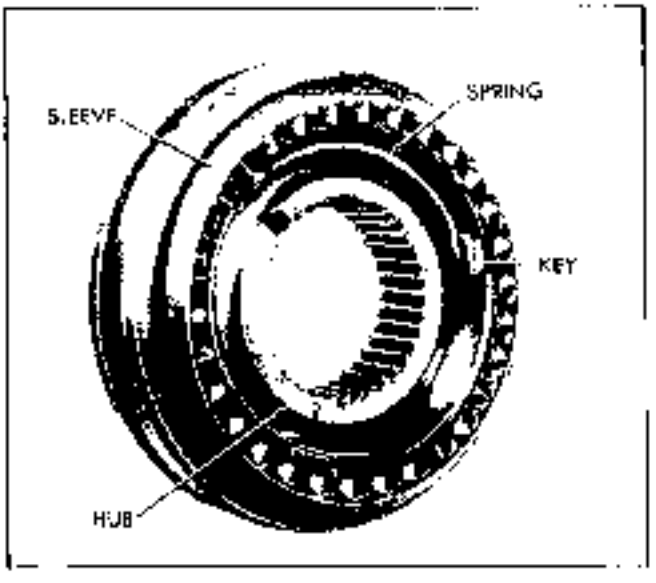


Fig. 7B-19 Synchronizer Assembly

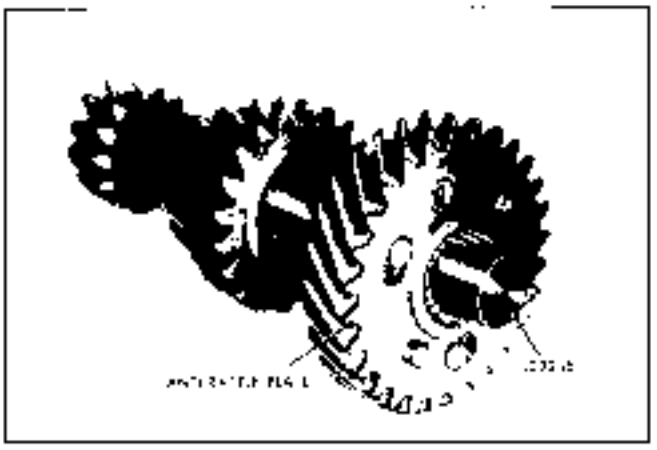


Fig. 7B-20 Loading Bearings into Countergear

3. Install reverse idler gear tanged steel thrust washer. Install reverse idler gear, shaft and woodruff key.

NOTE: Reverse idler gear snap ring will be installed after installation of mainshaft.

4. Install extension housing. Spread snap ring in housing to allow snap ring to drop around rear bearing (Fig. 7B-18). Press on end of mainshaft until snap ring engages groove in rear bearing.

5. Install fourteen (14) bearing rollers in the main drive gear, using heavy grease to hold bearings in place (Fig. 7B-25).

6. Assemble third speed blocking ring on main drive gear.

7. Pilot main drive gear and third speed blocking ring over front of mainshaft.

8. Using heavy grease, install extension housing to case gasket.

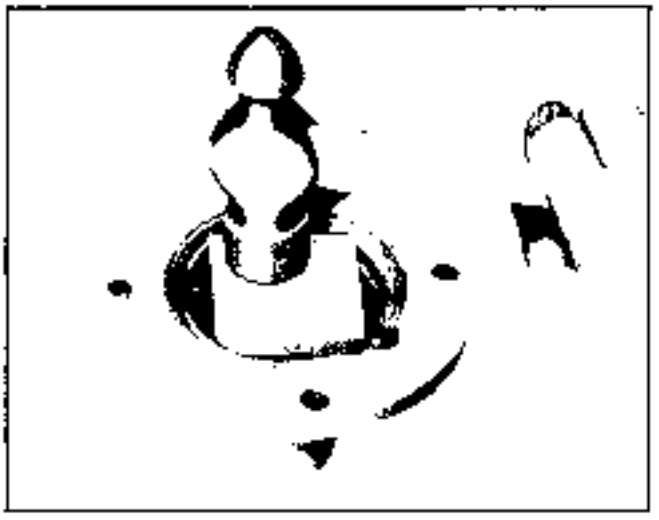


Fig. 7B-21 Installing Front Bearing Retainer Oil Seal

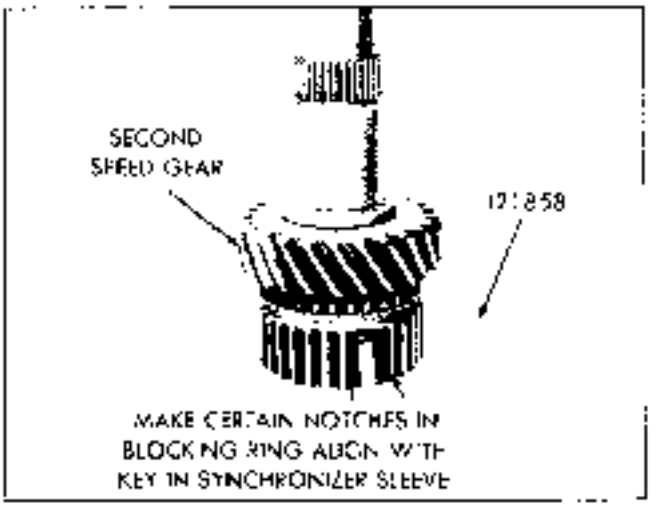


Fig. 7B-22 Installing Second - Third Speed Synchronizer and Gear

9. Install extension housing and mainshaft assembly into case. Install extension housing to case bolts. Torque 45 lb. ft.

CAUTION: Make certain notches in blocking ring align with keys in second-third synchronizer.

10. Install front bearing onto main drive gear. Outer snap ring groove must be toward front of gear.

11. Install retaining snap ring.

12. Install front bearing retainer, gasket and four attaching bolts, torquing bolts to 10 lb. ft.

NOTE: The retainer oil return hole must be at bottom of case.

13. Install reverse idler gear snap ring.

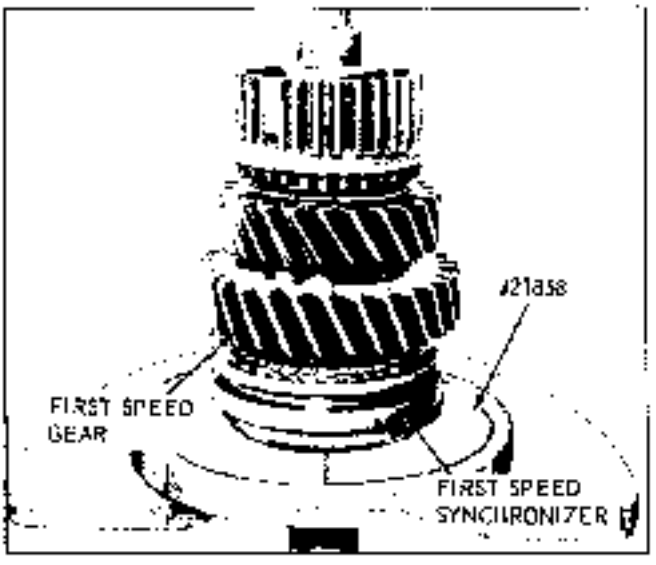


Fig. 7B-23 Installing First Speed Gear and Synchronizer

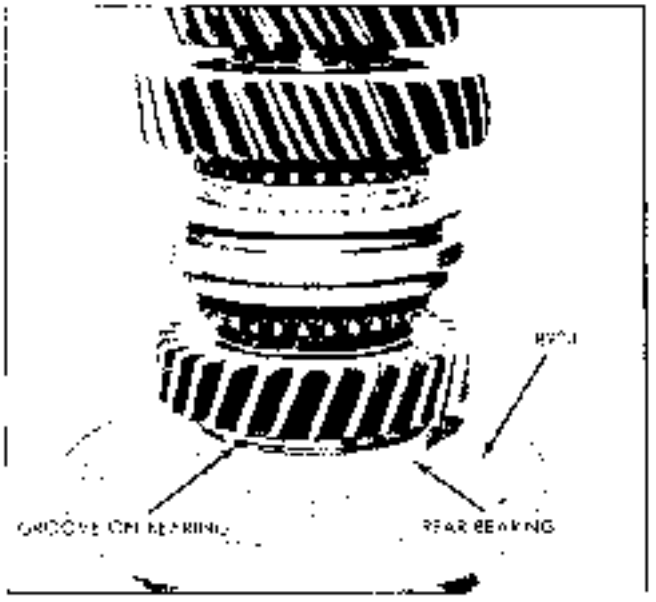


Fig. 7B-24 Installing Rear Bearing

14. Install new side cover gasket. Place transmission in neutral and install side cover. Secure with attaching bolts and torque evenly to 10 lb. ft. to avoid side cover distortion.

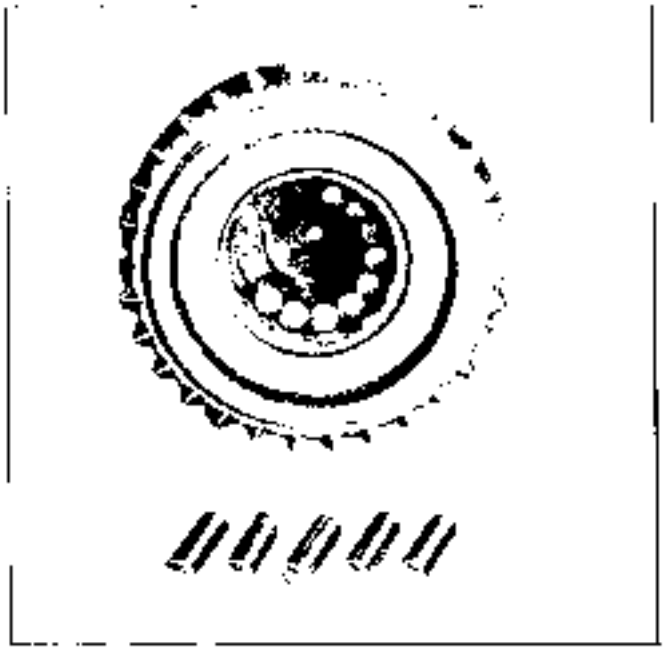


Fig. 7B-25 Loading Bearings Into Main Drive Gear

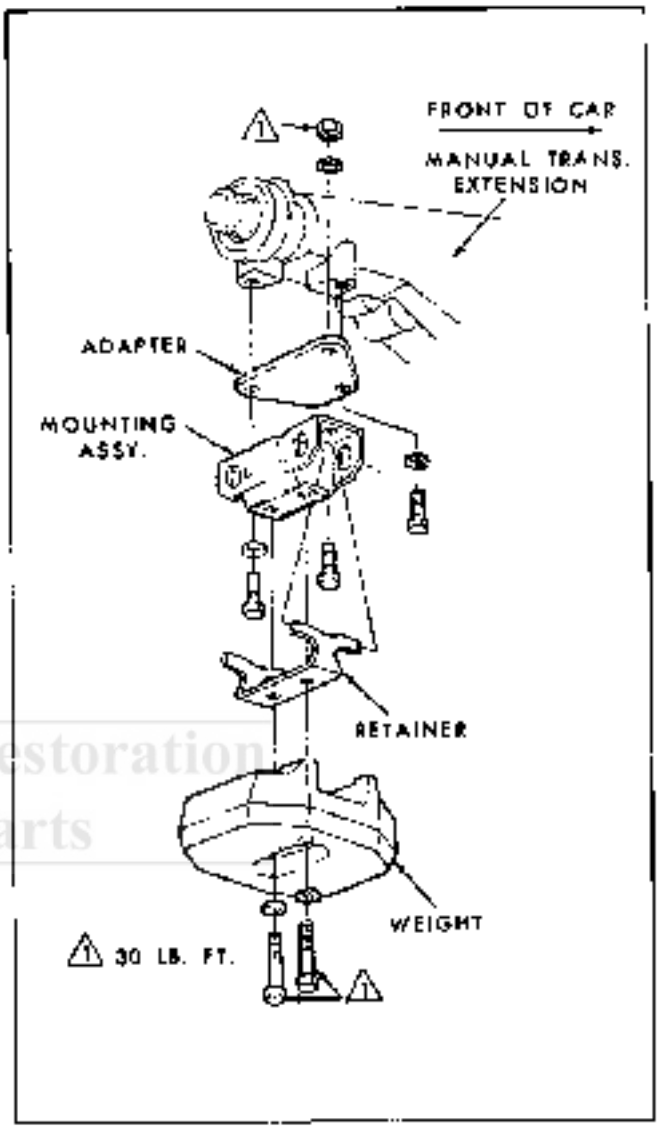


Fig. 7B-26 Drive Line Damper

TRANSMISSION—INSTALL IN VEHICLE

1. Install guide pin in upper right transmission to flywheel housing bolt hole for alignment and place transmission on guide pin. Rotate transmission as necessary to start main drive gear splines into clutch friction plate. Slide transmission forward.

NOTE: Make certain splines of clutch friction plate are concentric with pilot bearing in crankshaft and rollerse bearing properly installed.

2. Install two (2) lower transmission mounting bolts. Remove guide pins and install two (2) upper bolts. Torque bolts to 55 lb. ft.

3. Slide crossmember forward and install four (4) bolts. Torque to 25 lb. ft.

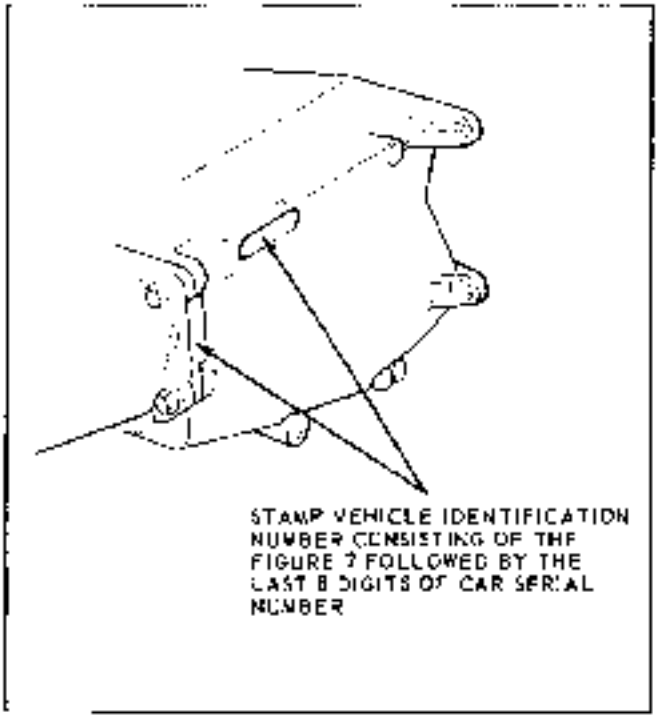


Fig. 7B-27 Vehicle Identification Number Location

4. Install transmission mount and lower engine. Torque mount bolts to 30 lb. ft.

5. Install propeller shaft.

NOTE: On 6-cyl. Firebirds, install driveline damper (Fig. 7B-26).

6. Connect linkage and adjust as described in ON CAR ADJUSTMENTS.

7. Connect speedometer cable.

8. Refill transmission with recommended lubricant.

FIREBIRD DRIVELINE DAMPER

A driveline damper is used to reduce power train vibration to an acceptable level. The damper is mounted under the rear of the transmission extension and consists of a weight retained by a mounting which, in turn, is attached to the underside of the transmission extension through an adapter (Fig. 7B-26).

SPECIFICATIONS

TRANSMISSION IDENTIFICATION

An identifying code is marked in yellow paint on all three speed manual transmissions. This code consists of two letters, 2 inches high, on the R.H. side of the transmission case.

Tempest	Code
6-cyl. (column shift)	FA
6-cyl. (floor shift)	FB
8-cyl. (350 cu. in.)	FC

Firebird	Code
6-cyl. (column shift)	FV
6-cyl. (floor shift)	FK
8-cyl. (350 cu. in.)	FJ

A number derived from the vehicle identification number is also stamped on the transmission case as shown in Fig. 7B-27.

GEAR RATIOS

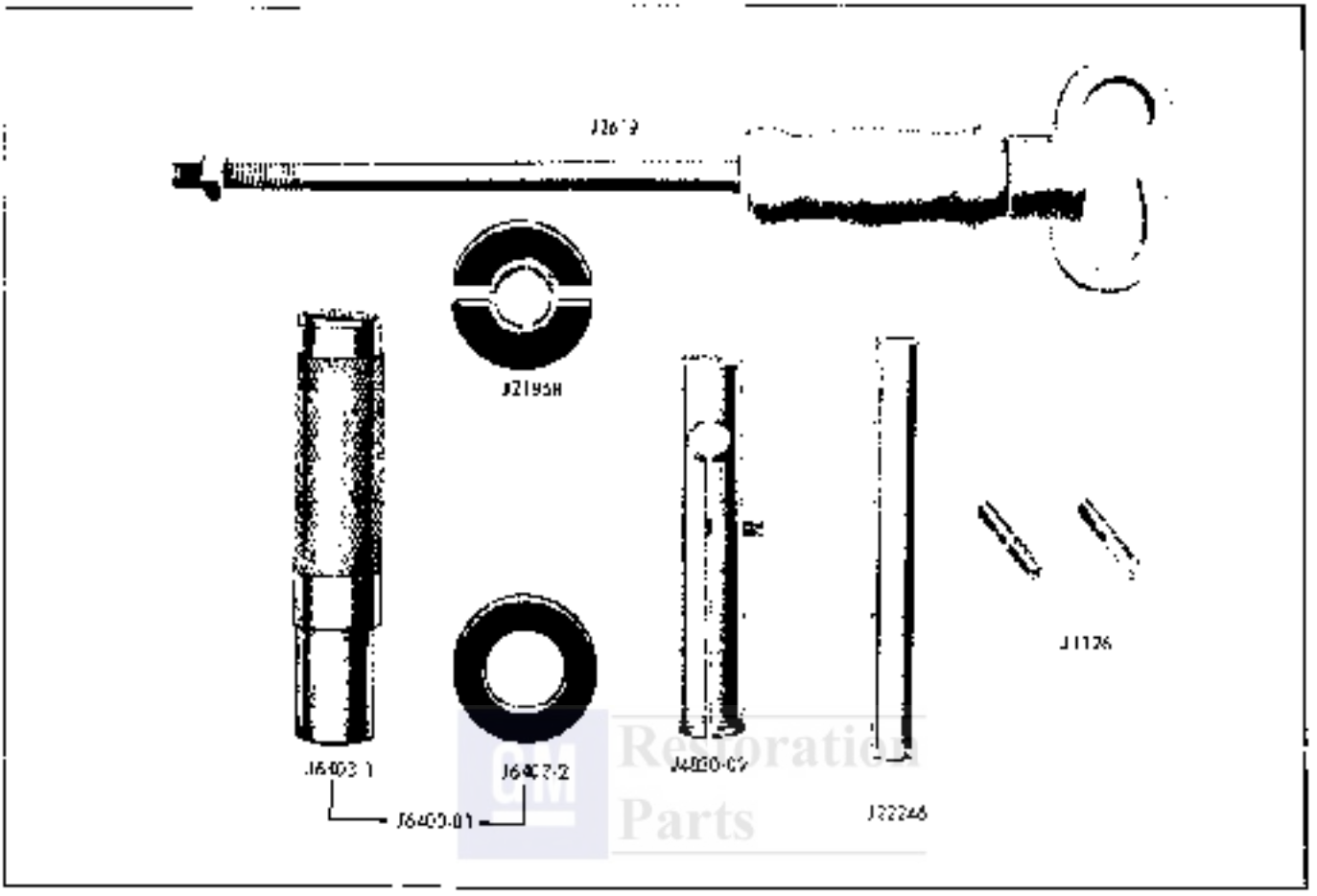
	6-Cylinder	8-Cylinder
First Speed	2.85:1	2.54:1
Second Speed	1.68:1	1.50:1
Third Speed	1.00:1	1.00:1
Reverse	2.95:1	2.63:1

LUBRICATION

Capacity	3 1/2 pints

TORQUE SPECIFICATIONS

Application	Lb. Ft.
Front Bearing Retainer to Case Bolts	20
Side Cover to Case Bolts	20
Extension Housing to Case Bolts	45
Shift Lever to Shifter Shaft Bolts	15
Lubrication Filler Plug	15
Transmission Case to Flywheel Housing Bolts	55
Linkage Swivel Clamp Screws	20
Trunnion Jam Nuts	30
Damper Weight to Mounting Assy. Bolts	30
Mounting Assy. and Adapter to Extension Housing Bolts and Nut	30



J 1126 Aligning Studs
J 2619 Slide Hammer
J 4600-02 Extension Housing Bushing and Oil Seal Remover
J 6403-01 Extension Housing Bushing and Oil Seal Installer
J 21858 Adapter (Axle Shaft Bearing Remover)
J 22246 Countershaft Alignment Tool

Fig. 7B-28 Special Tools

FOUR SPEED SAGINAW MANUAL TRANSMISSION

CONTENTS OF THIS SECTION

DESCRIPTION

The Saginaw 4-speed transmission is used on all Tempests and Firebirds when a 4-speed is ordered with the 6-cyl. engine. It has all forward gears synchronized with a constant mesh reverse idler.

Since the Saginaw 4-speed is very similar to the Saginaw 3-speed transmission, many operation procedures are the same. In such cases, a note will be made to refer to the Three Speed Saginaw Manual Transmission Section, Section 7B.

PERIODIC SERVICE

REFER TO SECTION 7B

ON CAR ADJUSTMENTS

SHIFT LINKAGE ADJUSTMENT (Fig. 7C-1, 7C-2)

1. Position selector lever in neutral position.

2. Loosen trunnion jam nuts on transmission gearshift control rods.

3. Place transmission lever and bracket assembly in neutral position and install gauge pin as illustrated.

4. Position levers on transmission in neutral.

5. Retorque trunnion jam nuts to 30 lb. ft.

6. Remove gauge pin and check complete shift pattern.

MINOR REPAIRS

EXTENSION HOUSING SEAL

Refer to Section 7-B.

EXTENSION HOUSING SEAL & BUSHING

Refer to Section 7-B.

TRANSMISSION SIDE COVER— REMOVE AND DISASSEMBLE

The following procedure may be performed with the transmission in or out of the car.

1. Disconnect linkage from shift levers on transmission, leaving it in neutral.

2. Loosen side cover bolts and allow transmission to drain.

3. Remove side cover from case.

4. Remove outer shifter levers.

5. Remove both shift forks from shifter shaft assemblies. Remove all three shifter shaft assemblies. Remove reverse shifter shaft detent ball and spring. (Fig. 7C-3)

6. Remove detent cam spring and pivot retainer O-ring. Mark to identify both detent cams and remove.

7. Inspect O-ring seals on shifter shafts. Replace any damaged parts.

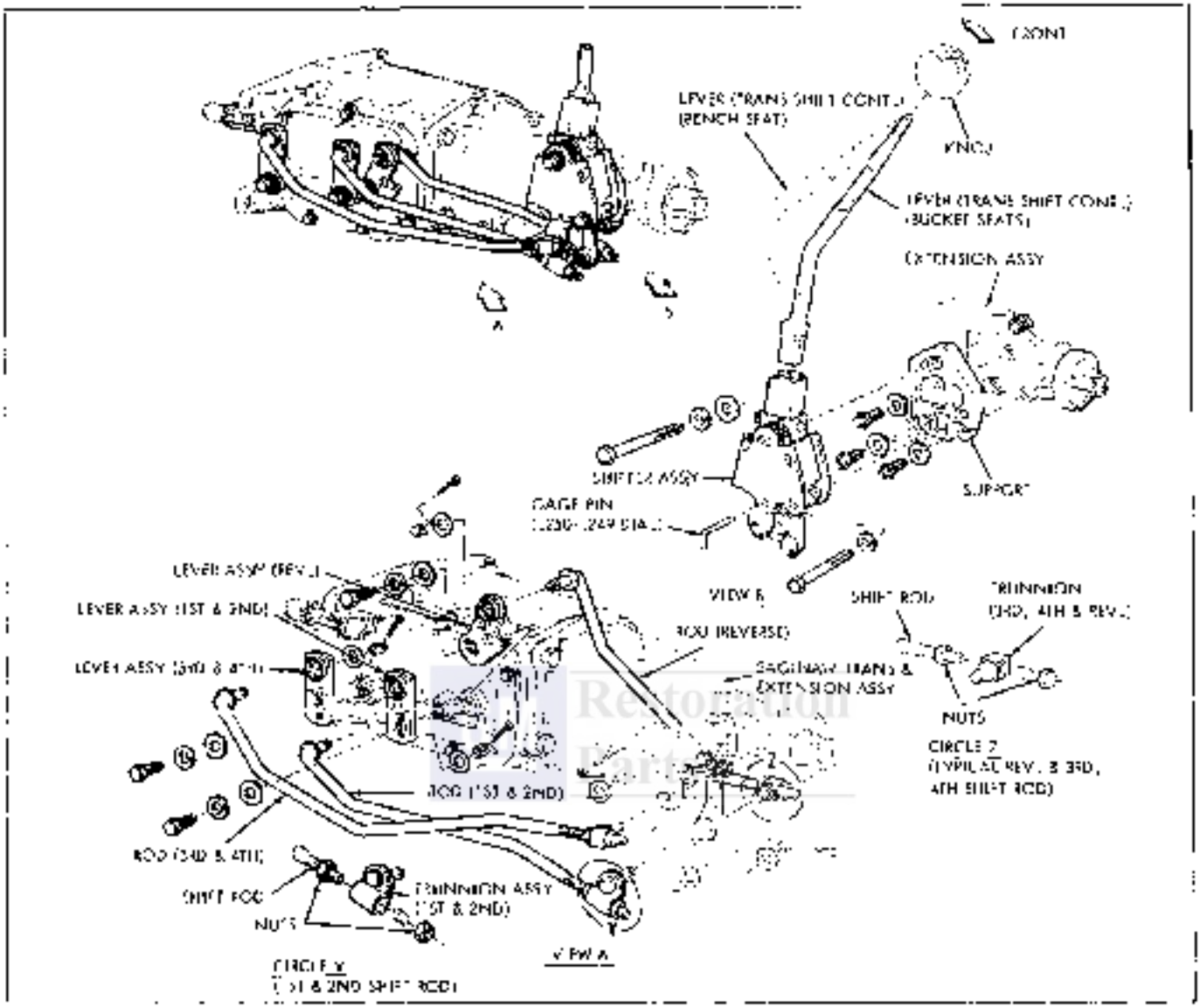


Fig. 7C-1 Tempest Shift Linkage

TRANSMISSION SIDE COVER—ASSEMBLE AND INSTALL

1. Install shifter shaft O-rings if removed.

2. Install the 1st and 2nd detent cam onto the detent cam pivot pin, with the detent cam spring tang projecting up over the 3rd and 4th shifter shaft opening. Install the 3rd and 4th detent cam onto the detent cam pivot pin, with the detent cam spring tang up over the 1st and 2nd shifter shaft opening.

NOTE: Detent cams are not interchangeable.

3. Install pivot retainer C-ring to pivot shaft and hook spring into notches in detent cam spring tangs.

4. Install 1st-2nd and 3rd-4th shifter shaft assemblies in cover, being careful not to damage seals. Install both shift forks to shifter shafts, lifting up on detent cams to allow forks to seat fully.

NOTE: Shift forks are not interchangeable.

5. Install reverse detent ball and spring to cover, then install reverse shifter shaft to cover.

6. Install outer shifter levers, flat washer, lock washers and bolts.

7. Position shift forks in neutral position.

8. Position cover gasket on case and carefully position side cover into place, making sure the shift forks align with their respective sliding sleeves.

9. Install cover attaching bolts and torque evenly to 20 lb. ft.

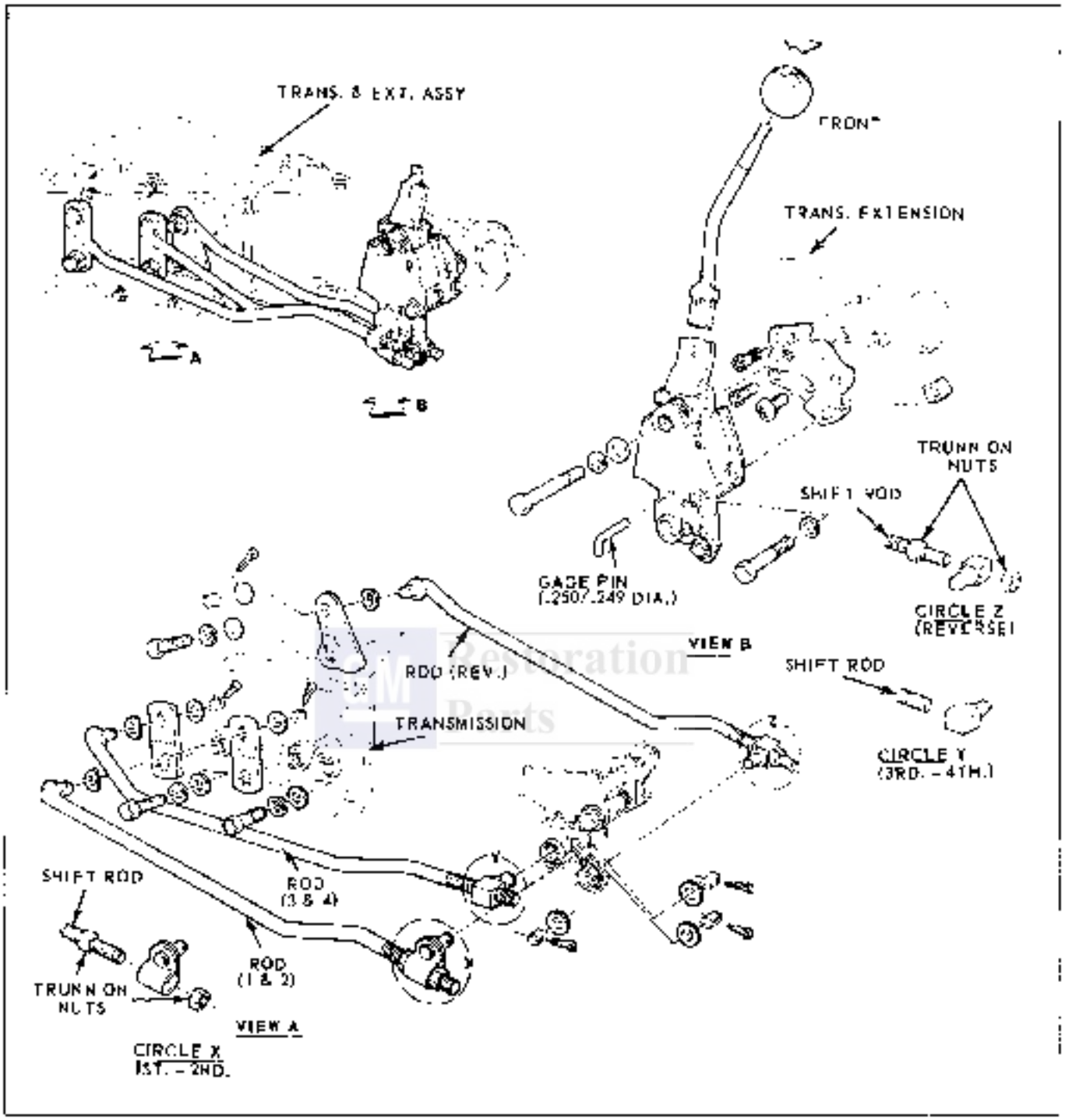


Fig. 7C-2 Firebird Shift Linkage

16. Remove filler plug and add 3 1/2 pints of SAE 90 or 90 multi-purpose gear lubricant.

MAJOR REPAIRS

TRANSMISSION—REMOVE

REFER TO SECTION 7B

TRANSMISSION—DISASSEMBLE

1. Drain lubricant.

2. Remove side cover attaching bolts, side cover and gasket.

3. Remove front bearing retainer and gasket.

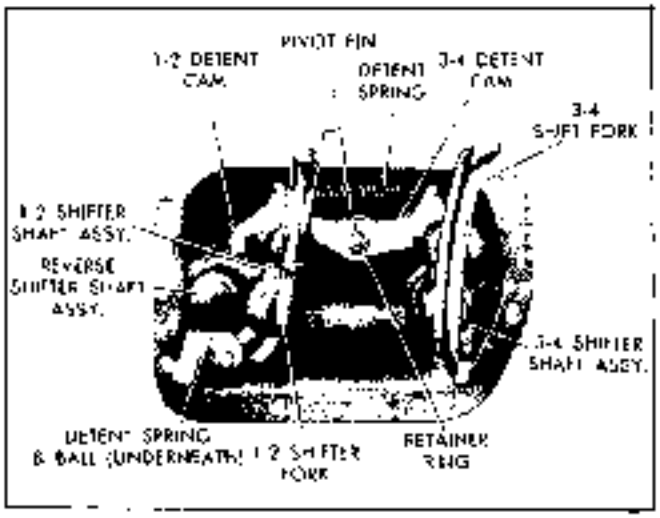


Fig. 7C-3 Side Cover Assy.

4. Remove front bearing to main drive gear snap ring.

5. Pull main drive gear out of case as far as possible and remove front bearing (Fig. 7C-6).

NOTE: Although front bearing is a slip fit on main drive gear, it may be necessary to aid removal with screwdriver.

6. Remove extension housing to case attaching bolts.

7. From rear of case, remove extension housing and mainshaft assembly (Fig. 7C-6).

8. Remove main drive gear and fourth speed blocking ring from inside of case and remove 14 bearing rollers from main drive gear.

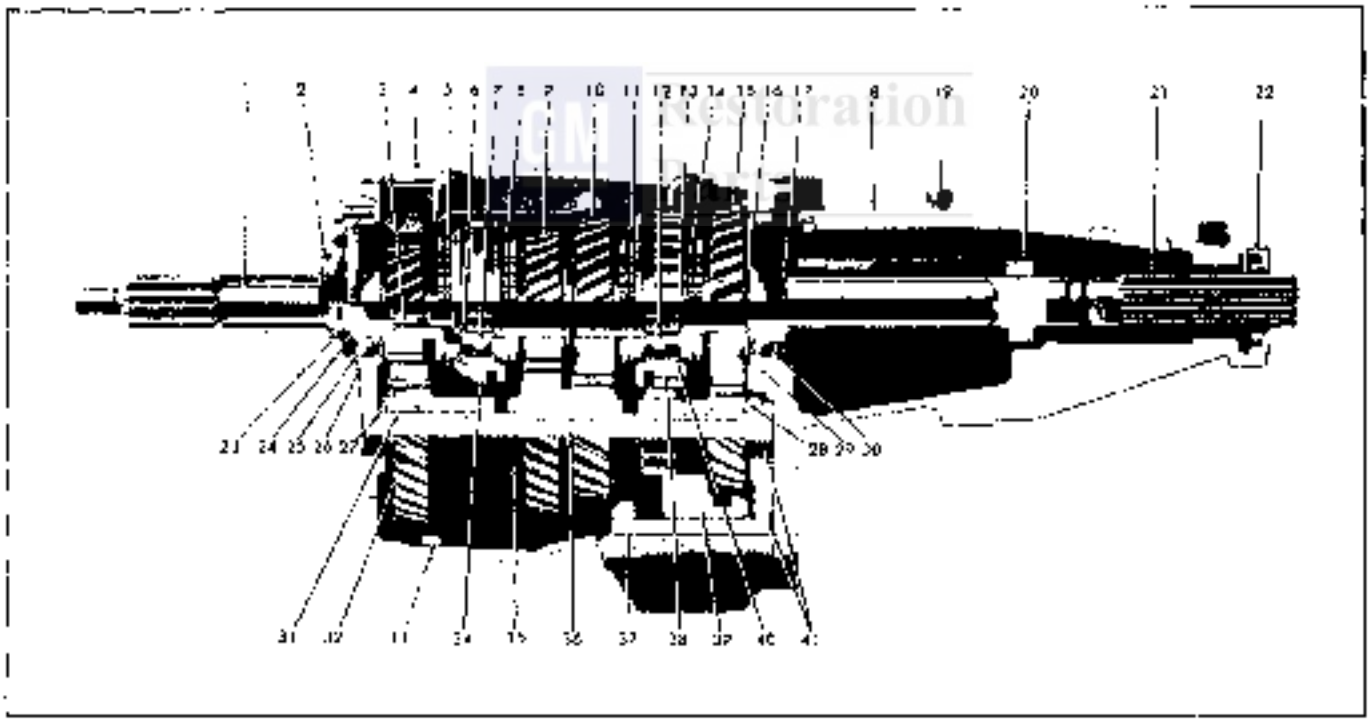


Fig. 7C-4 Saginaw Four Speed Transmission

1. Main Drive Gear
2. Front Bearing Retainer
3. Bearing Roller
4. Case
5. Fourth Speed Blocking Ring
6. Third and Fourth Synchronizer Snap Ring
7. Third and Fourth Synchronizer Hub
8. Blocking Ring
9. Third Speed Gear
10. Second Speed Gear
11. Blocking Ring
12. First and Second Synchronizer Hub
13. First and Second Synchronizer Snap Ring
14. First Speed Blocking Ring
15. First Gear
16. Reverse Gear Thrust and Spring Washer
17. Bearing To Mainshaft Snap Ring
18. Case Extension
19. Vent
20. Speedometer Drive Gear
21. Mainshaft
22. Rear Oil Seal
23. Bearing Retainer Oil Seal
24. Bearing To Gear Snap Ring
25. Front Bearing
26. Bearing To Case Snap Ring
27. Thrust Washer (Front)
28. Thrust Washer (Rear)
29. Bearing To Extension Snap Ring
30. Rear Bearing
31. Countergear Bearing Rollers
32. Anti-rattle Plate Assy.
33. Magnet
34. Third and Fourth Synchronizer Sleeve (Shifter)
35. Countergear Assy.
36. Countershaft
37. Reverse Idler Shaft
38. First and Second Speed Synchronizer Sleeve and Reverse Gear
39. Reverse Idler Gear
40. Clutch Keys
41. Woodruff Key

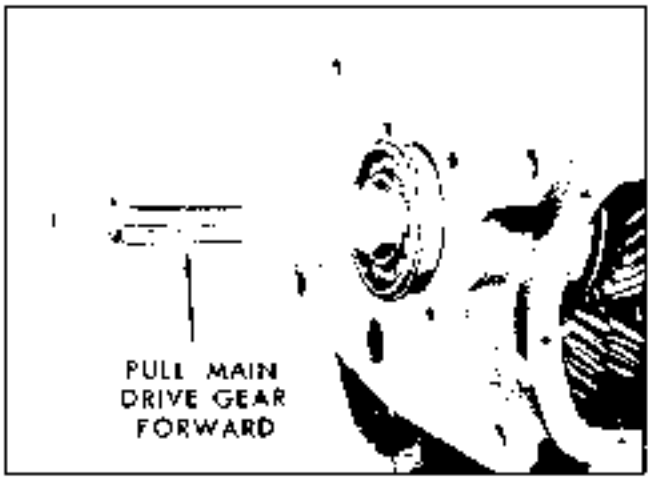


Fig. 7C-5 Removing Front Bearing

Fig. 7C-6 Removing Mainshaft

9. Using snap ring pliers, expand snap ring at rear of extension housing which retains extension housing to mainshaft (Fig. 7C-7) and remove extension housing.

10. Using countershaft alignment tool J 22246, tap out rounder gear shaft and its woodruff key through rear of case (Fig. 7C-8) and remove countergear and 2 tanged thrust washers.

At this point, tool J 22246 may be left in to hold the roller bearings in place or be taken out in which case 27 roller bearings and a spacer must be removed from each end of the shaft.

11. Remove reverse idler gear stop ring. Use a long drift or punch through the front bearing case bore and drive the reverse idler shaft and woodruff key through rear of the case (Fig. 7C-9).

12. Remove 3rd and 4th synchronizer snap ring (Fig. 7C-4).

13. Support third speed gear with press plates and press on front of mainshaft to remove synchronizer assembly, third gear blocker ring and third speed gear from mainshaft (Fig. 7C-10).

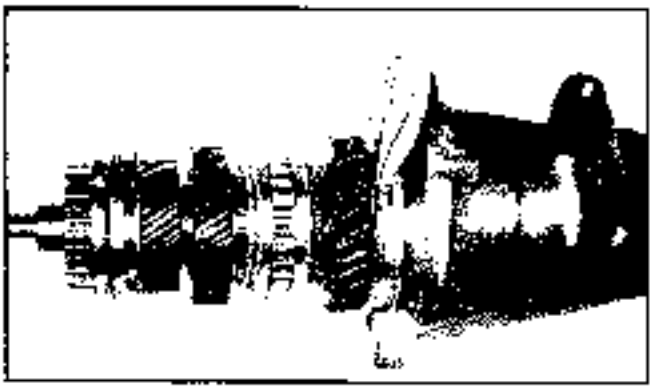


Fig. 7C-7 Expanding Extension Housing Snap Ring

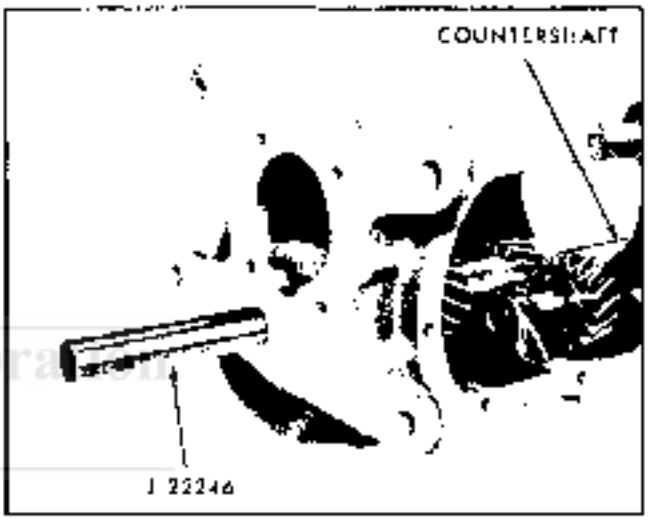


Fig. 7C-8 Removing or Installing Countershaft

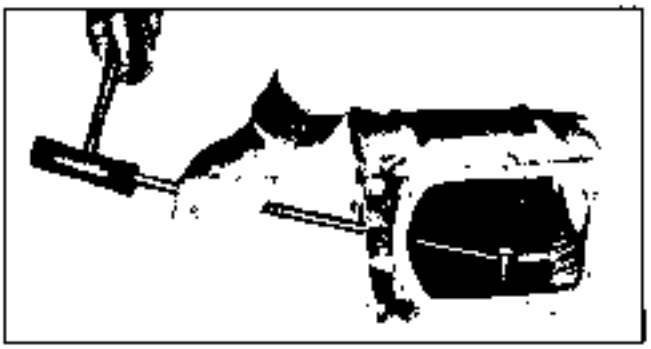


Fig. 7C-9 Removing Reverse Idler Gear Shaft

14. Remove rear bearing snap ring from mainshaft (Fig. 7C-4).

15. Support first gear with press plates and press on rear of main shaft to remove first gear, thrust washer, spring washer, rear bearing and snap ring (Fig. 7C-11).

16. Remove speedometer gear by depressing retainer clip and sliding gear off output shaft.

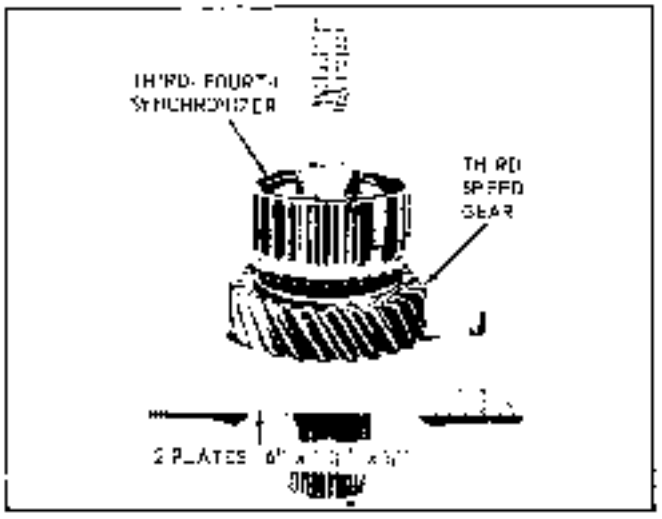


Fig. 7C-10 Removing Third and Fourth Synchronizer and Gear

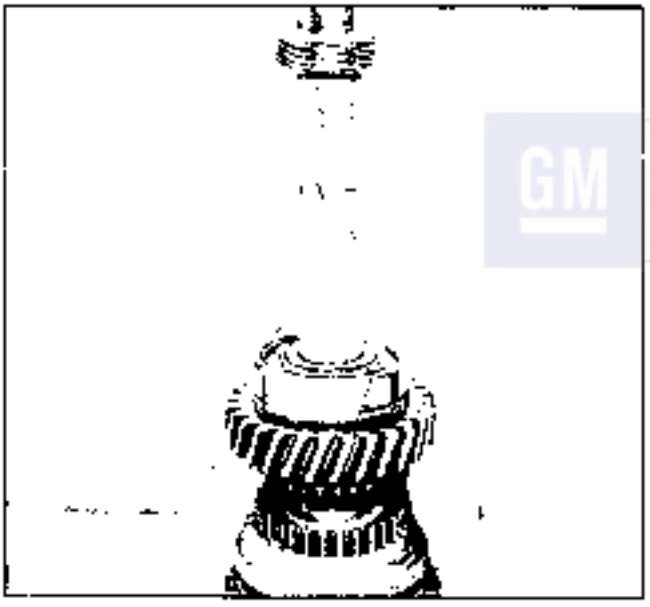


Fig. 7C-11 Removing Rear Bearing and First Speed Gear

11. Remove the 1st and 2nd synchronizer snap ring from mainshaft and press synchronizer assembly, 2nd speed blocker ring and second speed gear off end of mainshaft (Fig. 7C-12).

CLEANING AND INSPECTION

REFER TO SECTION 7B

TRANSMISSION—ASSEMBLE

MAINSHAFT—ASSEMBLE

Turn the front of the mainshaft upward and install the following components.

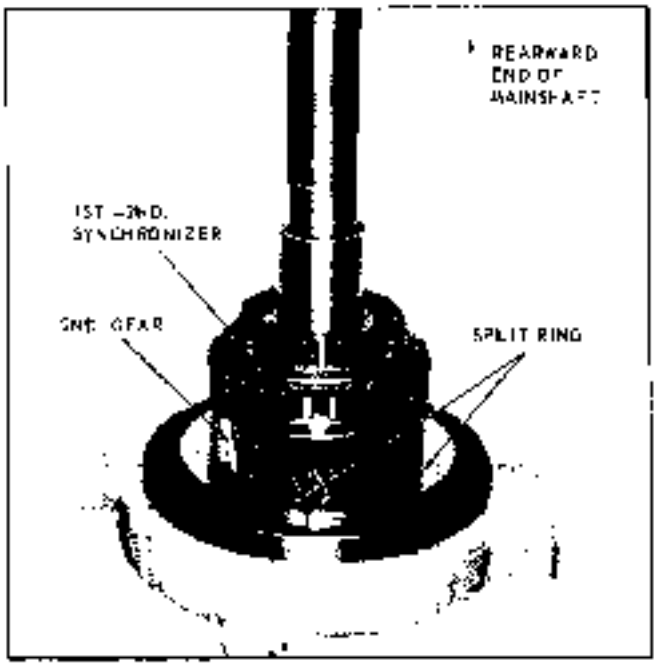


Fig. 7C-12 Removing 1st and 2nd Synchronizer and Second Gear

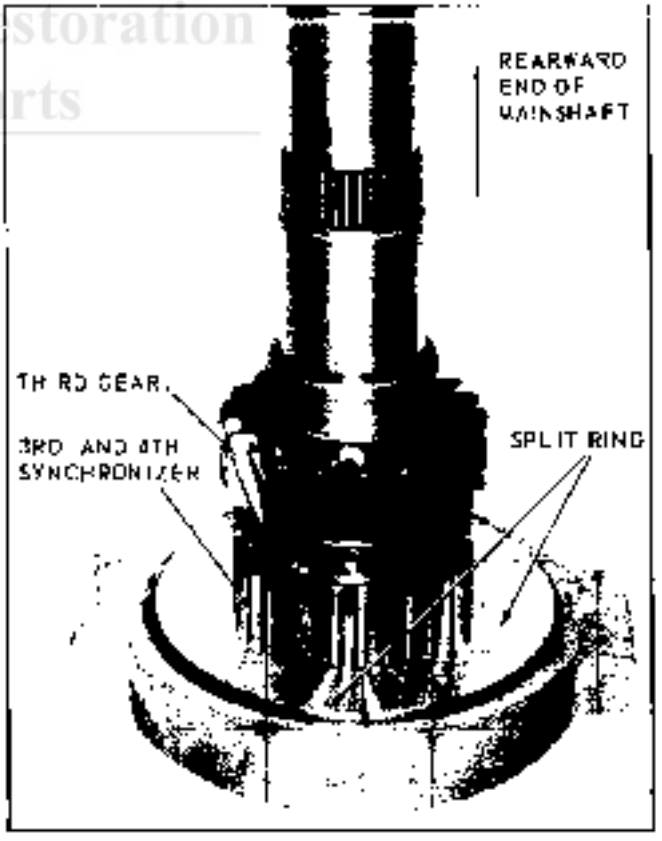


Fig. 7C-13 Installing 3rd and 4th Synchronizer and Third Gear

1. Install third speed gear with clutching teeth upward; rear face of gear will butt against the flange on the mainshaft.

2. Install a blocking ring with clutching teeth downward over synchronizing surface of the third speed gear.

NOTE: All 4 blocking rings in the transmission are the same and interchangeable.

3. Install 3rd and 4th synchronizer assemblies with the fork slot downward, pressing it onto splines on the mainshaft until it bottoms out (Fig. 7C-13).

CAUTION: Be sure the notches of the blocker ring align with the keys of the synchronizer assembly.

4. Install 3rd and 4th synchronizer snap ring. Both synchronizer snap rings are the same.

5. Turn the rear of the mainshaft upward and install second speed gear with clutching teeth upward; front of gear will butt against flange on mainshaft.

6. Install blocker ring with clutching teeth downward over synchronizing surface of second gear.

7. With fork slot downward, press 1st and 2nd synchronizer assemblies onto splines of mainshaft (Fig. 7C-14).

CAUTION: Be sure notches of blocker ring align with keys of synchronizer assembly.

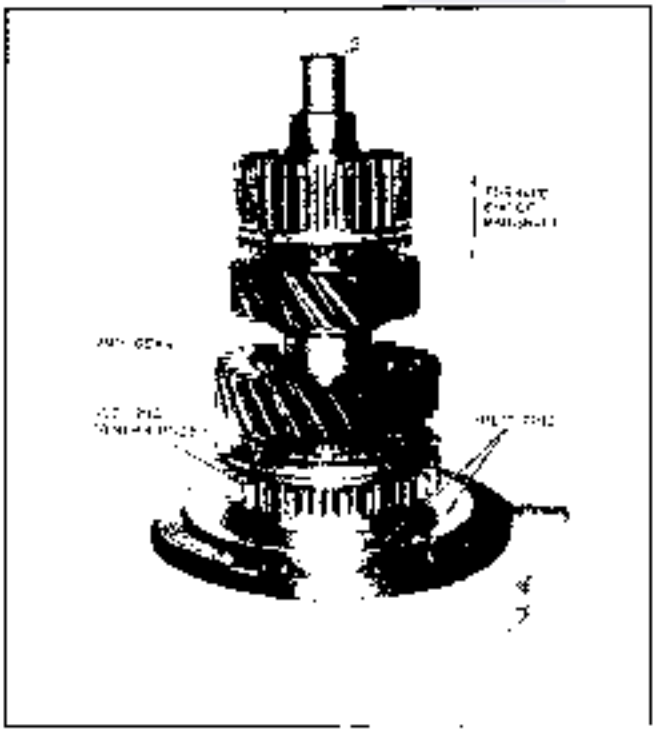


Fig. 7C-14 Installing 1st and 2nd Synchronizer and Second Gear

8. Install 1st and 2nd synchronizer snap ring (Fig. 7C-4).

9. Install blocker ring with notches downward so they align with keys of 1st and 2nd synchronizer assemblies.

10. Install thrust gear with clutching teeth downward.

11. Install first gear thrust washer (steel) and spring washer.

12. With snap ring slot downward, press rear bearing onto mainshaft (Fig. 7C-15).

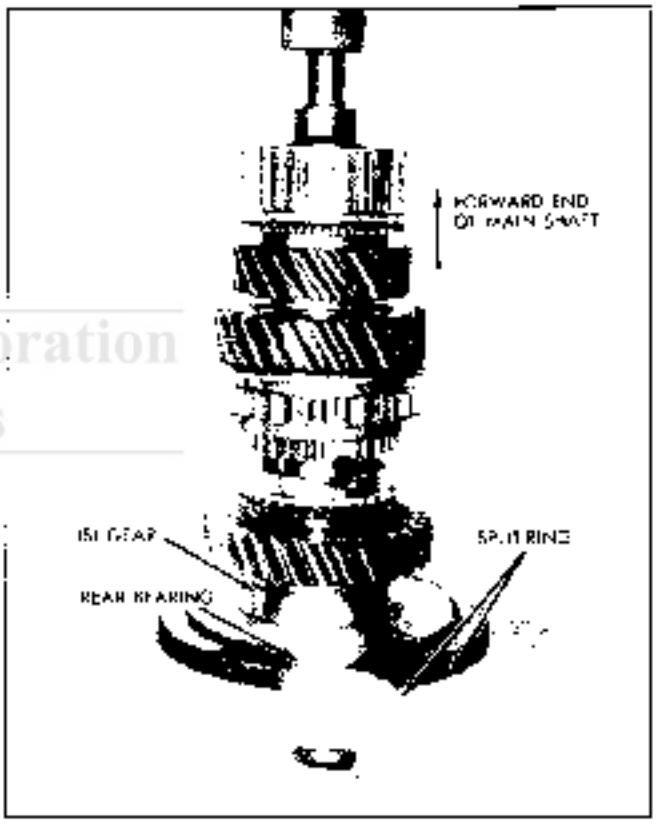


Fig. 7C-15 Installing Rear Bearing

13. Install rear bearing snap ring (Fig. 7C-4).

14. Place speedometer gear retainer on output shaft.

15. Align slot in speedometer drive gear with retainer clip and slide gear into place.

COUNTER GEAR—ASSEMBLE

Refer to Section 7B.

TRANSMISSION—ASSEMBLE

1. Install countergear to cast bronze thrust washer.

2. Install countergear assembly into case. Install countergear shaft from rear of case, making certain woodruff key is in position.

3. Install reverse idler gear, shaft and woodruff key from rear of case.

4. Install extension housing. Spread snap ring in housing to allow snap ring to drop around rear bearing (Fig. 7C-7). Press on end of mainshaft until snap ring engages groove in rear bearing.

5. Install fourteen (14) bearing rollers in main drive gear, using heavy grease to hold bearings in place (Fig. 7C-16).

6. Assemble fourth speed blocking ring on main drive gear.

7. Pilot main drive gear and fourth speed blocking ring over front of mainshaft.

CAUTION: Make certain notches in blocking ring align with keys in third-fourth synchronizer.

8. Using heavy grease, install rear bearing retainer to case gasket.

9. Install extension housing and mainshaft assembly into case. Install extension housing to case bolts, torquing to 45 lb. ft.

10. Install front bearing onto main drive gear. Outer snap ring groove must be toward front of gear.

11. Install retaining snap ring.

12. Install front bearing retainer, gasket and four attaching bolts, torquing bolts to 10 lb. ft.

NOTE: The retainer oil return hole must be at bottom of case.

Fig. 7C-16 Loading Bearings Into Main Drive Gear

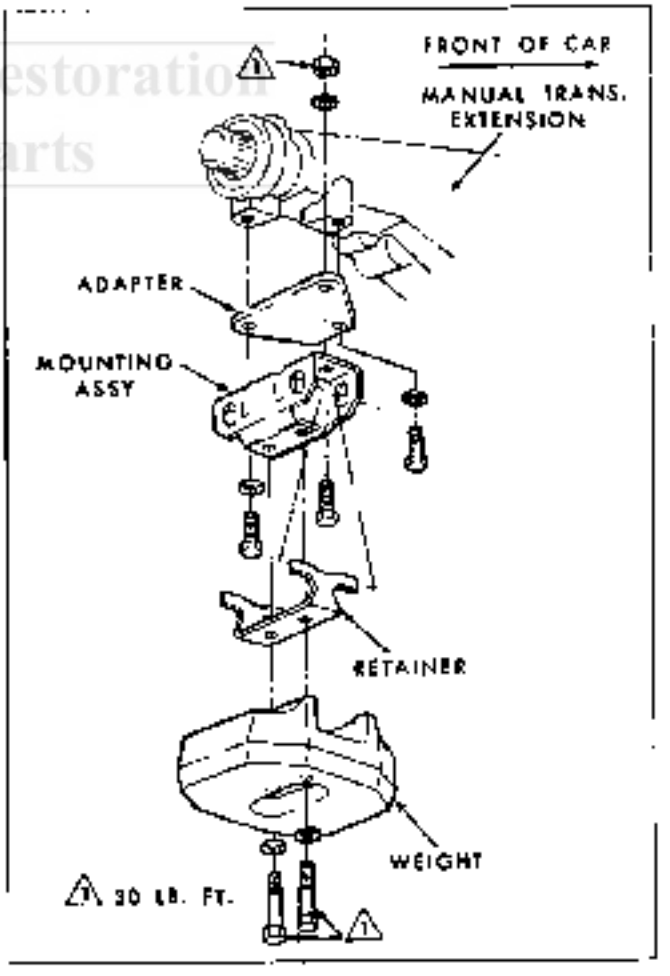


Fig. 7C-17 Drive Line Damper

13. Install new side cover gasket, place transmission in neutral and install side cover. Secure with attaching bolts and torque evenly to 20 lb. ft. to avoid side cover distortion.

TRANSMISSION—INSTALL IN VEHICLE

REFER TO SECTION 7B

DRIVELINE DAMPER—FIREBIRD ONLY

A driveline damper is used to reduce power train vibration to an acceptable level. The damper is mounted under the rear of the transmission extension and consists of a weight retained by a mounting which, in turn, is attached to the underside of the transmission extension through an adapter (Fig. 7C-17).

SPECIFICATIONS

TRANSMISSION IDENTIFICATION

An identifying code is marked in yellow paint on all four speed manual transmissions. This code consists of two letters, one inch high, on the RH side of the case.

The letters FS identify the Tempest Saginaw four-speed and FH identifies the Firebird Saginaw four-speed.

The vehicle identification number is also stamped on the transmission case as shown in Fig. 7C-18.

GEAR RATIOS

Tempest	Firebird	
2.85:1	3.11:1	first
2.02:1	2.20:1	second
1.35:1	1.47:1	third
1.00:1	1.00:1	fourth
2.85:1	3.11:1	reverse

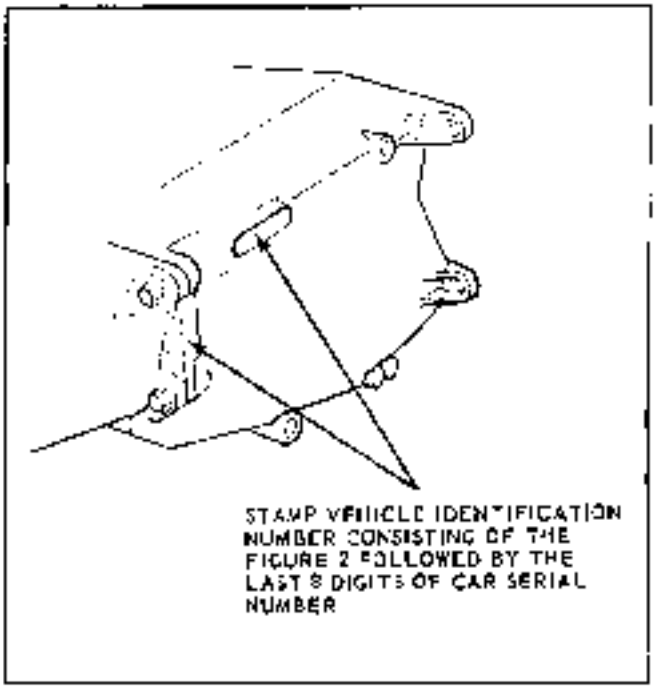


Fig. 7C-18 Vehicle Identification Number Location

LUBRICATION

Capacity . . . . . 3 1/2 pints

TORQUE SPECIFICATIONS

Application	Lb. Ft.
Front Bearing Retainer to Case Bolts . .	20
Side Cover to Case Bolts	20
Extension Housing to Case Bolts	45
Shift Lever to Shifter Shaft Bolts	30
Lubrication Filler Plug	15
Transmission Case to Flywheel Housing Bolts	55

SPECIAL TOOLS

Refer to Section 7B.

FOUR SPEED MUNCIE MANUAL TRANSMISSION

CONTENTS OF THIS SECTION

DESCRIPTION

The Muncie 4-speed transmission is used with all right cylinder engines when a 4-speed transmission is specified. It can be distinguished from the Saginaw 4-speed in that the reverse lever on the Muncie is mounted in the extension housing where on the Saginaw it is mounted in the side cover.

PERIODIC SERVICE

TRANSMISSION

No periodic service of the transmission is required except checking for leaks and proper lubricant level every 30 days.

If there is evidence of leakage, the leak should be corrected and lubricant added, if needed. Refill capacity is 2 1/2 pints.

Remove filler plug at side of case and add SAE 90 multi-purpose gear lubricant. Lubricant level should be approximately level with bottom of filler plug hole. Install plug.

SHIFT CONTROL

No periodic service of the shift control is required. Certain parts are lubricated on assembly and require further lubrication only when parts become dry and sticky.

ADJUSTMENTS ON CAR

SHIFT LINKAGE ADJUSTMENT (Figs. 7D-1, 7D-2, 7D-3)

1. Position selector lever in neutral position.

2. Loosen trunnion nuts on transmission gearshift control rods.

3. Place transmission bracket and lever assembly in neutral position and install gauge pin (View B).

Without console: Shift lever on car will be centrally located in floor boot.

4. Position levers on transmission in neutral.

5. Retorque trunnion nuts to 30 lb. ft.

6. Remove gauge pin and check complete shift pattern.

MINOR REPAIRS

SPEEDOMETER DRIVEN GEAR—REMOVE

1. Disconnect speedometer cable.

2. Remove retainer to housing bolt and lockwasher and remove retainer.

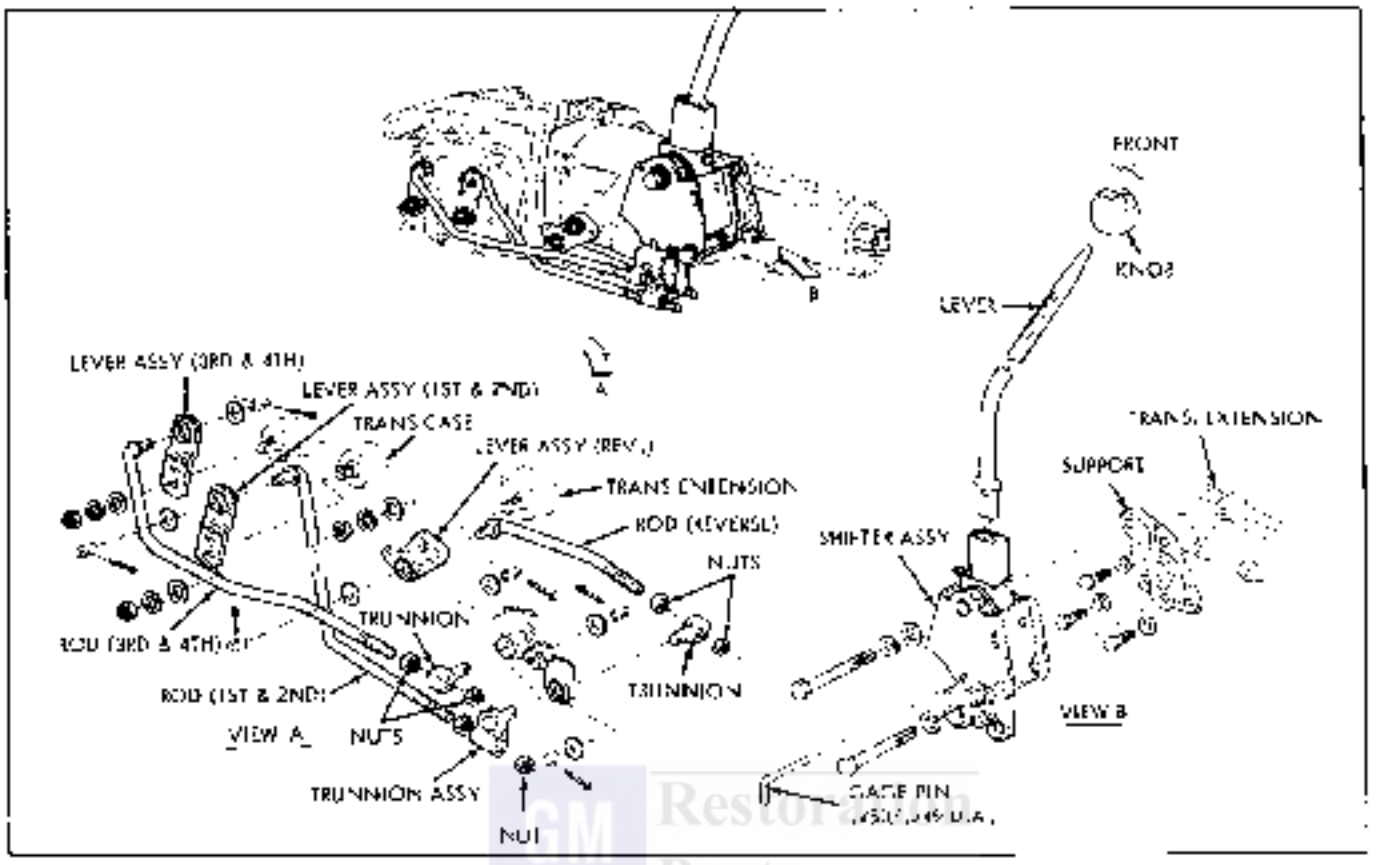


Fig. TD-1 Pontiac Shift Controls

3. Insert screwdriver in slot in fitting and pry fitting, gear and shaft from housing.

4. Pry O ring from groove in fitting and discard.

5. Check gear, shaft and fitting for wear and replace, if necessary.

NOTE: Check for correct usage by referring to speedometer drive and driven gear usage chart in Section 0.

SPEEDOMETER DRIVEN GEAR—INSTALL

1. Install new O-ring in groove and insert shaft.

2. Hold the assembly so slot in fitting is toward boss on housing and install in housing.

3. Push fitting into housing until retainer can be inserted into slot.

4. Install retainer bolt and lockwasher and tighten to 4 lb. ft. torque.

5. Connect speedometer cable to speedometer driven gear and sleeve assembly.

TRANSMISSION EXTENSION OIL SEAL—REMOVE AND INSTALL

To inspect or replace the rear extension oil seal, it is necessary to remove the propeller shaft assembly from the vehicle.

1. Remove U-bolt nuts, lock plates (or lockwashers) and U-bolts from rear axle drive pinion flange.

NOTE: If the wire has been removed, use rubber band to hold bearings onto journals to prevent loss of needle bearings when rear joint is disconnected.

2. Slide propeller shaft assembly rearward to disengage yoke from splines on transmission mainshaft.

3. Use punch or other suitable tool and loosen oil seal from extension, remove and discard (Fig. TD-4).

4. Wash counterbore with cleaning solvent and inspect for damage.

5. Inspect propeller shaft yoke for nicks, burrs or scratches which would cut new seal or cause seal to leak or damage bushing.

6. Coat new seal with sealing compound and press

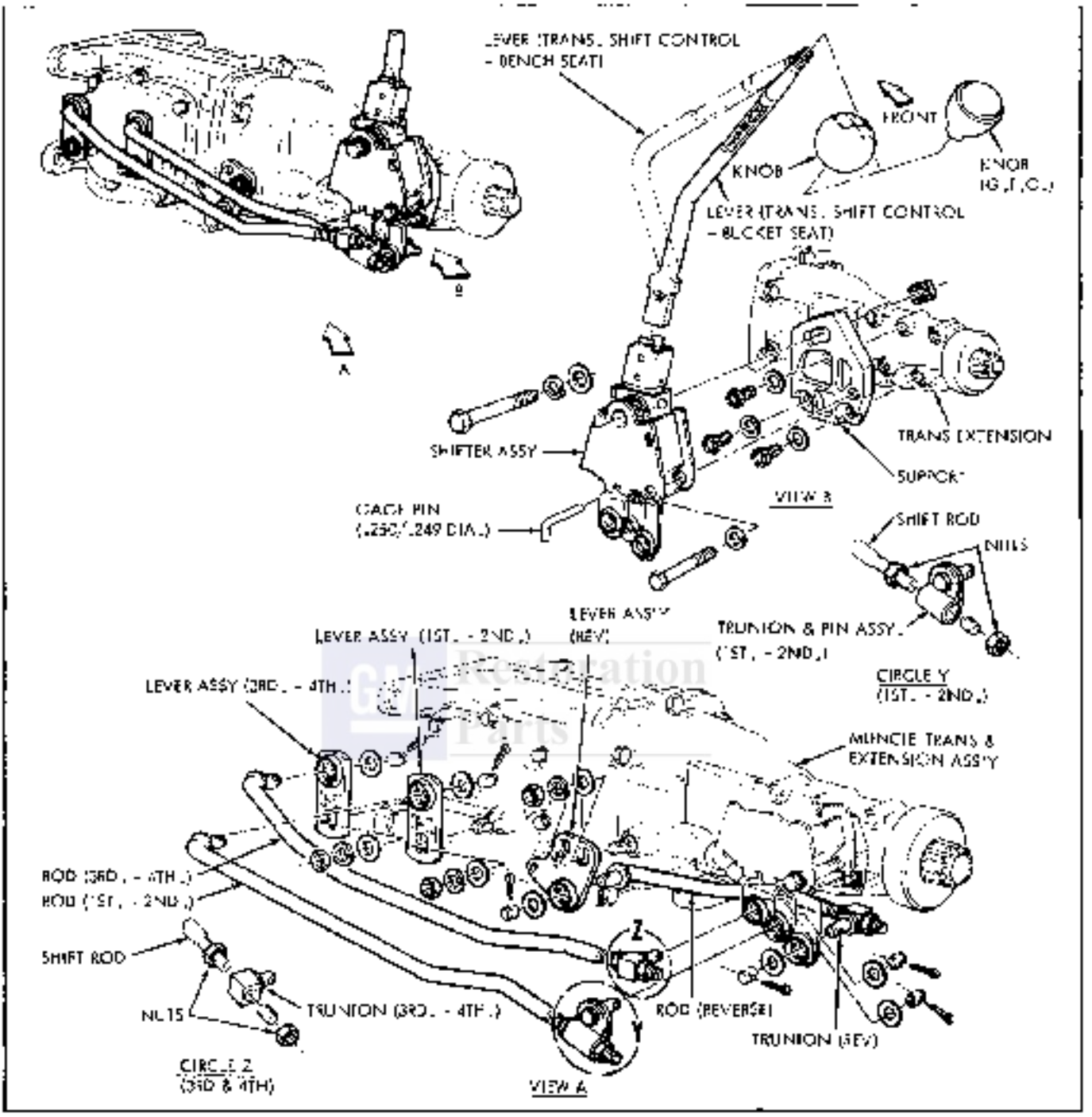


Fig. TD-2 Tempest Shift Controls

straight into bore of case extension with J 5154-A (Fig. TD-5).

CAUTION: Do not excessively force the seal against the seat in the extension.

7. Install propeller shaft assembly by reversing steps 1 and 2 above. Coat outside diameter of yoke with gear lubricant before assembly.

TRANSMISSION SIDE COVER— REMOVE AND DISASSEMBLE

It is not necessary to remove transmission from vehicle for inspection or replacement of parts in transmission side cover assembly, but the side cover assembly itself must be removed from transmission case.

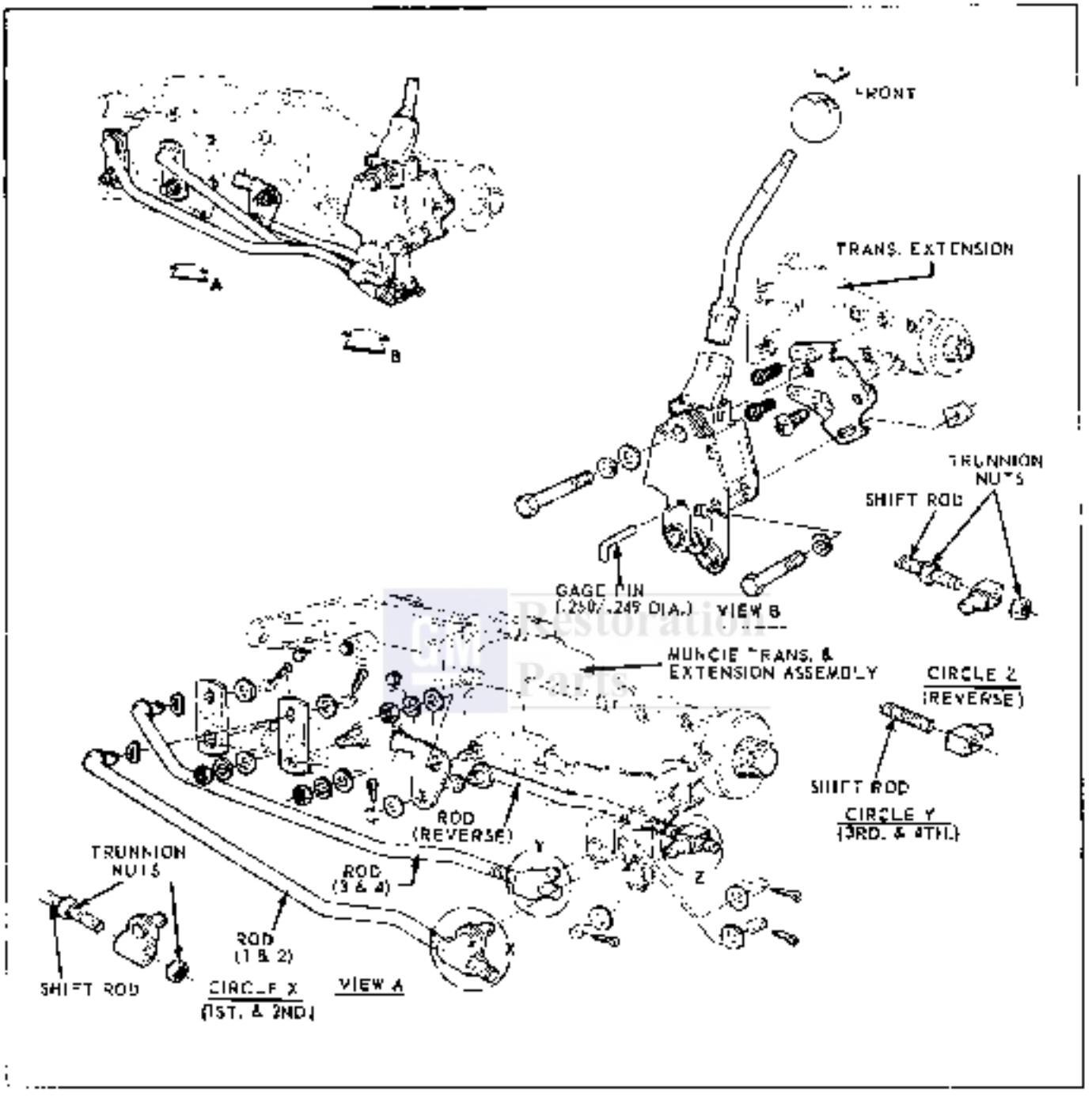


Fig. 7D-3 Firebird Shift Controls

1. Disconnect control rods from levers.

2. Shift transmission into second speed before removing cover, by moving 1-2 (rear) shifter lever into forward detent position.

3. Loosen side cover bolts and allow transmission to drain.

4. Remove transmission side cover assembly from transmission case (Fig. 7D-6).

5. Remove outer shifter lever nuts, lockwashers and flat washers. Pull levers from shafts.

6. Remove both shift forks from the shifter shaft and detent plate assemblies. Remove both shifter shaft assemblies from cover. Lip seals in side cover may now be pryed out if replacement is required because of damage (Fig. 7D-7).

7. Remove detent cam spring and pivot retainer C-ring. Remove both detent cams.

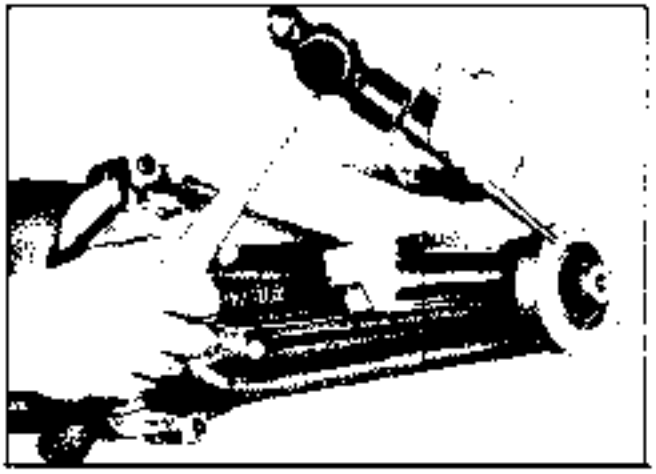


Fig. 7D-4 Removing Extension Oil Seal

Fig. 7D-5 Installing Extension Oil Seal

8. Inspect and replace necessary parts.

TRANSMISSION SIDE COVER—ASSEMBLE AND INSTALL

1. Install 1-2 detent cam to cover pivot pin first, then install 3-4 detent cam so the detent spring notches are offset or opposite each other. Detent cam notches must be facing downward.

2. Install detent cam retaining C-ring to pivot shaft and hook spring into detent cam notches.

3. Install both shifter shaft assemblies in cover, being careful not to damage lip seals. Install both shift forks to detent plates, lifting up on detent cam to allow forks to fully seat into position.

4. Install outer shift levers, flat washers, lockwashers and nuts, torquing to 30 lb. ft.

5. Shift 1-2 shifter lever into second speed (forward) position. Position cover gasket on case.

NOTE: When installing new gasket, do not coat with grease.

6. Carefully position side cover into place, making sure the shift forks are aligned with their respective mainshaft clutch sliding sleeves (Fig. 7D-6).

7. Install cover attaching bolts and tighten evenly to 18 lb. ft. torque.

8. Remove filler plug at side of transmission and add 2 1/2 pints of SAE 80 multi-purpose gear lubricant. Lubricant level should be approximately level with bottom of filler hole. Install and tighten plug to 30 lb. ft. torque.

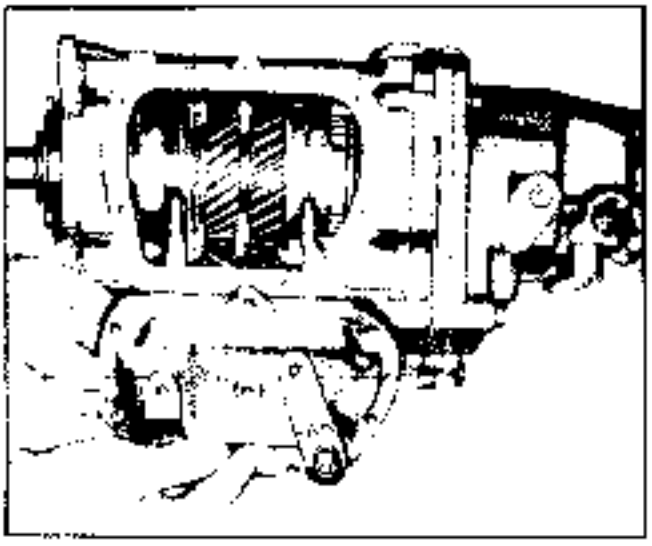


Fig. 7D-6 Removing and Installing Side Cover

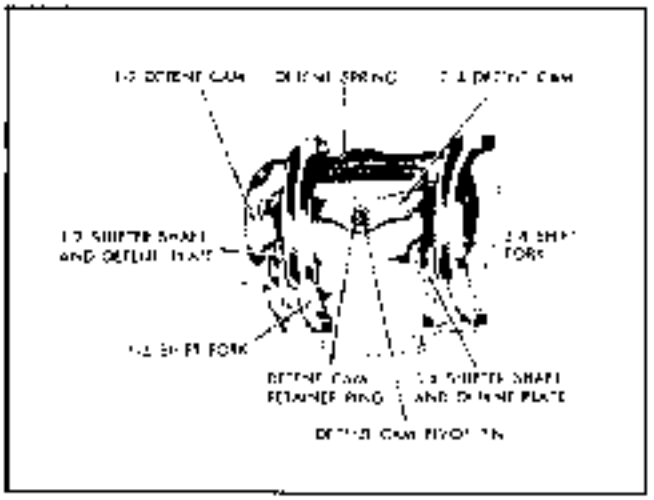
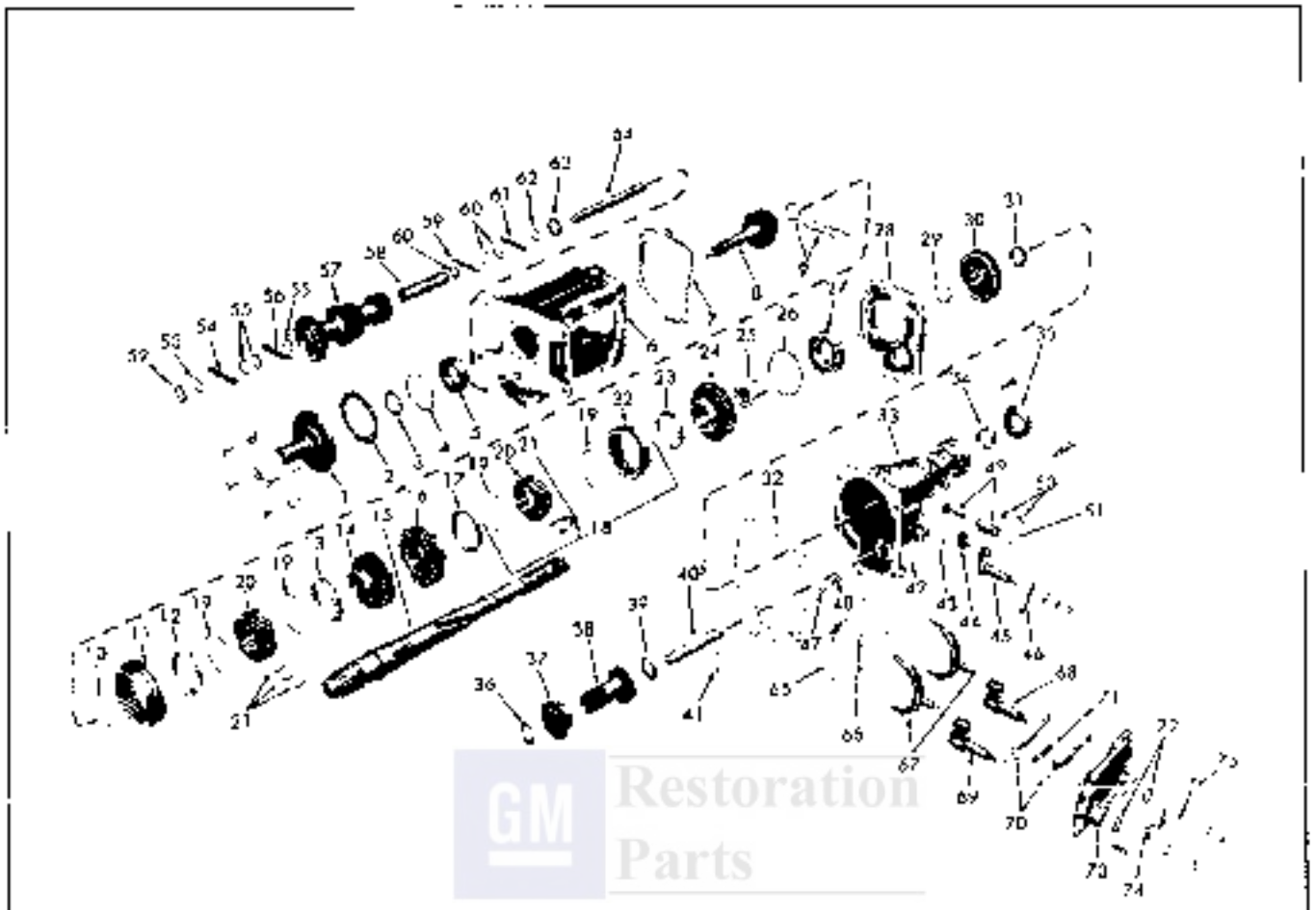


Fig. 7D-7 Transmission Side Cover



1. Bearing Retainer
2. Gasket
3. Bearing Retaining Nut
4. Bearing Snap Ring
5. Main Drive Gear Bearing
6. Transmission Case
7. Rear Bearing Retainer Gasket
8. Main Drive Gear
9. Bearing Rollers (17) and Cage
10. Snap Ring
11. Third and Fourth Speed Clutch Sliding Sleeve
12. Fourth Speed Gear Synchronizing Ring
13. Third Speed Synchronizing Ring
14. Third Speed Gear
15. Mainshaft
16. Second Speed Gear
17. Second Speed Gear Synchronizing Ring
18. First and Second Speed Clutch Assy.
19. Clutch Key Springs
20. Clutch Hubs
21. Clutch Keys
22. First and Second Speed Clutch Sliding Sleeve
23. First Speed Gear Synchronizing Ring
24. First Speed Gear
25. First Gear Sleeve
26. Rear Bearing Snap Ring
27. Rear Bearing
28. Rear Bearing Retainer
29. Selective Fit Snap Ring
30. Reverse Gear
31. Speedometer Drive Gear
32. Rear Bearing Retainer to Case Extension Gasket
33. Case Extension
34. Extension Bushing
35. Rear Oil Seal
36. Reverse Idler Front Thrust Washer (Tanged)
37. Reverse Idler Gear (Front)
38. Reverse Idler Gear (Rear)
39. Flat Thrust Washer
40. Reverse Idler Shaft
41. Reverse Idler Shaft Roll Pin
42. Reverse Shifter Shaft Lock Pin
43. Reverse Shifter Shaft Lip Seal
44. Reverse Shift Fork
45. Reverse Shifter Shaft and Detent Plate
46. Reverse Shifter Lever
47. Reverse Shifter Shaft-Detent Ball
48. Reverse Shifter Shaft Ball Detent Spring
49. Speedometer Driven Gear and Fitting
50. Retainer and Bolt
51. O-Ring Seal
52. Tanged Washer
53. Spacer (.050")
54. Bearing Rollers (28)
55. Spacers (.050")
56. Bearing Rollers (28)
57. Countergear
58. Countergear Roller Spacer
59. Bearing Rollers (28)
60. Spacers (.050")
61. Bearing Rollers (28)
62. Spacer (.050")
63. Tanged Washer
64. Countershaft
65. Gasket
66. Detent Cams Retainer Ring
67. Forward Speed Shift Forks
68. First and Second Speed Gear Shifter Shaft and Detent Plate
69. Third and Fourth Speed Gear Shifter Shaft and Detent Plate
70. Detent Cams
71. Detent Cam Spring
72. Lip Seals
73. Transmission Side Cover
74. Third and Fourth Speed Shifter Lever
75. First and Second Speed Shifter Lever

Fig. 7D-8 Exploded View of a Four Speed Muncie Manual Transmission

MAJOR REPAIRS

TRANSMISSION—REMOVE

1. Remove drain plug at bottom of transmission and drain lubricant.

2. Disconnect the speedometer cable from speedometer driven gear fitting and disconnect back-up light leads from back-up light switch.

3. Disconnect shift control rods from shifter levers. Remove two levers and bracket to extension support screws and remove manual shift lever and bracket.

4. Remove propeller shaft drive line assembly.

a. Remove U-bolt nuts, lock plates and U-bolts from rear axle drive pinion flange.

b. Use rubber band to hold bearing onto journals, if the wire has been removed, to prevent loss of needle bearings when rear joint is disconnected.

c. Remove complete drive line assembly by sliding rearward to disengage yoke from splines on transmission mainshaft.

5. Support rear of engine and remove two transmission extension insulator to cross member support retaining bolts (see Section 6).

6. Remove the two top transmission to clutch housing bolts and insert two transmission aligning studs J 1126 in these holes.

NOTE: The use of two aligning studs during this operation will support the transmission and prevent damage to the clutch disc through springing.

7. Remove the two lower transmission to clutch housing bolts.

8. Tilt rear of extension upward to disengage bracket studs from cross member support and withdraw transmission from clutch housing.

9. Remove the transmission.

TRANSMISSION—DISASSEMBLE

1. Remove transmission side cover assembly from transmission case.

NOTE: If cover assembly is to be disassembled for inspection or replacement of worn parts, follow procedures 2 through 8 under TRANSMISSION SIDE COVER - REMOVE AND DISASSEMBLE, page 7D-4.

2. Remove insulator assembly from transmission rear extension.

3. Remove four bolts from front bearing retainer and remove retainer and gasket.

4. Remove the main drive gear retaining nut (Fig. 7D-9), using tool J 933 after locking up transmission by shifting into two gears.

Fig. 7D-9 Removing Main Drive Gear Retaining Nut

NOTE: Nut has left hand threads.

5. With transmission gears in neutral, drive lock pin from bottom side of reverse shifter lever boss and pull shaft out about 1/8". This disengages the reverse shift fork from reverse gear (Fig. 7D-10).

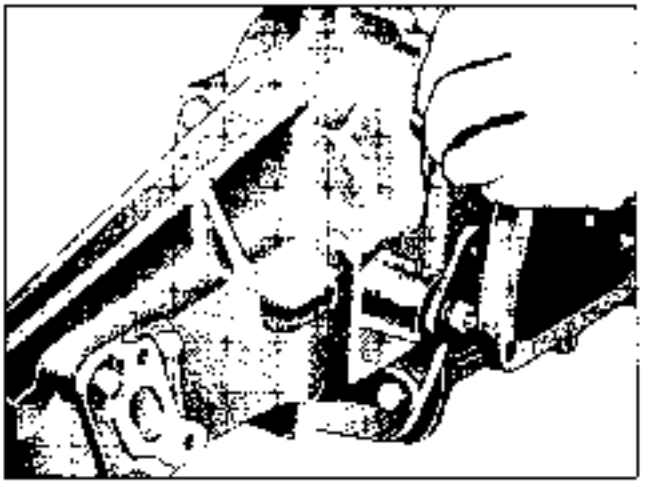


Fig. 7D-10 Removing Reverse Shifter Shaft Lock Pin

6. Remove six bolts attaching the case extension to the rear bearing retainer. Tap extension with soft hammer in a rearward direction to start. When the reverse idler shaft is out as far as it will go, move extension to left so reverse fork clears reverse gear and remove extension and gasket.

7. The rear section of the reverse idler gear, roll pin, shaft and tanged thrust washer may now be removed.

8. Remove speedometer gear by depressing retainer clip and sliding gear off output shaft.

9. Slide 3-4 synchronizer clutch sleeve to 4th speed position (forward) before trying to remove mainshaft assembly from case (Fig. 7-11).

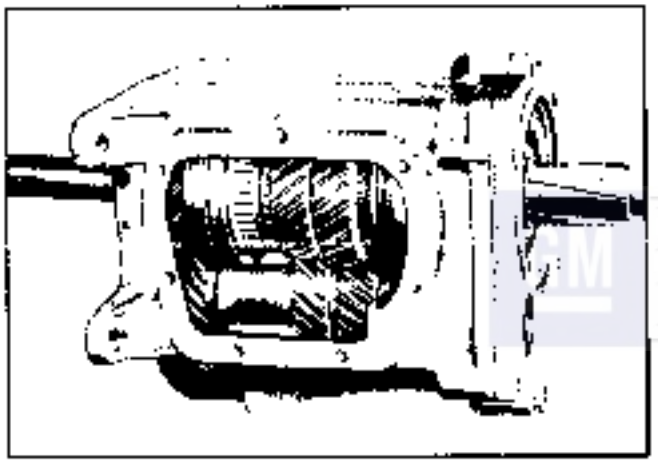


Fig. 7D-11 3rd and 4th Speed Synchronizer Sleeve in 4th Gear Position

10. Carefully remove the rear bearing retainer and mainshaft assembly from the case by tapping bearing retainer with a soft hammer.

11. Unload 17 bearing rollers and cage from main drive gear and remove fourth speed synchronizing ring.

12. Lift the front reverse idler gear and thrust washer from case.

13. With soft hammer, tap main drive gear down from front bearing as shown in Fig. 7D-12.

14. From inside case, tap out front bearing and snap ring.

15. From the front of the case, tap out the countershaft, using loader J 22379 as shown in Fig. 7D-13. Remove the countergear and both tanged washers. Remove loader J 22379 from countergear.

16. Remove the 112 rollers, six .050" spacers and roller spacer from countergear (Fig. 7D-8).

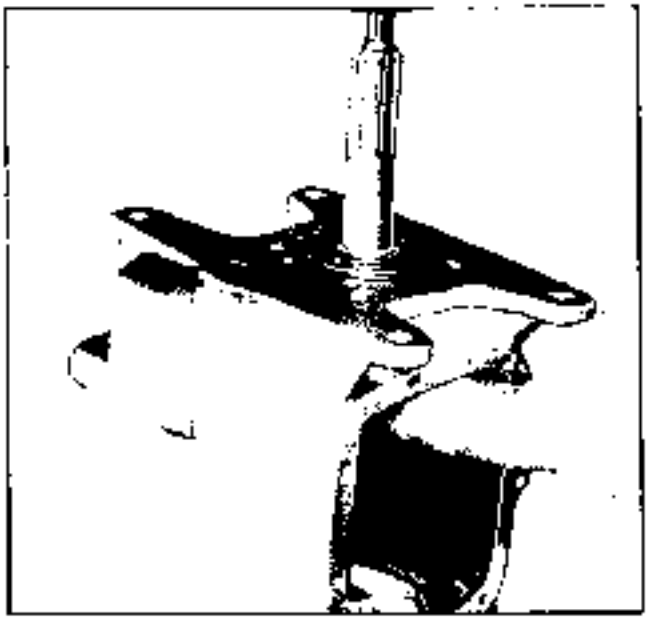


Fig. 7D-12 Removing Main Drive Gear

17. Remove mainshaft front snap ring, using J 6125 as shown in Fig. 7D-14, and slide third and fourth speed clutch assembly, third speed gear and synchronizing ring from front of mainshaft.

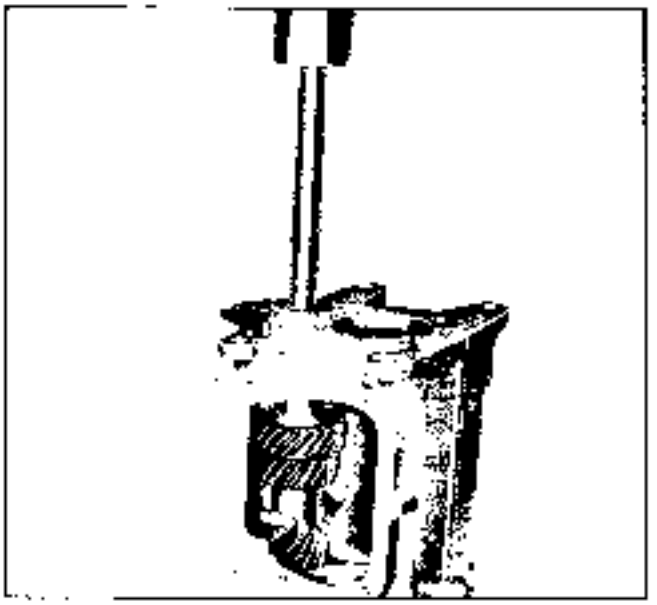


Fig. 7D-13 Removing Countershaft with J 22379

18. Spread rear bearing retainer snap ring and press mainshaft out of the retainer (Fig. 7D-15).

19. Remove mainshaft rear snap ring. Support second speed gear and press on rear of mainshaft to remove rear bearings, first speed gear and sleeve, first speed synchronizing ring, 1-2 syn-

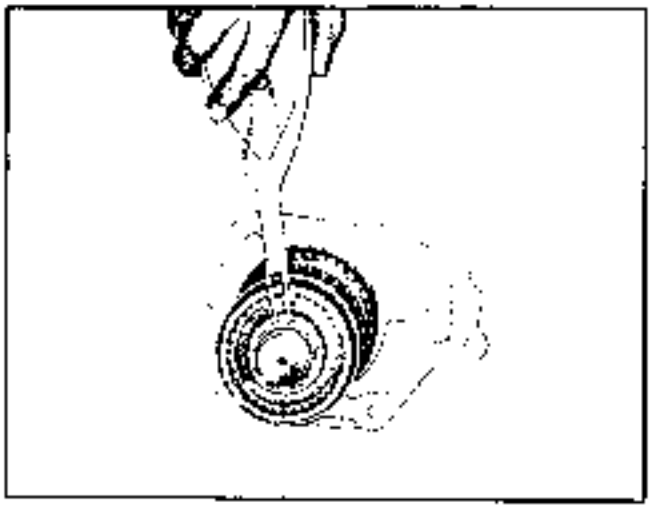


Fig. 7D-14 Removing Mainshaft From Snap Ring using J 932

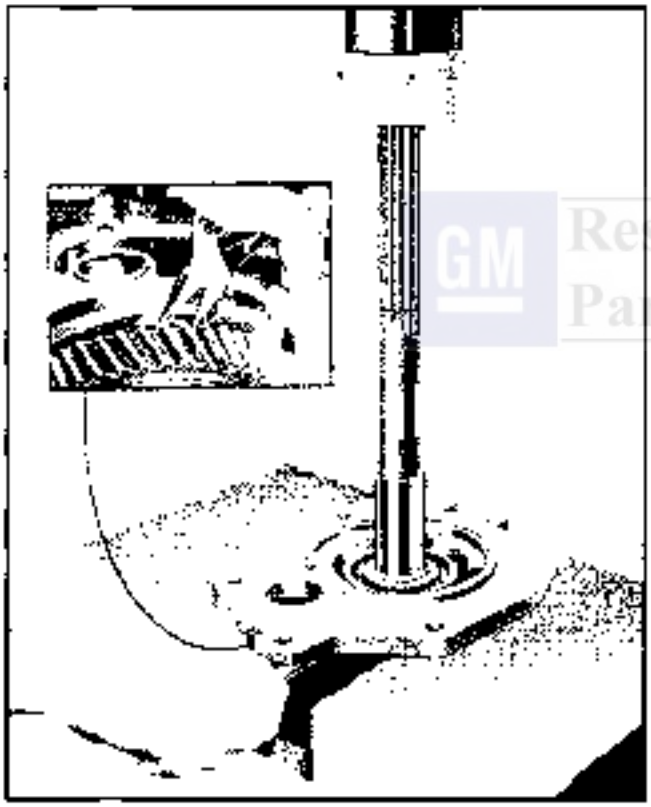


Fig. 7D-15 Pressing Mainshaft from Rear Bearing Retainer

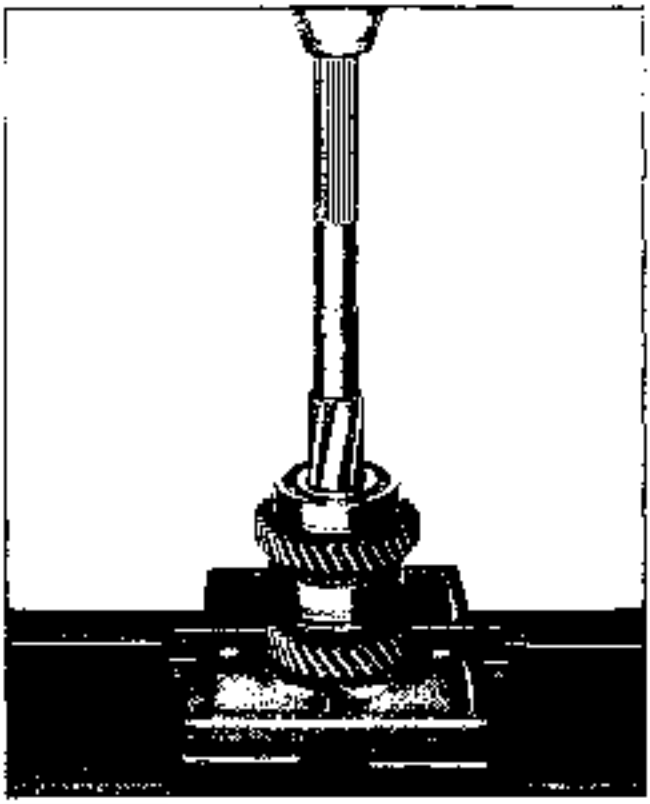


Fig. 7D-16 Pressing Mainshaft from First and Second Speed Gears

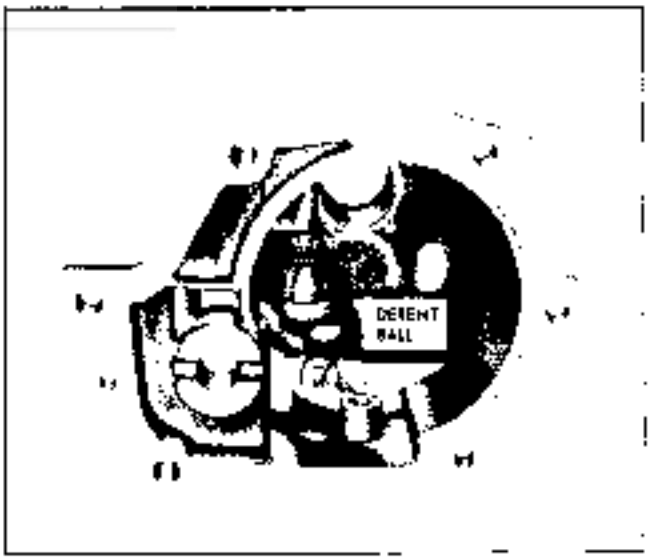


Fig. 7D-17 Installing Reverse Shifter Shaft and Detent Ball

chronizer clutch assembly, second speed synchronizing ring and second speed gear from the mainshaft (Fig. 7C-16).

REVERSE SHIFTER SHAFT AND SEAL— REMOVE AND INSTALL

1. With case extension removed from transmission, the reverse shifter shaft lock pin will already be removed (see step 5 under Transmission-Disassemble).

2. Remove shift fork.

3. Carefully drive shifter shaft into case extension, allowing ball detent to drop into case. Remove shaft, ball detent spring and ball detent.

4. Place ball detent spring into detent spring hole and, from inside of extension, install shifter shaft

fully into its opening until the detent plate is butted against inside of extension housing.

5. Place detent ball on spring and, holding ball down with a suitable tool, push shifter shaft into place and turn until ball drops into place in detent on the shaft detent plate (Fig. 7C-17).

6. Install shift fork.

NOTE: Do not drive the shifter shaft lock pin into place until the extension has been installed on the transmission case.

TRANSMISSION EXTENSION CASE BUSHING AND OIL SEAL—REMOVE AND INSTALL

1. Remove oil seal with punch or other suitable tool and discard seal (Fig. 7D-4).

2. Using tool J 6399, drive bushing forward into case extension (Fig. 7D-18).

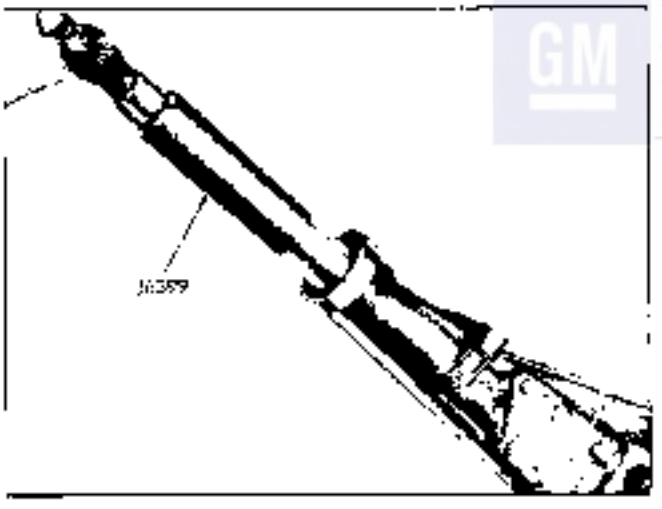


Fig. 7D-18 Removing or Installing Extension Case Bushing

3. Drive new bushing in from rear of case extension with same tool (J 6399), until end of bushing is slightly below counterbore for oil seal.

4. Coat I.D. of bushing with transmission oil, new seal with sealing compound and start straight into bore of case extension. Using installer J 5154-A, tap seal into extension case (Fig. 7D-5).

CAUTION: Do not excessively force the seal against the seat in the extension.

CLUTCH KEYS AND SPRING—REMOVE AND INSTALL

NOTE: The clutch hubs and sliding sleeves are a selected assembly and should be kept together as originally assembled, but the three keys and two springs may be replaced if worn or broken.

1. Push the hub from the sliding sleeve. The keys will fall free and the springs may be easily removed.

2. Place the two springs in position (one on each side of the hub), so a tanged end of each spring falls into the same keyway in the hub. Place the keys in position and, holding them in place, slide the hub into the sleeve.

CLEANING AND INSPECTION

TRANSMISSION CASE

Wash the transmission case inside and out with a cleaning solvent and inspect for cracks. Inspect the front face which fits against clutch housing for burrs. If any are present, dress them off with a fine cut mill file.

FRONT AND REAR BEARINGS

1. Wash the front and rear bearings thoroughly in a cleaning solvent.

2. Blow out bearings with compressed air.

CAUTION: Do not allow the bearings to spin; turn them slowly by hand. Spinning bearings will damage the race and balls.

3. Make sure the bearings are clean, then lubricate them with light engine oil and check them for roughness. Roughness may be determined by slowly turning the outer race by hand.

BEARING ROLLERS AND SPACERS

All main drive gear and countergear bearing rollers should be inspected closely and replaced if they show wear. Inspect countershaft at the same time and replace if necessary. Replace all worn spacers.

GEARS AND BUSHING

Inspect all gears and first speed gear bushing and, if necessary, replace all that are worn or damaged.

REVERSE IDLER

1. The bushings used in the idler gear are pressed into the gear, then peened into holes in the bores and are bored in place. This insures the positive

alignment of the bushings and main shafts, as well as proper meshing of the gears. Because of the high degree of accuracy to which these parts are machined, the bushings are not serviced separately.

2. Check bushings for excessive wear by using a narrow feeler gauge between the shaft and the bushing or use a micrometer. The proper clearance is from .003" to .005".

TRANSMISSION—ASSEMBLE

ASSEMBLE MAINSHAFT

1. From the rear of mainshaft, assemble the second speed gear (with hub of gear toward rear of shaft).

2. Install 1-2 synchronizer clutch assembly to mainshaft (sliding clutch sleeve taper toward the rear, hub to the front), together with a synchronizing ring on either side so their keyways line up with the clutch keys (Fig. 7D-19).

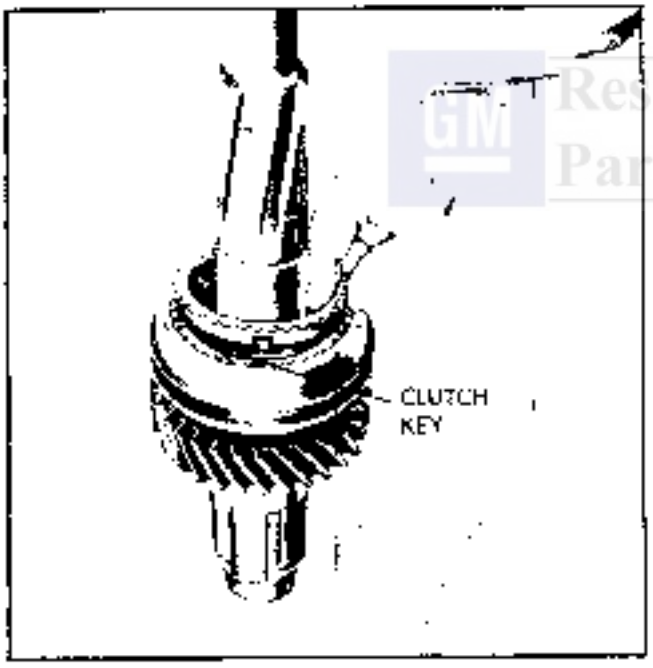


Fig. 7D-19 Installing First Speed Synchronizing Ring

3. Press first gear sleeve onto mainshaft, using a 1-3/4" I.D. pipe cut to convenient length.

4. Install the first speed gear (with hub toward front) and, using a 1-5/8" I.D. pipe cut to a suitable length, press on the rear bearing (snap ring groove toward front of transmission). Firmly seat the bearing (Fig. 7D-20).

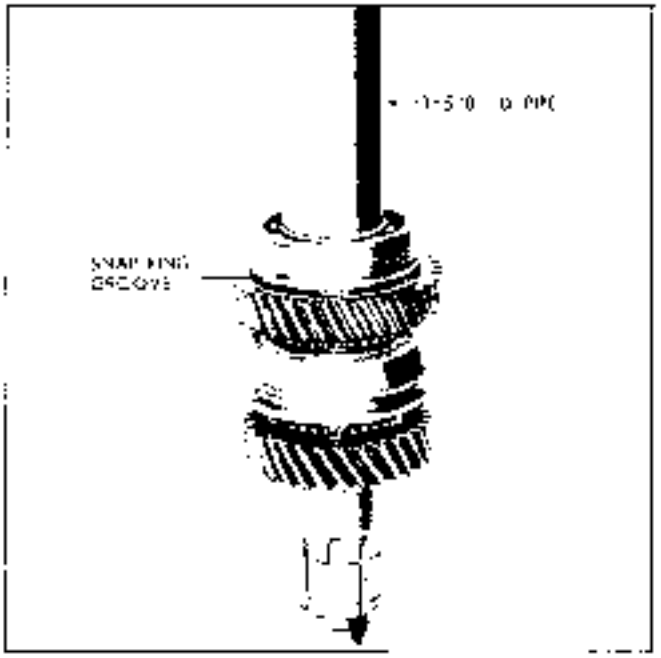


Fig. 7D-20 Installing Rear Bearing

5. Choose the correct selective fit snap ring (.087", .090", .093" or .096") and install it in the groove in mainshaft behind rear bearing. With proper ring, maximum distance between snap ring and rear face of bearing will be from zero to .005".

NOTE: Always use new snap rings when reassembling transmission and do not expand the snap ring further than is necessary for assembly.

6. Install the third speed gear (hub to front of transmission) and the third speed gear synchronizing ring (notches to front of transmission).

7. Install the third and fourth speed gear clutch assembly (hub and sliding sleeve) with bolt sleeve taper and hub toward front, making sure keys in hub correspond to notches in the third speed gear synchronizing ring.

8. Install snap ring in groove in mainshaft in front of the third and fourth speed clutch assembly, with ends of snap ring seated behind spline teeth.

9. Install the rear bearing retainer (Fig. 7D-21). Spread the snap ring in the retainer to allow the snap ring to drop around the rear bearing. Press on the end of the mainshaft until snap ring engages groove in the rear bearing.

10. Install the reverse gear (shift collar to rear).

11. Place speedometer gear retainer in output shaft.

12. Align slot in speedometer drive gear with retainer clip and slide gear into place.

CAUTION: Make certain correct speedometer drive gear is installed. Refer to Speedometer Gear Usage Chart in Section 0.

ASSEMBLE COUNTERGEAR

1. Install seam-type roller spacer in countergear and insert tool J 22379 into countergear.

2. Using heavy grease to retain the rollers, install a .050" spacer and 28 rollers in either end of the countergear, a .050" spacer, 28 more rollers and another .050" spacer (Fig. 7D-22).

3. Follow the same procedure for the opposite end of the countergear.

Fig. 7D-21 Installing Rear Bearing Retainer

ASSEMBLE TRANSMISSION

1. Rest the transmission case on its side, with the side cover opening toward the assembler. Put countergear tanged thrust washers in place, retaining them with heavy grease and making sure the tangs are resting in the notches of the case.

2. Set countergear in place in bottom of transmission case, making sure that tanged thrust washers are not knocked out of place.

3. Position the transmission case, resting on its front face.

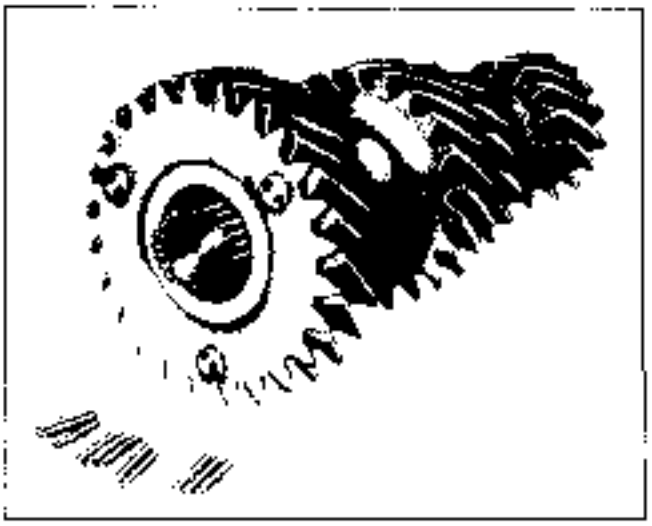


Fig. 7D-22 Loading Countergear Bearing using J 22379

4. Lubricate and insert countershaft in rear of case. Turn countershaft so flat on end of shaft is horizontal and facing bottom of case.

NOTE: The flat on shaft must be horizontal and toward the bottom to mate with rear bearing retainer when installed.

5. Align countergear with shaft in rear and hole in front of case and press countershaft into case (pushing tool J 22379 out front of case) until flat on shaft is flush with rear of case. Be sure thrust washers remain in place (Fig. 7D-23).

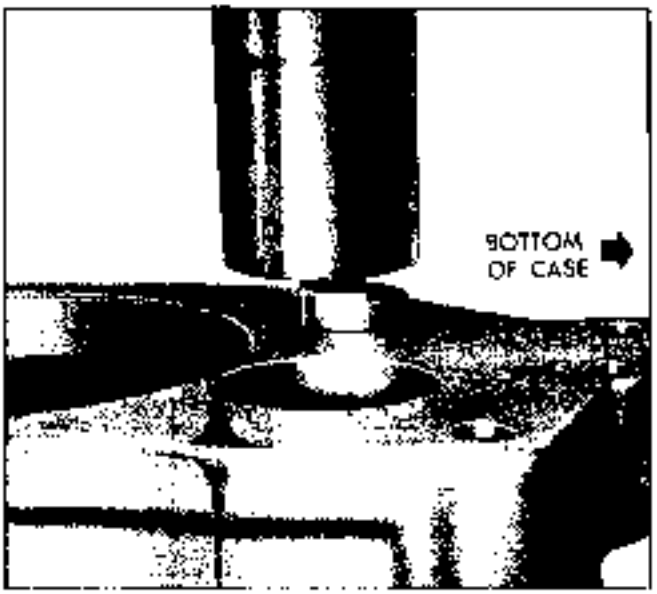


Fig. 7D-23 Installing Countershaft

6. Attach a dial indicator as shown in Fig. 7D-24 and check end play of the countergear. If end play is greater than .025", new thrust washers must be installed.

Fig. 7D-24 Checking Countergear End Play

7. Install cage and the seventeen roller bearings into main drive gear, using heavy grease to hold the bearings and cage in place.

8. Install main drive gear and pilot bearings through the side cover opening and into position in transmission front bore.

9. Place gasket in position on front face of rear bearing retainer.

10. Install the fourth speed synchronizing ring on main drive gear with the notches toward the rear of the transmission.

11. Position the reverse idler gear thrust washer (tanged) on the machined face of the ear cast in the case for the reverse idler shaft and hold with heavy grease. Position the front reverse idler gear next to the thrust washer, with the hub facing toward rear of the case.

CAUTION: Before attempting to install mainshaft assembly to case, slide the 3-4 synchronizing clutch sleeve forward into fourth speed detent position (Fig. 7D-11).

12. Lower the mainshaft assembly into case, making certain notches on the fourth speed synchronizing ring correspond to keys in the clutch assembly (Fig. 7A-25).

13. With the guide pin in rear bearing retainer aligned with hole in rear of case, tap rear bearing retainer into position with a soft hammer.

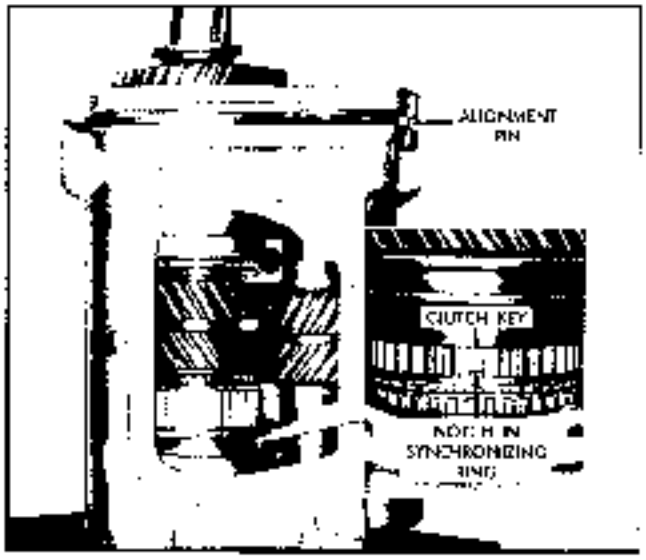


Fig. 7D-25 Installing Mainshaft Assy.

14. From rear of the case, insert the rear reverse idler gear, engaging the splines with the portion of the front gear inside the case.

15. Using heavy grease, place gasket in position on rear face of rear bearing retainer.

16. Install the remaining flat thrust washer on reverse idler shaft. If new idler shaft is being used, drive out the roll pin and press it into new shaft.

17. Install reverse idler shaft, roll pin and thrust washer into gears and front boss of case. Make sure to pick up front tanged thrust washer.

NOTE: Roll pin should be in a vertical position.

18. Position reverse gear at rear of spline, pull reverse shifter shaft to left side of extension and rotate shaft to bring reverse shift fork forward in extension (reverse detent position). Start the extension onto the transmission case (Fig. 7D-26), while slowly pushing in on the shifter shaft to engage the shift fork with the reverse gear shift collar. Then pilot the reverse idler shaft into the extension bushing, permitting the extension to slide onto the transmission case.

19. Install 6 extension and retainer-to-case attaching bolts. Torque upper 3 bolts to 20 lb. ft.; lower 3 bolts to 30 lb. ft.

20. Push or pull reverse shifter shaft to line up groove in the shaft with holes in the boss and drive in the lock pin. Install shifter lever.

21. Press front bearing onto main drive gear (snap ring groove to front) and into case, until sev

eral main drive gear retaining nut threads are exposed.

22. Lock transmission up by shifting into two gears. Install main drive gear retaining nut on the gear shaft and draw it up tight, using tool J 933. Be sure bearing fully seats against shoulder on gear.

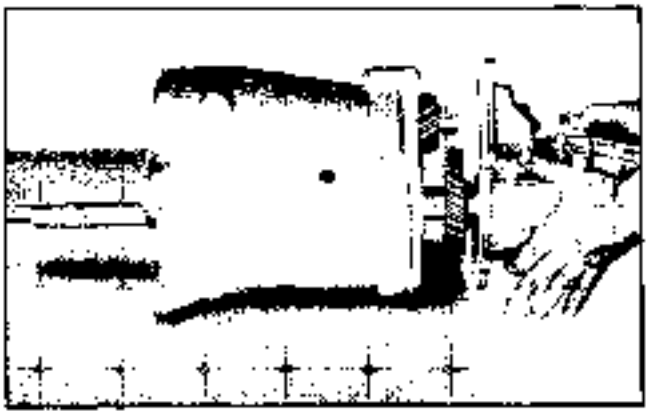


Fig. 7D-26 Installing Extension to Case

Torque retaining nut to 40 lb. ft. and lock in place by staking securely into main drive gear shaft hole with a center punch. Care must be used to avoid damaging the threads on the shaft.

23. Install the main drive gear bearing retainer, gasket and four attaching bolts, using a suitable sealer on bolts. Torque to 20 lb. ft.

24. Shift mainshaft 3-4 sliding clutch sleeve into neutral position and 1-2 sliding clutch sleeve into second gear (forward) detent position. Shift side cover 3-4 shifter lever into neutral detent and 1-2 shifter lever into second gear (forward) detent position.

25. Install side cover gasket and carefully position side cover into place. There is a dowel pin in cover to assure proper alignment with case. Install attaching bolts and tighten evenly to avoid side cover distortion. Torque to 19 lb. ft.

NOTE: When installing new gasket, do not coat with grease.

26. Install insulator assembly on rear extension. Torque bolts to 30 lb. ft.

27. If lever and bracket support to extension was removed, reinstall, tightening 3 bolts to 30 lb. ft. torque.

TRANSMISSION—INSTALL IN VEHICLE

1. Raise transmission until rear extension can be moved rearwards over center cross member support.

NOTE: If it was necessary to remove cross member support before removing transmission, install support while transmission is held in a raised position.

2. Move transmission forward until extension bracket studs engage holes in cross member support and main drive gear shaft enters clutch housing. Care should be taken to make certain clutch release bearing remains seated.

3. Install aligning stud J 1126 in lower right transmission to clutch housing bolt hole for alignment.

4. Install two upper transmission to clutch housing mounting bolts and washers and tighten securely to 55 lb. ft. torque. Remove aligning stud and install two lower mounting bolts and washers and tighten to 55 lb. ft. torque.

5. Install rear extension to cross member support insulator and tighten bolts to 30 lb. ft. torque.

6. Install propeller shaft drive line assembly by reversing steps 4a. through 4c. under TRANSMISSION -- REMOVE, page 7D-7.

7. Install manual shift lever and secure shift bracket to transmission rear extension support with two bracket to extension bolts. Tighten upper bolt to 50 lb. ft. torque. Tighten lower bolt to 30 lb. ft. torque.

8. Connect shift rods to shift bracket at rear extension. See SHIFT LINKAGE ADJUSTMENT, page 7D-1.

9. Connect speedometer cable to speedometer driven gear and tighten securely.

10. Connect back-up light leads to back-up light switch leads, using female connectors.

11. If rubber boot or console was removed, slide rubber boot with metal boot retainer over shift stick and secure to floor plate with six metal screws. Install console.

12. Remove filler plug at side of transmission and add 2 1/2 pints of SAE 90 multi-purpose gear lubricant. Lubricant level should be approximately level with bottom of filler plug hole. Install plug.

13. Check shift pattern and adjust as required.

SPECIFICATIONS

TRANSMISSION IDENTIFICATION

An identifying code is marked in yellow paint on all four-speed manual transmissions. This code consists of two letters, one inch high, on the top of the case.

Pontiac
Std. . . . . FM
Close Ratio . . . . . FN

Tempest
Std. . . . . FO
Close Ratio . . . . . FT

Firebird
Std. . . . . FV
Close Ratio . . . . . FX

The vehicle identification number is also stamped on the transmission case, as shown in Fig. 7D-27.

GEAR RATIOS

	Std	Close
First	2.52	2.20
Second	1.88	1.64
Third	1.46	1.28
Fourth	1.00	1.00
Reverse	2.59	2.27

Lubrication Capacity . . . . . 2 1/2 pints

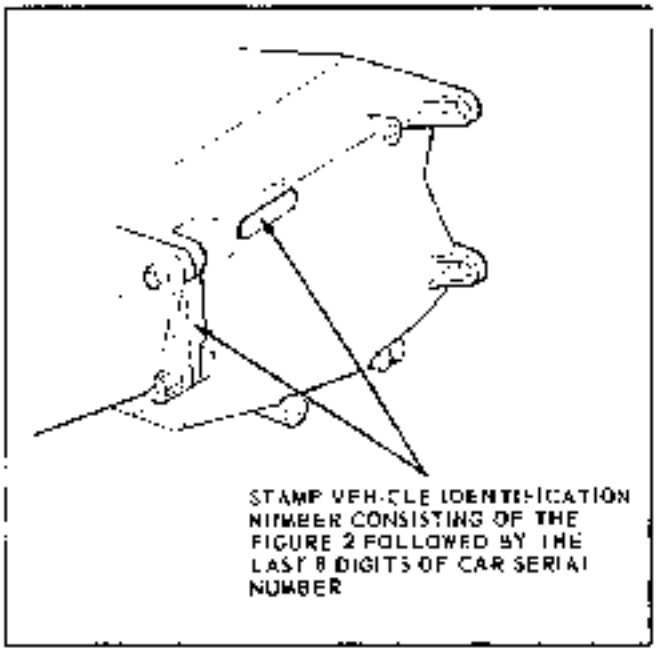
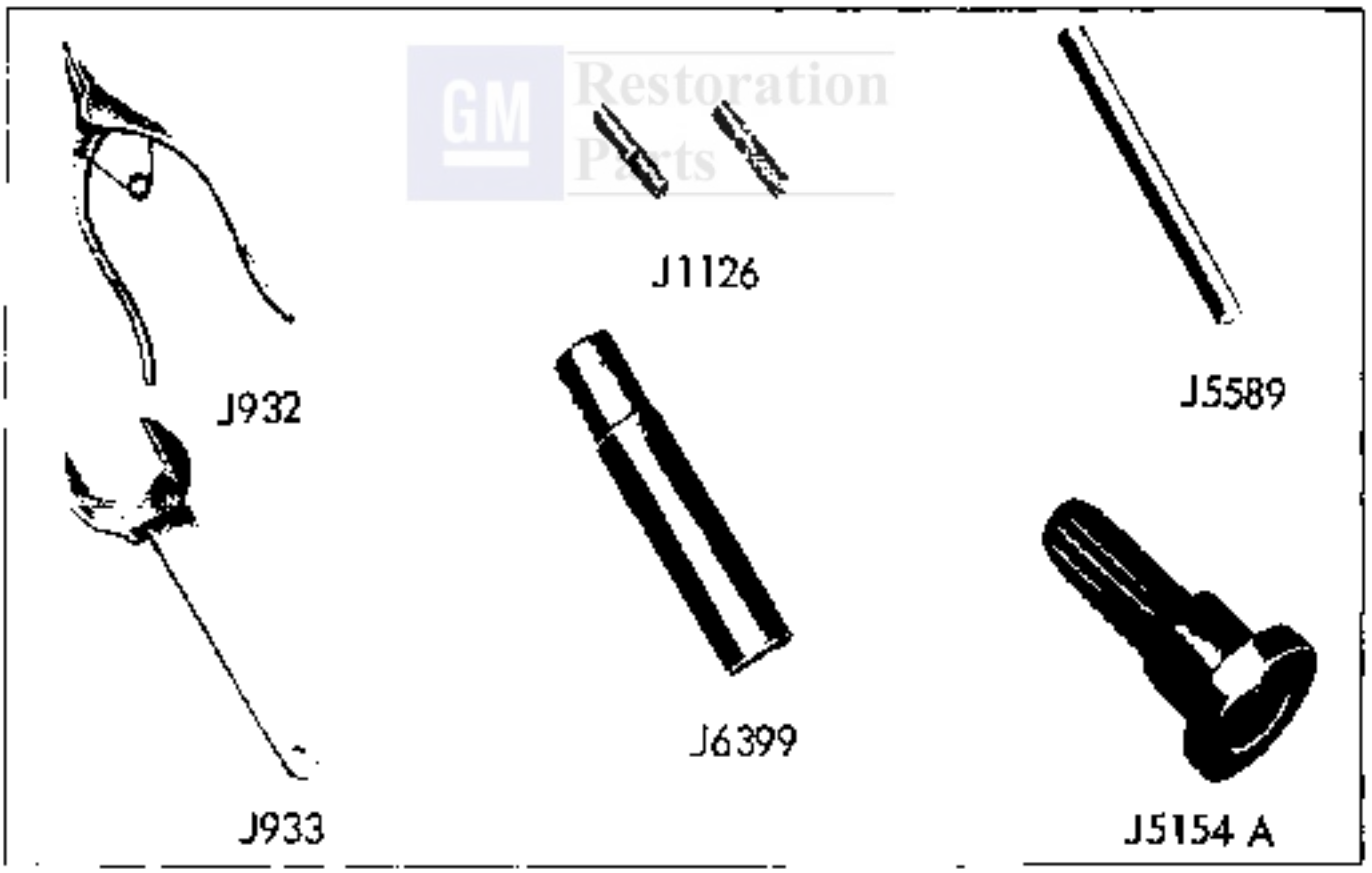


Fig. 7D-27 Vehicle Identification Number Location



J 932 Snap Ring Pliers
J 933 Clutch Gear Retainer Nut Wrench
J 1126 Aligning Studs
J 5154-A Transmission Extension Oil Seal Installer
J 6399 Rear Bearing Extension Bushing - Remover and Installer
J 22379 Countershaft Bearing Loader

Fig. 7D-28 Special Tools

TORQUE SPECIFICATIONS

Application	Lb. Ft.
Main Drive Gear Bearing Retaining Nut	40
Main Drive (Clutch) Gear Retaining Bolts	20
Side Cover Bolts	18
Extension to Case Bolts (3 Upper)	20
Extension to Case Bolts (3 Lower)	30
Shift Lever to Shifter Shaft Nuts	30
Transmission Filler Plug	30
Lever and Bracket Support to Extension Bolts	30
Lever and Bracket Assembly to Support Bolt (Upper)	50
Lever and Bracket Assembly to Support Bolt (Lower)	30
Support Insulator to Extension Housing and to Cross Member Bolts	30
Transmission to Clutch Housing Bolts	55
Transmission Control Rod to Transmission Lever Nuts	30
Speedometer Gear Retainer Bolts	4
Speedometer Cable to Driven Gear Nut	4

TURBO HYDRA-MATIC TRANSMISSION

CONTENTS OF THIS SECTION

TOWING

If the transmission, drive line or axle do not have a malfunction, the vehicle may be towed in neutral at speeds up to 45 mph. The distance should not exceed 50 miles.

For higher speeds or extended distances, it is recommended that the propeller shaft be disconnected or the rear wheels be off the ground.

TRANSMISSION SERIAL NUMBER

The serial number plate on the Turbo Hydra-Matic is located on the right side of the transmission, just forward of the governor. The serial numbers are all preceded by either PA, PB, PC, PG, PH, PQ, PT, PX or PY. The application of each transmission is as follows:

PA - 428 cubic inch single exhaust.
PB - 400 cubic inch 2 barrel.
PC - 428 cubic inch 4 barrel and 428 cubic inch H.O.
PG - 400 cubic inch 4 barrel (GP).
PH - 400 and 428 cubic inch for heavy duty requirements.
PQ - 400 cubic inch 4 barrel - Ram Air (GTO and Firebird)
PT - 400 cubic inch 2 barrel (GTO).
PX - 400 cubic inch 4 barrel and 400 cubic inch H.O. (GTO and Firebird except Air Cond.).
PY - 400 cubic inch 4 barrel and 400 cubic inch H.O. (Firebird with Air Cond.).

It is very important that any communications concerning Turbo Hydra-Matic always contain the transmission serial number and the vehicle identification number (Fig. 7E-2). All transmission parts returned to Pontiac Motor Division must always be tagged with the transmission serial number.

PERIODIC SERVICE RECOMMENDATIONS

TRANSMISSION FLUID

Transmission fluid level should be checked (with transmission hot) every time engine oil level is checked or every 6000 miles when engine oil is changed.

CAUTION: Since the Turbo Hydra-Matic transmission is very sensitive to oil level, special precautions should be taken when checking the oil level, to ensure against an overfill (see Checking Procedure, page 7E-4).

Transmission fluid should be changed every 24,000 miles or 24 months. When the car is in heavy duty service (police, taxi, fleet service, or constant use in heavy metropolitan area traffic), it is recommended that the fluid be changed at 12,000 mile intervals.

ADJUSTMENTS WITH TRANSMISSION IN CAR

SHIFT CONTROL LINKAGE ADJUSTMENT

GEARSHIFT CONTROLS—COLUMN SHIFT

NOTE: For Pontiac models, see Fig. 7E-3; for GTO models, see Fig. 7E-4; for Firebird models, see Fig. 7E-5.

1. Loosen screw (nut - Firebird) on adjusting swivel clamp.

2. Set transmission selector lever in DRIVE detent.

NOTE: Obtain DRIVE position by rotating transmission lever clockwise to PARK position, then counterclockwise three positions to DRIVE position (View B).

3. Set upper gearshift lever against DRIVE stop (View A)

4. Tighten screw on adjusting swivel clamp to 20 lb. ft. (Pontiac and GTO); tighten nut on adjusting swivel clamp to 30 lb. ft. (Firebird only).

GEARSHIFT CONTROLS—CONSOLE SHIFT

NOTE: For Pontiac models, see Fig. 7E-6; for GTO models, see Fig. 7E-7; for Firebird models, see Fig. 7E-8.

1. Disconnect shift cable from transmission selector lever pin.

2. Rotate transmission selector lever clockwise to PARK position and adjust pin on selector lever to dimension shown in View A.

3. Torque selector pin nut to 30 lb. ft., set the gearshift lever in PARK position and connect shift cable to pin.

NEUTRALIZER SWITCH ADJUSTMENT

COLUMN SHIFT CONTROLS

NOTE: For Pontiac models, see Fig. 7E-3; for GTO models, see Fig. 7E-4, for Firebird models, see Fig. 7E-5.

If the starter operates in any transmission shift lever position other than PARK and NEUTRAL, the starter neutralizer must be adjusted as follows:

1. Insert blade of any adjusting gauge of J 22791 gauge set into RESET slot, exerting sufficient pressure to insure full penetration (approx. 0.4") of the blade (View A).

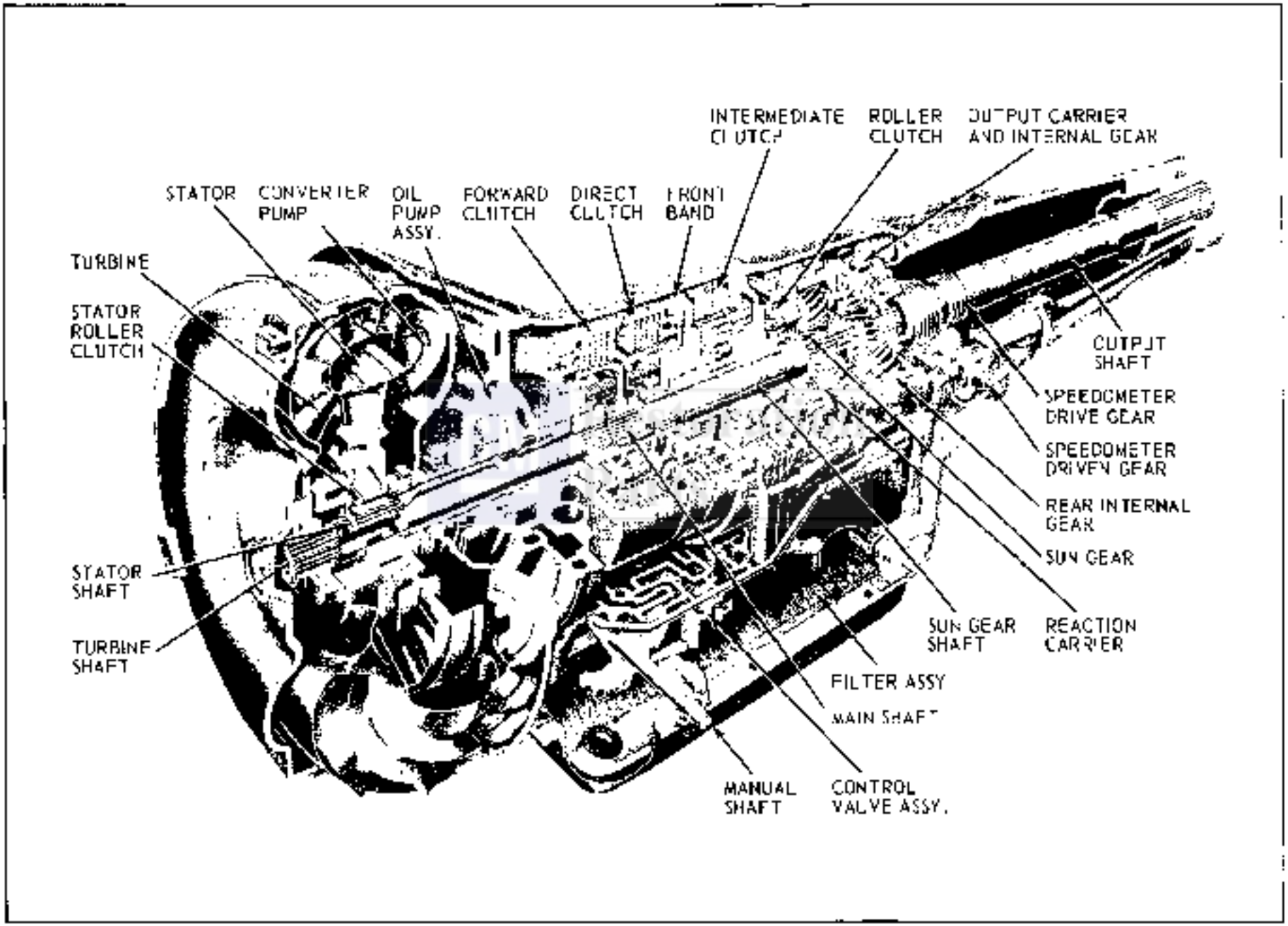


Fig. 7E-1 Side Cross Section of Turbo Hydra-Matic Transmission

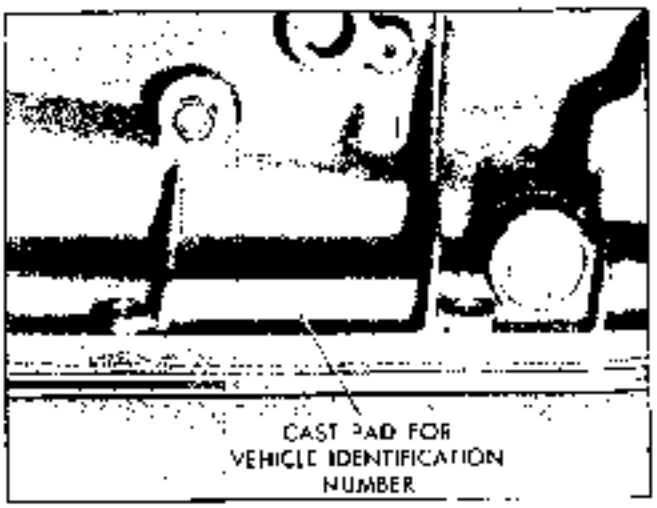


Fig. 7E-2 Vehicle Identification Number on Transmission Case

2. Slowly move upper gearshift lever to LOW position and remove the gauge.

3. Insert blade of "0" gauge into ADJUST slot, move shift lever to PARK position and remove adjusting gauge.

4. Check starter operation.

5. If starter operates in:

a. REVERSE, repeat steps 1 thru 3, using "1+" gauge or "2-" gauge until starter will not operate in REVERSE position.

b. DRIVE, repeat steps 1 thru 3 using "1-" gauge or "2-" gauge until starter will not operate in DRIVE position.

CONSOLE SHIFT CONTROLS

If the starter operates in any transmission shift lever position other than PARK and NEUTRAL, the starter neutralizer must be adjusted as follows:

Pontiac only (Fig. 7E-6) - Adjust neutralizer switch adjustment screw so that engine can be started only in the PARK and NEUTRAL positions.

GTO and Firebird (Figs. 7E-7 and 7E-8)

1. Insert blade of any adjusting gauge of J 22701 gauge set into RESET slot, exerting sufficient pressure to insure full penetration (approx. 0.4") of the blade.

2. Slowly move gearshift lever to LOW position and remove the gauge.

3. Insert blade of "0" gauge into ADJUST slot, move shift lever to PARK position and remove adjusting gauge.

4. Check starter operation.

5. If starter operates in:

a. REVERSE, repeat steps 1 thru 3, using "1+" gauge or "2-" gauge until starter will not operate in REVERSE position.

b. DRIVE, repeat steps 1 thru 3, using "1-" gauge or "2-" gauge until starter will not operate in DRIVE position.

MINOR SERVICE AND REPAIR

Services outlined in this section can be performed without removing the transmission from the car. Complete procedures are not given for all of these services, since they are covered in detail under disassembly and reassembly.

FLUID LEVEL

The fluid level indicator is located in the filler pipe at the right rear of the engine. To bring the (fluid level) from the ADD mark to the FULL mark requires one pint.

Fluid level should be to the FULL mark with transmission at normal operating temperature (160-190°F). With warm fluid (room temp.), the level should be approximately 1/4" below the ADD mark.

NOTE: In checking the oil, insert the dipstick in the filler tube with the markings up toward center of car).

CHECKING PROCEDURE

To determine proper fluid level, proceed as follows:

CAUTION: The full mark on the dipstick is an indication of transmission fluid at normal operating temperature of 180°F. This temperature is only obtained after at least 15 miles of expressway driving or equivalent of city driving.

1. With manual control lever in Park position, start engine, DO NOT RACE ENGINE. Move manual control lever through each range.

2. Immediately check fluid level with selector lever in Park, engine running and vehicle on LEVEL surface.

At this point, when a reading is made, fluid level on the dipstick should be at the FULL mark.

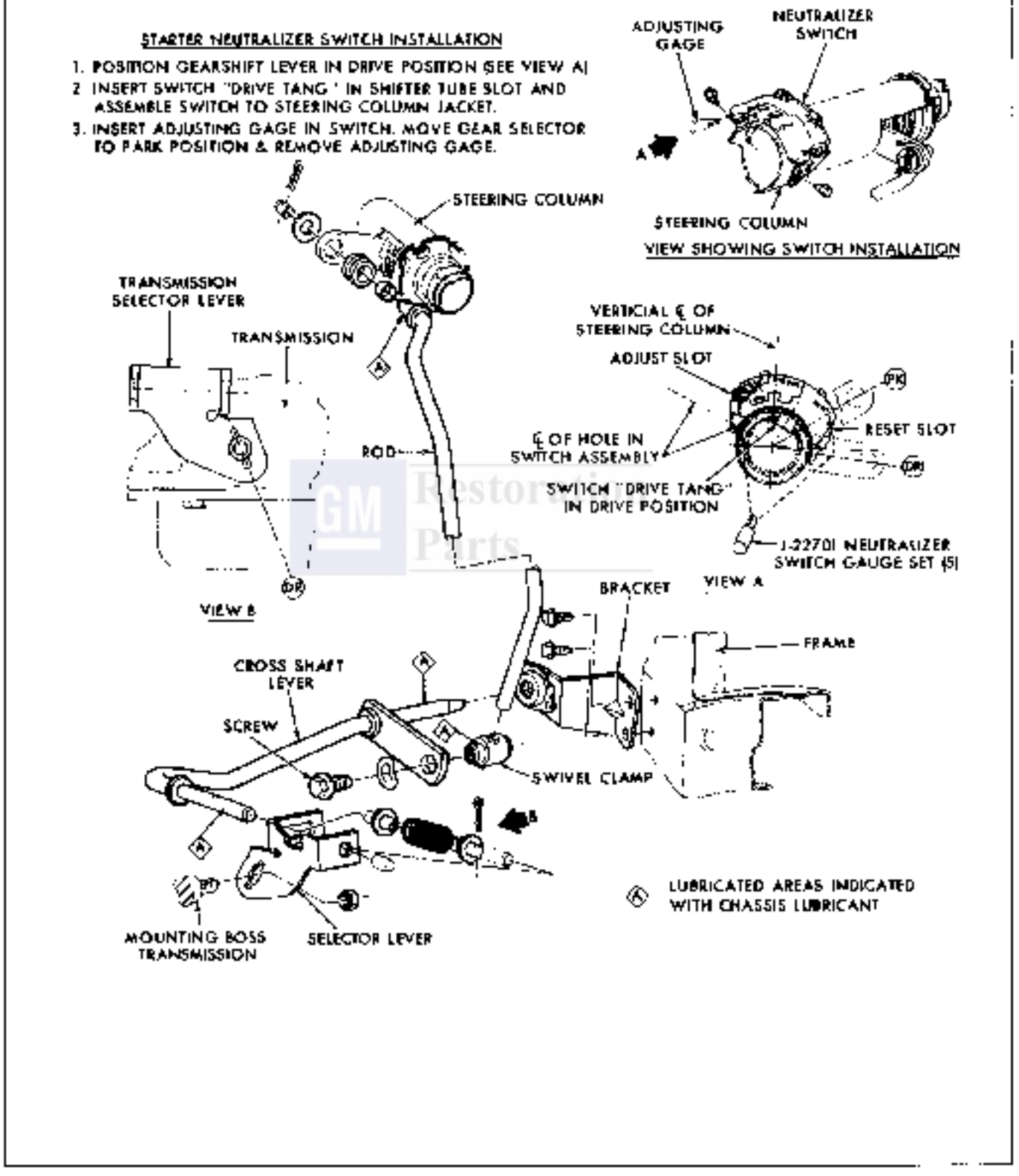


Fig. 7E-3 Gearshift Controls (Column) - Pontiac

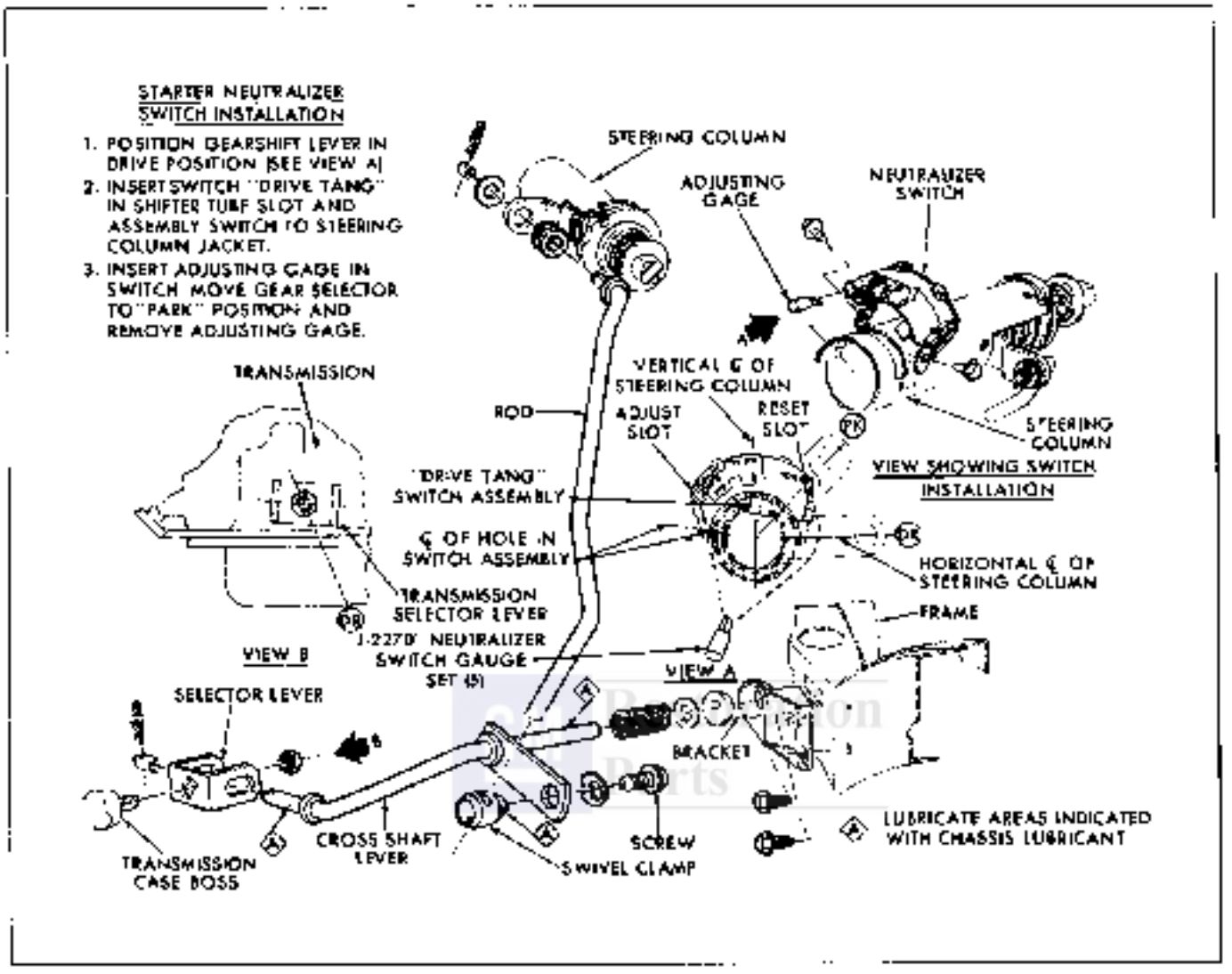


Fig. 7E-4 Gearshift Controls (Column) - GTO

3. If additional fluid is required, add fluid to the FULL mark on the dipstick.

If vehicle is not driven 15 expressway miles or equivalent and it becomes necessary to check fluid level, the transmission fluid must be at room temperature (70°F).

With fluid at room temperature (70°F), follow steps 1, 2 and 3 below:

1. With manual control lever in Park position, start engine. DO NOT RACE ENGINE. Move manual control lever through each range.

2. Immediately check fluid level with selector lever in Park, engine running and vehicle on LEVEL surface.

At this point, when a reading is made, fluid level on the dipstick should be 1/4" below the ADD mark.

3. If additional fluid is required, add fluid to bring level to 1/4" below the ADD mark on the dipstick.

CAUTION: Do Not Overfill, as foaming and loss of fluid through the vent pipe might occur as fluid heats up. If fluid is too low, especially when cold, complete loss of drive may result which can cause transmission failure.

NOTE: If transmission fluid level is correctly established at 70°F, it will appear at the FULL mark on the dipstick when the transmission reaches normal operating temperature (180°F). The fluid level is set 1/4" below the ADD mark on the dipstick to allow for expansion of the fluid which occurs as transmission temperatures rise to normal operating temperature of 180°F.

IMPORTANT: When adding fluid, use only DEXRON automatic transmission fluid. The difference in oil level between ADD and FULL is one pint.

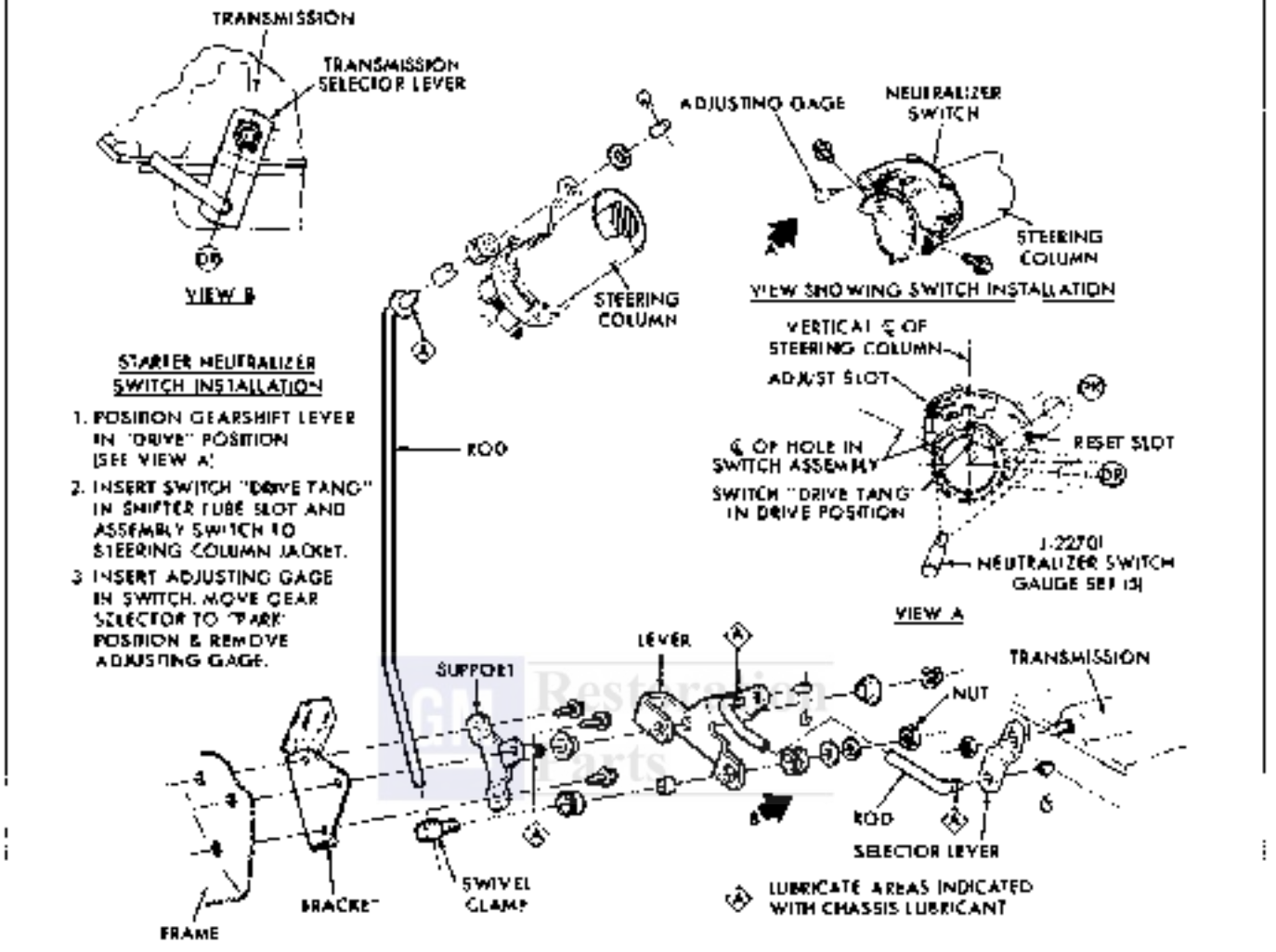


Fig. 7E-5 Gearshift Controls (Column) - Firebird

In all 1967 and earlier model automatic transmissions, use either DEXRON automatic transmission fluid or Type A automatic transmission fluid identified by the mark "AQ-ATF", followed by a number and the suffix letter "A" (AQ-ATF-XXXA).

FLUID CAPACITY, DRAINING AND REFILLING CAPACITY

Approximately 7 1/2 pints of fluid are required to refill transmission after oil pan has been drained. When unit has been disassembled and rebuilt, approximately 19 pints will be required to refill. Use only DEXRON automatic transmission fluid.

DRAINING AND REFILLING TRANSMISSION

Drain oil immediately after operation before it has had an opportunity to cool.

To drain oil, proceed as follows:

1. Remove bottom pan attaching screws, pan and gasket. Discard gasket.

2. Remove oil strainer retainer bolt, oil strainer assembly, O-ring seal from intake pipe and discard the strainer and O-ring seal.

3. Install new O-ring seal on intake pipe and install new strainer on pipe assembly.

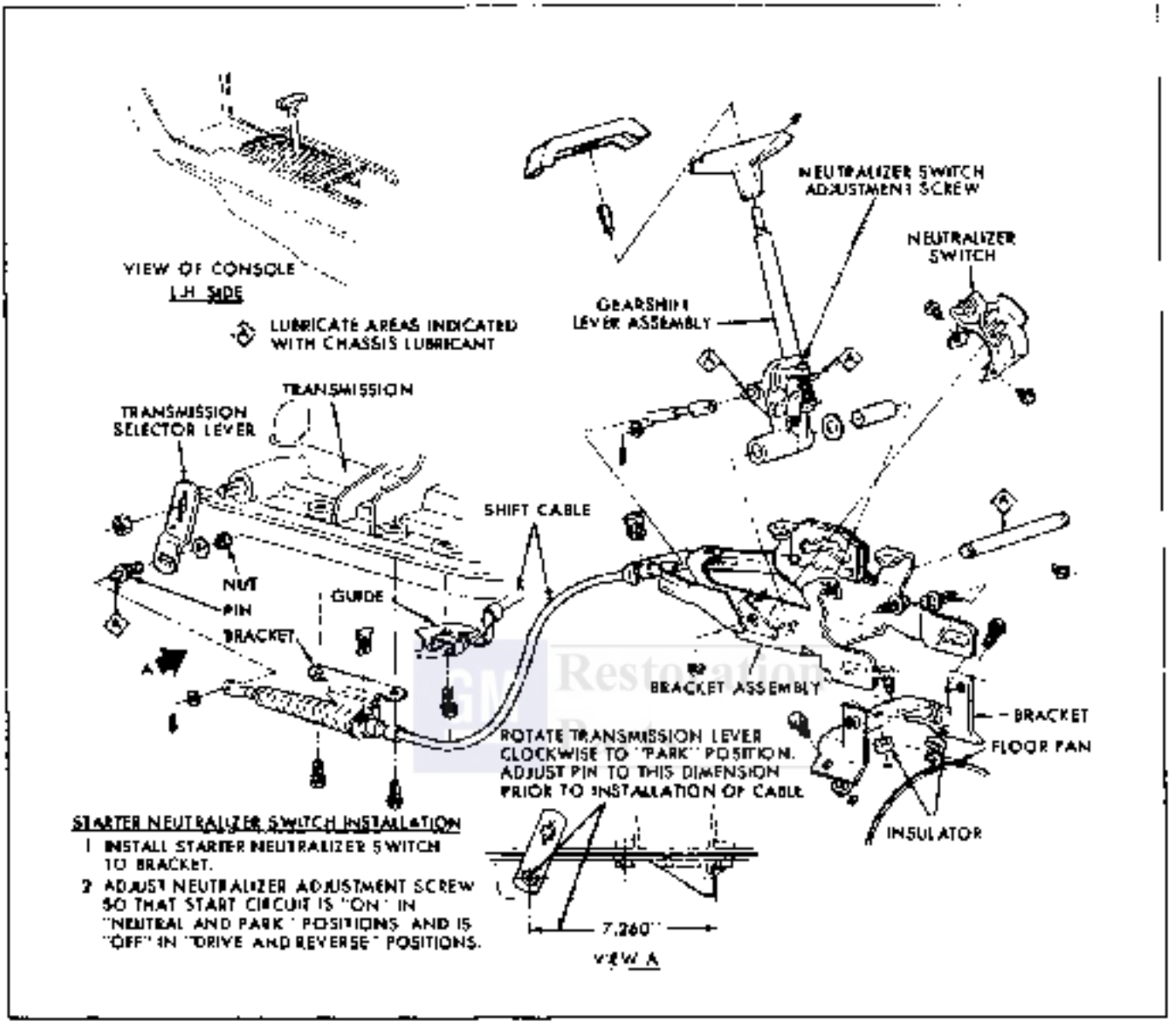


Fig. 7E-6 Gearshift Controls (Console) - Pontiac

4. With O-ring seal on intake pipe, install pipe and strainer assembly, attaching strainer to the control valve assembly with its retainer bolt.

5. Thoroughly clean bottom pan.

6. Affix new gasket to bottom pan with petrolatum.

7. Install bottom pan with attaching screws and torque to 12 lb. ft.

8. Pour approximately 7 1/2 pints of fluid into the transmission (If the valve body has also been removed, use 9 1/2 pints). After a complete overhaul, approximately 16 pints are required. Be sure container, spout or funnel is clean.

9. Start engine and let idle (carburetor off fast idle step). Place selector lever in P position and apply hand brake.

10. With transmission hot (approximately 180-190°F), add fluid to bring level to FULL mark on indicator.

With transmission at room temperature (70°F), add fluid to bring level to 1/4" below the ADD mark.

CAUTION: Do not overfill. Foaming will result.

PRESSURE REGULATOR VALVE

REMOVAL

1. Remove bottom pan and strainer. Discard gasket.

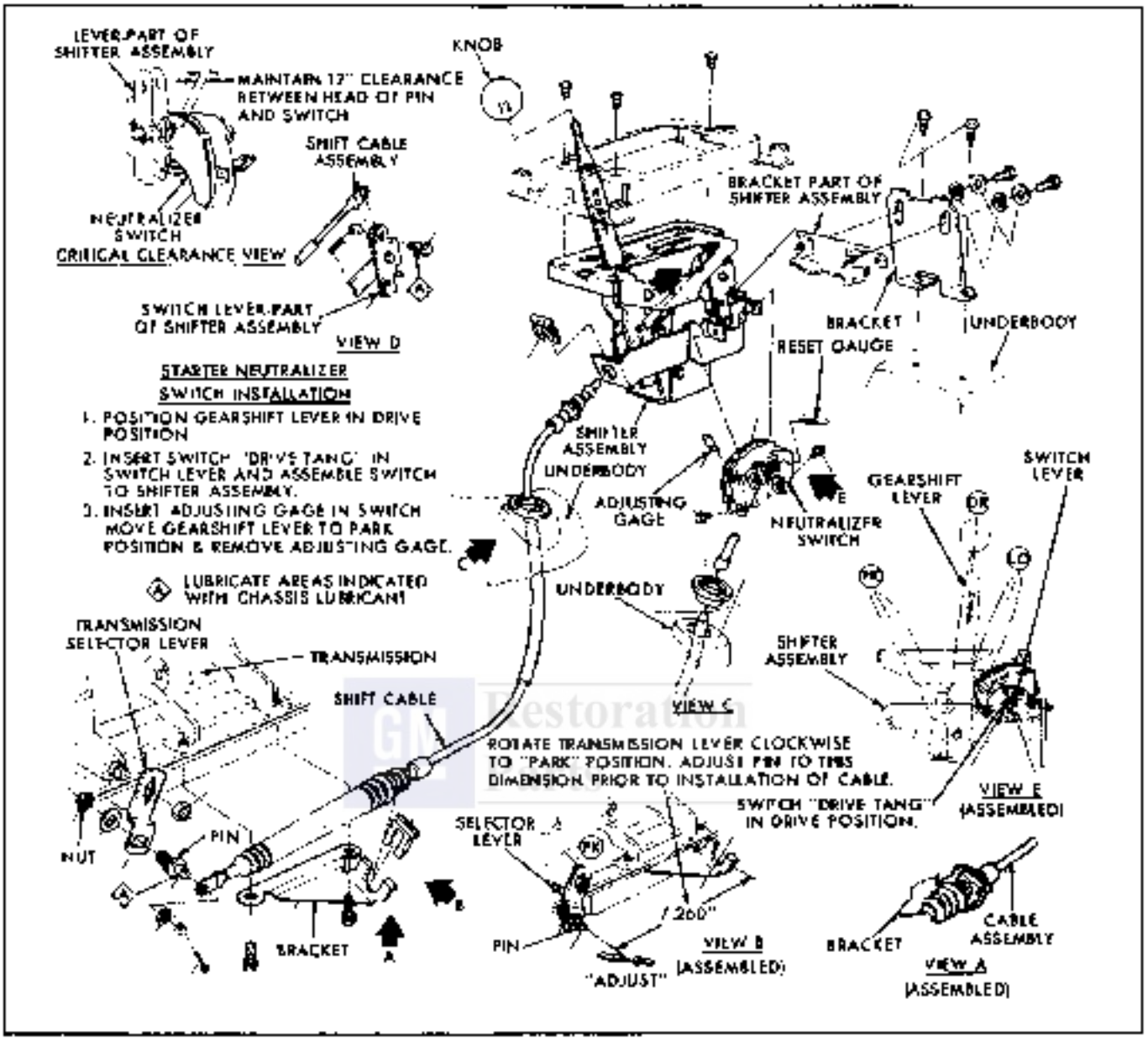


Fig. 7E-7 Gearshift Controls (Console) - S10

2. Compress regulator boost valve bushing against pressure regulator spring and remove snap ring, using snap ring pliers and tool as shown in Fig. 7E-9.

3. Remove regulator boost valve bushing and valve.

4. Remove pressure regulator spring.

5. Remove regulator valve, spring retainer and spacer(s) if present.

INSTALLATION

Installation of the pressure regulator valve is the reverse of the removal. Affix new gasket to bottom pan and adjust oil level.

CONTROL VALVE BODY

REMOVAL

1. Remove bottom pan and strainer. Discard gasket.

2. Disconnect solenoid lead from connector terminal

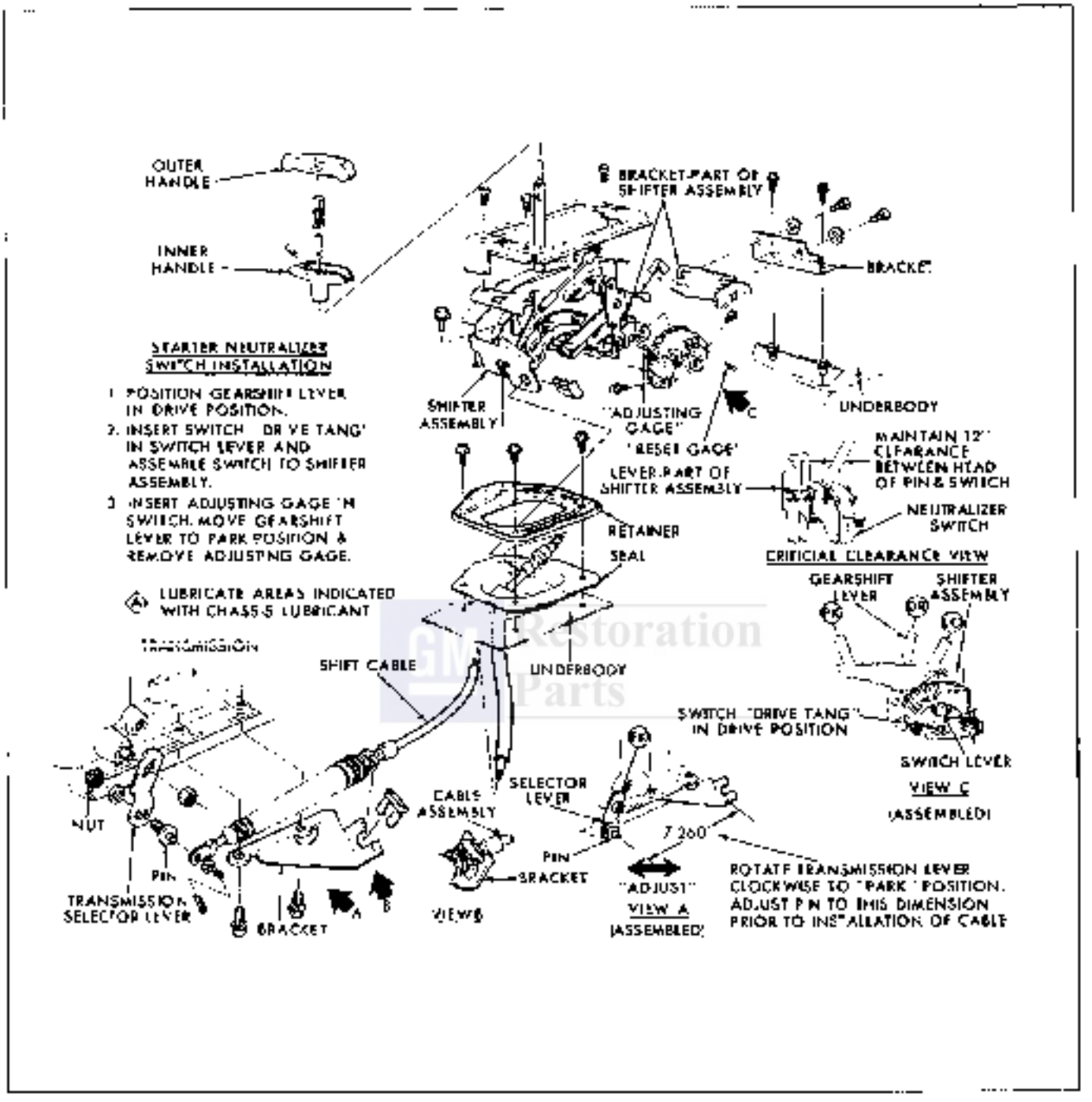


Fig. 7E-8 Gearshift Controls (Console) – Firebird

3. Remove control valve body attaching screws and detent roller spring assembly.

NOTE: Do not remove solenoid attaching screws.

4. Remove control valve body assembly and governor pipes. If care is taken in removing control valve body, the six (6) check balls will stay in place above the spacer plate.

CAUTION: Do not drop manual valve.

5. Remove the governor pipes and manual valve from control valve body.

INSTALLATION

Installation of the control valve body is the reverse of the removal. Affix new gasket to bottom pan and adjust oil level.

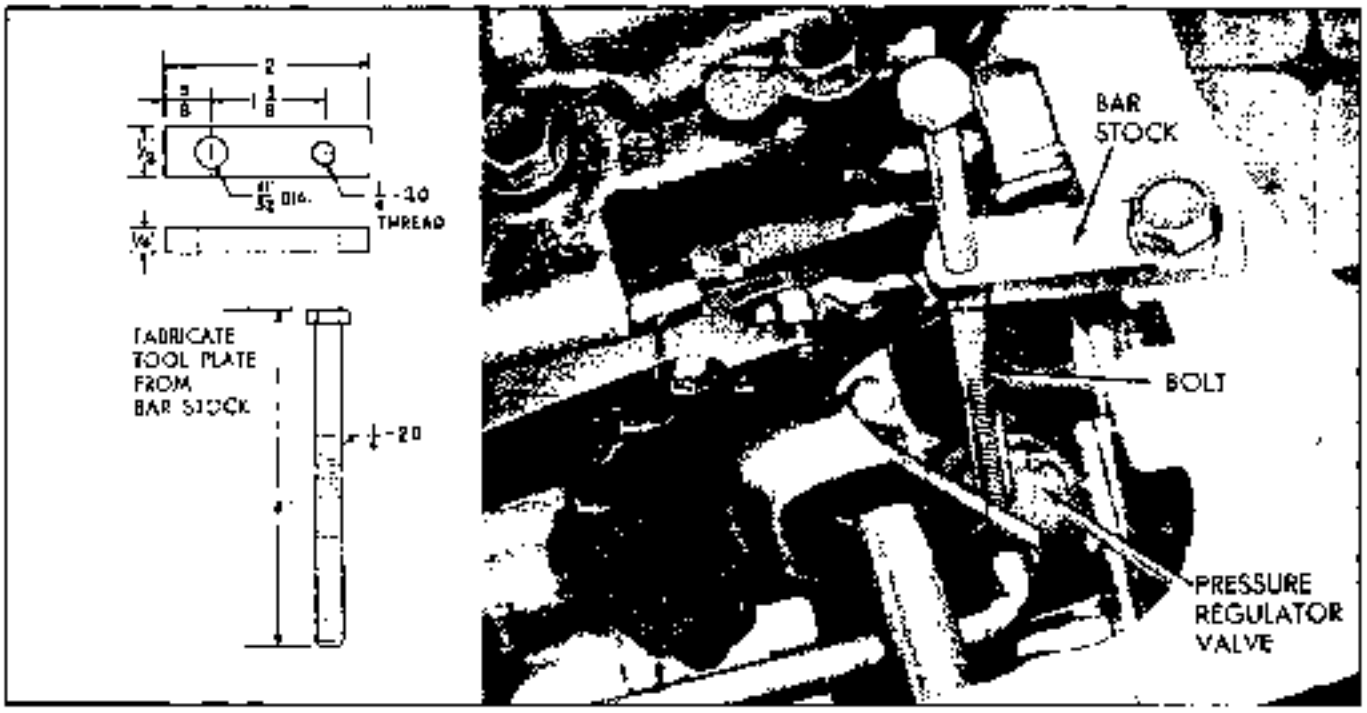


Fig. 7E-9 Removing Pressure Regulator Valve

GOVERNOR

REMOVAL

1. Remove governor cover attaching screws, cover and gasket.

2. Discard gasket.

3. Withdraw governor assembly from case.

INSTALLATION

Installation of the governor assembly is the reverse of the removal. Use a new gasket under the governor cover. Adjust oil level.

MODULATOR AND MODULATOR VALVE

REMOVAL

1. Remove modulator assembly attaching screw and retainer.

2. Remove modulator assembly from case. Discard O-ring seal.

3. Remove modulator valve from case.

INSTALLATION

Installation of the modulator assembly and modulator valve is the reverse of the removal. Use a new O-ring seal on the modulator assembly. Adjust oil level.

PARKING LINKAGE

REMOVAL

1. Remove bottom pan and strainer. Discard gasket.

2. Unthread jam nut holding detent lever to manual shaft.

3. Remove manual shaft retaining pin from case.

4. Remove manual shaft and jam nut from case.

NOTE: Do not remove manual shaft seal unless replacement is required.

5. Remove parking actuator rod and detent lever assembly.

6. Remove parking pawl bracket attaching screws and bracket.

7. Remove parking pawl return spring.

NOTE: The following steps should not be completed unless part replacement is required.

8. Remove parking pawl shaft retainer.

9. Remove parking pawl shaft plug, parking pawl shaft and parking pawl.

INSTALLATION

Installation of the parking linkage is the reverse of the removal. Use new seal plug (if required) and new gasket. Adjust oil level.

REAR SEAL

REMOVAL

1. Remove propeller shaft.

2. Pry seal out with screwdriver or small chisel.

INSTALLATION

1. Using tool J 21359, install new seal.

2. Re-install propeller shaft.

REMOVAL OF TRANSMISSION

Before raising the car, disconnect the battery and release the parking brake.

1. Remove propeller shaft.

2. Disconnect speedometer cable, electrical lead to case connector, vacuum line at modulator and oil cooler pipes.

3. Disconnect shift control linkage.

4. Support transmission with jack.

5. Disconnect rear mount from transmission and frame crossmember.

6. Remove two bolts at each end of frame crossmember and remove crossmember.

7. Remove converter dust shield.

8. Remove converter to flex plate bolts.

9. Loosen exhaust pipe to manifold bolts approximately 1/4" and lower transmission until jack is barely supporting it.

10. Remove transmission to engine mounting bolts.

11. Raise transmission to its normal position, slide rearward from engine and lower it away from car.

CAUTION: When lowering transmission, keep rear of transmission lower than front so as not to lose converter.

The installation of the transmission is the reverse of the removal.

TRANSMISSION DISASSEMBLY AND REASSEMBLY

REMOVAL OF CONVERTER AND MODULATOR

1. With transmission in cradle on portable jack, remove converter assembly by pulling straight out.

NOTE: Converter contains a large amount of oil

2. Install holding fixture J 8763-01 on transmission so that modulator will be located on side to holding fixture nearest bench (Fig. 7E-10).

NOTE: Do not over-torque holding screw. This will bind case center support.

3. Install fixture and transmission into holding tool Base J 3289-20 with bottom pan facing up.

4. Remove modulator attaching screw and retainer (Fig. 7E-11).

5. Remove modulator assembly and O-ring seal from case (Fig. 7E-12).

6. Remove modulator valve from transmission case.

REMOVAL OF GOVERNOR, SPEEDOMETER DRIVEN GEAR, PAN, STRAINER AND INTAKE PIPE

1. Remove attaching screws, governor cover and gasket. Discard gasket (Fig. 7E-13)

2. Withdraw governor assembly from case.

Fig. 7E-10 Transmission in Holding Fixture

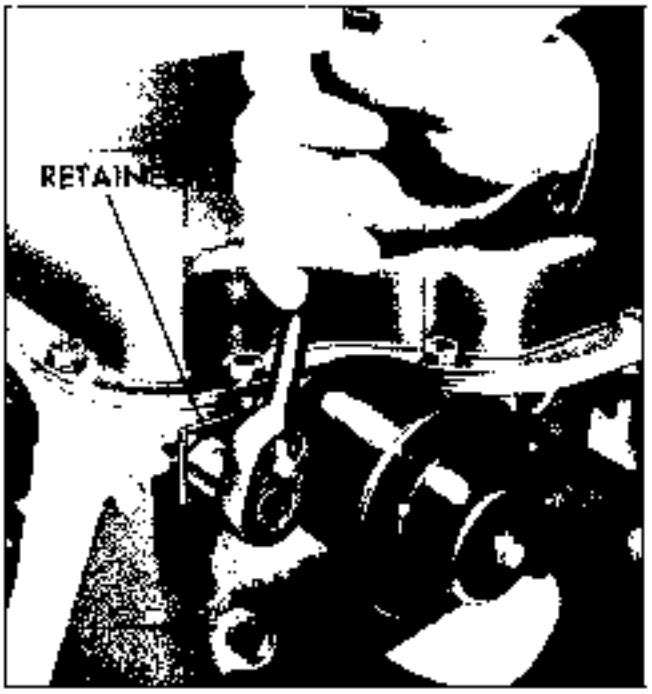


Fig. 7E-11 Removing Modulator Retainer

3. Remove speedometer driven gear attaching screw and retainer (Fig. 7E-14).

4. Withdraw speedometer driven gear assembly from case.

5. Remove bottom pan attaching screws, bottom pan and bottom pan gasket. Discard gasket (Fig. 7E-15).

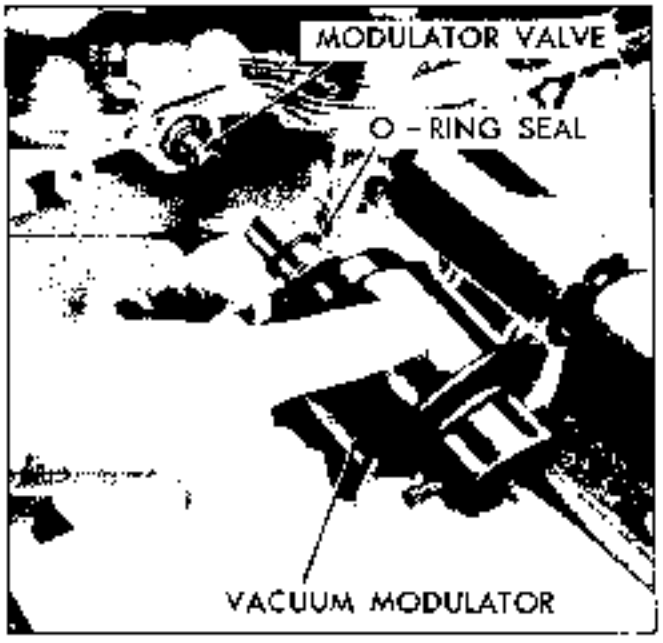


Fig. 7E-12 Removing Vacuum Modulator and Valve

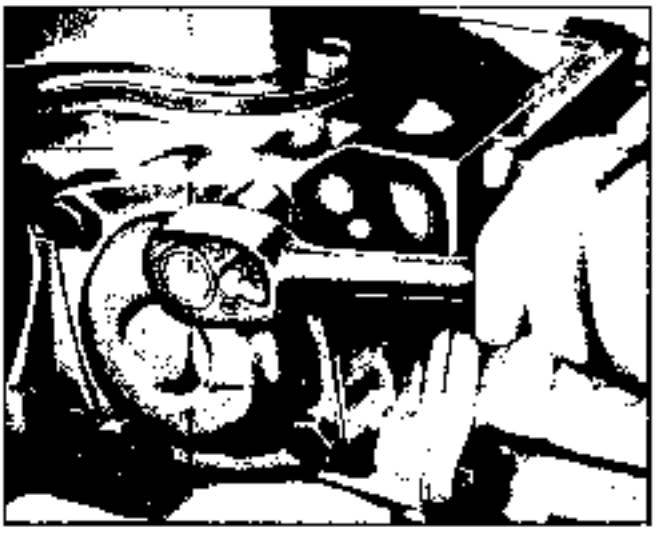


Fig. 7E-13 Removing Governor Cover Attaching Screws

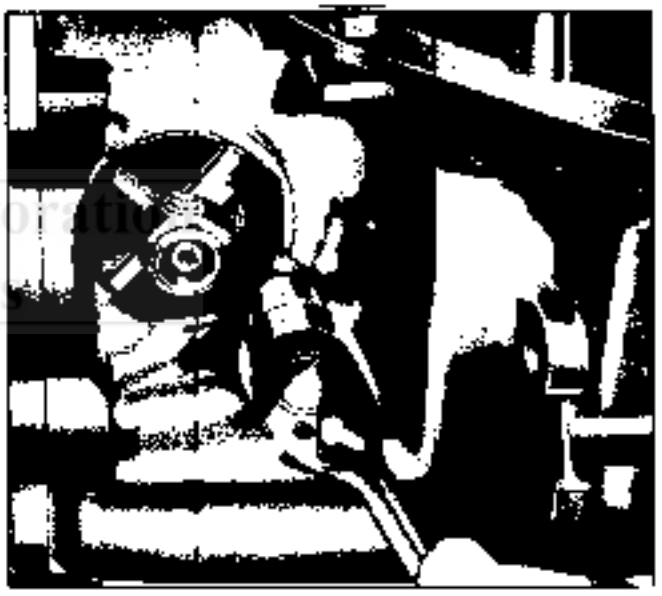


Fig. 7E-14 Removing Speedometer Driven Gear Retainer

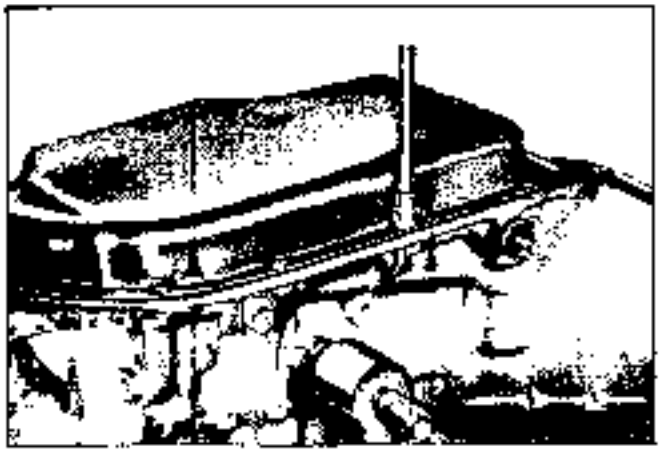


Fig. 7E-15 Removing Transmission Oil Pan Attaching Screws

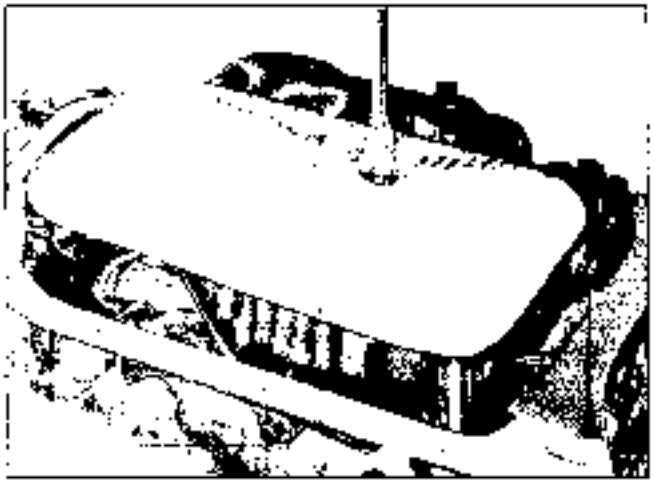


Fig. 7E-16 Remove Strainer Bolt

6. Remove the strainer retainer bolt (Fig. 7E-16).

7. Remove intake pipe to case O-ring seal from intake pipe or case and discard.

REMOVAL OF CONTROL VALVE ASSEMBLY, SOLENOID CONNECTOR, GOVERNOR PIPES AND DETENT SPRING ASSEMBLY

1. Remove control valve body attaching screws and detent roller spring assembly (Fig. 7E-16).

NOTE: *Do not remove solenoid attaching screws.*

2. Disconnect solenoid lead from connector terminal.

3. Remove control valve body assembly and governor pipes (Fig. 7E-19).

CAUTION: Do not drop manual valve.

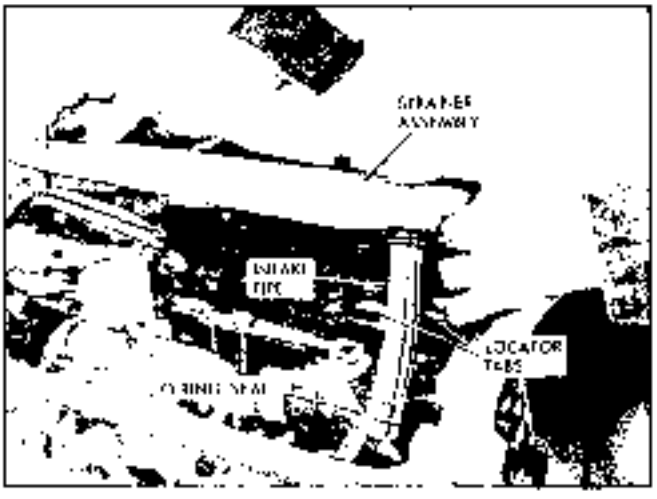


Fig. 7E-17 Removing Strainer and Intake Pipe Assembly

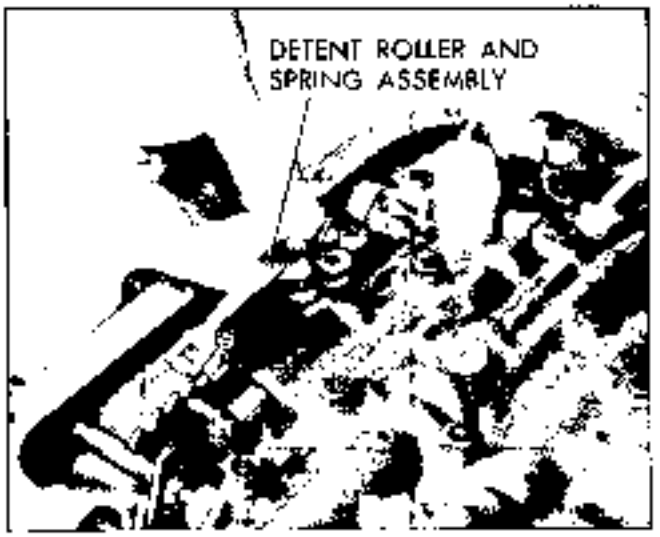


Fig. 7E-18 Removing Detent Roller and Spring Assembly

4. Remove governor pipes from control valve assembly.

5. Remove control valve assembly to spacer gasket.

REMOVAL OF REAR SERVO, VALVE BODY SPACER, GASKET AND FRONT SERVO

1. Remove rear servo cover attaching screws, servo cover and gasket. Discard gasket (Fig. 7E-20).

2. Remove rear servo from case (Fig. 7E-21).

3. Remove rear servo accumulator spring.

4. Make band apply pin selection check to determine possible cause of malfunction (Fig. 7E-22).

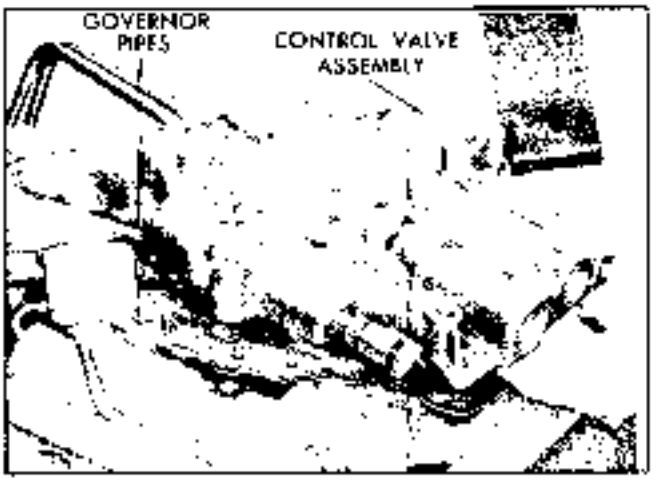


Fig. 7E-19 Removing Control Valve Assembly and Governor Pipes from Case

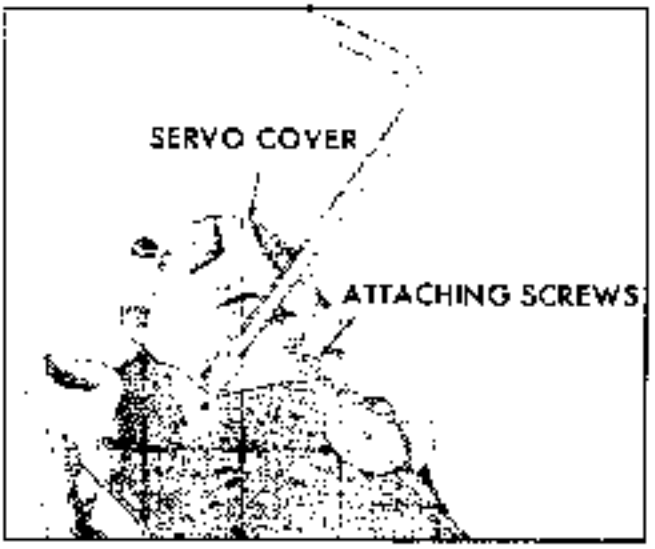


Fig. 7E-20 Removing Rear Servo Cover Attaching Screws

BAND APPLY PIN SELECTION

a. Attach band apply pin and fixture J 21370-6 and J 21370-5 to transmission case with attaching screws.

b. Apply 20 ft. lb. torque and select proper pin to be used during assembly of transmission.

There are three selective pins identified as follows:

c. If both steps of J 21370-5 are below the gauge surface, the long pin, identified by 3 rings, should be used.

b. If the gauge surface is between the steps, the medium pin, identified by 2 rings, should be used.

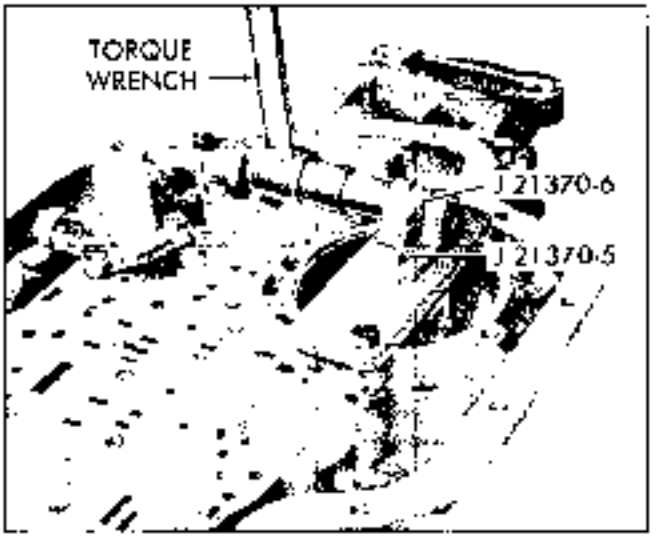


Fig. 7E-22 Checking Rear Band Pin

a. If both steps are above the gauge surface, the short pin, identified by 1 ring, should be used.

Identification rings are located on band lug end of the pin. Selecting the proper pin is equivalent of adjusting the band.

5. Remove solenoid attaching screws, solenoid assembly and gasket (Fig. 7E-23).

6. Withdraw detent solenoid case connector sleeve and O-ring seal (Fig. 7E-24).

7. Remove control valve assembly spacer plate and gasket.

8. Remove six (6) check balls from cored passages in transmission case (Fig. 7E-25).

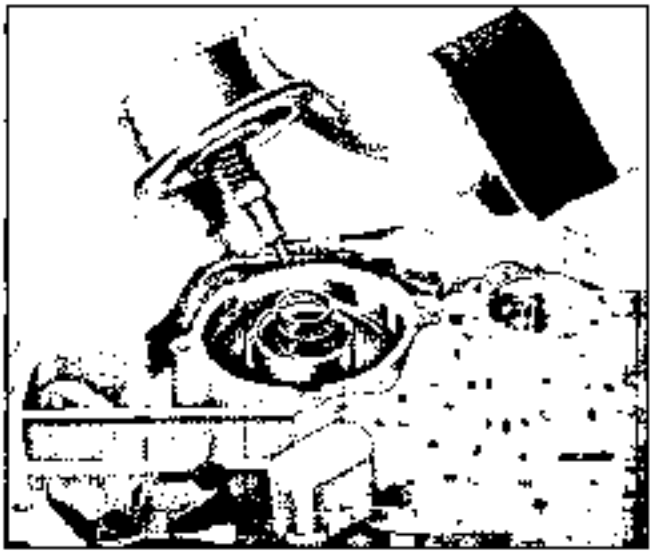


Fig. 7E-21 Removing Rear Servo

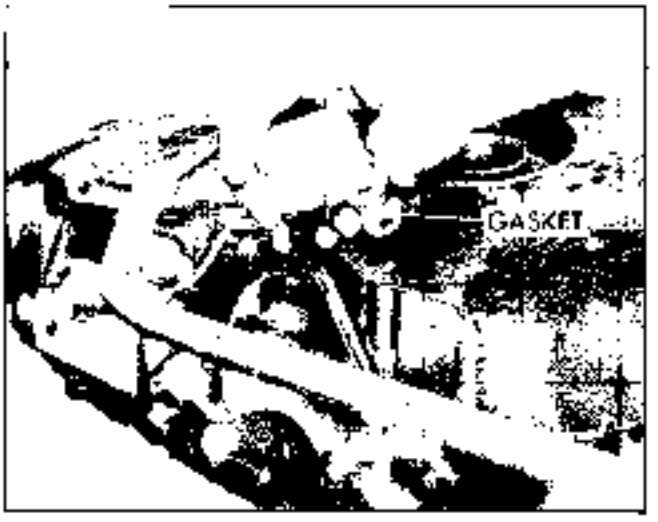


Fig. 7E-23 Removing Detent Solenoid and Gasket

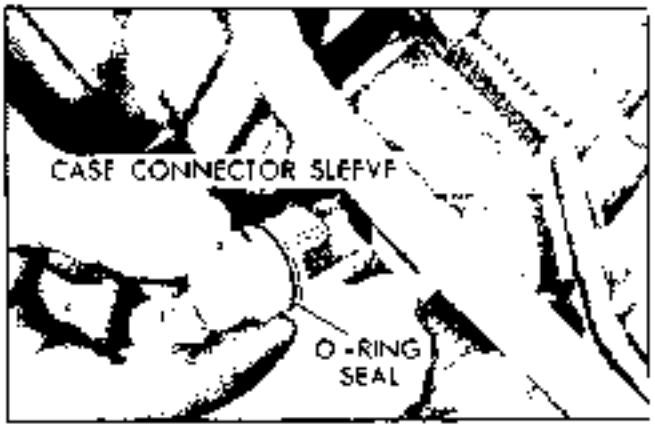


Fig. 7E-24 Removing Case Connector Sleeve and O-Ring Seal

NOTE: Mark location of bolts for aid in re-assembly.

9. Remove front servo piston, washer, pin, retainer and spring from transmission case (Fig. 7E-26).

REMOVAL OF REAR OIL SEAL AND EXTENSION HOUSING

1. If necessary to replace, pry rear oil seal from extension housing (Fig. 7E-27).

2. Remove extension housing to case attaching bolts.

3. Remove extension housing and extension housing to case gasket (Fig. 7E-28).

4. Make front unit end play check as follows (Fig. 7E-29):

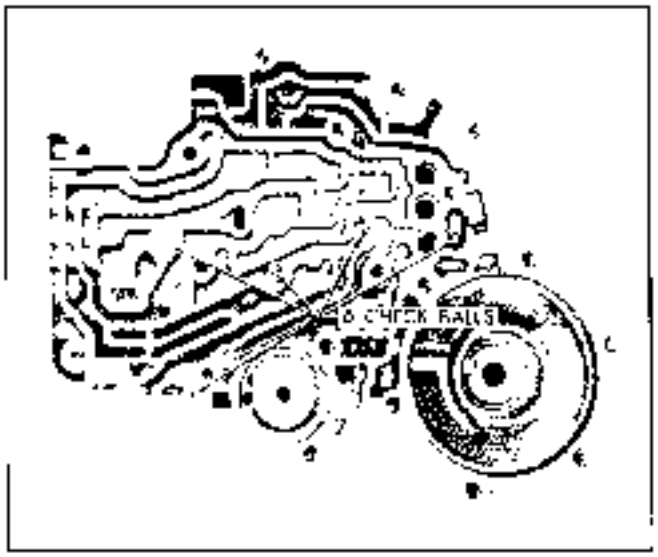


Fig. 7E-25 Location of Check Balls

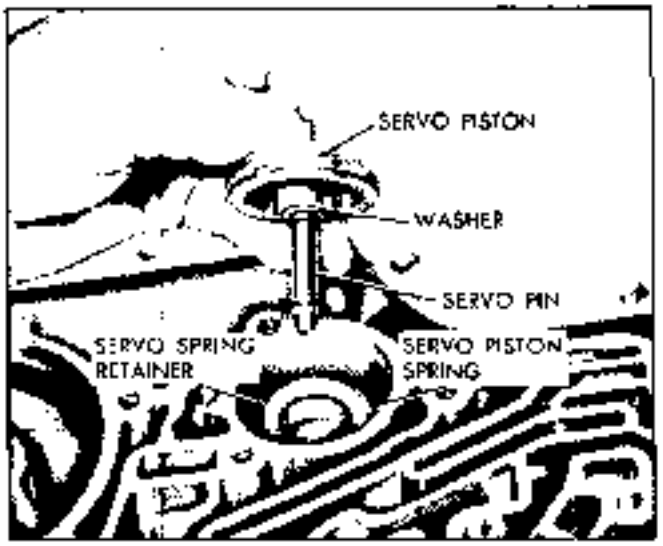


Fig. 7E-26 Removing Front Servo Piston, Washer and Pin

FRONT UNIT END PLAY CHECKING PROCEDURE

a. Remove one front pump attaching bolt and lock seal.

b. Install a 5/16"-18 threaded slide hammer bolt or J 21904-1 into bolt hole (see Fig. 7E-29 for location).

c. Mount dial indicator J 8001 on rod and index indicator to register with end of turbine shaft.

d. Push turbine shaft rearward.

e. Pull output shaft forward.

f. Set dial indicator to Zero.

g. Pull turbine shaft forward.

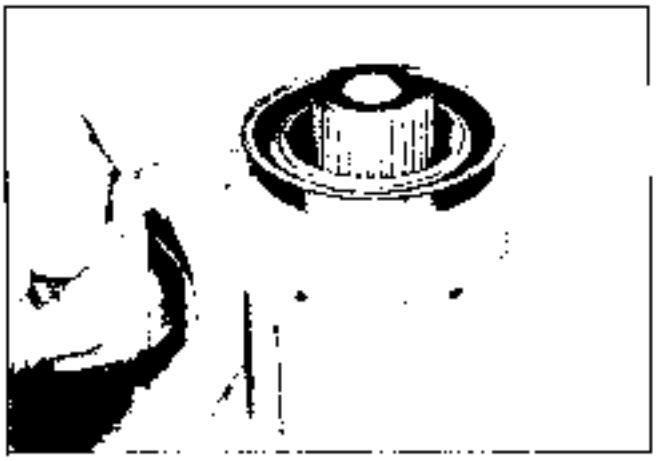


Fig. 7E-27 Removing Rear Oil Seal from Case Extension

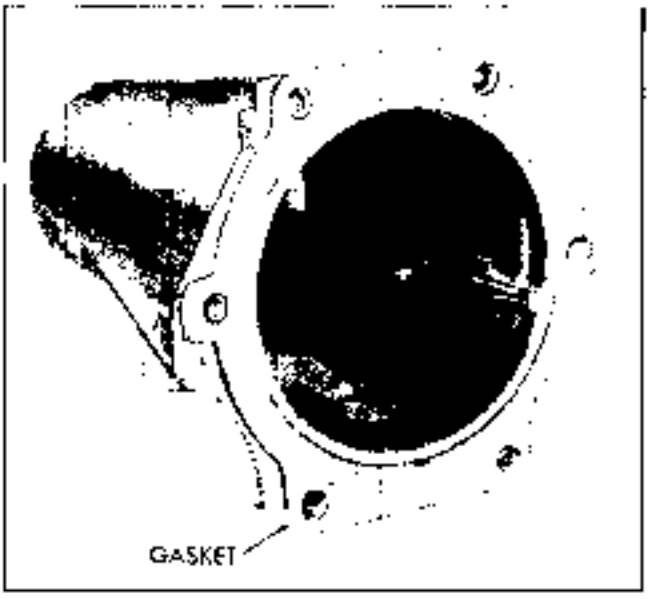


Fig. 7E-28 Location of Case Extension Gasket

b. Read resulting travel or end play. Should be .003"-.024".

Selective washer controlling this end play is the phenolic resin washer located between pump cover and forward clutch housing. If more or less washer thickness is required to bring end play within specifications, select proper washer from the following chart:

Thickness	Color
.068 - .064	Yellow
.071 - .075	Blue
.082 - .086	Red
.093 - .097	Brown
.104 - .108	Green
.115 - .119	Black
.126 - .130	Purple

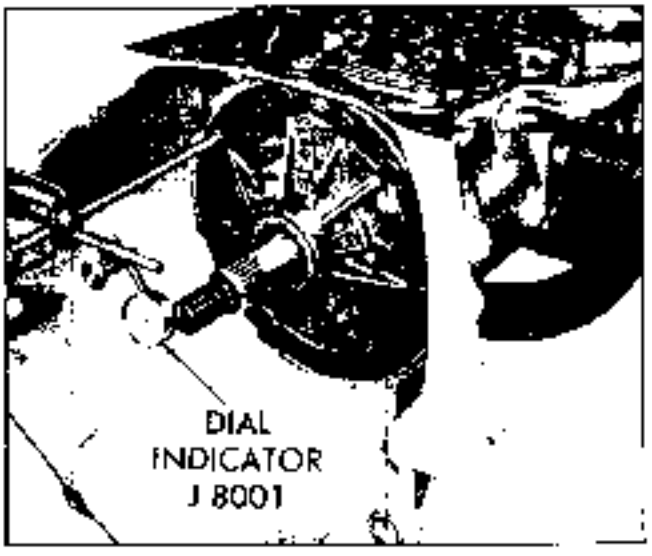


Fig. 7E-29 Checking Front Unit End Play

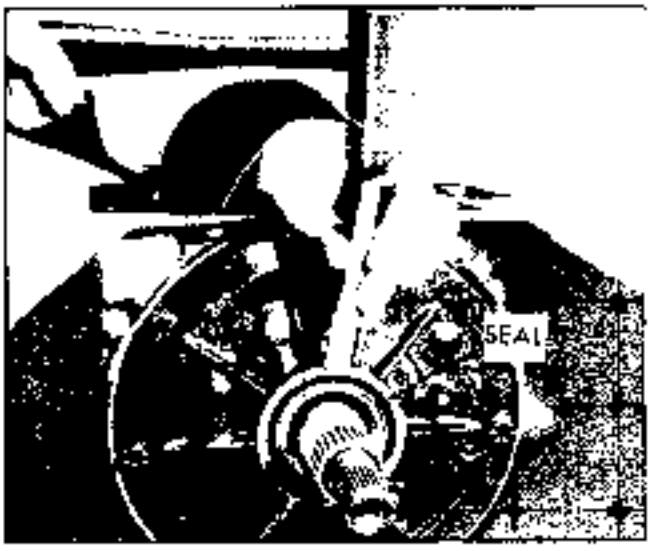


Fig. 7E-30 Removing Front Seal

NOTE: An oil soaked washer may tend to discolor, so it will be necessary to measure washer for its actual thickness.

REMOVAL OF OIL PUMP

1. If necessary to replace, pry front seal from pump (Fig. 7E-30).

2. Remove pump attaching bolts.

3. Install 3/8-16 threaded slide hammer adapters J 6125-2 into bolt holes in pump body, attach slide hammers J 6125-1 and remove pump assembly from case (See Fig. 7E-21 for location of threaded holes).

4. Remove and discard pump to case seal ring and gasket.

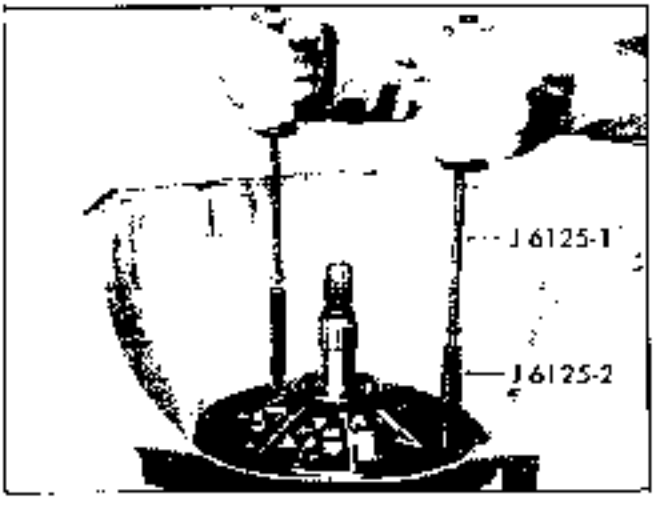


Fig. 7E-31 Removing Pump Assembly

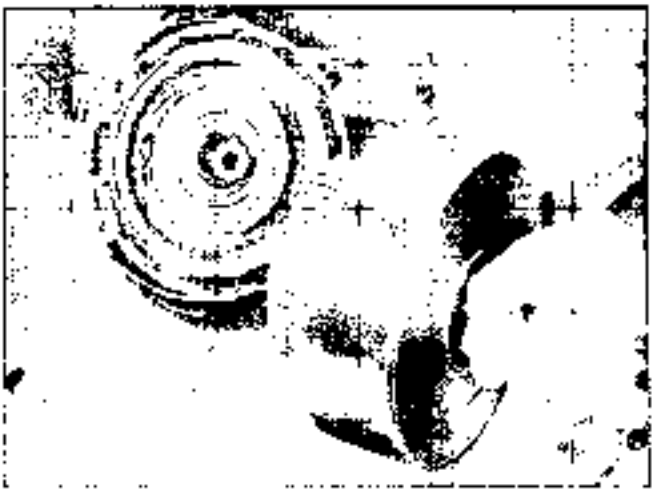


Fig. 7E-32 Removing Forward Clutch Assembly and Turbine Shaft

5. Remove forward clutch assembly and turbine shaft from transmission (Fig. 7E-32).

6. Remove forward clutch hub to direct clutch housing thrust washer if it did not come out with forward clutch housing.

7. Remove direct clutch assembly (Fig. 7E-33).

NOTE: If necessary, remove manual linkage as follows:

a. Unthread jam nut holding detent lever to manual shaft.

b. Remove manual shaft retaining pin from case (Fig. 7E-34).

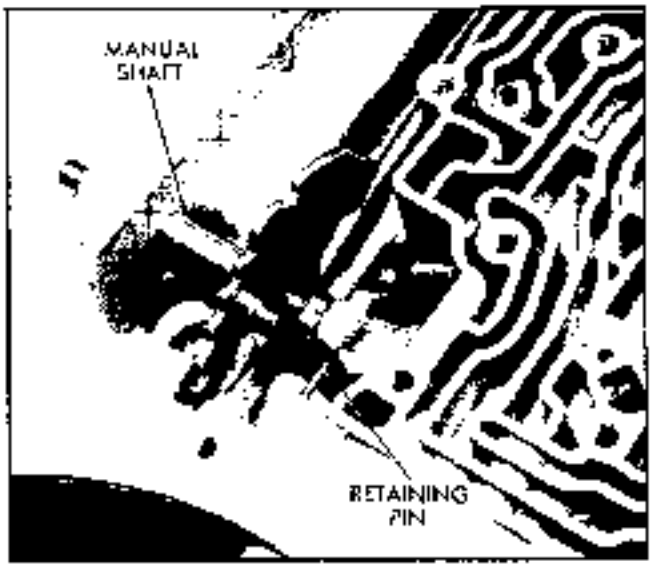


Fig. 7E-34 Removing Manual Shaft Retaining Pin from Case

CAUTION: Do not lose jam nut as it becomes free from manual shaft.

c. Remove manual shaft and jam nut from case (Fig. 7E-35).

d. Remove parking actuator rod and detent lever assembly.

e. Remove attaching screws and parking bracket (Fig. 7E-36).

f. Remove parking pawl return spring (Fig. 7E-37).

Fig. 7E-33 Removing Direct Clutch Assembly

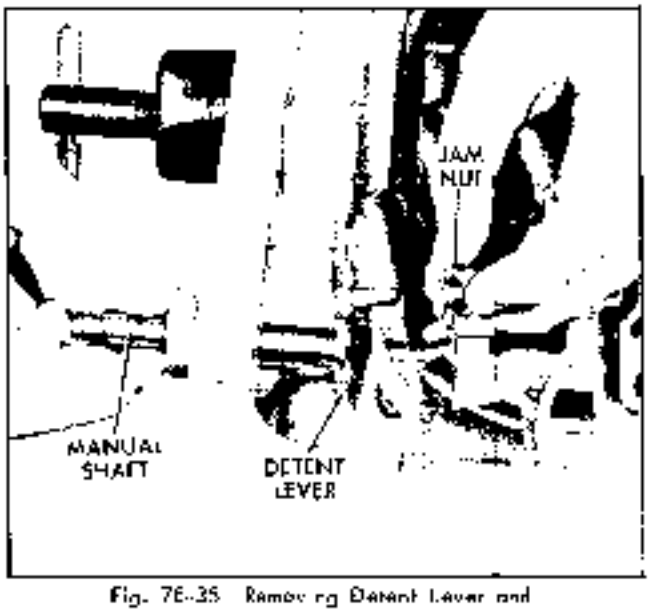


Fig. 7E-35 Removing Detent Lever and Jam Nut from Manual Shaft

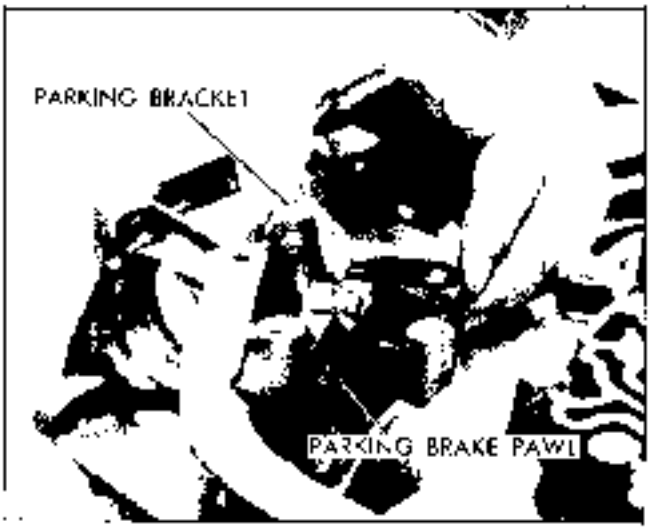


Fig. 7E-36 Removing Parking Bracket

Fig. 7E-38 Removing Parking Shaft Retaining Spring

NOTE: The following steps are to be completed only if one or more of the parts involved require replacement.

g. Remove parking pawl shaft retainer (Fig. 7E-38).

h. Remove parking pawl shaft cup plug by inserting a screwdriver between the parking pawl shaft and the transmission case rib (Fig. 7E-39).

i. Remove parking pawl shaft and parking pawl (Fig. 7E-40).

j. Remove front band (Fig. 7E-41).

k. Remove sun gear shaft (Fig. 7E-42).

Check Rear End Play As Follows:

a. Install J 21904 into an extension housing attaching bolt hole (Fig. 7E-43).

b. Mount dial indicator J 8001 on rod and index with end of output shaft.

c. Move output shaft in and out to read end play. End play should be from .003" to .019". Selective washer controlling this end play is steel washer having 3 lugs. It is located between thrust washer and rear face of transmission case.

If a different washer thickness is required to bring end play within specification, it can be selected from the following chart:

Fig. 7E-37 Removing Parking Pawl Return Spring

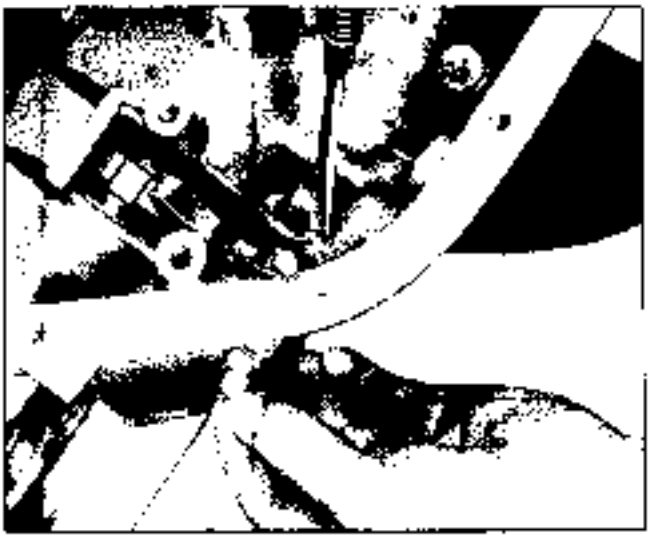


Fig. 7E-39 Removing Parking Pawl Shaft Cup

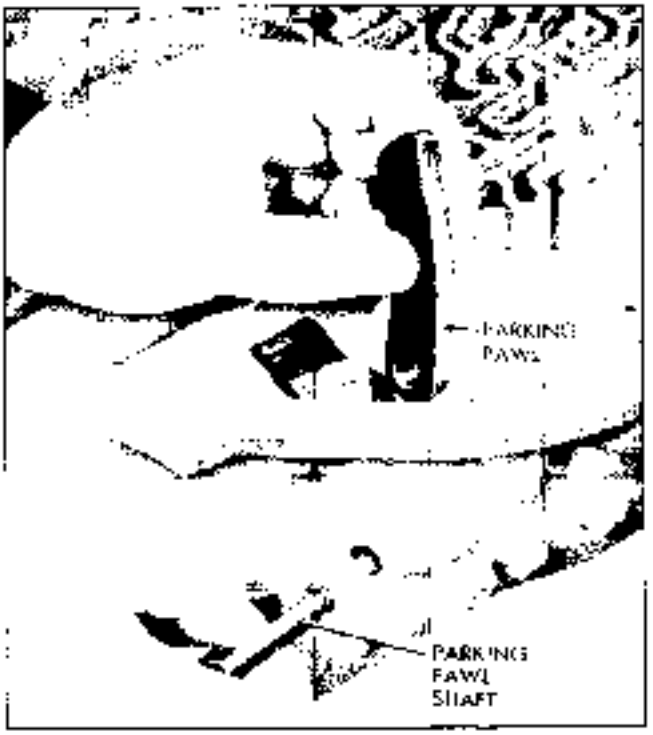


Fig. 7E-40 Removing Parking Pawl and Shaft with O-Ring

Thickness (in inches)	Notches	and/or Stamped No.
.074 - .078	None	1
.082 - .086	1 Tab Side	2
.090 - .094	2 Tab Side	3
.098 - .102	1 Tab O.D.	4
.106 - .110	2 Tabs O.D.	5
.114 - .118	3 Tabs O.D.	6

10. Remove case center support to case bolt (Fig. 7E-44).

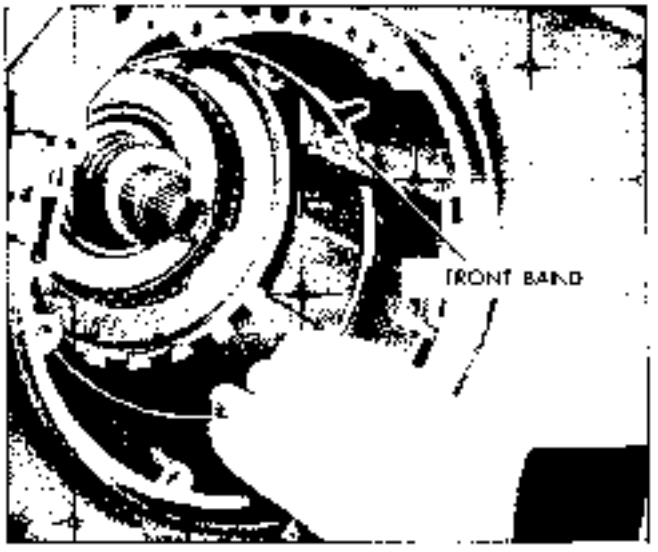


Fig. 7E-41 Removing Front Band

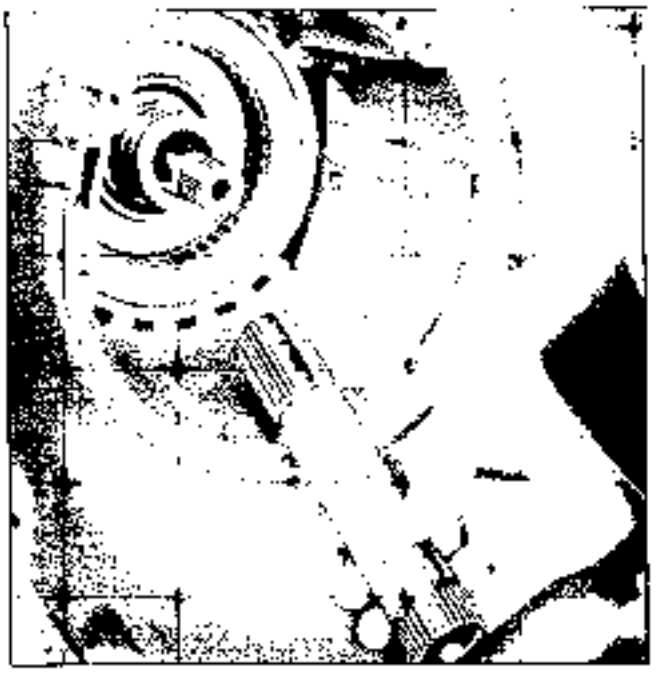


Fig. 7E-42 Removing Sun Gear Shaft

11. Remove intermediate clutch backing plate to case snap ring.

12. Remove intermediate clutch backing plate, three (3) composition and three (3) steel clutch plates (Fig. 7E-45).

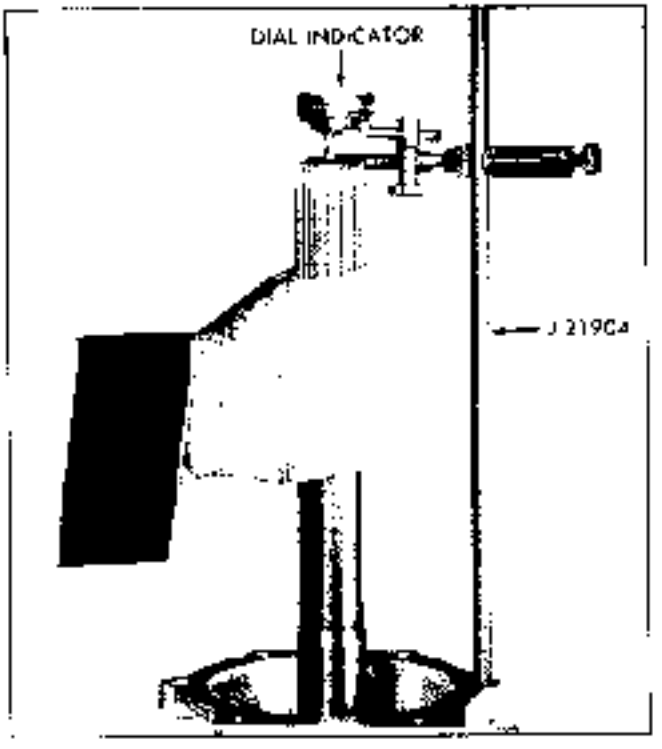


Fig. 7E-43 Checking Gear Unit End Play

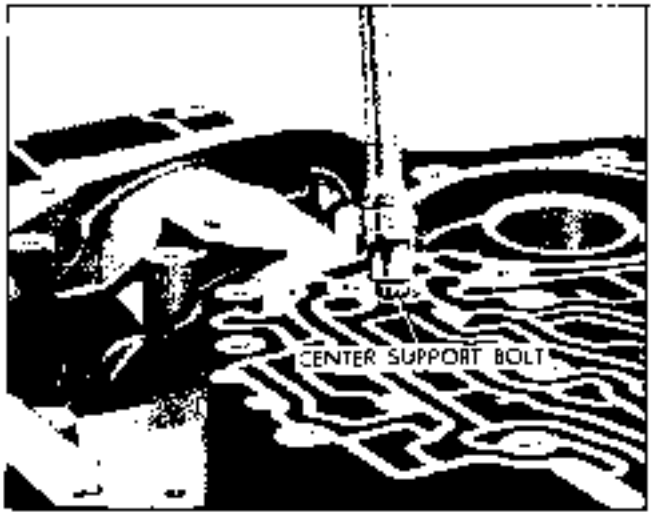


Fig. 7E-44 Removing Center Support Bolt

13. Remove center support to case retaining snap ring (Fig. 7E-46).

14. Remove entire gear unit assembly by lifting with gear assembly installing and removing tool J 21795 with J 6125-1 slide hammer (Fig. 7E-47).

15. Remove output shaft to case thrust washer from rear of output shaft or from inside of case.

16. Place gear unit assembly, with output shaft facing down, in hole in work bench or holding fixtures J 6116 and J 21396.

17. Remove rear unit selective washer from transmission case (Fig. 7E-48).

18. Remove rear band assembly (Fig. 7E-49).

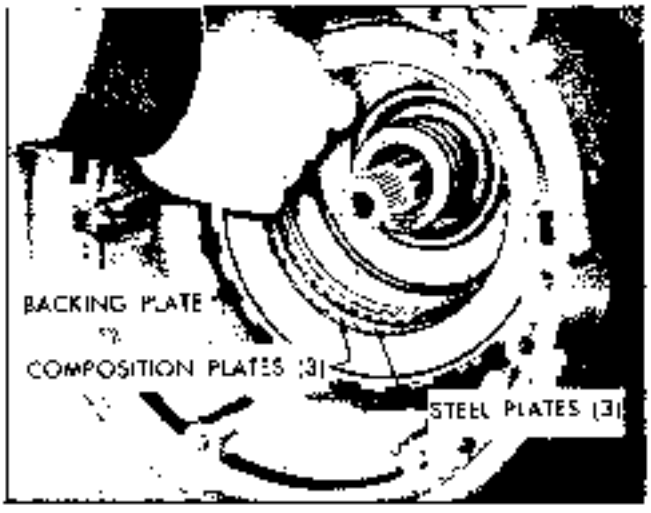


Fig. 7E-45 Removing Intermediate Backing Plate and Clutch Plates

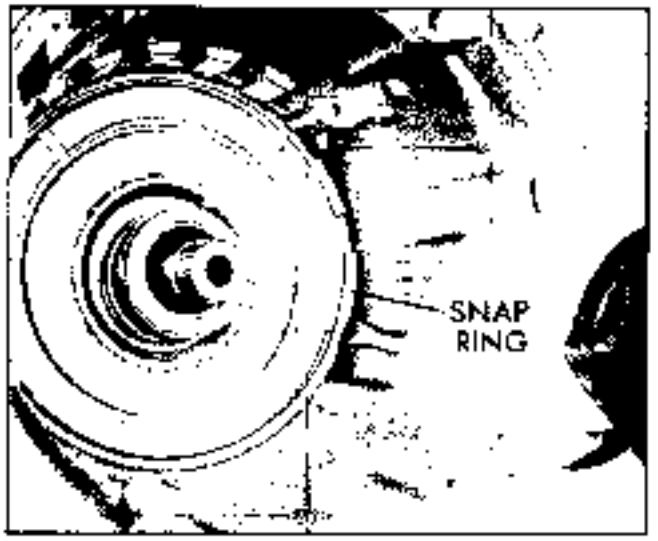


Fig. 7E-46 Removing Center Support to Case Snap Ring

DISASSEMBLY OF GEAR UNIT

1. Remove case center support assembly (Fig. 7E-50).

2. Remove center support to reaction carrier phenolic thrust washer (Fig. 7E-51).

3. Remove center support to sun gear races and thrust bearing.

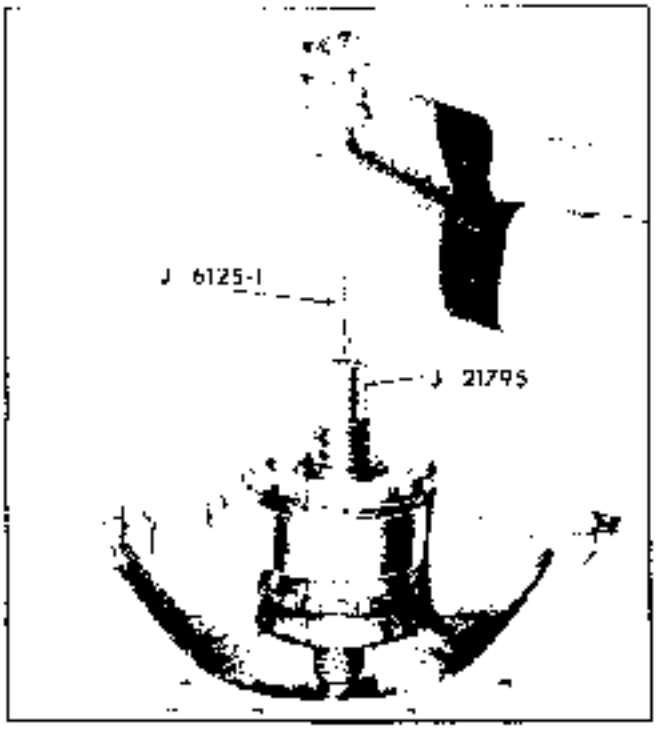


Fig. 7E-47 Removing Case Center Support and Gear Unit from Case

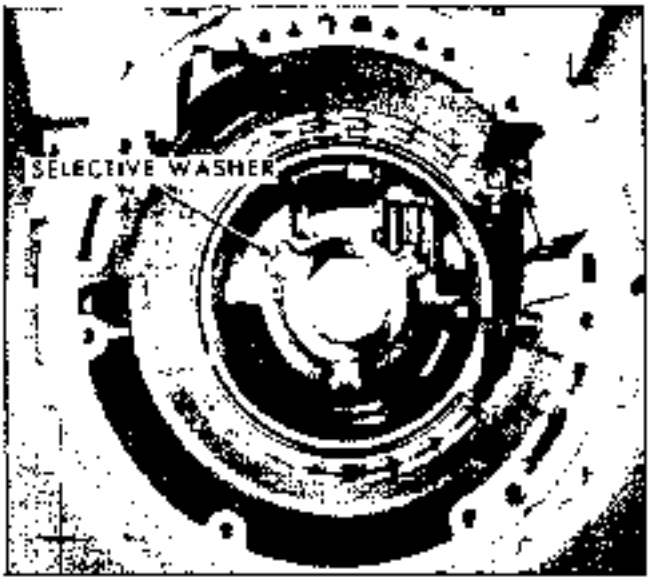


Fig. 7E-48 Removing Selective Washer

NOTE: One race may have been removed with center support.

4. Remove reaction carrier and roller clutch assembly (Fig. 7E-52).

5. Remove front internal gear ring from output carrier assembly.

6. Remove sun gear (Fig. 7E-53).

7. Remove reaction carrier to output carrier thrust washer.

8. Turn carrier assembly over.

9. Remove output shaft to output carrier snap ring (Fig. 7E-54).

10. Remove output shaft.

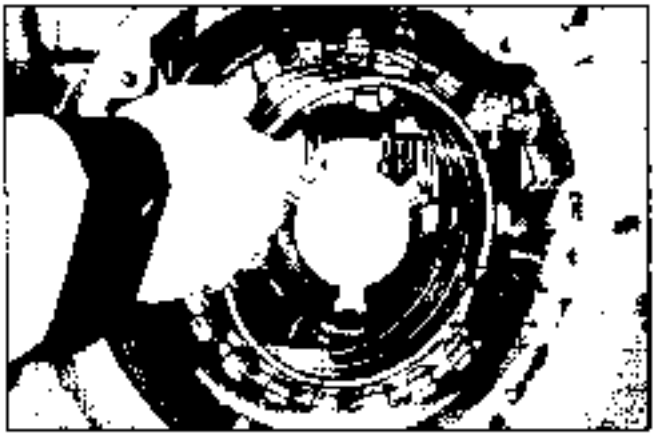


Fig. 7E-47 Removing Rear Band

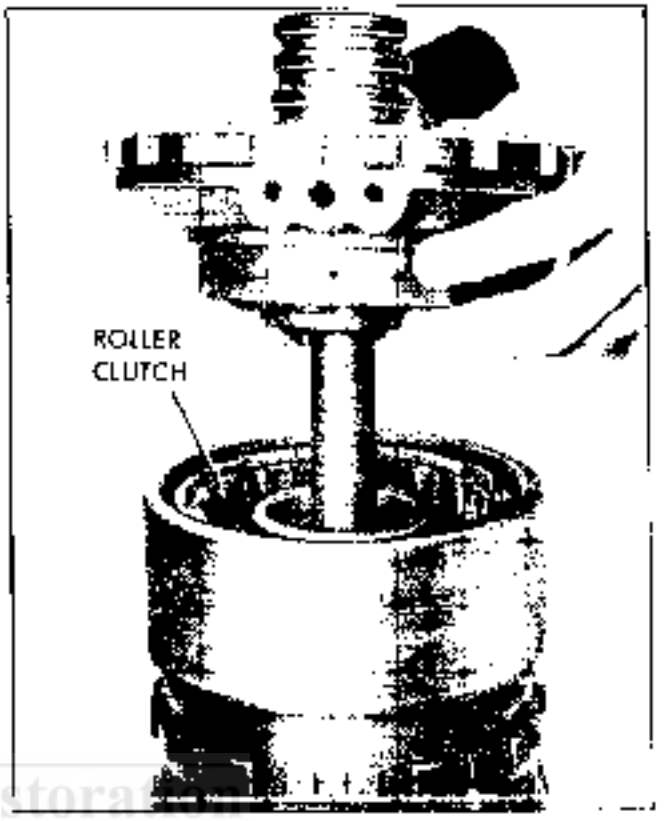


Fig. 7E-50 Removing Case Center Support Assembly

NOTE: If replacement of drive speedo gear is necessary, remove in following manner.

a. Install speedo gear removing tool J 21427 and J 8433 and bolts J 21965 on output shaft and remove drive speedo gear (Fig. 7E-55).

b. Install new drive speedo gear and drive to location 11 29/64" below end of output shaft for models PA, PB, PC, PG and PH and 5 21/32" below end of output shaft for models PQ, PT, PX and PY, using J 21528 (cup side up) and J 6133 (Fig. 7E-56).

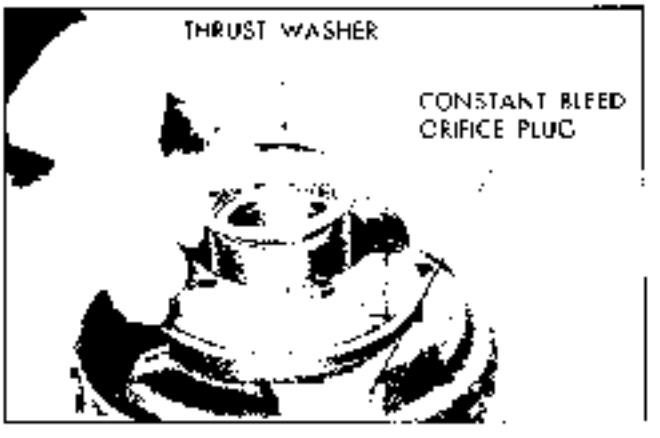


Fig. 7E-51 Removing Center Support Thrust Washer

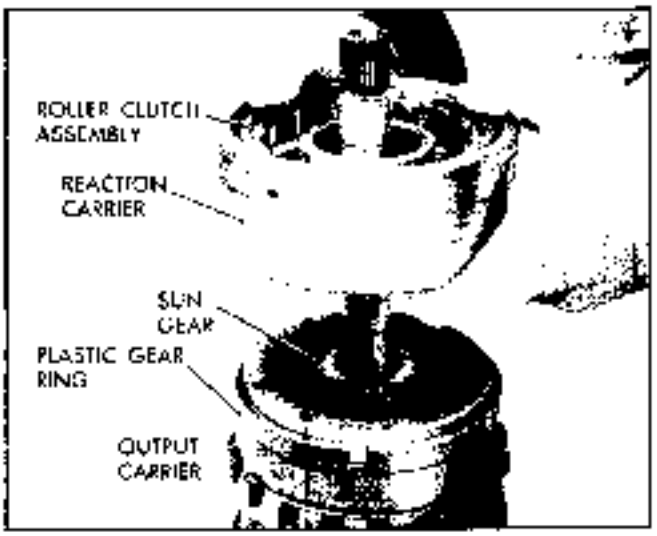


Fig. 7E-52 Removing Reaction Carrier and Roller Clutch from Output Carrier

11. Remove output shaft to rear internal gear thrust bearing and two (2) races.

12. Remove rear internal gear and mainshaft (Fig. 7E-57).

NOTE: Do not drop bearings.

13. Remove rear internal gear to sun gear thrust bearing and two (2) races.

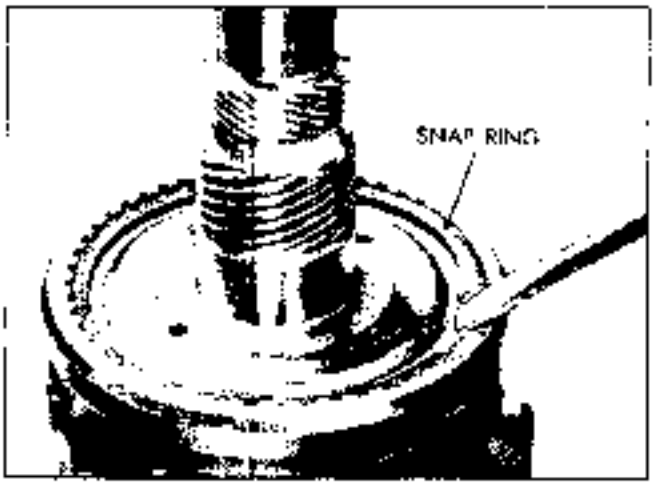


Fig. 7E-54 Removing Output Shaft to Carrier Snap Ring

14. If necessary, remove rear internal gear to mainshaft snap ring to remove mainshaft (Fig. 7E-58).

GOVERNOR ASSEMBLY

All components of governor assembly, with exception of driven gear, are a select fit and each assembly is calibrated. The governor, including the driven gear, is serviced as a complete assembly. However, the driven gear can also be serviced separately.

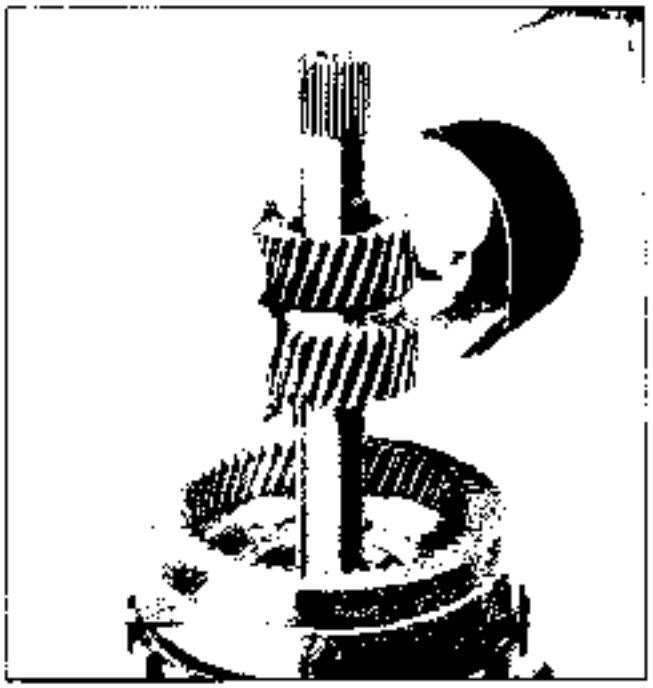


Fig. 7E-53 Removing Sun Gear

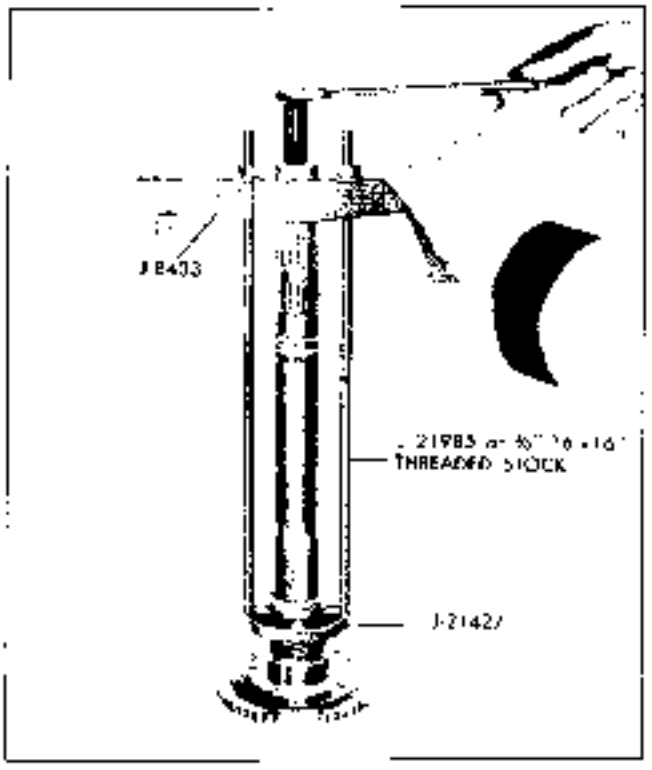


Fig. 7E-55 Removing Speedometer Drive Gear

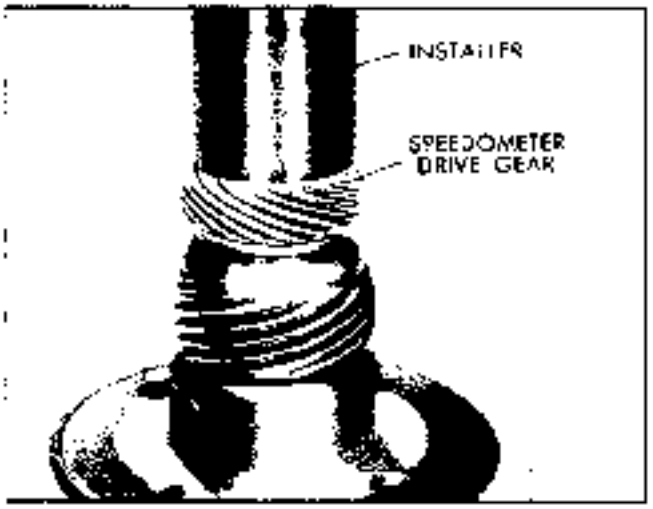


Fig. 7E-56 Installing Speedometer Drive Gear

It is necessary to disassemble governor assembly in order to replace driven gear. Disassembly may also be necessary due to foreign material causing improper operation. In such cases, proceed as follows:

DISASSEMBLY OF GOVERNOR

1. Cut off one end of each governor weight pin and remove pins, governor thrust cap, governor weights and springs. Governor weights are interchangeable from side to side and need not be identified (Fig. 7E-59).

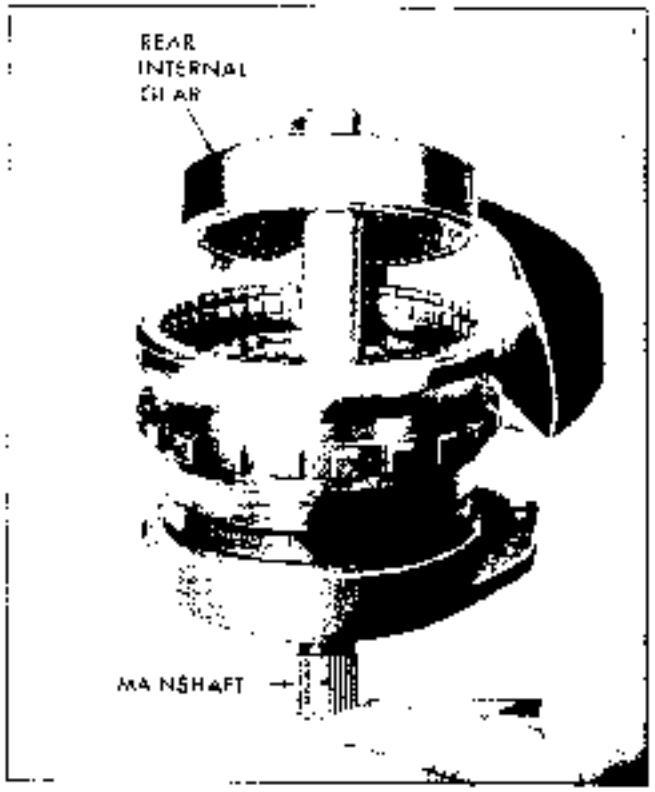


Fig. 7E-57 Removing Rear Internal Gear and Mainshaft

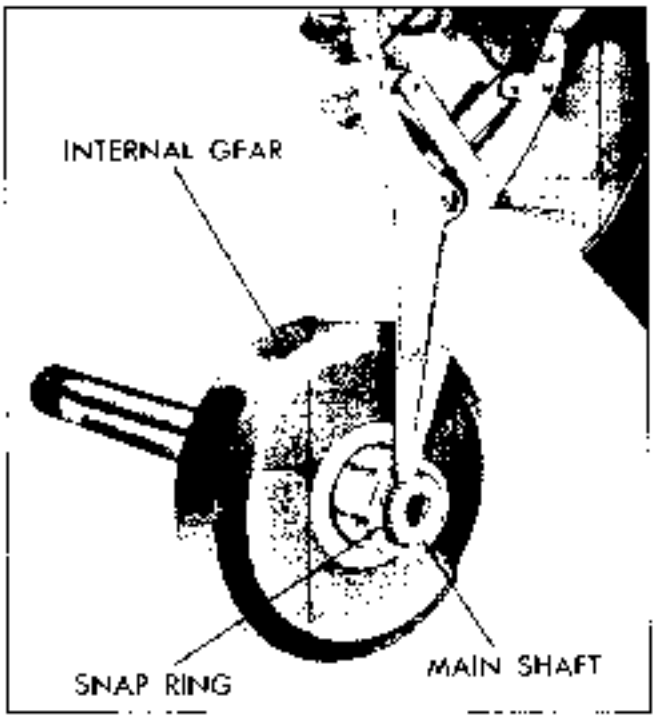


Fig. 7E-58 Removing Rear Internal Gear to Mainshaft Snap Ring

2. Remove governor valve from governor sleeve. Be careful not to damage valve.

3. Perform the following inspections and replace governor driven gear, if necessary.

INSPECTION OF GOVERNOR

1. Wash all parts in cleaning solvent, air dry and blow out all passages.

2. Inspect governor sleeve for nicks, burrs, scoring or galling.

3. Check governor sleeve for free operation in bore of transmission case.

4. Inspect governor valve for nicks, burrs, scoring or galling.

5. Check governor valve for free operation in bore of governor sleeve.

6. Inspect governor driven gear for nicks, burrs or damage.

7. Check governor driven gear for looseness on governor sleeve.

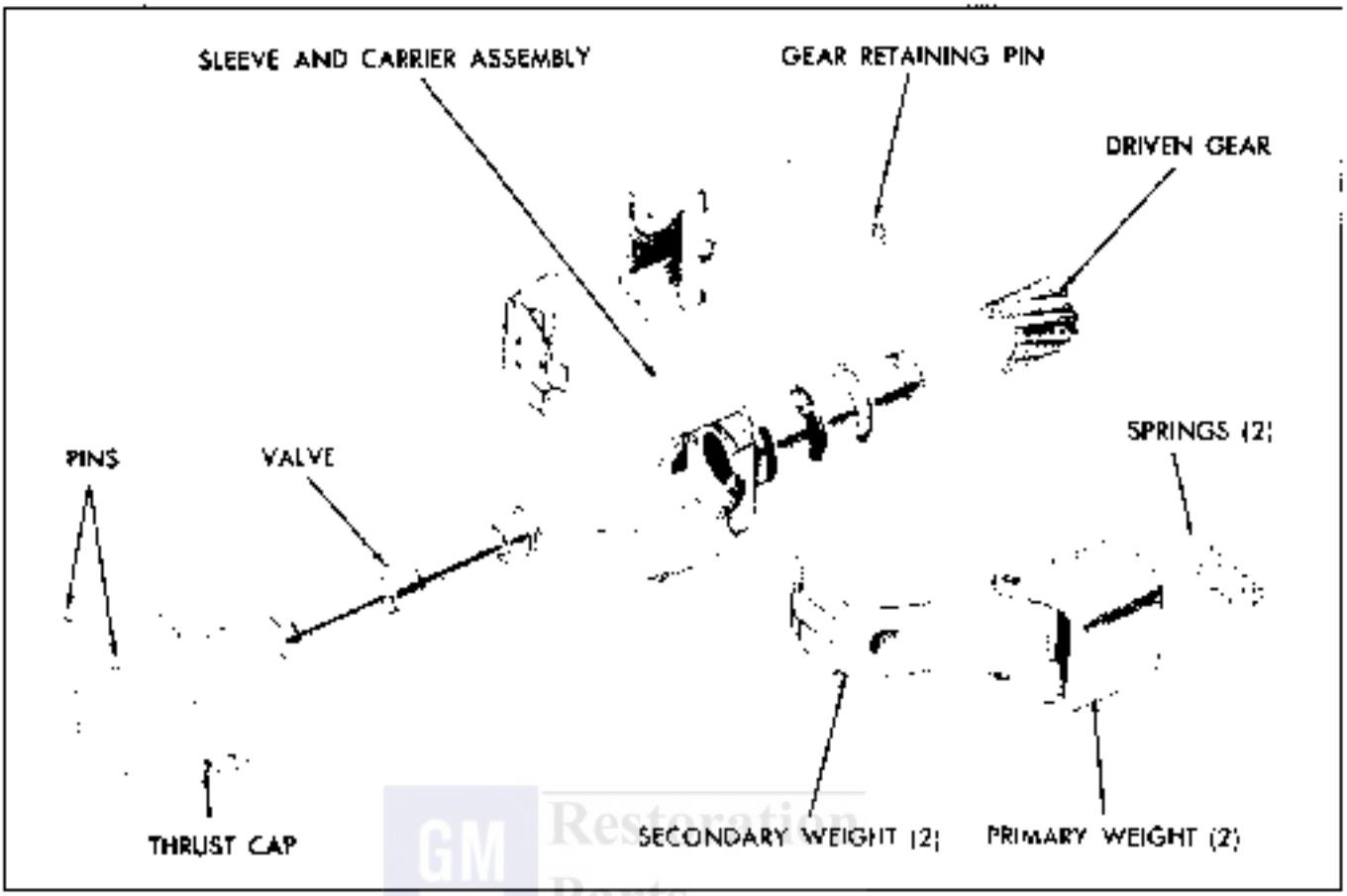


Fig. 7E-39 Exploded View of Governor

8. Inspect governor weight springs for distortion or damage.

9. Check governor weights for free operation in their retainers.

10. Check valve opening at entry and exhaust (.020" minimum).

GOVERNOR DRIVEN GEAR REPLACEMENT

To facilitate governor repair in the field, a governor driven gear and replacement pins are available for service use. The service package contains a nylon driven gear, two governor weight retaining pins and one governor gear retainer split pin. Replacement of gear must be performed with care in the following manner:

1. Drive out governor gear retaining split pin using small punch (Fig. 7E-60).

2. Support governor on 3/16" plates installed in exhaust slots of governor sleeve, place in arbor press, and with long punch, press gear out of sleeve.

3. Carefully clean governor sleeve of chips that remain from original gear installation.

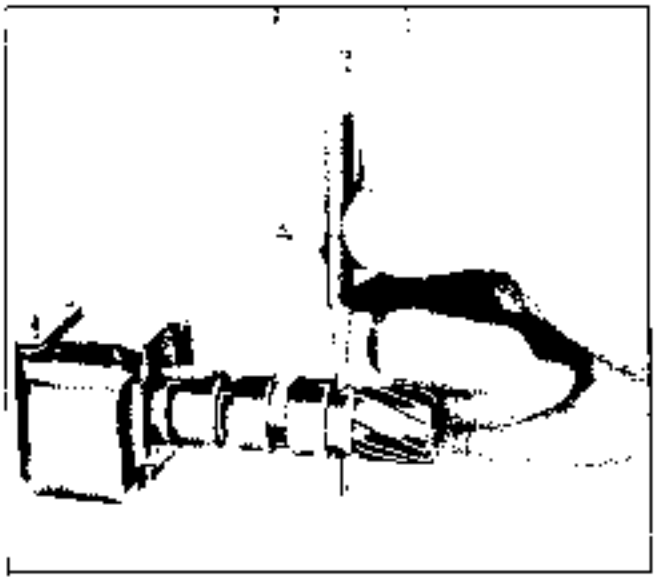


Fig. 7E-60 Removing Governor Gear Retaining Pin

4. Support governor on 3/16" plates installed in exhaust slots of sleeve, position new gear in sleeve and, with suitable socket, press gear into sleeve until nearly seated. Carefully remove any chips that may have shaved off gear hub and press gear in until it bottoms on shoulder.

5. A new pin hole must be drilled through sleeve and gear. Locate hole position 90° from existing hole, center punch and then while supporting governor in press, drill new hole through sleeve and gear using a standard 1/8" drill.

6. Install retaining pin.

7. Wash governor assembly thoroughly to remove any chips that may have collected.

ASSEMBLY OF GOVERNOR

1. Install governor valve in bore of governor sleeve.

2. Install governor weights and springs and thrust cap on governor sleeve.

3. Align pin holes in thrust cap, governor weight assemblies and governor sleeve and install new pins. Crimp both end of pins to prevent them from falling out.

4. Check governor weight assemblies for free operation on pins and governor valve for free movement in governor sleeve.

INSPECTION OF FRONT SERVO

1. Inspect servo pin for damage.

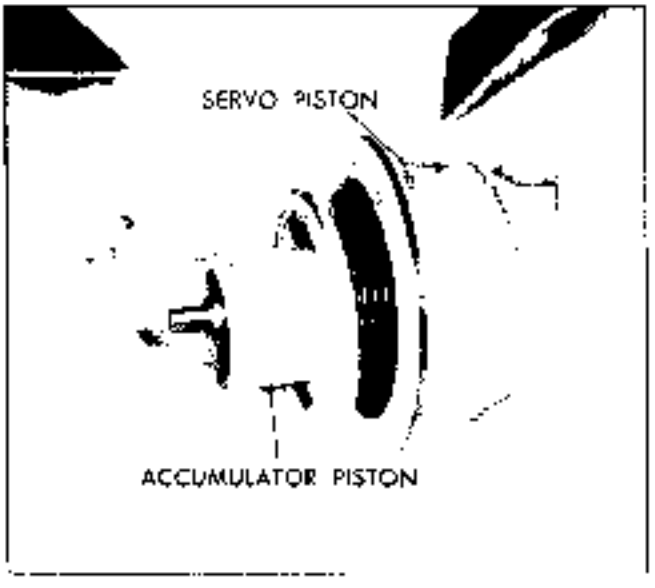


Fig. 7E-61 Removing Rear Accumulator Piston from Rear Servo

2. Inspect servo piston for damaged oil ring groove and check freedom of ring in groove.

3. Inspect piston for cracks or porosity.

4. Check fit of servo pin in piston.

REAR SERVO

DISASSEMBLY OF REAR SERVO

1. Remove rear accumulator piston from rear servo piston (Fig. 7E-61).

2. Remove E-ring retaining rear servo piston to band apply pin (Fig. 7E-62).

3. Remove rear servo piston and seal from band apply pin (Fig. 7E-63).

4. Remove washer, spring and retainer.

INSPECTION OF REAR SERVO

1. Inspect freedom of accumulator rings to piston.

2. Inspect fit of band apply pin in servo piston.

3. Inspect band apply pin for scores or cracks.

4. Inspect accumulator and servo pistons for cracks or porosity.

ASSEMBLY OF REAR SERVO

1. Install spring retainer, spring and washer on band apply pin.

2. Install band apply pin, retainer, spring and washer into bore of servo piston and secure with E-ring.

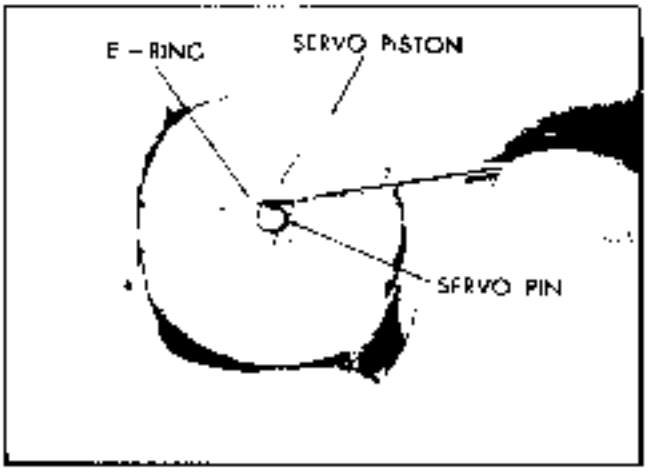


Fig. 7E-62 Removing Retaining E-Ring from Rear Servo Pin

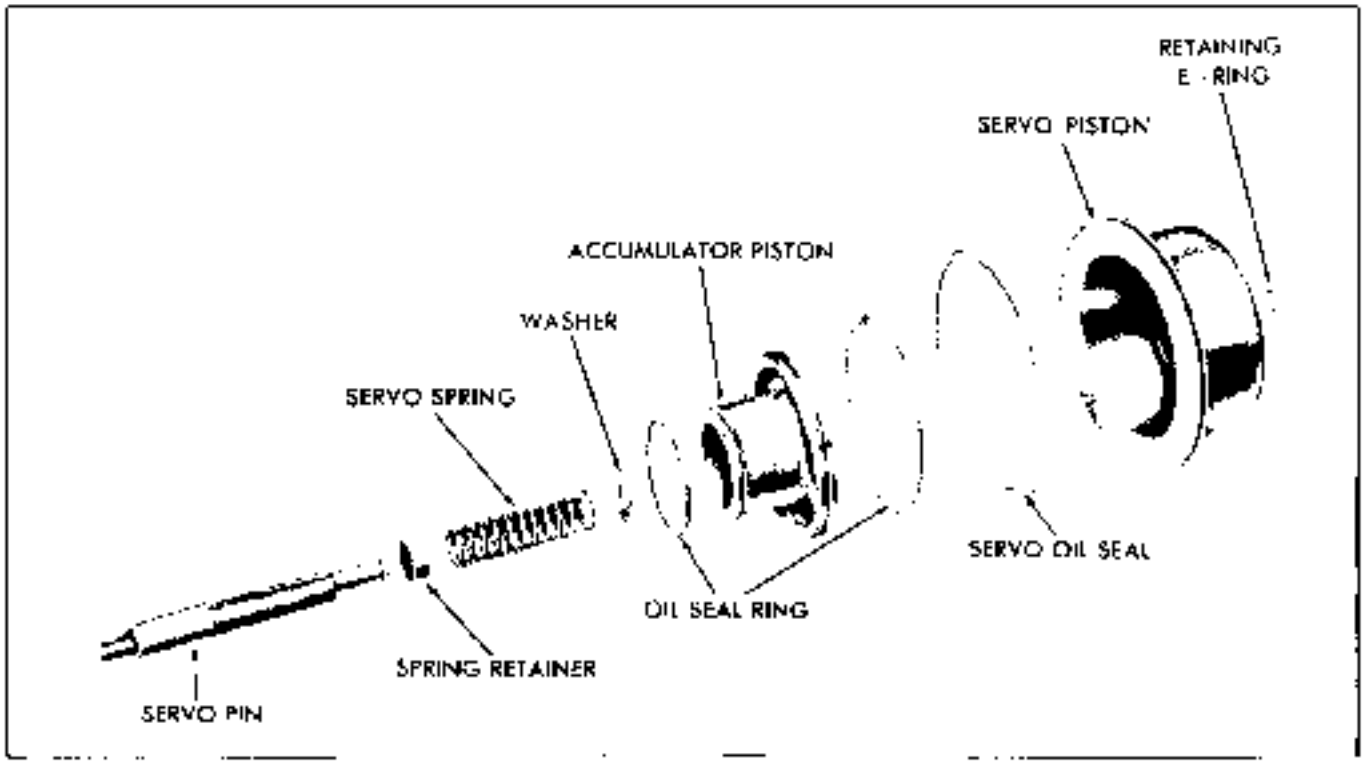


Fig. 7E-63 Exploded View of Rear Servo and Accumulator

3. Install oil seal on servo piston, if removed.

4. Install outer and inner oil rings on accumulator piston, if removed, and assemble into bore of servo piston.

CONTROL VALVE ASSEMBLY

DISASSEMBLY OF CONTROL VALVE ASSEMBLY

1. Position control valve assembly with cored face up and accumulator pocket toward operator.

2. Remove manual valve from upper bore.

3. Install special tool J 21885 on accumulator piston valve and remove retaining ring (Fig. 7E-64).

4. Remove front accumulator piston and spring (Fig. 7E-65).

5. From the top right hand bore, remove the 1-2 valve train as follows:

a. (All models except PA and PC) Remove retaining pin, 1-2 modulator bushing, 1-2 regulator valve, 1-2 regulator spring, 1-2 detent valve and 1-2 shift valve.

b. (Models PA and PC) Remove retaining pin, 1-2 modulator bushing, 1-2 modulator spring, 1-2 modulator valve and 1-2 shift valve.

6. From next bore, remove retaining pin, 2-3 shift valve spring, modulator valve bushing, 2-3 modulator valve, 2-3 intermediate spring and 2-3 shift valve.

7. From next bore, remove retaining pin, bore plug, spring, spacer and 3-2 valve (Except PB and PT models).

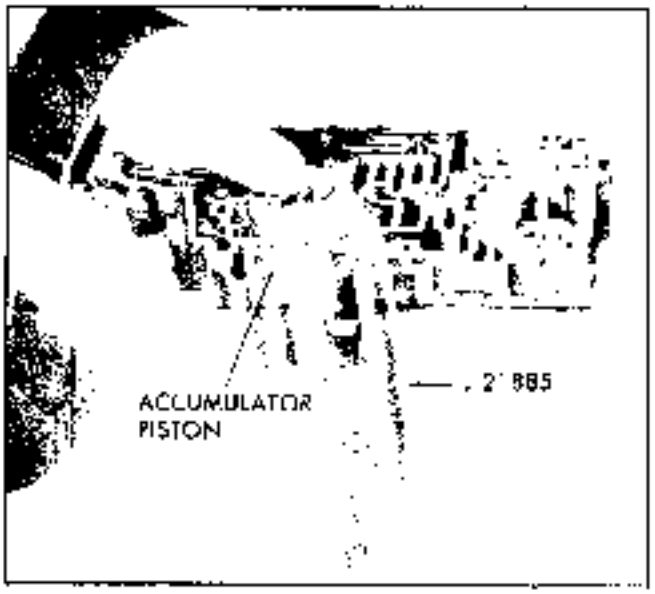


Fig. 7E-64 Installing Compressor Tool to Front Accumulator Piston

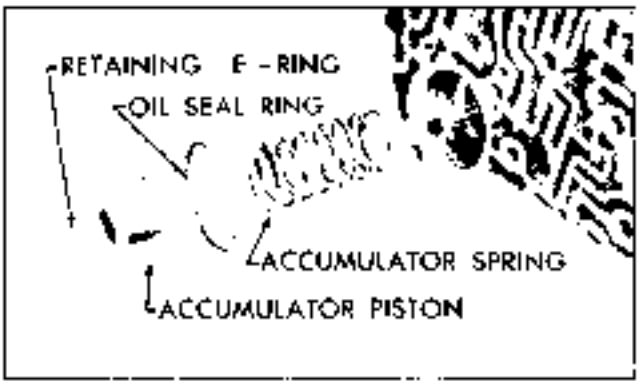


Fig. 7E-65 Removing Front Accumulator Piston and Spring

8. At other end of assembly, top bore, remove retaining pin and bore plug, detent valve, detent regulator valve, spring and spacer.

9. Remove the grooved retaining pin from the next bore down, the bore plug, 1-2 accumulator secondary spring, 1-2 accumulator valve, 1-2 accumulator bushing, 1-2 primary accumulator valve and the 1-2 accumulator primary spring.

10. Remove the governor oil screen from the governor oil feed pipe (Fig. 7E-67).

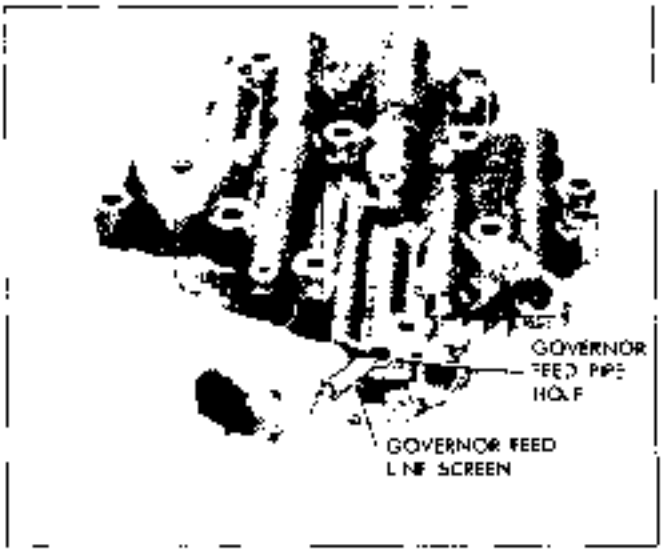
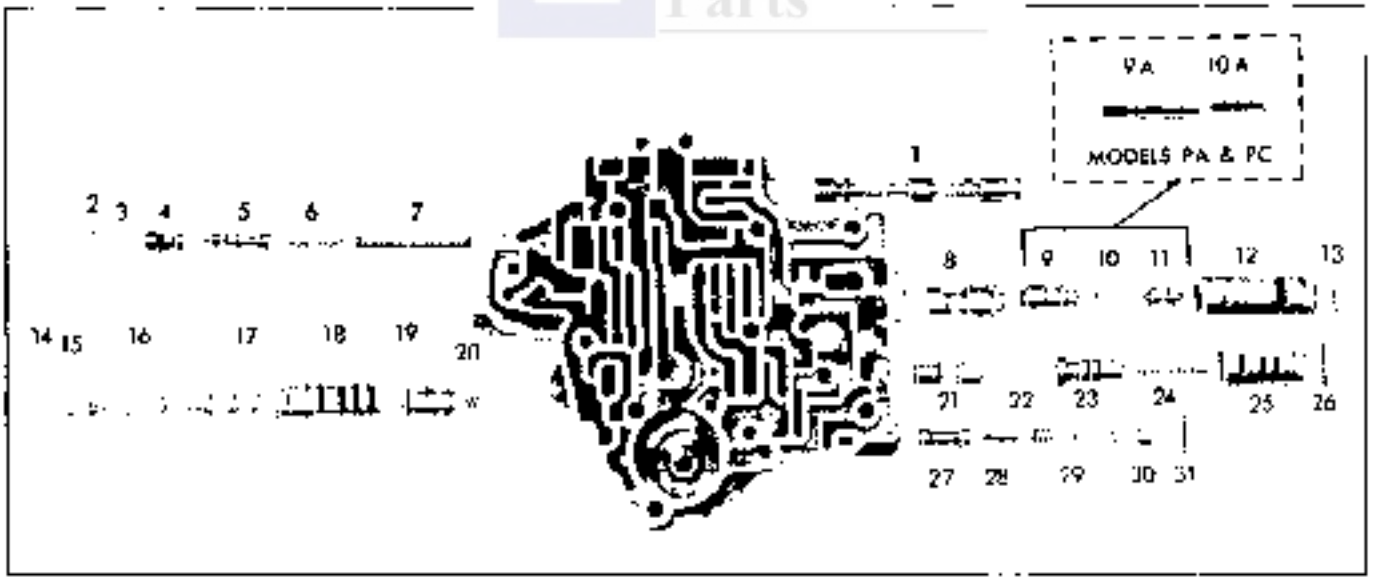


Fig. 7E-67 Removing Governor Feed Line Screen

INSPECTION OF CONTROL VALVE

1. Inspect all valves for scoring, cracks and free movement at their respective bore.



1. Manual Valve
2. Retaining Pin
3. Bore Plug
4. Detent Valve
5. Detent Regulator Valve
6. Spacer
7. Detent Regulator Valve Spring
8. 1-2 Shift Valve
9. 1-2 Detent Valve
9A. 1-2 Modulator Valve (PA and PC only)
10. 1-2 Regulator Valve Spring
10A. 1-2 Modulator Valve Spring (PA and PC only)
11. 1-2 Regulator Valve
12. 1-2 Modulator Bushing
13. Retaining Pin
14. Grooved Retaining Pin
15. Bore Plug
16. 1-2 Accumulator Valve Bushing
17. 1-2 Secondary Accumulator Spring
18. 1-2 Accumulator Valve
19. 1-2 Primary Accumulator Valve
20. 1-2 Primary Accumulator Spring
21. 2-3 Shift Valve
22. 3-2 Intermediate Spring
23. 2-3 Modulator Valve
24. 2-3 Shift Valve Spring
25. 2-3 Modulator Bushing
26. Retaining Pin
27. 3-2 Valve } All Models Except PB and PT
28. Spacer
29. 3-2 Valve Spring
30. Bore Plug
31. Retaining Pin

Fig. 7E-66 Exploded View of Control Valve

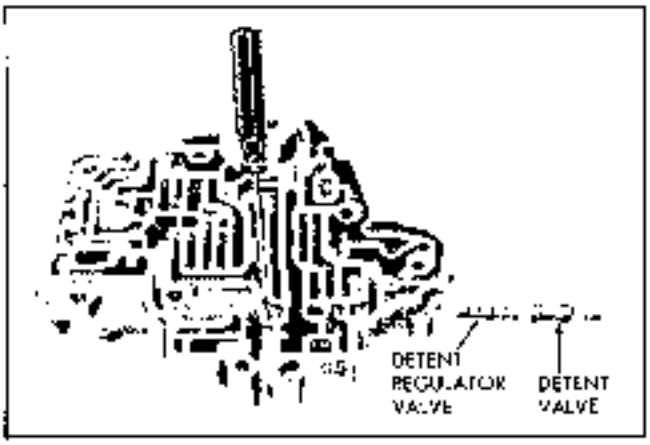


Fig. 7E-68 Installing Detent Regulator and Valve

2. Inspect bushing for cracks, scratches or distortion.

3. Inspect body for cracks or scored bores.

4. Check all springs for distortion or collapsed coils.

5. Clean governor oil screen in clean solvent.

ASSEMBLY OF CONTROL VALVE

1. Install front accumulator spring and piston into valve body.

2. Install special tool J 21885 and compress spring and piston and secure with retaining E-ring.

3. Install 1-2 primary accumulator spring in lower left bore.

4. Install 1-2 primary accumulator valve.

5. Install 1-2 accumulator valve with stem end out into the 1-2 accumulator bushing and install the bushing into the bore.

6. Install 1-2 accumulator secondary spring and bore plug. Compress plug and install grooved retaining pin from cast surface side of the valve body, with the grooves entering the pin hole last. Tap pin with hammer until flush with cast surface.

7. In next bore up, install detent spring and spacer. Compress spring and secure with small screwdriver (Fig. 7E-68).

8. Install detent regulator valve, wide land first.

9. Install detent valve, narrow land first.

10. Install bore plug (hole out), depress spring by pressing in on plug and install retaining pin. Remove screwdriver.

11. In lower right hand bore, install 3-2 valve. (Except PB and PT models)

12. Install 3-2 spring, spacer, bore plug (hole out) and retaining pin (Except PB and PT models).

13. In next bore up, install 2-3 valve, stem end out, and 3-2 intermediate spring.

14. Install 2-3 modulator valve into bushing and install both parts into valve body bore.

15. Install 2-3 valve spring and retaining pin.

16. In next bore up, install 1-2 valve, stem end out (Small land first).

17. Install the 1-2 regulator valve train as follows:

a. (All models except PA and PC) Install the 1-2 regulator valve, spring and detent valve into bushing, aligning spring in bore of detent valve and install parts into valve body bore.

b. (Models PA and PC) Install the 1-2 modulator spring and 1-2 modulator valve into the 1-2 modulator bushing. Install parts into valve body bore.

18. Compress bushing against spring and install retaining pin.

19. Install the governor oil screen in the governor oil feed hole (Fig. 7E-67).

NOTE: Screen is held in place by the governor feed pipe when installed on the transmission case.

20. Install manual valve with detent pin groove to the right.

OIL PUMP

DISASSEMBLY OF OIL PUMP (Fig. 7E-69)

1. Place oil pump assembly in hole in bench or holding fixture J 6116 and J 21364 adapter.

2. Compress regulator boost valve bushing against pressure regulator spring and remove snap ring, using snap ring pliers (Fig. 7E-70).

3. Remove regulator boost valve bushing and valve.

4. Remove pressure regulator spring.

5. Remove regulator valve, spring retainer and spacer(s), if present (Fig. 7E-71).

6. Remove pump cover to body attaching bolts.

7. Remove pump cover from body.

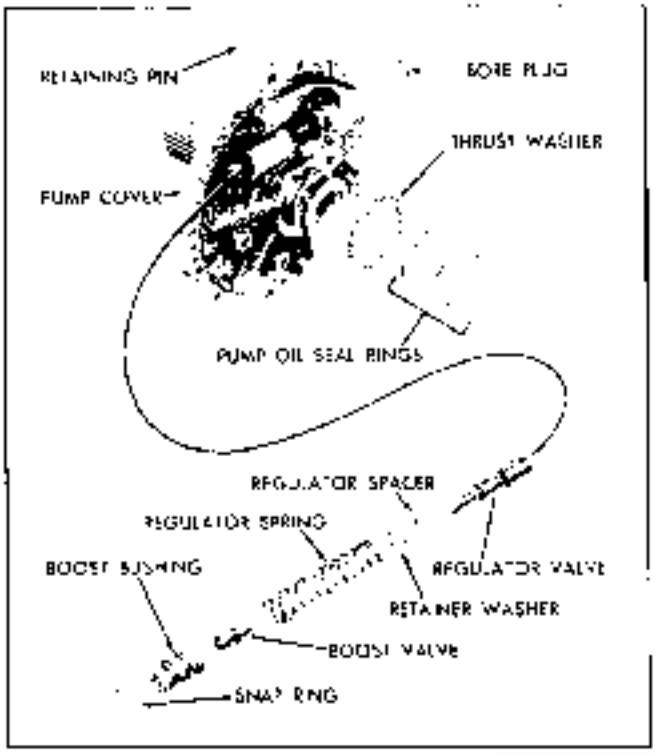


Fig. 7E-69 Exploded View of Pump Cover

8. Remove retaining pin and bore plug from pressure regulator bore (Fig. 7E-72).

9. Remove link type oil rings from pump cover.

10. Remove pump to forward clutch housing selective washer (fiber).

11. Mark drive and driven gears for reassembly and remove gears (Fig. 7E-73).

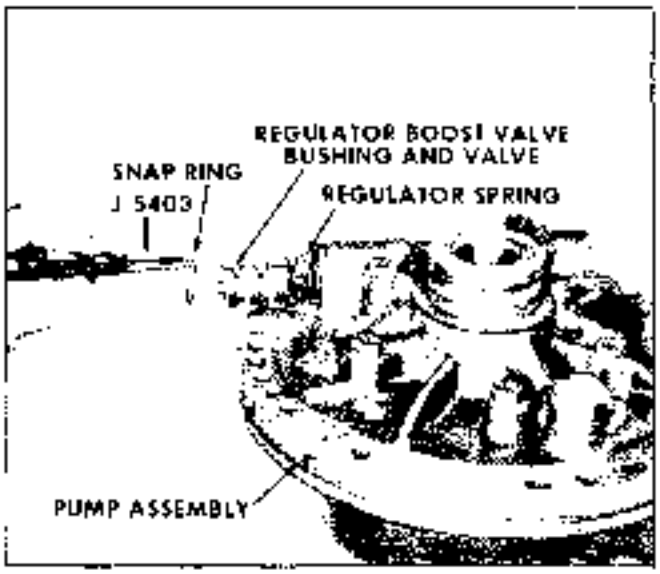


Fig. 7E-70 Removing Pump Regulator Valve Snap Ring

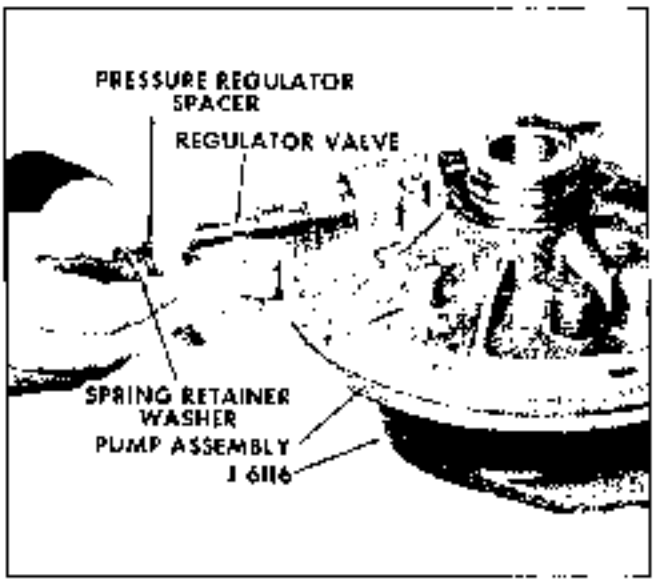


Fig. 7E-71 Removing Pressure Regulator Valve

INSPECTION OF *PUMP* BODY AND COVER

1. Inspect drive gear, driven gear, gear pocket and crescent for scoring, galling or other damage.

2. Place pump gears in pump and check pump body face to gear face clearance, should be .0008"-.0015" (Fig. 7E-74).

3. Check face of pump body for scores or nicks.

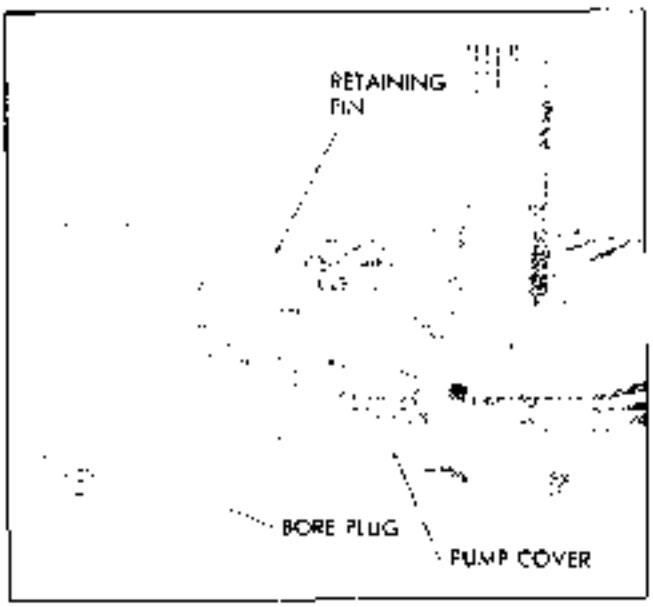


Fig. 7E-72 Installing Pressure Regulator Retaining Pin and Bore Plug

Fig. 7E-73 Inspecting Pump Drive Gear

4. Check oil passages (Fig. 7E-75).

5. Check for damaged cover bolt attaching threads.

6. Check for overall flatness of pump body face.

7. Check bushing for scores or nicks. If replacement is necessary, proceed as follows:

a. Using tool J 21465-17, remove bushing.

b. From gear pocket side of pump and using J 21465-17, install new bushing flush to .010".

8. Inspect pump attaching bolt seals for damage, replace if necessary.

9. Inspect pump cover face for overall flatness.

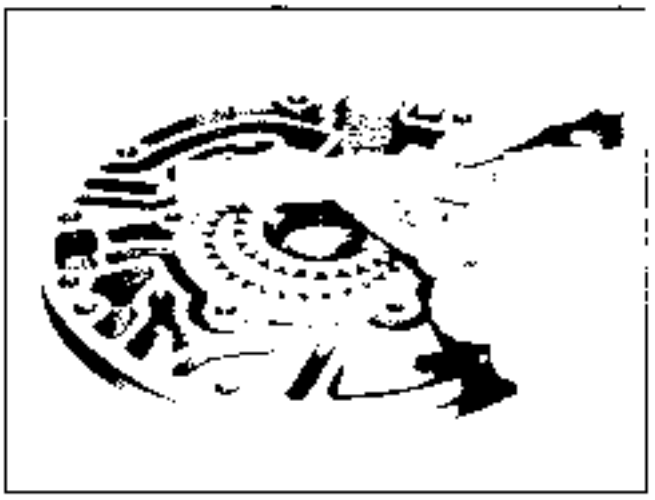


Fig. 7E-74 Checking Pump Body Face to Gear Face Clearance

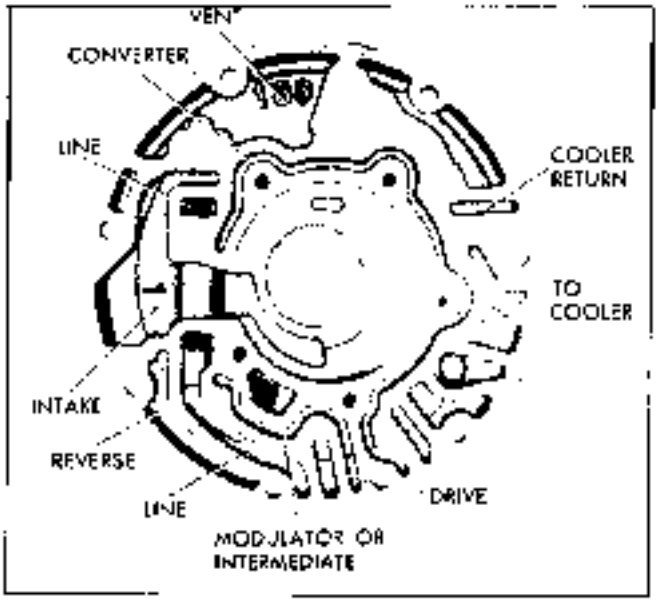


Fig. 7E-75 Pump Body Oil Passage

10. Check for scores or chips in pressure regulator bore.

11. Check that all passages are open and not inter-connected (Fig. 7E-75).

12. Check for scoring and damage at pump gear face.

13. Inspect stator shaft for damaged splines or scored bushing. If replacement of bushings is necessary, proceed as follows:

a. Thread J 21465-15 into stator shaft bushing. Thread slide hammer J 2619 into remover. Clamp slide hammer handle into vise. Grasp stator shaft and remove.

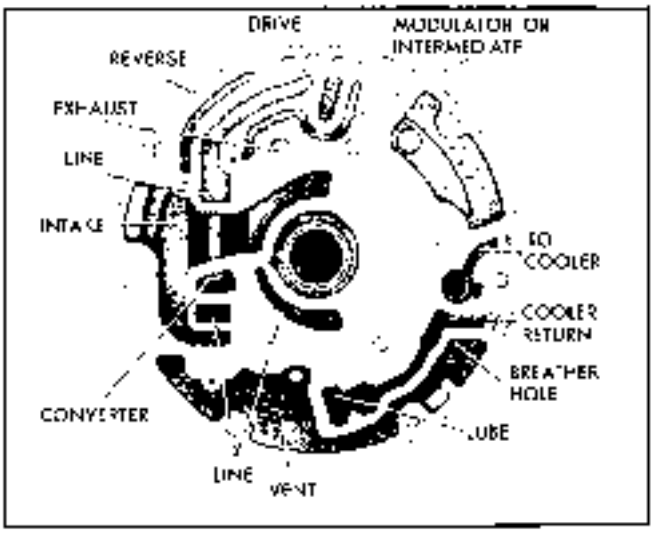


Fig. 7E-76 Pump Cover Oil Passages

b. Using installer J 21465-3 (front) or J 21465-2 (rear), install bushing.

14. Inspect oil ring grooves for damage or wear.

15. Inspect selective washer thrust face for wear or damage.

16. Inspect pressure regulator and boost valve for free operation.

17. Inspect pump cover for open 1/8" diameter breather hole (Fig. 7E-76).

ASSEMBLY OF OIL PUMP

1. Install drive and driven pump gears into pump body with alignment marks up (Fig. 7E-75).

NOTE: Install drive gear with drive lugs up.

2. Protect stator shaft and install pump in vise.

3. Install spacer(s) if used, retainer and spring into pressure regulator bore (Fig. 7E-69).

4. Install pressure regulator valve from opposite end of bore, stem end first.

5. Install boost valve into bushing, stem end out, and install both parts into pump cover by compressing bushing against spring.

6. Install retaining snap ring.

7. Install pressure regulator valve bore plug and retaining pin into opposite end of bore.

8. Install previously selected front and selective thrust washer (fiber) over pump cover delivery sleeve.

9. Install two (2) hook type oil seal rings.

10. Assemble pump cover to pump body with attaching bolts.

NOTE: Leave bolts one turn loose at this time.

11. Place pump aligning strap J 21366 over pump body and cover and tighten tool (Fig. 7E-77)

12. Tighten pump cover bolts (10 lb. ft. torque).

13. Install and align pump to case gasket.

14. Install pump to case O-ring seal.

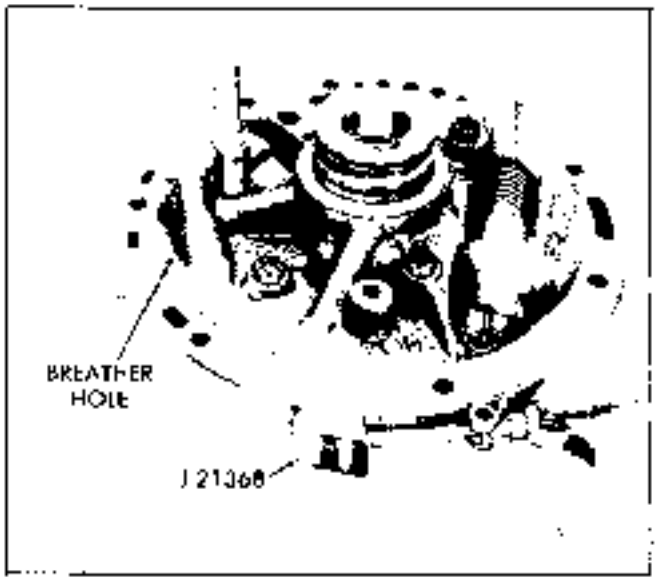


Fig. 7E-77 Installing Pump Cover to Pump Body

FORWARD CLUTCH

DISASSEMBLY OF FORWARD CLUTCH

1. Place forward clutch and turbine shaft in hole in bench or holding fixture J 6116 and remove forward clutch housing to direct clutch hub snap ring (Fig. 7E-78).

2. Remove direct clutch hub.

3. Remove forward clutch hub and thrust washers (Fig. 7E-79).

4. Remove five (5) radial grooved composition and five (5) steel clutch plates.

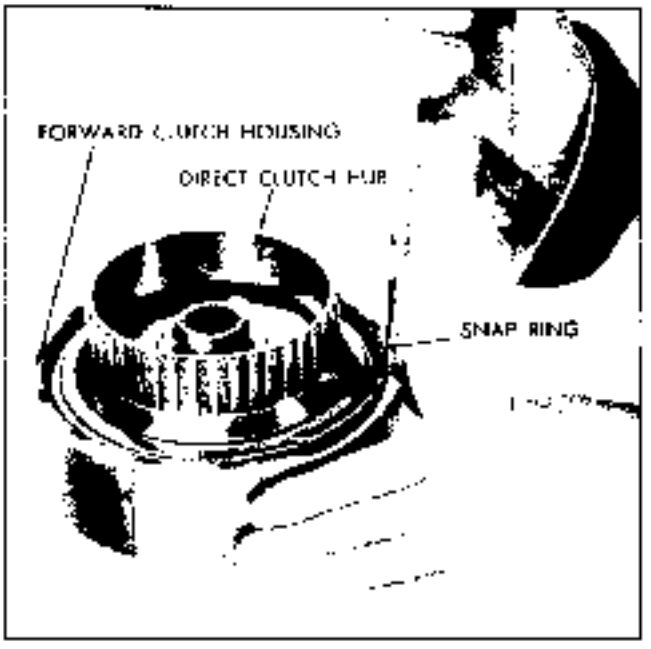


Fig. 7E-78 Removing Forward Clutch Housing to Direct Clutch Hub Snap Ring

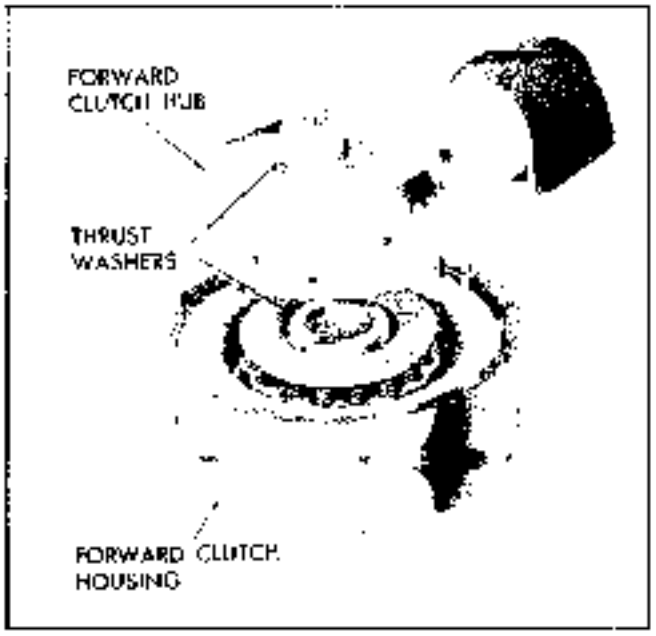


Fig. 7E-79 Removing Forward Clutch Hub and Thrust Washers

5. If necessary, place forward clutch and turbine shaft in arbor press and remove turbine shaft (Fig. 7E-80).

6. Using J 4670 clutch spring compressor with adaptor J 6129 and J 8765, compress spring retainer and remove snap ring, (Fig. 7E-81).

7. Remove snap ring, spring retainer and sixteen (16) clutch release springs.

8. Remove forward clutch piston.

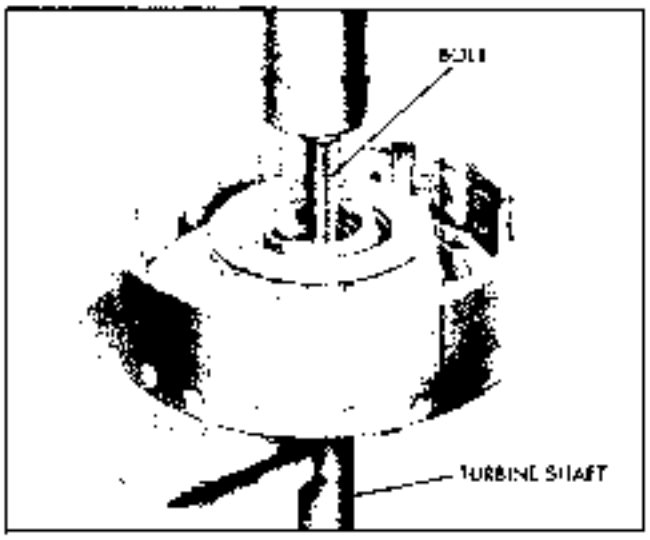


Fig. 7E-80 Removing Turbine Shaft from Forward Clutch Housing

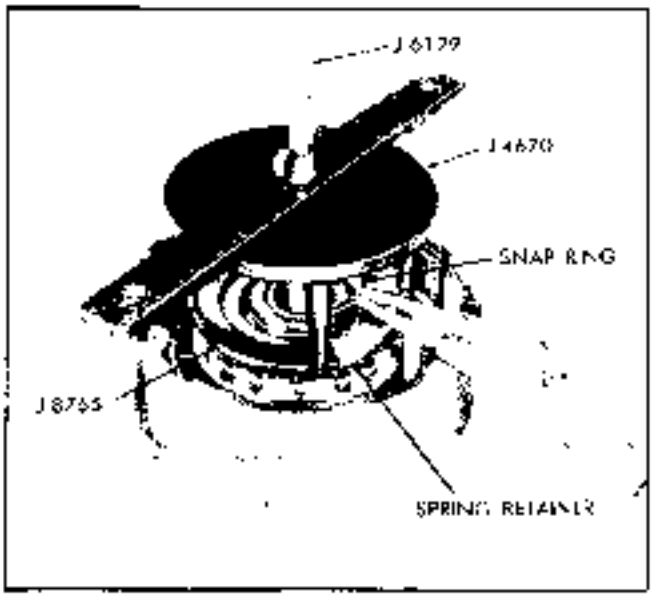


Fig. 7E-81 Removing Forward Clutch Spring Retainer Snap Ring

9. Remove inner and outer clutch piston seals (Fig. 7E-82).

10. Remove center piston seal from forward clutch housing (Fig. 7E-83).

INSPECTION OF FORWARD CLUTCH

1. Inspect drive and driven clutch plates for signs of burning, scoring or wear.

2. Inspect sixteen (16) springs for collapsed coils or signs of distortion.

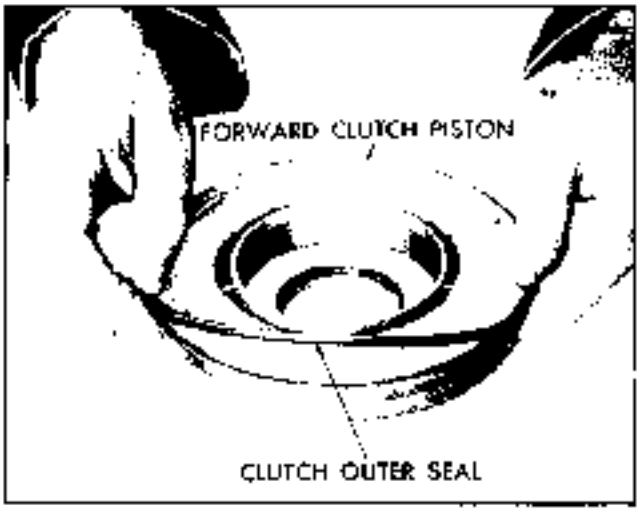


Fig. 7E-82 Removing Forward Clutch Piston Outer Seal

Fig. 7T-83 Removing Forward Clutch Center Seal

3. Inspect clutch hubs for worn splines, proper lubrication holes, thrust faces.

4. Inspect piston for cracks.

5. Inspect clutch housing for wear, scoring, open oil passages and free operation of ball check.

6. Inspect turbine shaft:

a. Inspect for open lubrication passages at each end.

b. Inspect splines for damage.

c. Inspect ground bushing journals for damage.

d. Inspect shaft for cracks or distortion.

NOTE: Turbine shaft and clutch housing are serviced separately. Shaft may be removed from housing by using a suitable size bolt in an arbor press (Fig. 7T-80).

ASSEMBLY OF FORWARD CLUTCH

NOTE: Apply automatic transmission oil to oil seals and clutch plates before re-assembly.

1. Place new inner and outer oil seals on clutch piston, lips face away from spring pockets (Fig. 7T-85).

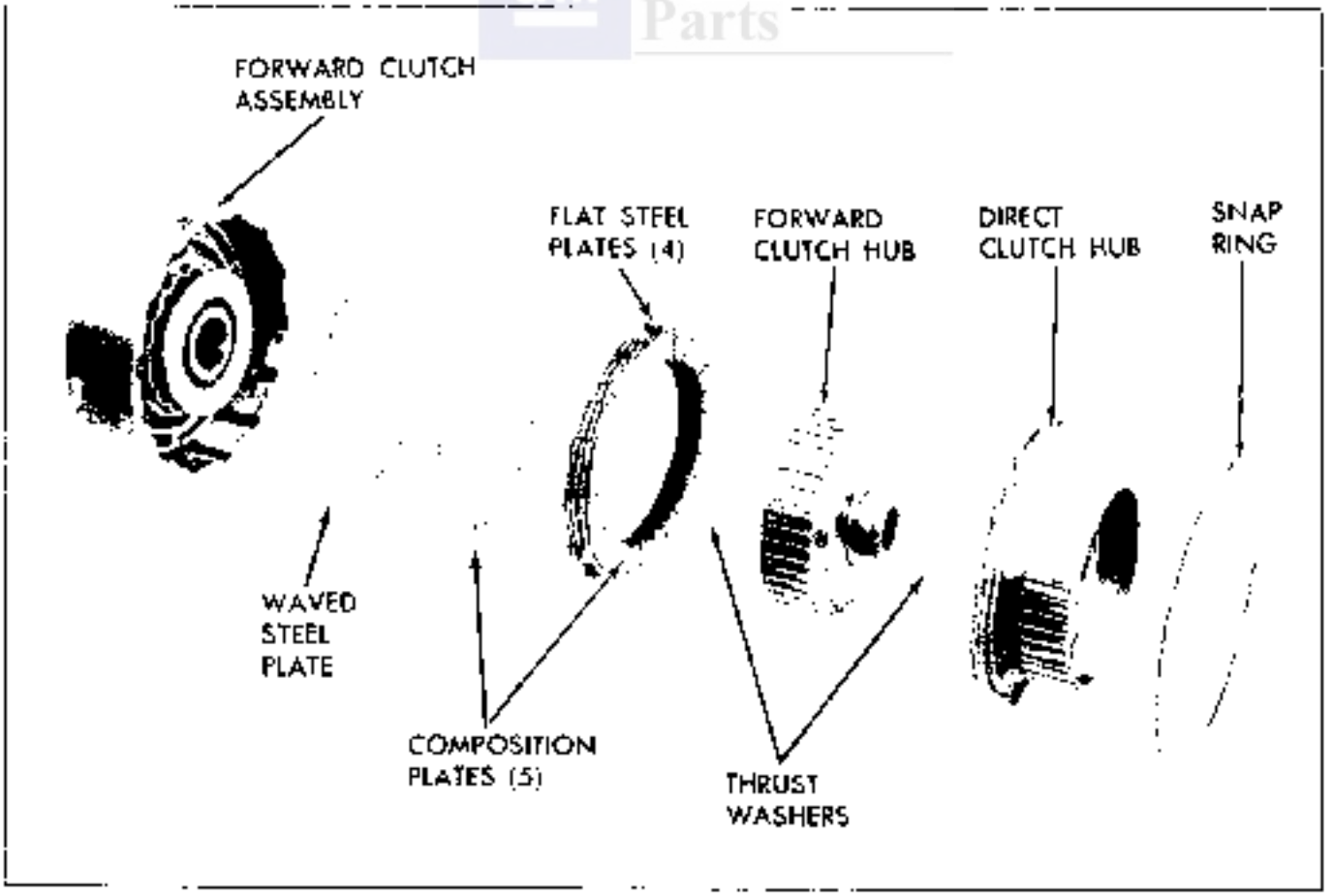


Fig. 7T-84 Exploded View of Forward Clutch

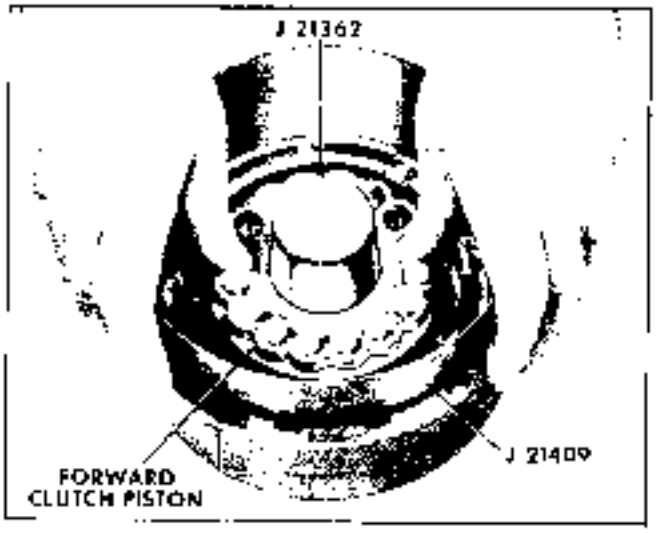


Fig. 7E-85 Installing Forward Clutch Piston

NOTE: The forward and direct clutch pistons have identical inside and outside diameters. It is possible to reverse the pistons during reassembly, therefore care should be exercised to make certain the proper piston be installed in the clutch assemblies.

As shown in Fig. 7E-85, the forward clutch piston can be identified by the blind hole in the clutch apply face of the piston.

2. Place a new center seal on clutch housing, lip faces up (Fig. 7E-83).

3. Place seal protector tool J 21362 over clutch hub and install outer clutch piston seal protector J 21409 into clutch drum and install piston, rotating piston on drum until seated (Fig. 7E-85).

4. Install sixteen (16) clutch release springs (green) into pockets in piston.

5. Place spring retainer and snap ring on springs.

6. Compress springs, using clutch compressor tools J 4670, J 6129 and J 8765, and install snap ring.

7. If removed, install turbine shaft in forward clutch housing, using arbor press.

8. Install forward clutch hub washers on forward clutch hub. Retain with petrolatum.

NOTE: The 1968 Forward Clutch Hub, identified by a machined groove on the rear or hub side, is NOT interchangeable with pre-1968 parts.

Due to a spline change, if replacement of either forward clutch hub or the mainshaft is required, ONLY 1968 parts must be used. The mainshaft to be used for 1968 is identified by a "U" groove on the rear or internal gear end of the shaft.

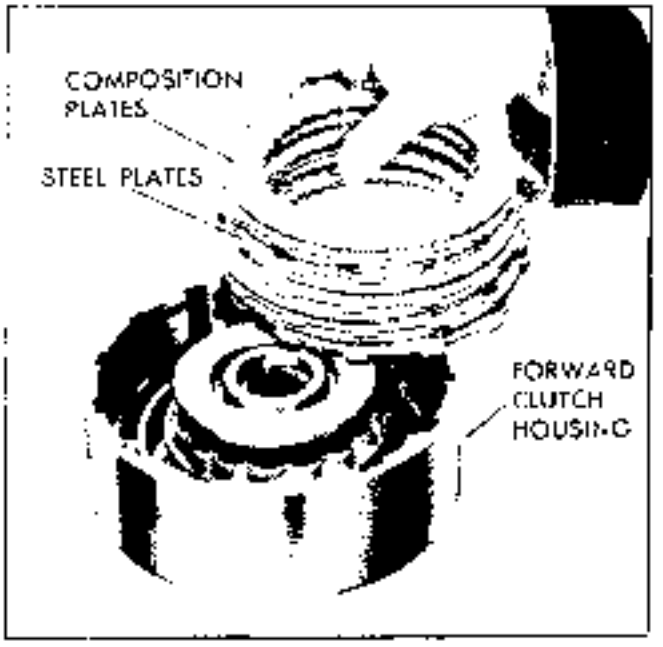


Fig. 7E-86 Installing Forward Clutch Composition and Steel Plates

9. Place forward clutch hub into forward clutch housing.

10. Oil and install five (5) radial grooved composition and four (4) flat steel and one (1) waved steel

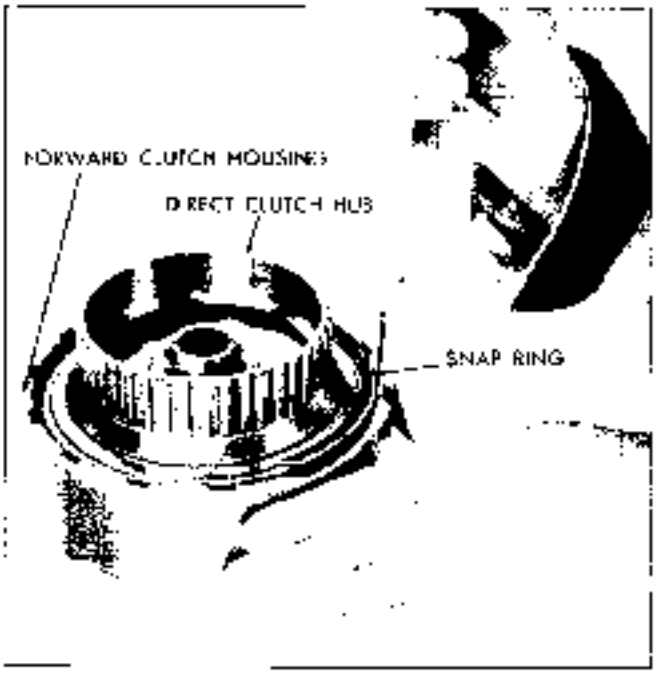


Fig. 7E-87 Installing Forward Clutch Housing to Direct Clutch Hub Snap Ring

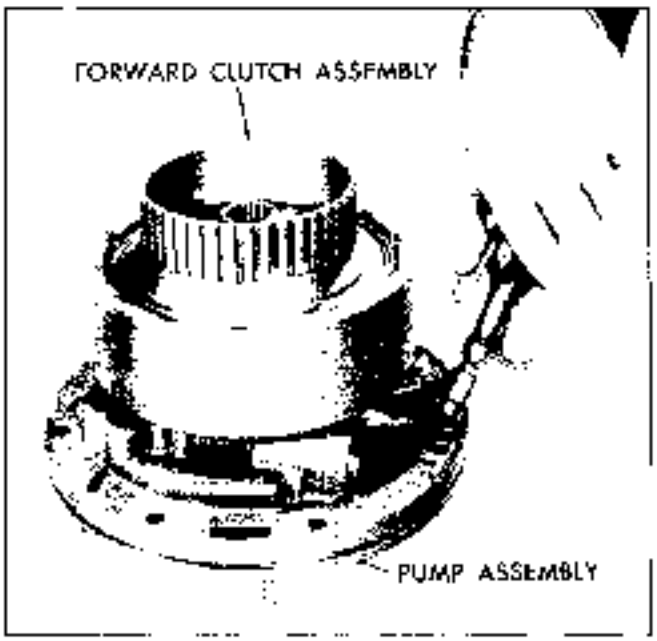


Fig. 7E-88 Air Checking Forward Clutch

clutch plate (plate with notches) starting with waved steel and alternating steel and composition. (Fig. 7E-66).

NOTE: Radially grooved composition clutch plates are installed at the factory only. ALL service composition plates have the smooth surface configuration.

11. Install direct clutch hub and retaining snap ring (Fig. 7E-87).

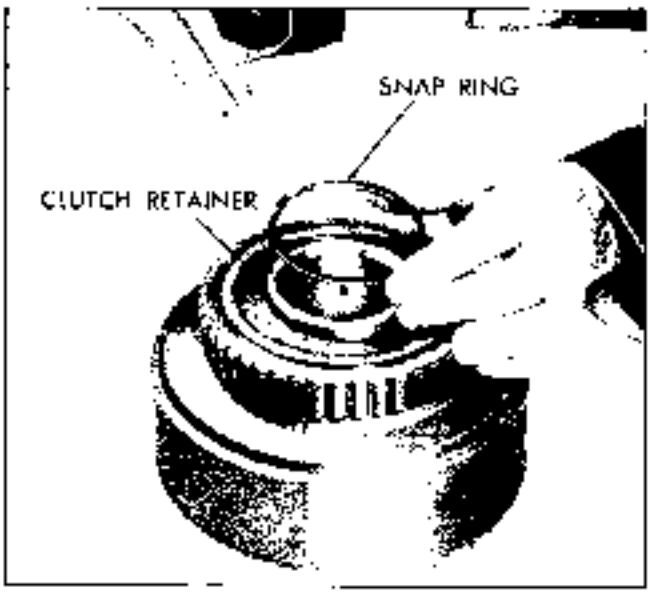


Fig. 7E-89 Removing Intermediate Clutch Retainer Snap Ring

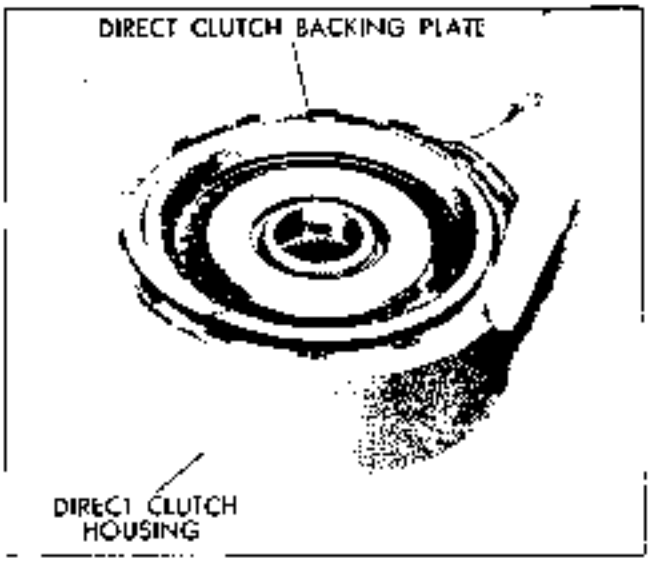


Fig. 7E-90 Removing Direct Clutch Backing Plate Snap Ring

12. Place forward clutch housing on pump delivery sleeve and air check clutch operation (Fig. 7E-88).

DIRECT CLUTCH AND INTERMEDIATE SPRAG

DISASSEMBLY OF DIRECT CLUTCH AND INTERMEDIATE SPRAG

1. Remove intermediate sprag retainer snap ring and retainer (Fig. 7E-89).

2. Remove sprag outer race, bushings and sprag assembly.

3. Turn unit over and remove backing plate to direct clutch housing snap ring (Fig. 7E-90).

4. Remove direct clutch backing plate, five (5) composition and five (5) steel clutch plates.

5. Using clutch compressor tools J 4670, J 5129 and J 8765, compress spring retainer and remove snap ring (Fig. 7E-92).

6. Remove retainer and sixteen (16) piston release springs.

7. Remove direct clutch piston (Fig. 7E-93).

8. Remove outer seal from piston.

9. Remove inner seal from piston.

10. Remove center piston seal from direct clutch housing.

INSPECTION OF DIRECT CLUTCH AND INTERMEDIATE SPRAG

1. Inspect sprag assembly for popped or loose sprags.

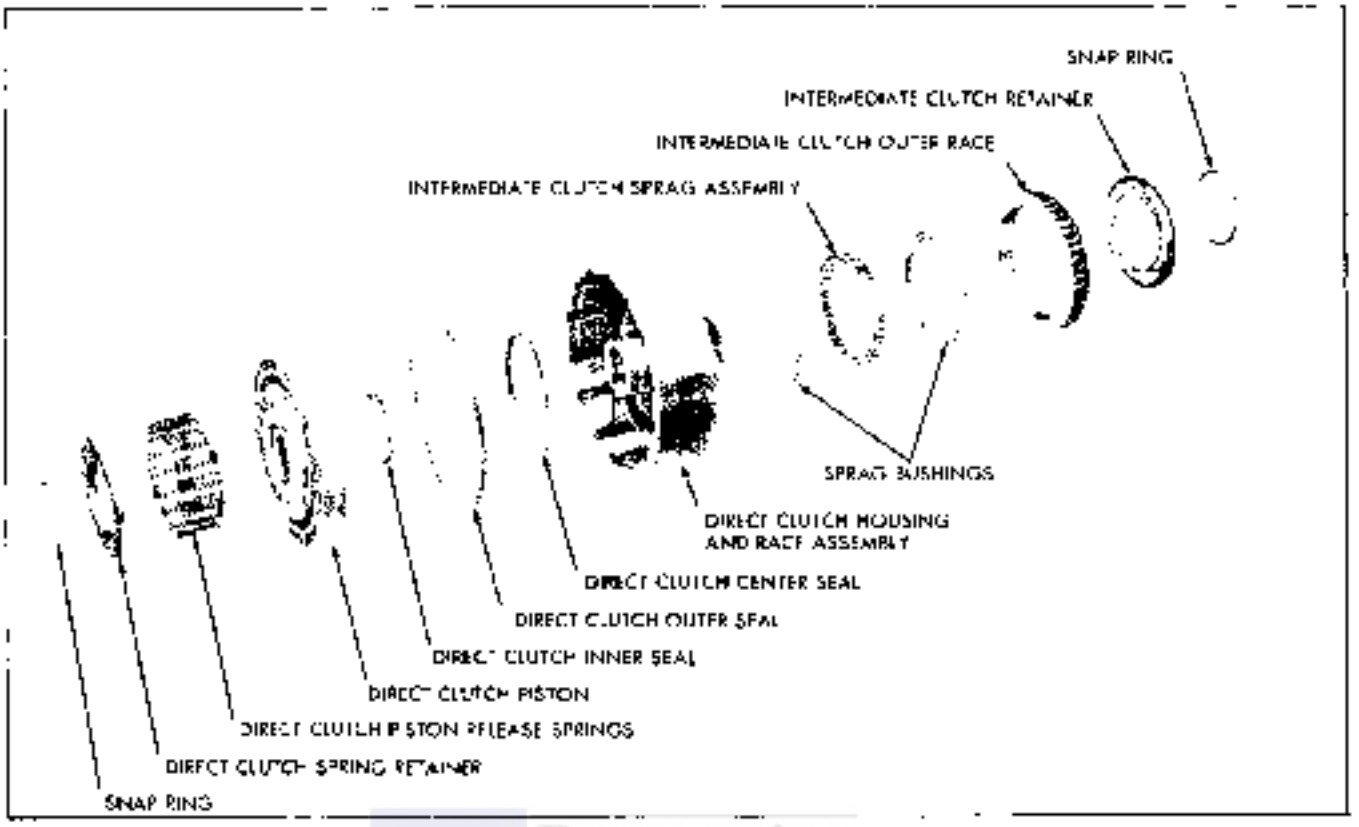


Fig. 7E-91 Exploded View of Direct Clutch and Intermediate Sprag

2. Inspect sprag bushings for wear or distortion.

3. Inspect inner and outer races for scratches or wear.

4. Inspect clutch housing for cracks, wear, proper opening of oil passages or wear on clutch plate drive lugs.

5. Inspect drive and driven clutch plates for sign of wear or burning.

6. Inspect backing plate for scratches or other damage.

7. Inspect clutch piston for cracks and free operation of ball check.

ASSEMBLY OF DIRECT CLUTCH AND INTERMEDIATE SPRAG

1. Install a new inner clutch piston seal on piston.

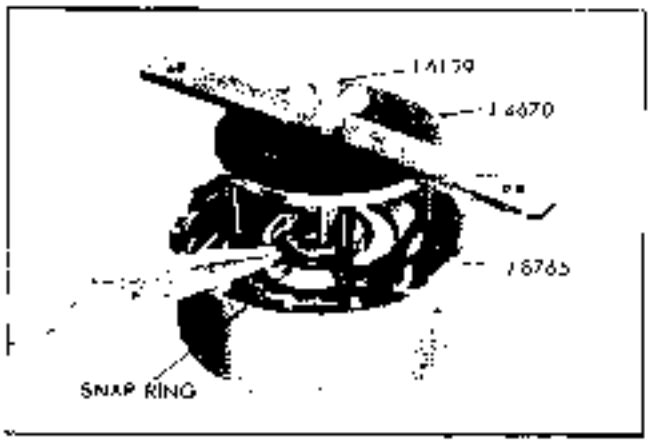


Fig. 7E-92 Removing Direct Clutch Snap Ring

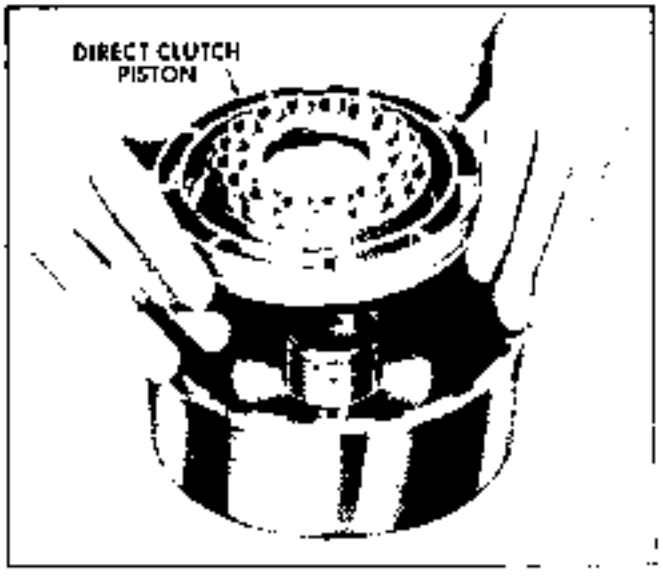


Fig. 7E-93 Removing Direct Clutch Piston

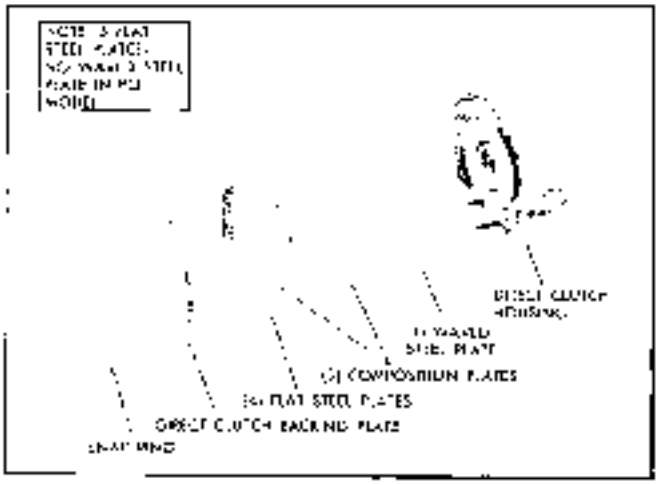


Fig. 7E-94 Exploded View of Direct Clutch

with lip facing away from spring pockets (Fig. 7E-95).

NOTE: Apply Hydra-matic oil to all seals.

2. Install a new inner clutch piston seal with lip facing away from spring pockets (Fig. 7E-96).

3. Install a new center seal on clutch housing with lip of seal facing up (Fig. 7E-97).

NOTE: Care should be exercised, when installing the piston, to make certain the proper piston is used.

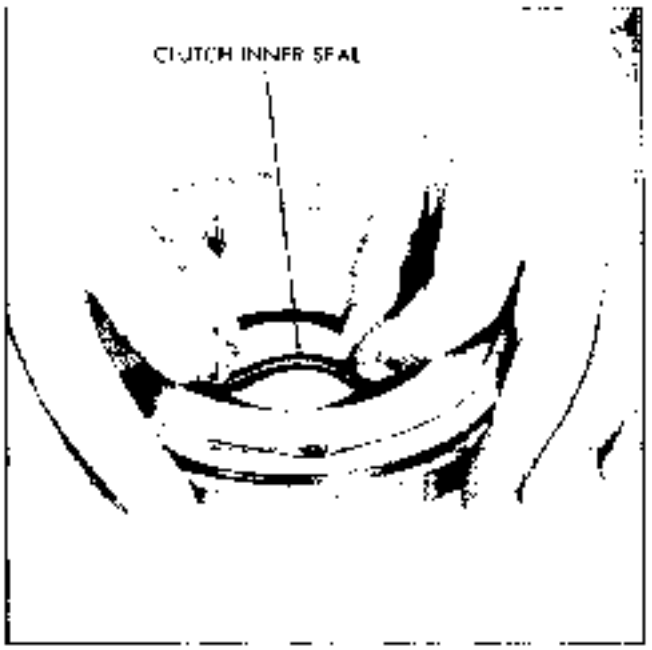


Fig. 7E-95 Installing Direct Clutch Piston Inner Seal

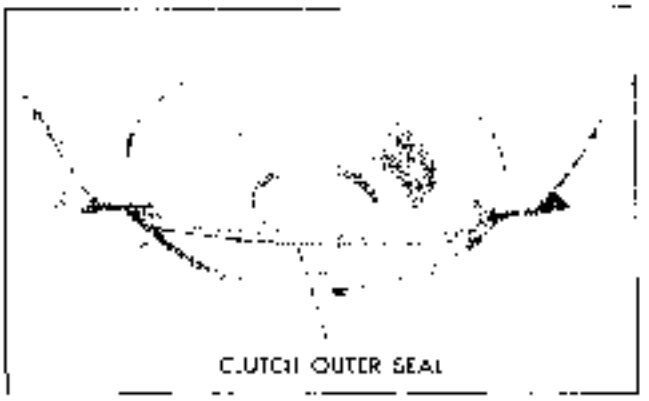


Fig. 7E-96 Installing Direct Clutch Piston Outer Seal

The direct clutch piston can be identified by the ball check installed in the casting. (Fig. 7E-99)

4. Place seal protectors, tools J 21362 Inner and J 21409 Outer, over hub and clutch housing and install clutch piston with a rotating motion (Fig. 7E-98).

5. Install sixteen (16) springs (plain) into piston.

6. Place spring retainer and snap ring on retainer.

7. Using clutch compressor tool J 6870, J 6139 and J 8765, install snap ring (Fig. 7E-100).

8. Lubricate with transmission oil and install five (5) composition and five (5) steel clutch plates, starting with the waved steel plate and alternating steel and composition (Fig. 7E-101).

NOTE: No waved steel plate is used in the HQ model. Five (5) flat steel plates are used.

NOTE: Do not use radial groove composition plates here.

9. Install clutch backing plate.

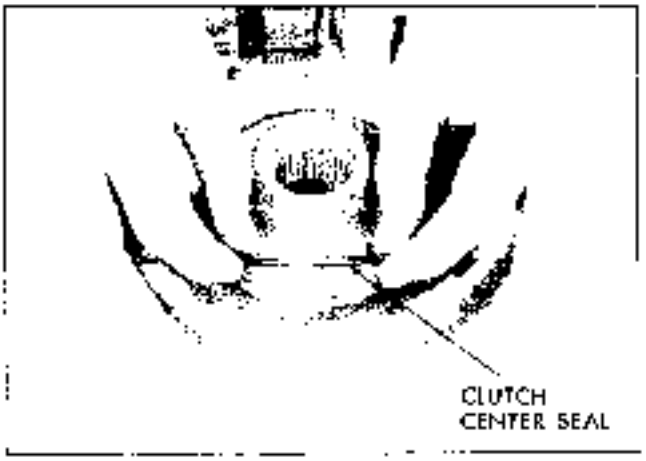


Fig. 7E-97 Installing Direct Clutch Center Seal

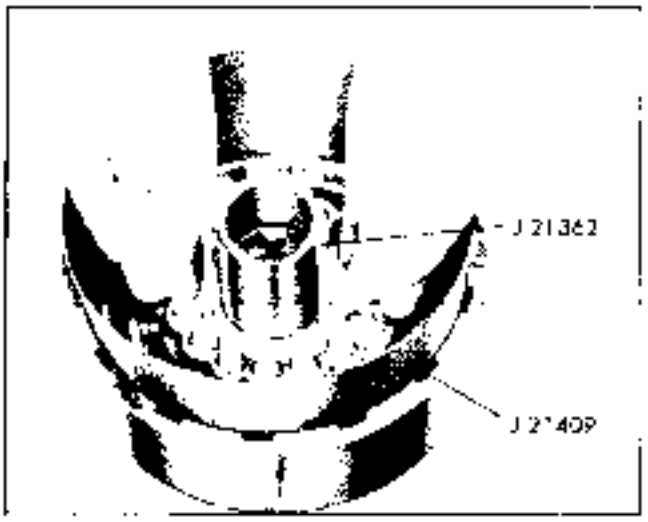


Fig. 7E-98 Installing Direct Clutch Piston

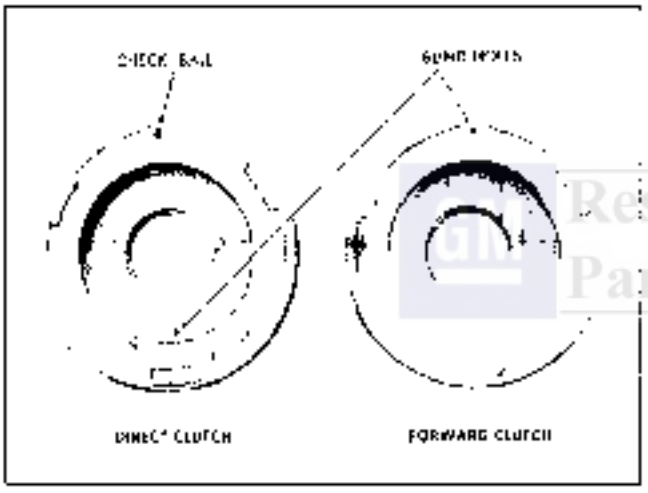


Fig. 7E-99 Identification of Direct Clutch Piston

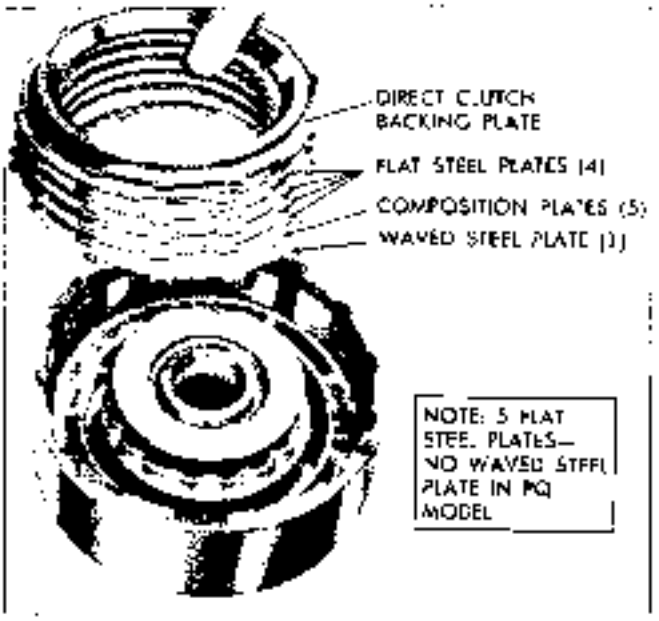


Fig. 7E-101 Installing Direct Clutch Backing Plate, Composition Plates and Steel Plates

10. Install backing plate retaining snap ring (Fig. 7E-102).

11. Turn unit over and install one sprag bushing, cup side up, over inner race.

12. Install sprag assembly into outer race.

13. With ridge or shoulder on inner cage down, start sprag and outer race over inner race with clockwise turning motion (Fig. 7E-103).

NOTE: Outer race should not turn counterclockwise after installation.

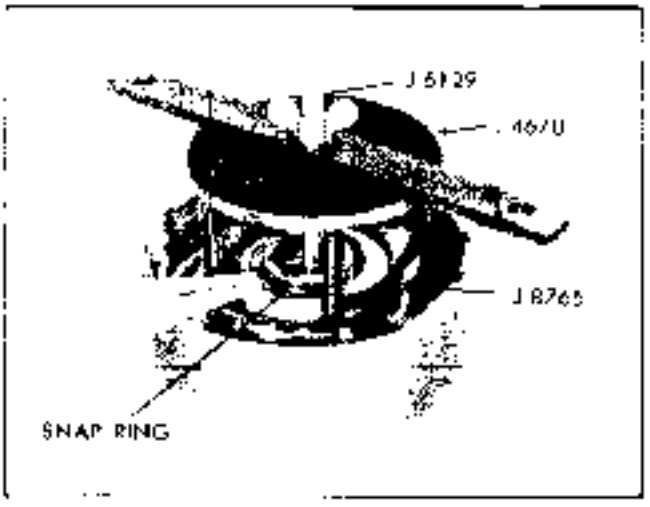


Fig. 7E-100 Installing Direct Clutch Spring Retainer and Snap Ring

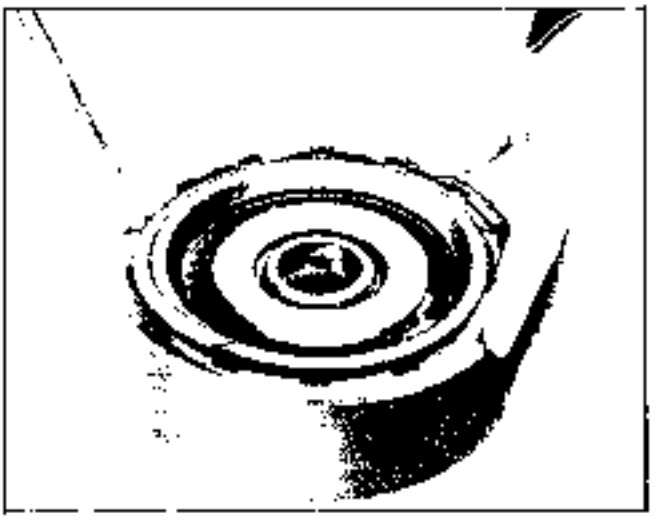


Fig. 7E-102 Installing Direct Clutch Housing to Backing Plate Snap Ring

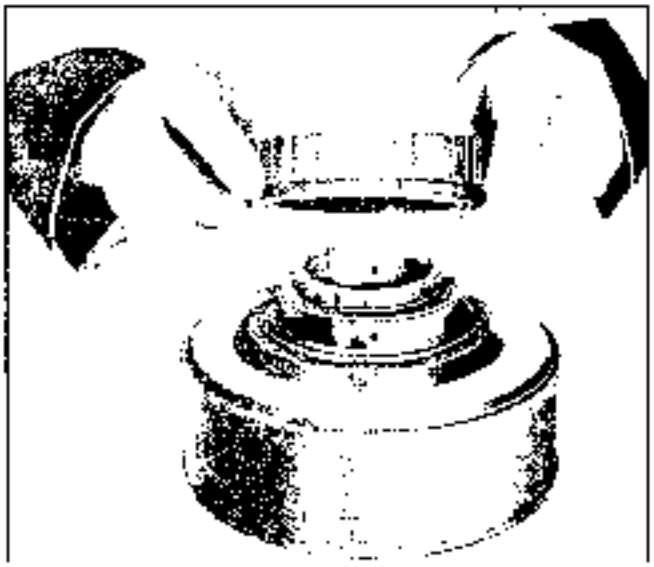


Fig. 7E-103 Installing Intermediate Sprag to Direct Clutch

14. Install sprag bushing over sprag, cup side down (Fig. 7E-104).

15. Install sprag retainer (Fig. 7E-105) and snap ring (Fig. 7E-106).

16. Place direct clutch assembly over center support and air check operation of direct clutch (Fig. 7E-107).

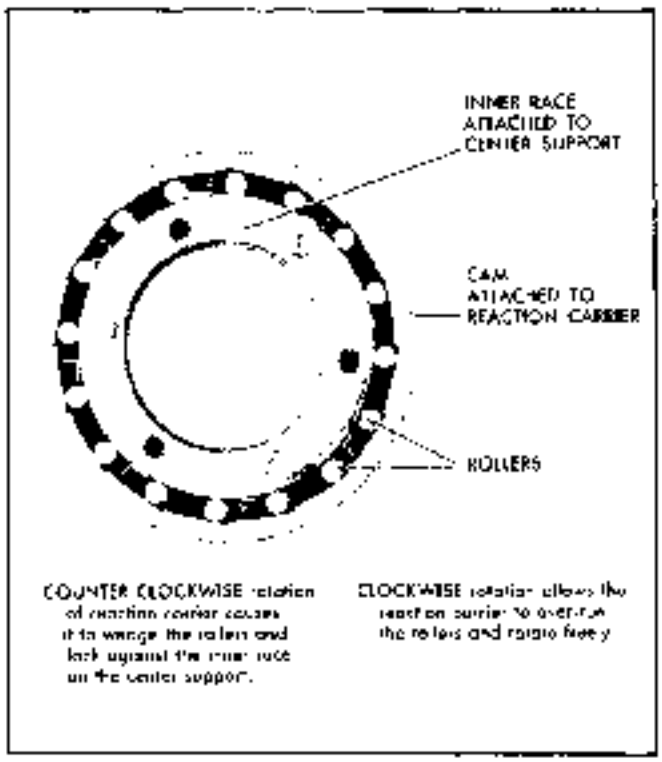


Fig. 7E-104 Carrier Sprag Clutch Rotation

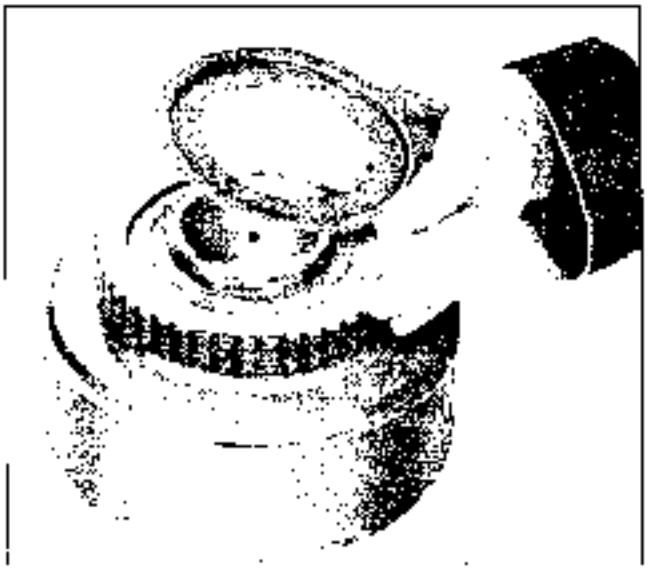


Fig. 7E-105 Installing Intermediate Clutch Retainer

NOTE: If air is applied through reverse passage, it will escape from direct clutch passage. This is normal.

CASE CENTER SUPPORT

DISASSEMBLY OF CASE CENTER SUPPORT

1. Remove four (4) lock type oil seal rings from center support.

2. Using clutch compressor J 4670 and J 6129, compress spring retainer and remove snap ring (Fig. 7E-108).

3. Remove spring retainer and three (3) clutch release springs.

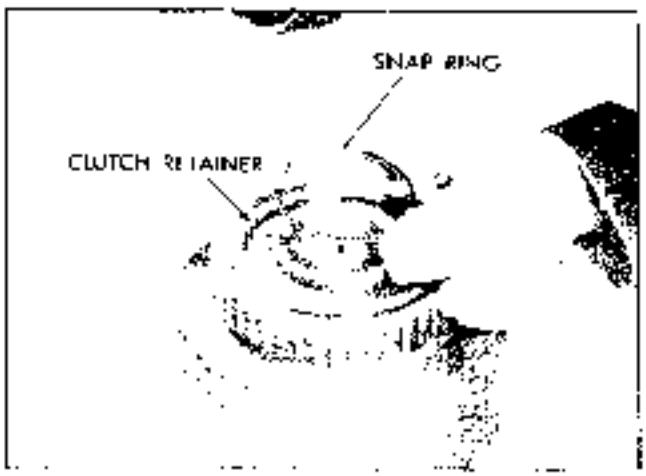


Fig. 7E-106 Installing Intermediate Clutch Retainer Snap Ring

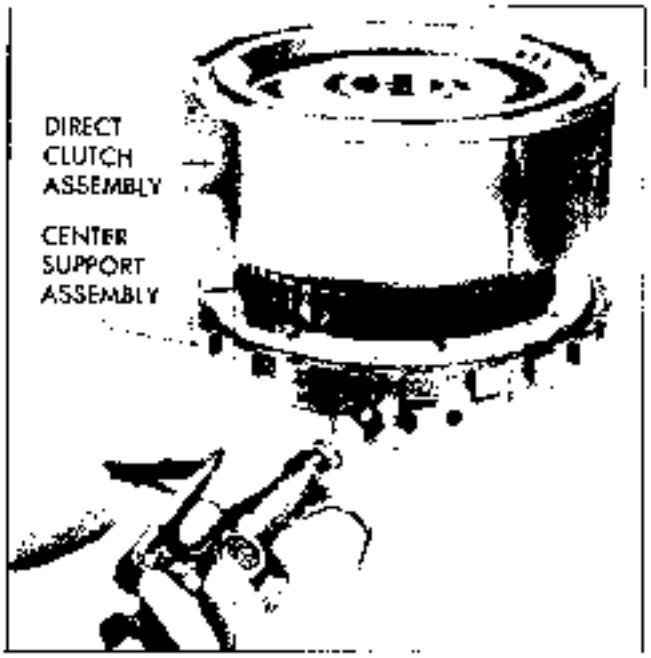


Fig. 7E-107 Air Checking Direct Clutch

4. Remove intermediate clutch piston.

5. Remove inner and outer piston seal.

NOTE: Do not remove three (3) screws retaining roller clutch inner race to center support.

INSPECTION OF CASE CENTER SUPPORT

1. Inspect roller clutch inner race for scratches or indentations. Be sure lubrication hole is open.

NOTE: Be sure constant bleed ping orifice (approx. .020 dia.) is open (Fig. 7E-51).

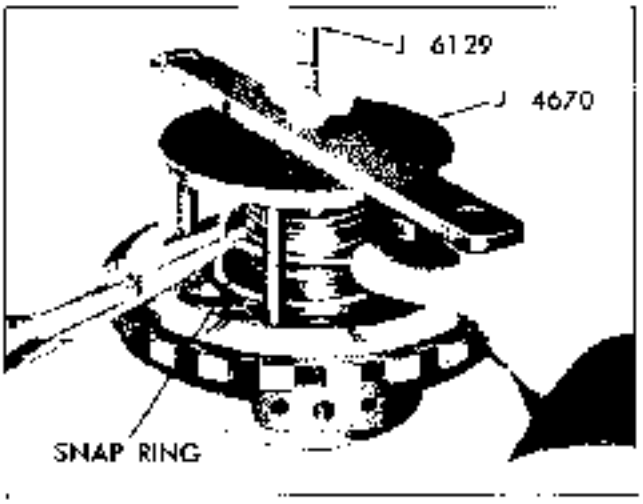


Fig. 7E-108 Removing Intermediate Clutch Piston Snap Ring

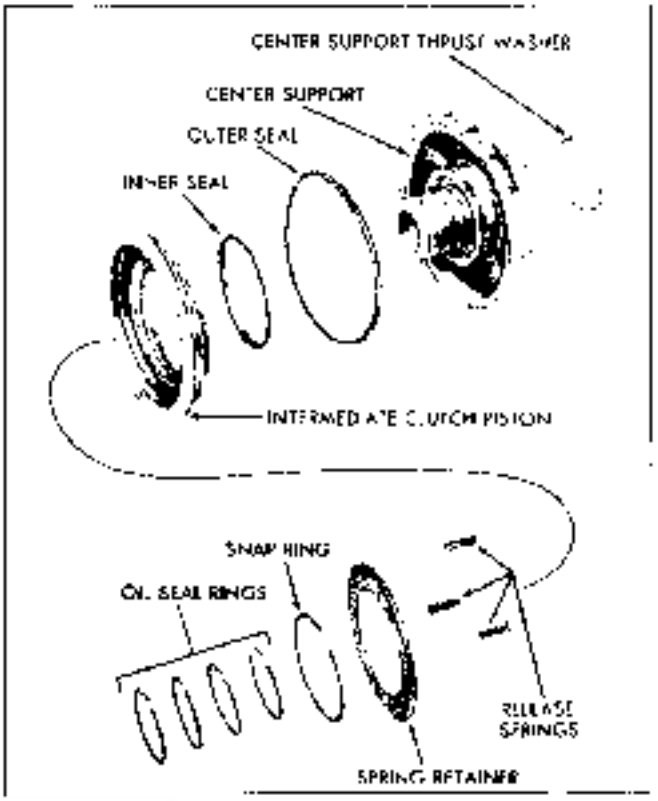


Fig. 7E-109 Exploded View of Center Support

2. Inspect bushing for scoring, wear or galling. If replacement is necessary, proceed as follows:

a. Using tool J 21466-6, remove bushing.

b. From rear side of support, install bushing, using tool J 21466-6. Install bushing flush to .010" below counter bore.

3. Check oil ring grooves for damage.

4. Air check oil passages to be sure they are not interconnected.

5. Inspect piston sealing surfaces for scratches.

6. Inspect piston seal grooves for nicks or other damage.

7. Inspect piston for cracks or porosity.

8. Inspect release springs for distortion.

ASSEMBLY OF CASE CENTER SUPPORT

1. Install new inner and outer seals on piston with lip of seal facing away from spring pocket (Fig. 7E-110 and 7E-111).

2. Install inner seal protector tool J 21363 on center support hub and install piston, indexing spring

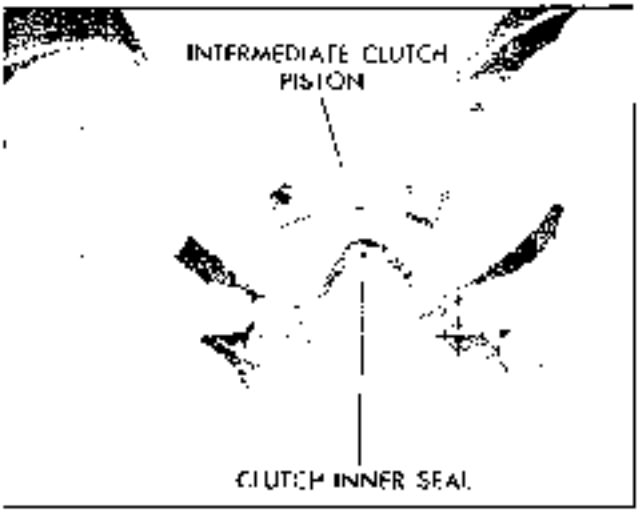


Fig. 7E-110 Installing Intermediate Clutch Inner Seal

pockets of piston into bored areas of center support (Fig. 7E-112).

3. Install three (3) release springs into counterbores of piston. Space equally during assembly.

4. Place spring retainer and snap ring over springs.

5. Using clutch spring compressor J 4670 and J 6125, compress springs and install snap ring (Fig. 7E-113).

6. Install four (4) hook type oil rings.

7. Air check operation of intermediate clutch piston (Fig. 7E-114).

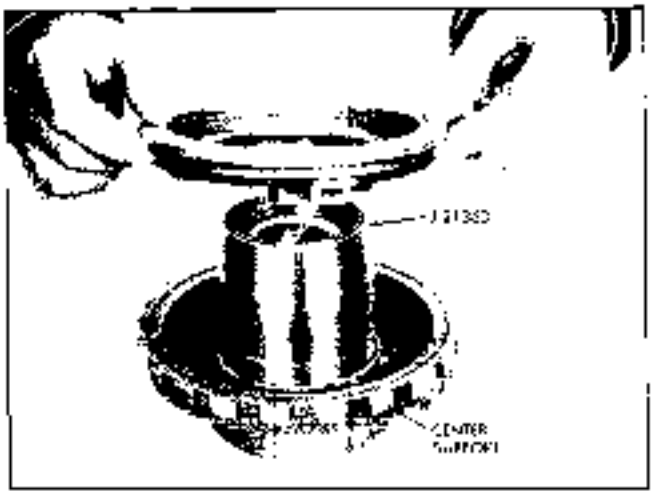


Fig. 7E-112 Installing Intermediate Clutch Piston

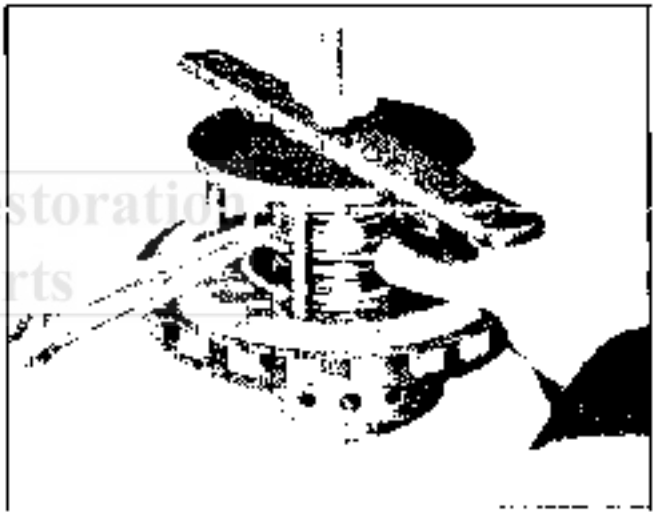


Fig. 7E-113 Installing Intermediate Clutch Piston Snap Ring

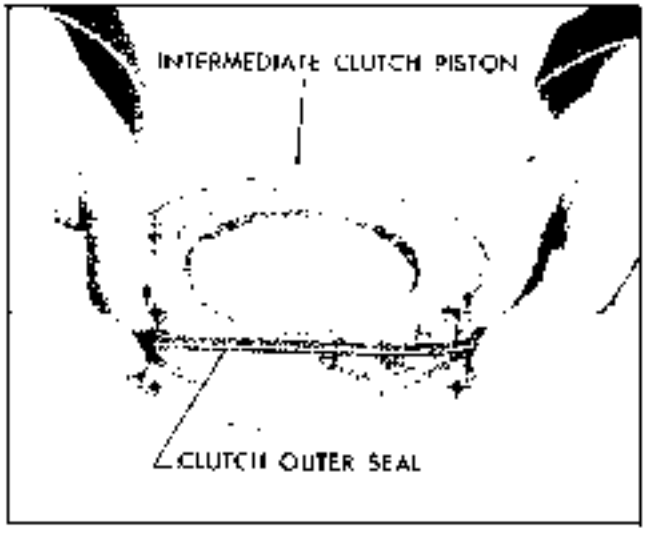


Fig. 7E-111 Installing Intermediate Clutch Outer Seal

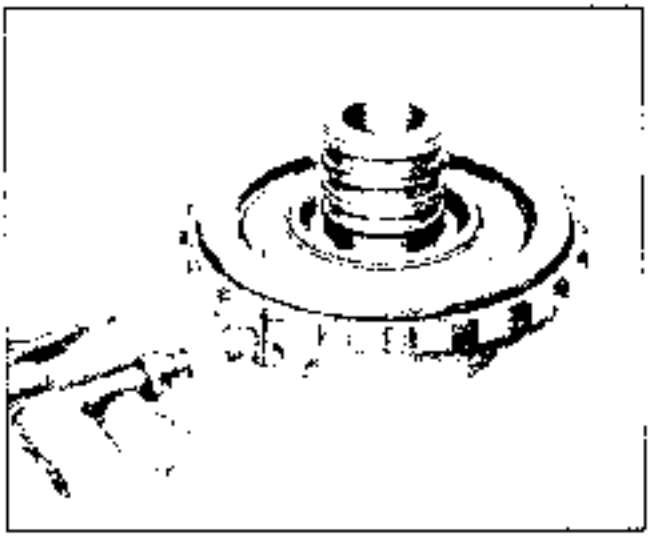


Fig. 7E-114 Air Checking Intermediate Clutch Piston

INSPECTION OF REACTION CARRIER, ROLLER CLUTCH AND OUTPUT CARRIER ASSEMBLY

1. Inspect band surface on reaction carrier for signs of burning or scoring.

2. Inspect roller clutch outer race for scoring or wear.

3. Inspect thrust washer surfaces for signs of scoring or wear.

4. Inspect bushing for damage. If bushing is damaged, reaction carrier must be replaced.

5. Inspect reaction carrier pinions for damage, rough bearings or excessive tilt.

6. Check reaction carrier pinion end play. Should be .009"-.024" (Fig. 7E-115).

7. Inspect roller clutch for damaged members.

8. Inspect roller clutch cage for damage.

9. Inspect front internal gear (output carrier) for damaged teeth.

10. Inspect output carrier pinions for damage, rough bearings or excessive tilt.

11. Check output carrier pinion end play. Should be .009"-.024" (Fig. 7E-116).

12. Inspect parking pawl lugs for marks or damage.

13. Inspect output bearing splines for damage.

14. Inspect front internal gear ring for flaking.

PINION REPLACEMENT PROCEDURE
(Reaction Carrier Shown)

1. Support carrier assembly on its front face.

Fig. 7E-115 Checking Pinion End Play

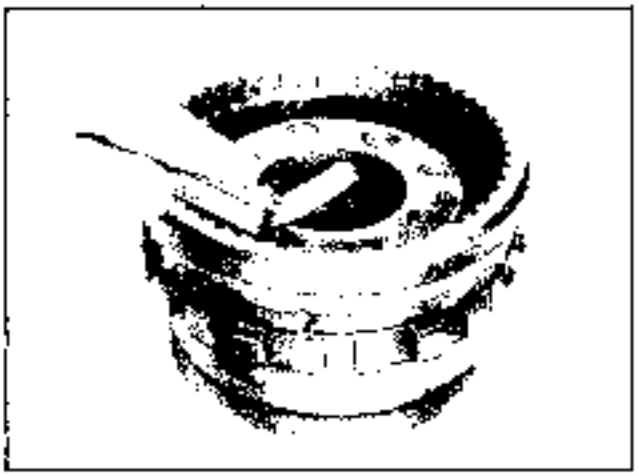


Fig. 7E-116 Checking Output Carrier Pinion End Play

2. Using a 1/2" diameter drill, remove stake marks from end of the pinion pin or pins to be replaced. This will reduce the probability of cracking the carrier when pinion pins are pressed out.

CAUTION: Do not allow drill to remove any stock from the carrier as this will weaken the part and future failure would be probable.

3. Using a tapered punch, drive or press pinion pins out of carrier (Fig. 7E-117).

4. Remove pinions, thrust washers and roller needle bearings.

5. Inspect pinion pocket thrust faces for burrs and remove if present.

6. Install eighteen (18) needle bearings into each pinion, using petrolatum to hold bearings in place. Use pinion pin as guide (Fig. 7E-118).

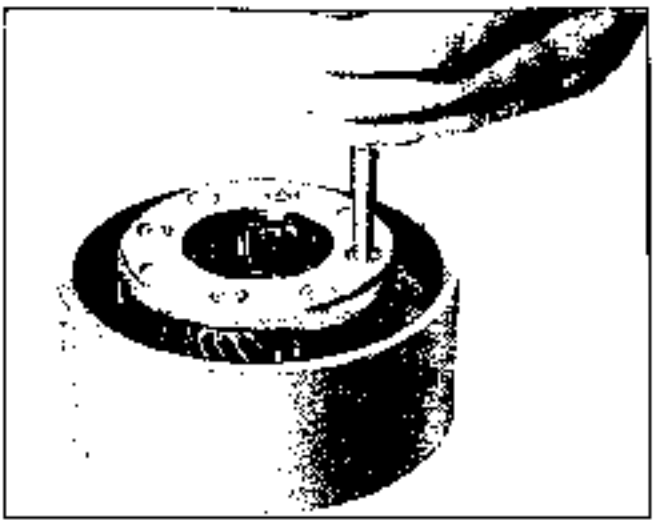


Fig. 7E-117 Removing Planet Pinion Pin

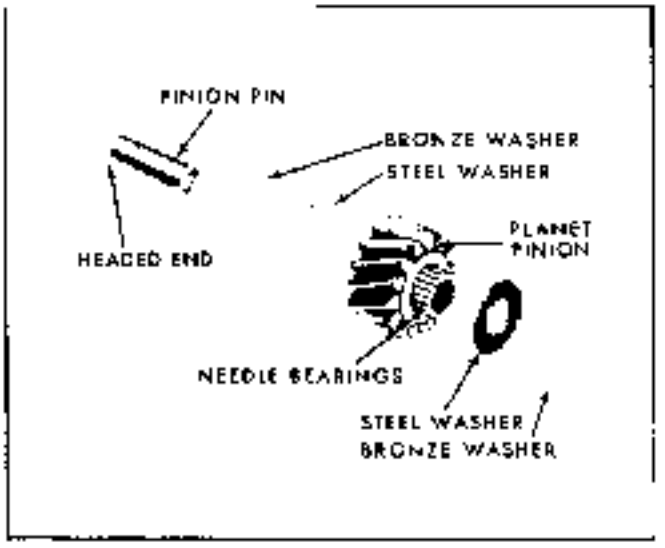


Fig. 2E-118 Exploded View of Planet Pinion

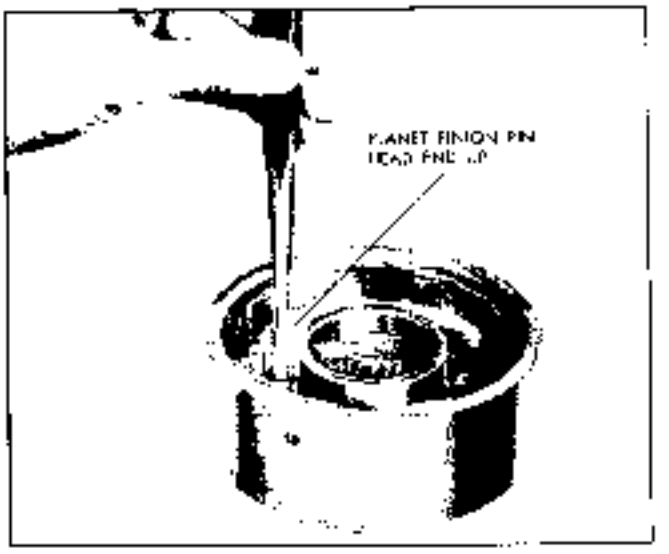


Fig. 2E-119 Installing Planet Pinion Pin

7. Place a bronze and steel washer on each side of pinion so steel washer is against pinion and hold them in place with petrolatum.

8. Place pinion assembly in position in carrier and install a pilot shaft through rear face of assembly to hold parts in place.

9. Drive a new pinion pin into place while rotating pinion from front, being sure that headed end is flush or below face of carrier (Fig. 2E-119).

10. Place a large punch in a bench vise to be used as an anvil while staking opposite end of pinion pin in three places.

NOTE: Both ends of pinion pins must lie below face of carrier or interference may occur.

INSPECTION OF MAJOR UNITS

A. OUTPUT SHAFT

1. Inspect bushing, for wear or galling. If replacement is necessary, proceed as follows:

a. Thread tool J 21465-16 into bushing and, using slide hammer J 2619, remove bushing.

b. Using tool J 21465-1, install bushing to .010" below the thrust washer face.

2. Inspect bearing and thrust washer surfaces for damage.

3. Inspect governor drive gear for rough or damaged teeth.

4. Inspect splines for damage.

5. Inspect orificed cup plug in lubrication passage.

6. Inspect drive lugs for damage.

B. REAR INTERNAL GEAR

1. Inspect gear teeth for damage or wear.

2. Inspect splines for damage.

3. Inspect gear for cracks.

C. SUN GEAR

1. Inspect gear teeth for damage or wear.

2. Inspect splines for damage.

3. Be sure oil lubrication hole is open.

D. SUN GEAR SHAFT

1. Inspect shaft for cracks or splits.

2. Inspect splines for damage.

3. Inspect bushings for scoring or galling. If necessary to replace, proceed as follows:

A. SUN GEAR SHAFT BUSHING, FRONT—

Remove

With sun gear shaft properly supported and using tool J 21465-16 with slide hammer and adapter J 2619, remove bushing.

Replace

Using tool J 21465-5 with adapter J 8092, press

or drive replacement bushing into place until tool bottoms.

SUN GEAR SHAFT BUSHING, REAR—

Remove

With sun gear shaft properly supported and using tool J 21465-15 with slide hammer J 2619, remove bushing.

Replace

Using tool J 21465-5 with adapter J 8092, press or drive replacement bushing into place until tool bottoms.

4. Inspect ground bushing journals for damage.

5. Be sure oil lubrication hole is open.

E. MAIN SHAFT

1. Inspect shaft for cracks or distortion.

2. Inspect splines for damage.

3. Inspect ground bushing journals for damage.

4. Inspect snap ring groove for damage.

5. Inspect orificed cup plug pressed into end of mainshaft. Be sure it is not plugged and all lubrication holes are open.

NOTE: If mainshaft replacement is required, it is necessary to use a shaft with the identification groove on the ground journal of the internal gear end of the shaft. Because of a spline change, the 1968 shaft is NOT interchangeable with pre 1968 parts.

F. FRONT AND REAR BANDS

1. Inspect lining for cracks, flaking, burning or looseness.

2. Inspect bands for cracks or distortion.

3. Inspect end for damage at anchor lugs or apply lugs.

G. CASE EXTENSION

1. Inspect bushing for excessive wear or damage. If replacement is necessary, proceed as follows.

a. Install tool J 21465-17 and remove bushing.

b. Using tool J 21465-17, install new bushing, flush to .010" below rear chamfer.

c. Stake bushing in place, using tool J 21465-10 in diamond area of bushing tube groove.

2. Inspect gasket mounting face for damage.

3. Inspect housing for cracks or porosity.

4. Be sure rear seal drain back port is not obstructed.

H. MODULATOR AND VALVE

1. Inspect modulator assembly for any signs of bending or distortion (Fig. 7E-120).

2. Inspect O-ring seal seat for damage.

3. Apply suction to vacuum tube and check for diaphragm leaks.

4. Check modulator bellows (modulator plunger is under pressure - 18 lbs.). If bellows are damaged, plunger will have very little pressure.

5. Inspect modulator valve for nicks or damage.

6. Check freeness of valve operation in case bore.

I. MANUAL AND PARKING LINKAGE

1. Inspect parking detent rod for cracks or broken spring retainer lugs (Fig. 7E-121).

2. Inspect actuator spring for damage.

3. Inspect actuator for free fit on actuator rod.

4. Inspect parking pawl for cracks or wear, if removed.

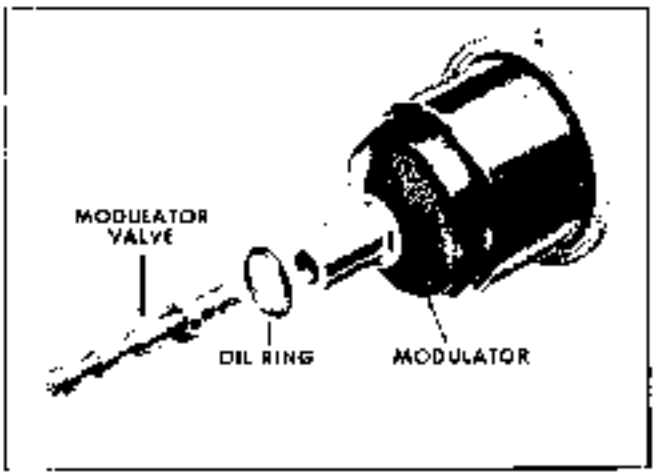


Fig. 7E-120 Modulator and Valve

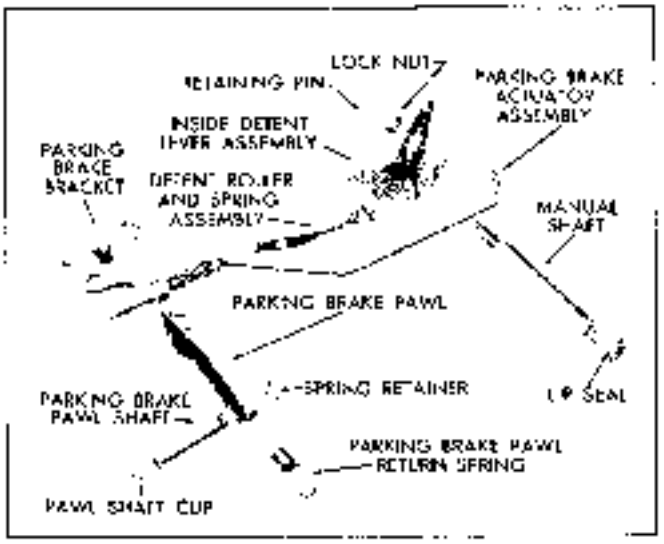


Fig. 7E-121 Exploded View of Manual and Parking Linkage

5. Inspect manual shaft for damaged threads, rough oil seal surface or loose lever.

6. Inspect inside detent lever for cracks or a loose pin.

7. Inspect parking pawl shaft for damaged retainer groove, if removed.

8. Inspect parking pawl return spring for deformed coils or ends.

9. Inspect parking bracket for cracks or wear.

10. Inspect detent roller and spring assembly.

J. CASE ASSEMBLY

1. Inspect case for cracks, porosity or interconnected passages (Fig. 7E-122).

2. Check for good retention of band anchor pins.

3. Inspect all threaded holes for thread damage (Fig. 7E-123).

4. Inspect intermediate clutch driven plate lugs for damage or brinnelling.

5. Inspect snap ring grooves for damage.

6. Inspect governor assembly bore for scratches or scoring.

7. Inspect modulator valve bore for scoring or damage.

8. Inspect cup plug, inside case, for good staking and sealing.

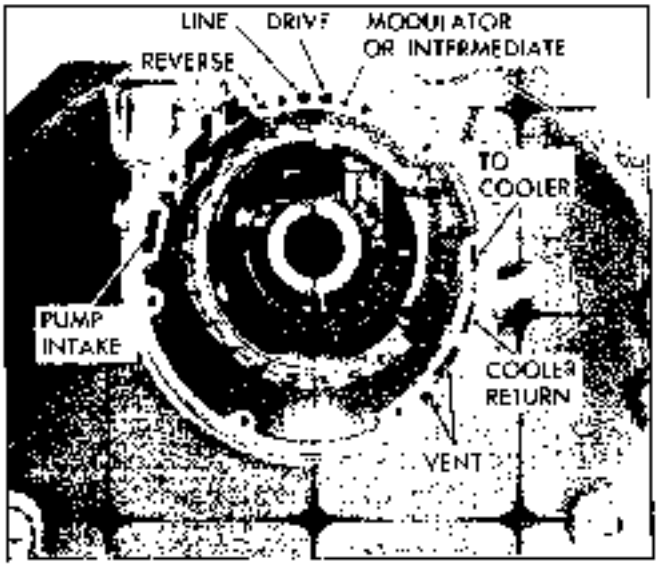


Fig. 7E-122 Case Passage Identification—Front View

B. Inspect case bushing. If necessary to replace, proceed as follows:

A. CASE BUSHING—

Remove

With case properly supported, using tool J 21465-8 with handle J 8092, remove bushing.

Replace

Using tool J 21465-8, ring adapter J 21465-9, handle J 8092 and extension J 21465-13, drive replacement bushing into place. Stake bushing with tool J 21465-10 and stake marks in lube grooves.

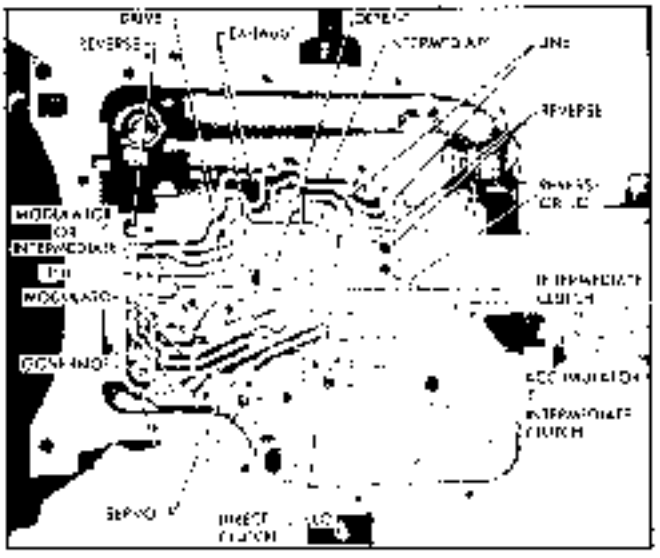


Fig. 7E-123 Inspect Transmission Case

Fig. 7E-124 Air Checking Converter

K. CONVERTER

1. Check converter for leaks as follows (Fig. 7E-124):

a. Install tool J 21369 and tighten.

b. Apply 80 psi air pressure to tool.

c. Submerge in water and check for leaks.

2. Check converter hub surfaces for signs of scoring or wear.

ASSEMBLY OF REAR UNIT
[Fig. 7E-125]

1. Install rear internal gear on end of mainshaft.

NOTE: Make sure mainshaft lug on identification groove on the rear ground journal.

2. Install internal gear retaining snap ring (Fig. 7E-126).

3. Install sun gear to internal gear thrust races and bearings against inner face of rear internal gear as follows, and retain with petrolatum:

a. Place large race against internal gear, with flange facing forward or up (Fig. 7E-127).

b. Place thrust bearing against race.

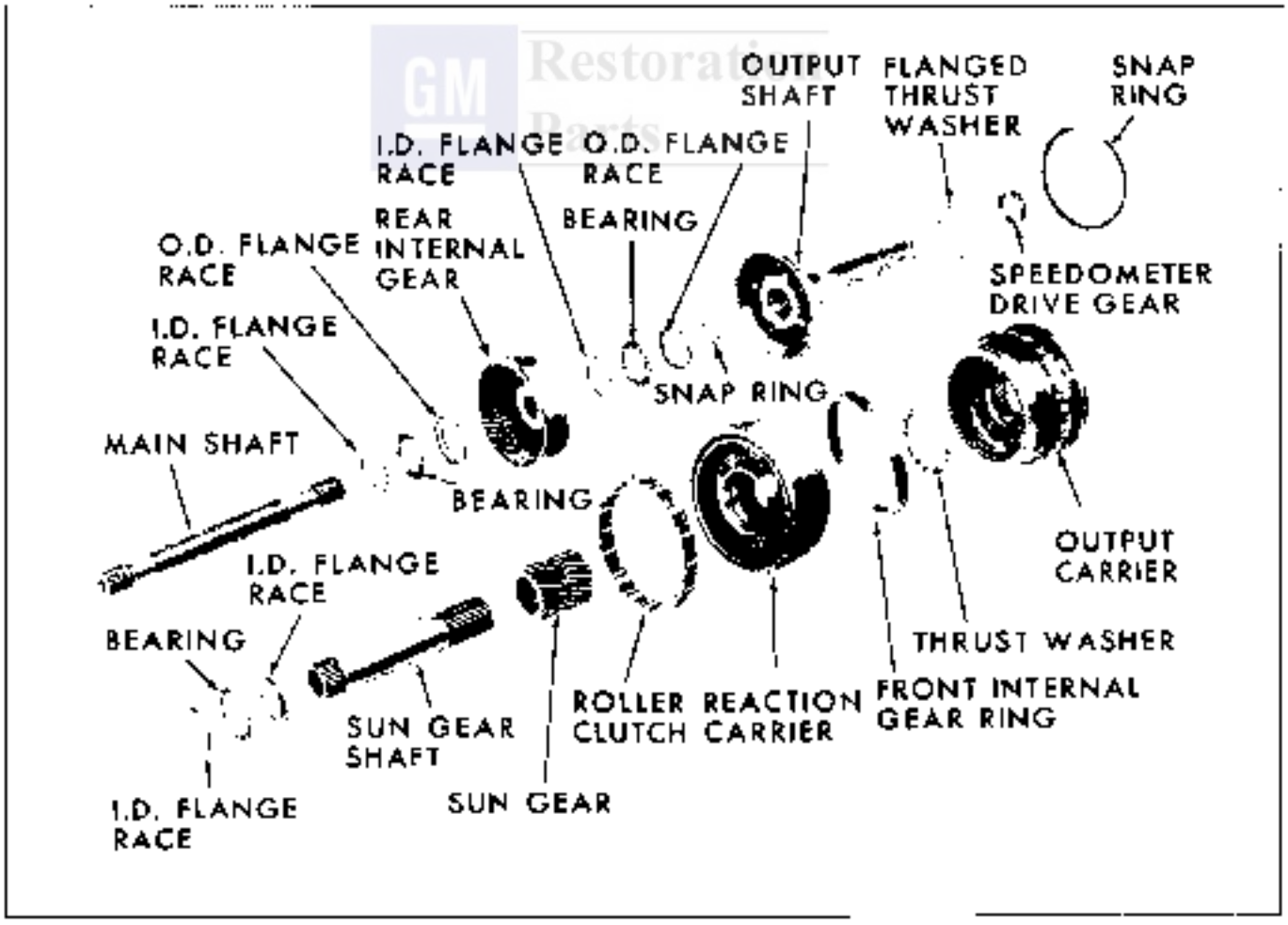


Fig. 7E-125 Exploded View of Rear Unit

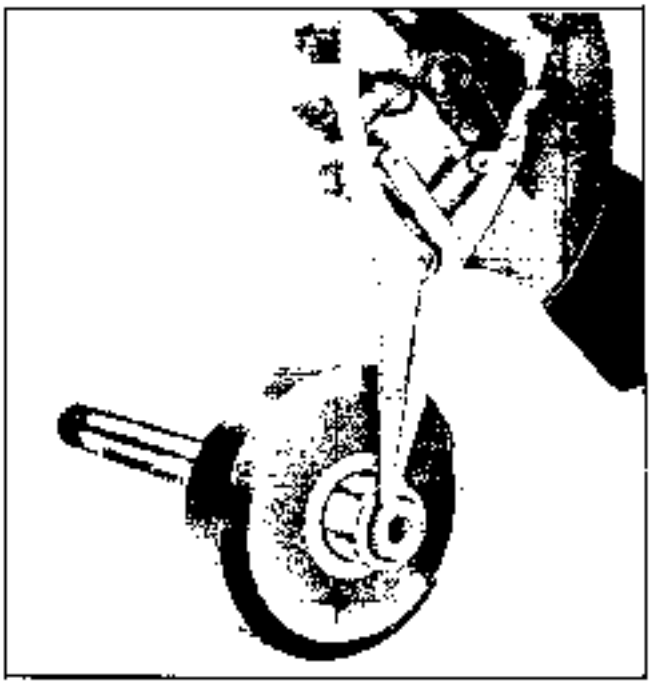


Fig. 7E-126 Installing Rear Internal Gear to Main Shaft Snap Ring

c. Place small race against bearing, with inner flange facing into bearing or down.

4. Install output carrier over mainshaft so that pinions mesh with rear internal gear.

5. Place above portion of build-up through hole in bench so that mainshaft hangs downward.

6. Install rear internal gear to output shaft thrust races and bearings as follows and retain with petrolatum (Fig. 7E-128):

a. Place small diameter race against internal gear, with center flange facing up.

b. Place bearing on race.

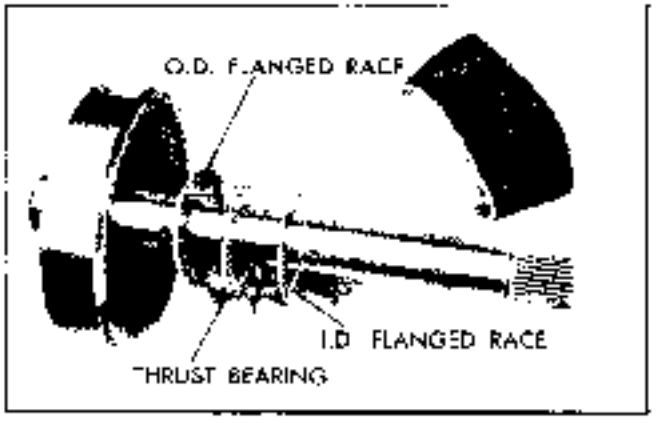


Fig. 7E-127 Installing Rear Internal Gear to Sun Gear Bearing and Races

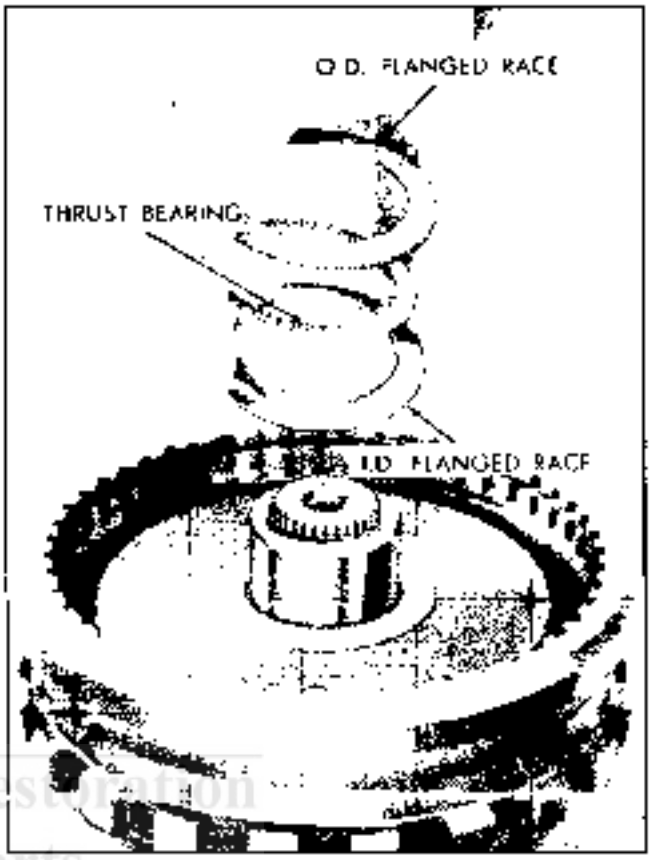


Fig. 7E-128 Installing Rear Internal Gear to Output Shaft Bearing and Races

c. Place second race on bearing, with outer flange cupped over bearing.

7. Install output shaft into output carrier (Fig. 7E-129).

8. Install output shaft to output carrier snap ring, with beveled side facing up.

9. Turn assembly over and support so that output shaft hangs downward.

10. Install reaction carrier to output carrier plastic thrust washer, with tabs facing down in pockets and retain with petrolatum.

11. Install sun gear, splines with chamfer down.

12. Install composition ring over output carrier (Fig. 7E-130).

13. Install sun gear shaft, with long splined end down.

14. Install reaction carrier (Fig. 7E-131).

15. Install center support to sun gear thrust races and bearings, retaining with petrolatum, as follows:

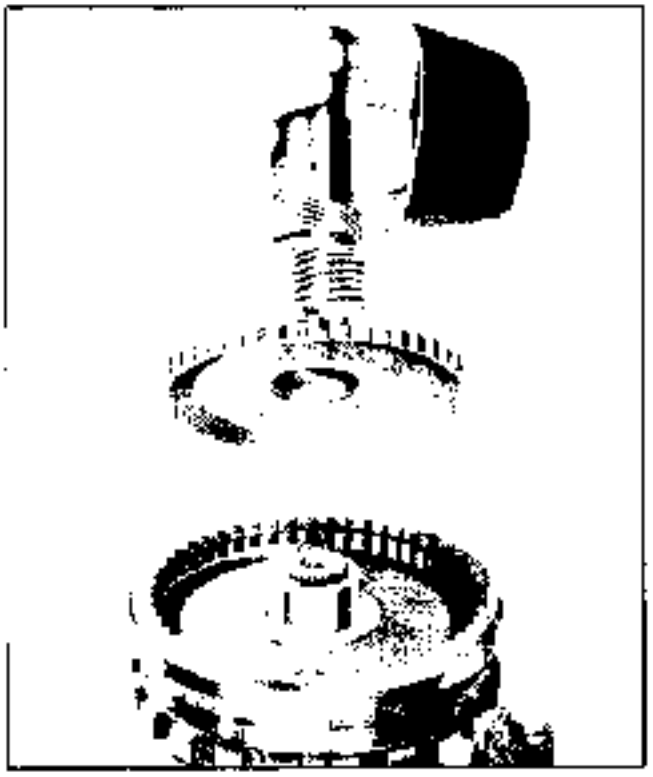


Fig. 7E-129 Installing Output Shaft

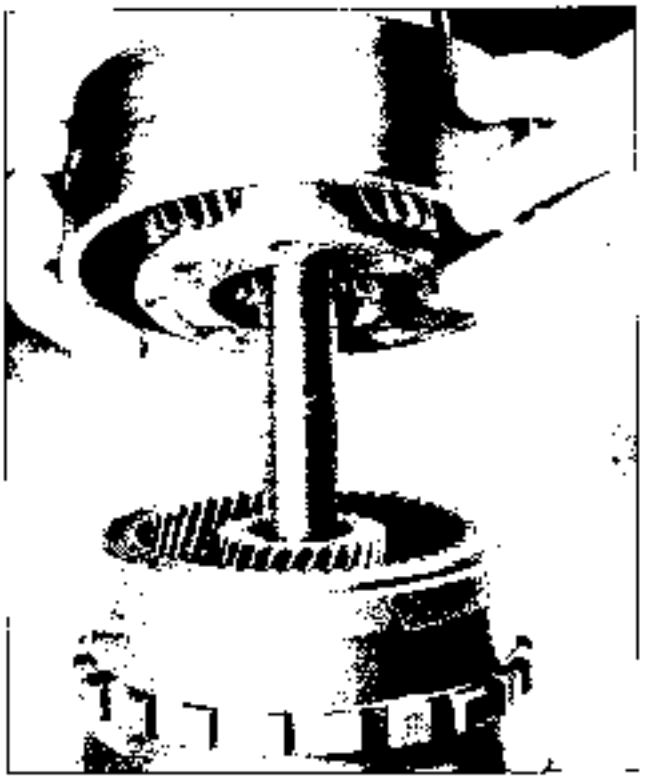


Fig. 7E-131 Installing Reaction Carrier

a. Install large race, center flange up over sun gear shaft.

b. Install thrust bearing against race.

c. Install second race, center flange up (Fig. 7E-132).

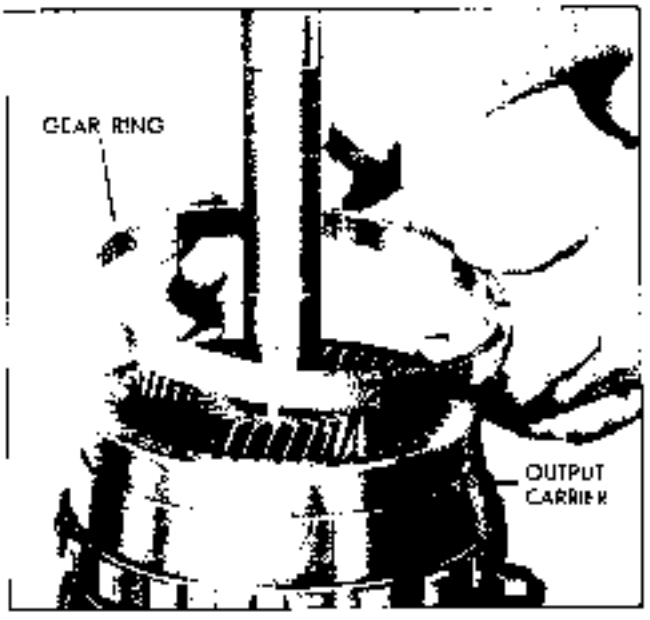


Fig. 7E-130 Installing Front Internal Gear Ring to Output Carrier

16. Install rollers that may have come out of the roller cage by compressing the energizing spring with forefinger and inserting roller from the outer side (Fig. 7E-134).

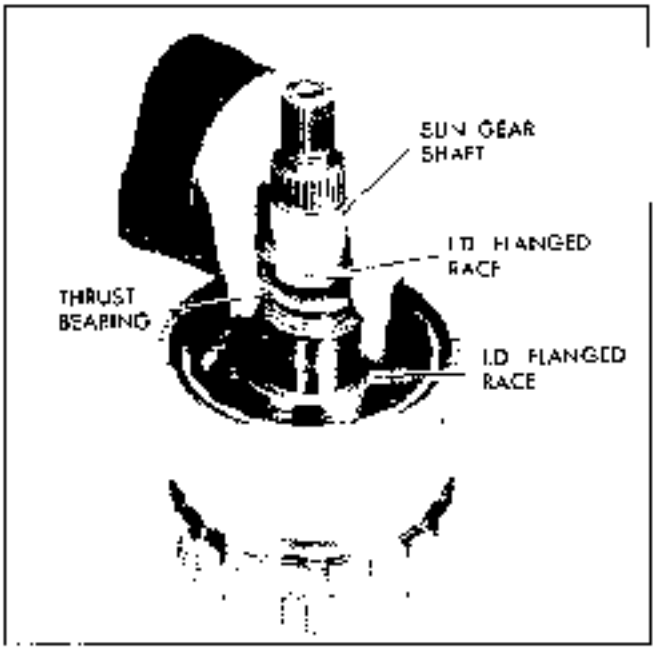


Fig. 7E-132 Installing Center Support to Sun Gear Thrust Bearing and Races

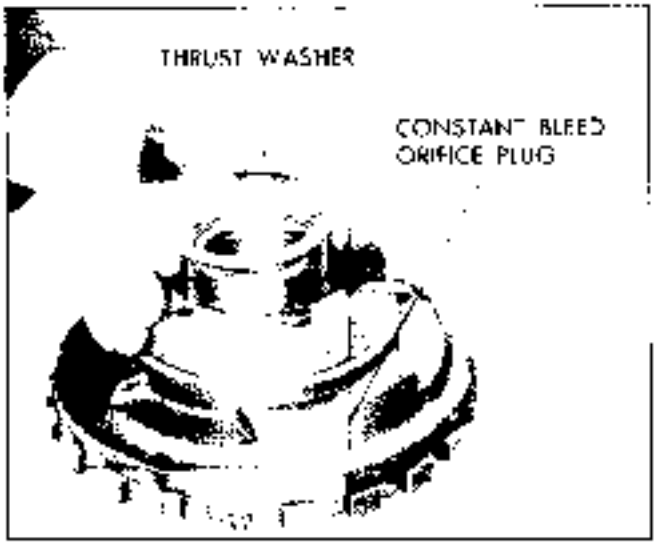


Fig. 7E-133 Installing Center Support to Reaction Carrier Thrust Washer

17. Install roller clutch into reaction carrier outer race (Fig. 7E-135).

18. Install planetary center support to reaction carrier thrust washer into recess in center support. Retain with petrolatum (Fig. 7E-133).

19. Install case center support into reaction carrier and roller clutch assembly (Fig. 7E-136).

NOTE: With reaction carrier held, case support should only turn counterclockwise.

20. Install J 21795 on gear unit to hold units in place.

21. Install output shaft to cast thrust washer tabs in notches and retain with petrolatum (Fig. 7E-137).

Fig. 7E-134 Installing Roller Clutch

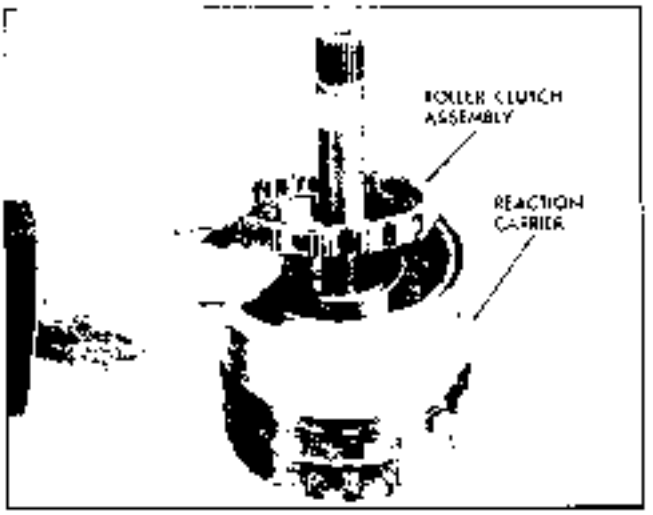


Fig. 7E-135 Into Ring Roller Clutch

ASSEMBLY OF UNITS INTO TRANSMISSION CASE

NOTE: The first 3 steps can be omitted if the parts involved were not removed on disassembly.

1. Install parking pawl, tooth toward inside of case, and parking pawl shaft (Fig. 7E-138).

2. Install parking pawl shaft retainer clip (Fig. 7E-139).

3. Install new cup plug, using a 3/4" dia. rod, and drive into transmission case until parking pawl shaft bottoms on case rib (Fig. 7E-140).

4. Install parking pawl return spring, square end hooked on pawl and other end on case (Fig. 7E-141).

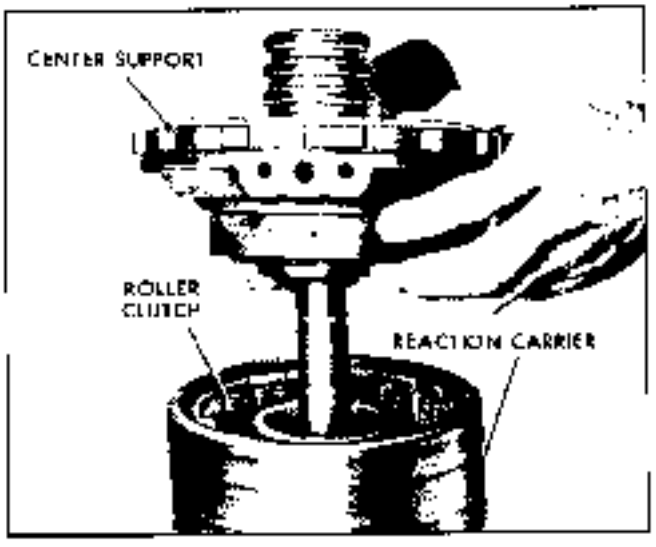


Fig. 7E-136 Installing Center Support into Reaction Carrier and Roller Clutch

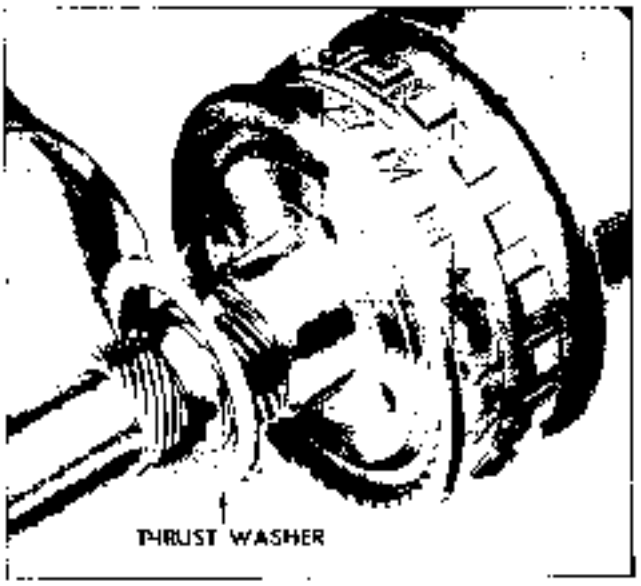


Fig. 7E-137 Installing Case to Output Shaft Thrust Washer

5. Install parking brake bracket guides over parking pawl, using two attaching bolts. Torque to 18 lb. ft.

6. Install rear band so that two lugs index with two anchor pins. Check to make sure band is seated on lugs (Fig. 7E-142).

7. Install proper rear selective washer (proper washer determined by previous end play check) into slots provided inside rear of transmission case.

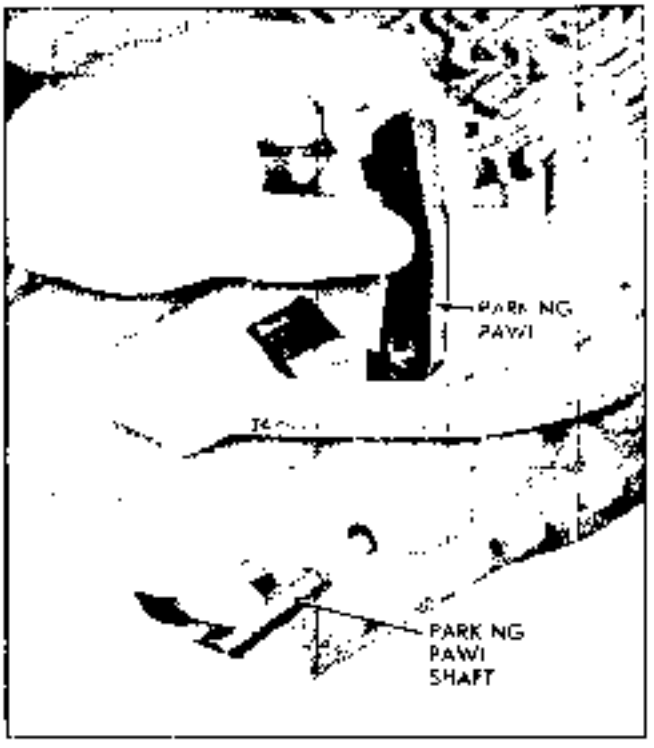


Fig. 7E-138 Installing Parking Pawl and Shaft with O-Ring

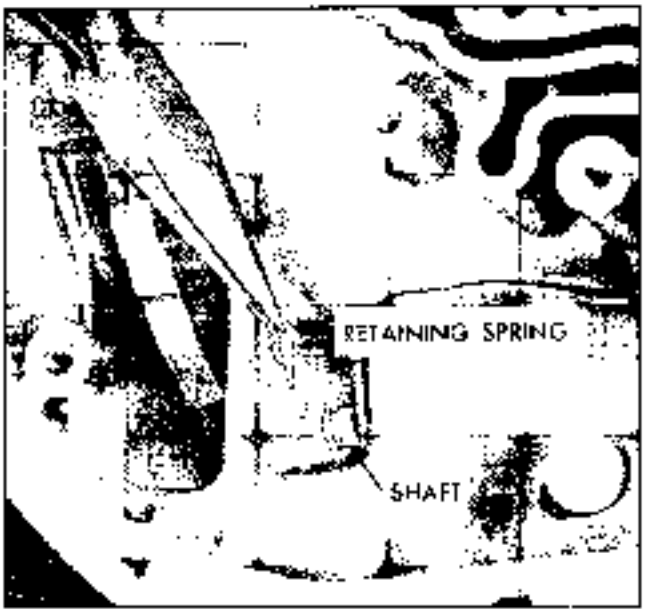


Fig. 7E-139 Installing Parking Shaft Retaining Spring

Fig. 7E-140 Installing New Cup Plug

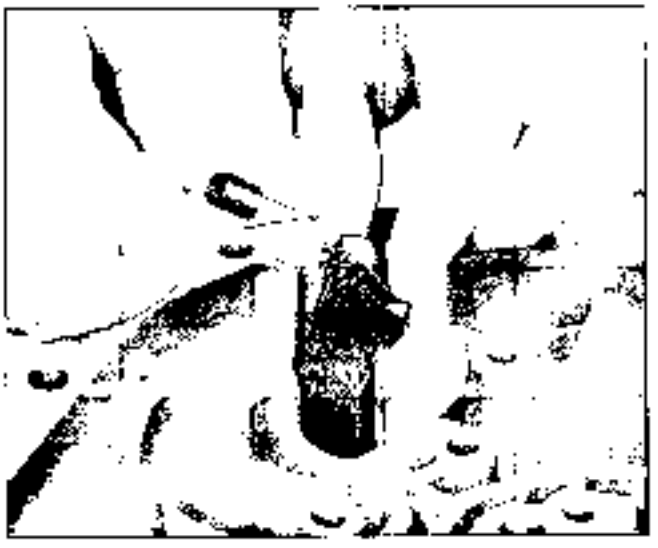


Fig. 7E-141 Installing Parking Pawl Return Spring

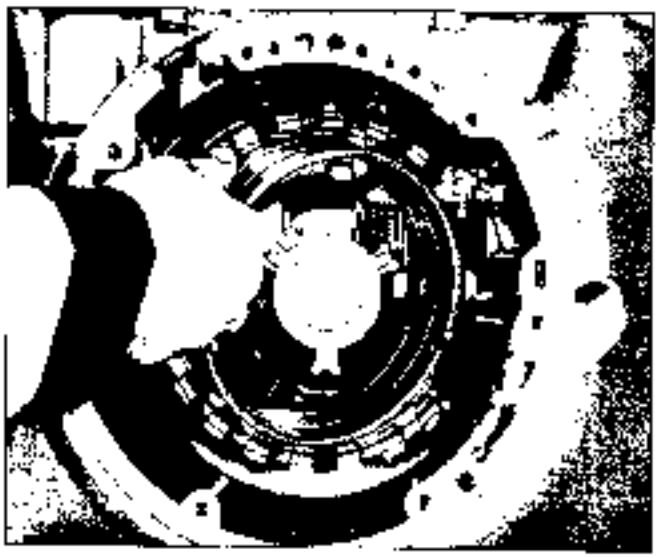


Fig. 7E-142 Installing Rear Band

NOTE: Dip washer in transmission oil before installation

8. Install complete gear unit assembly into case, using tool J 21795 (Fig. 7E-143) and making certain center support bolt hole is properly aligned with hole in case.

9. Install center support to case retaining snap ring, with bevel side up and locating gap adjacent to band anchor pin. Make certain ring is properly seated in case (Fig. 7E-144).

10. Install case to center support locating screw and torque to 5 lb. ft. Lubricate and install case to center support bolt and torque to 32 lb. ft. Remove locating screw and keep for use on future rebuild jobs to properly locate the case center support (Fig. 7E-145).

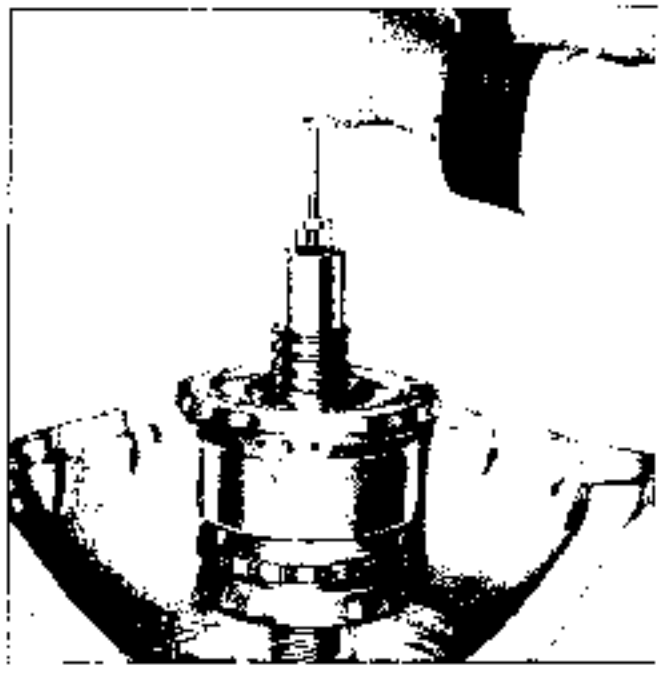


Fig. 7E-143 Installing Center Support and Gear Unit

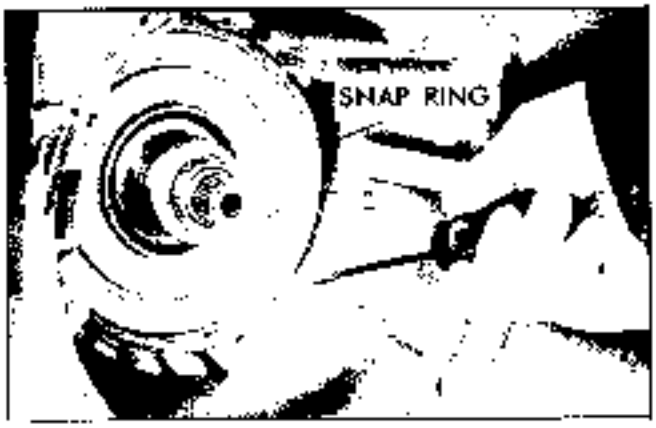


Fig. 7E-144 Installing Center Support to Case Snap Ring

11. Lubricate with transmission oil and install three (3) steel and three (3) composition intermediate clutch plates. Start with waved steel, alternate plates (Fig. 7E-146).

12. Install intermediate clutch backing plate, ridge up.

13. Install backing plate to case snap ring, locating gap opposite band anchor pin.

14. Check rear end play as follows;

a. Install J 21904 with 3/8" adapter into an extension housing attaching bolt hole (Fig. 7E-147).

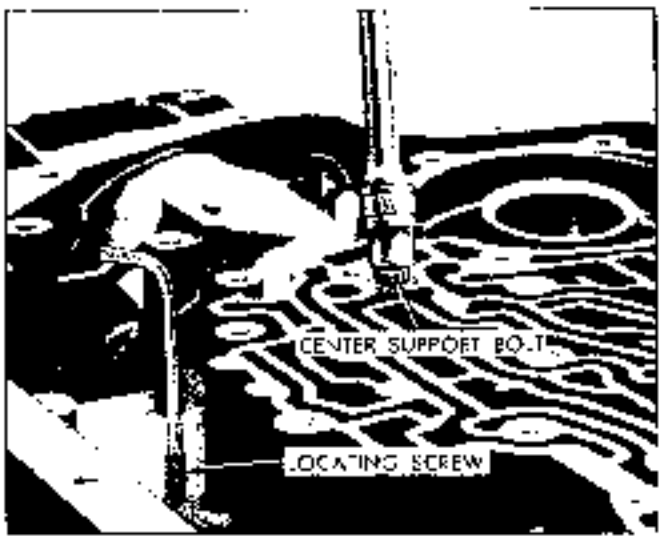


Fig. 7E-145 Install Center Support Bolt

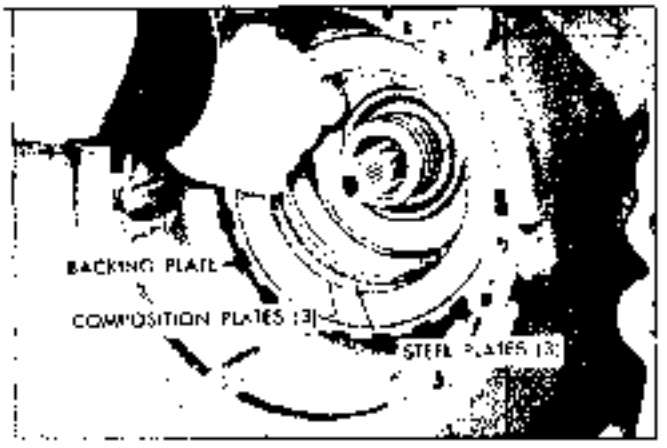


Fig. 7E-146 Installing Intermediate Backing Plate and Clutch Plates

b. Mount dial indicator J 8001 on rod and index with end of output shaft.

c. Move output shaft in and out to read end play. End play should be from .003"-.019". The selective washer controlling this end play is a steel washer having 3 lugs and is located between thrust washer and rear face of transmission case.

If a different washer thickness is required to bring end play within specifications, it can be selected from the following chart:

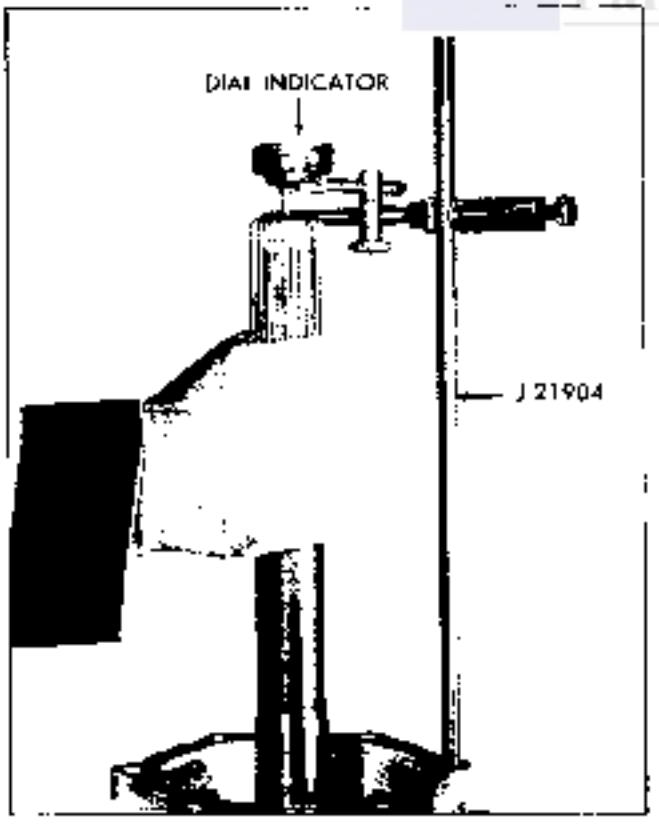


Fig. 7E-147 Checking Rear Unit End Play

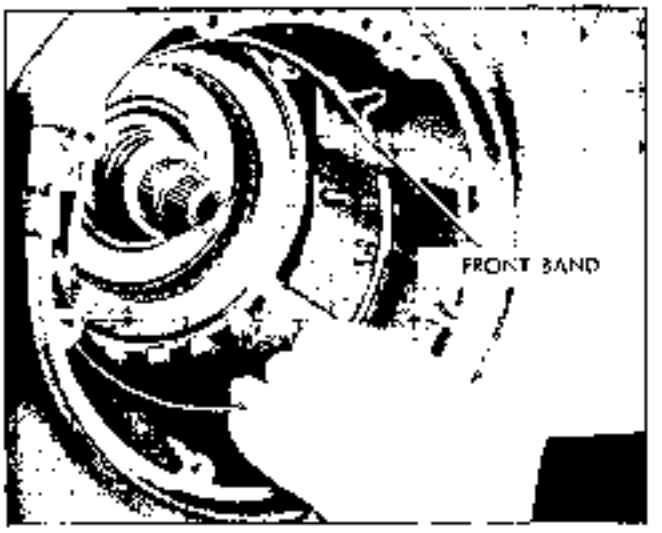


Fig. 7E-148 Installing Front Band

Thickness	Notches	and/or Stamped No.
.074 - .078	None	1
.082 - .086	1 Tab Side	2
.090 - .094	2 Tab Side	3
.098 - .102	1 Tab. O.D.	4
.106 - .110	2 Tabs O.D.	5
.114 - .118	3 Tabs O.D.	6

15. Install front band with anchor hole placed over band anchor pin and apply lug facing servo hole (Fig. 7E-148).

Fig. 7E-149 Installing Manual Shaft to Case

16. Install manual linkage as follows:

a. If necessary, install a new manual shaft seal into transmission case using a 3/4 dia. rod to seat the seal.

b. If removed, insert actuator rod into manual detent lever from side opposite pin.

c. Install actuator rod plunger under parking bracket and over parking pawl (Fig. 7E-149).

d. Install manual shaft through case and detent lever.

e. Install detent retaining hex lock nut on manual shaft and tighten (Fig. 7E-150).

f. Install retaining pin, indexing with groove in manual shaft. Rotate transmission to vertical position and remove J 21795.

17. Install direct clutch and intermediate sprag assembly. It will be necessary to twist housing to allow sprag outer race to index with clutch drive plates. Housing hub will bottom on sun gear shaft (Fig. 7E-151).

NOTE: Removal of direct clutch drive and driven plates may be helpful.

18. Install forward clutch hub to direct clutch housing thrust washer on forward clutch hub. Retain with petrolatum.

19. Install forward clutch and turbine shaft, indexing direct clutch hub so end of mainshaft will bottom on end of forward clutch hub. When forward clutch is seated, it will be approximately 1 1/4" from pump face in case (Fig. 7E-152).

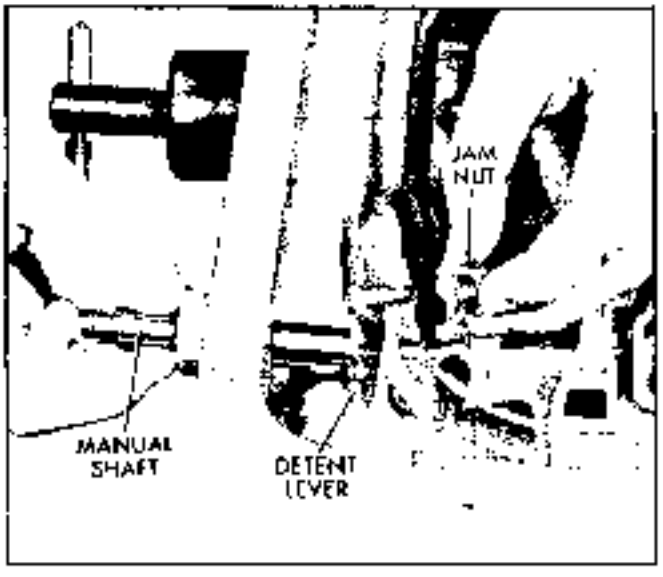


Fig. 7E-150 Installing Detent Lever and Jam Nut to Manual Shaft

Fig. 7E-151 Installing Direct Clutch

20. Install front pump.

21. Install all but one pump attaching bolt and seal. Torque to 10 lb. ft.

NOTE: If turbine shaft can not be rotated as pump is being pulled into place, forward or direct clutch housing has not been properly installed to index with all clutch plates. This condition must be corrected before pump is pulled fully into place.

22. If necessary, install a new front seal, using tool J 21359 to drive seal in place (Fig. 7E-153).

23. Check front unit end play as follows (Fig. 7E-154):

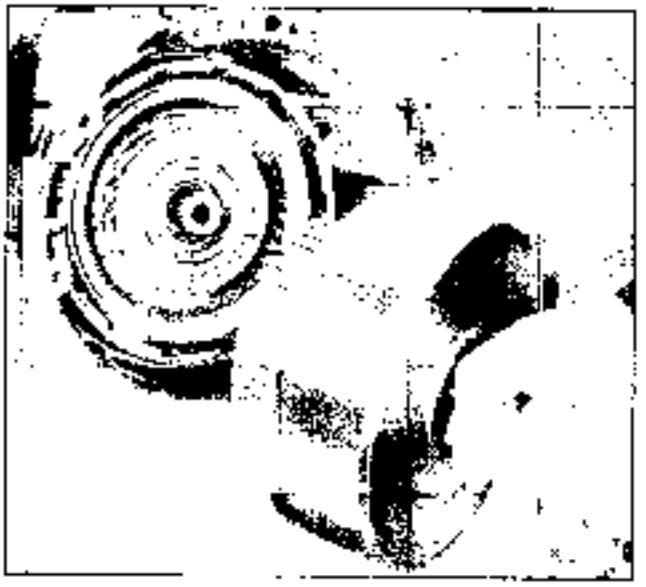


Fig. 7E-152 Installing Forward Clutch and Turbine Shaft

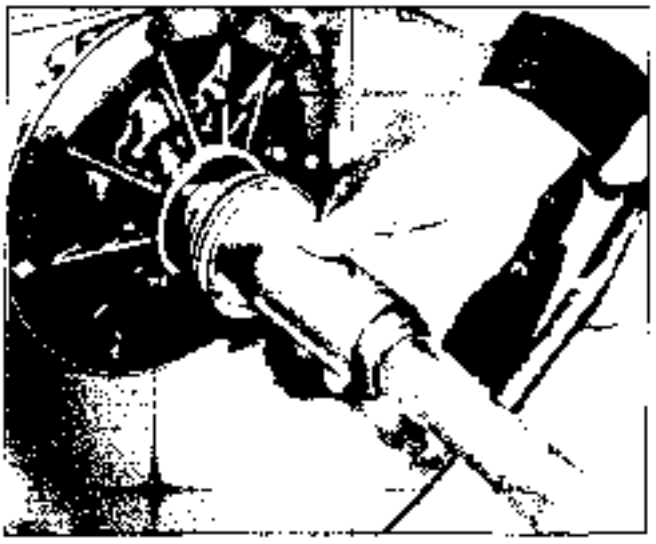


Fig. 7B-153 Installing Pump Seal

a. Install a 5/16"-18 threaded slide hammer or J 6125 into bolt hole in pump.

b. Mount a dial indicator on rod and index indicator to revolver with end of turbine shaft.

c. Push turbine shaft rearward.

d. Pull output shaft forward.

e. Set dial indicator to zero.

f. Pull turbine shaft forward.

Read resulting travel or end play - should be .002" to .024". Selective washer controlling this end play is phenolic resin washer located between pump cover and forward clutch housing. If more or less washer thickness is required to bring end play within specifications, select proper washer from the chart below:

Thickness (in inches)	Color
.060-.064	Yellow
.071-.075	Blue
.082-.086	Red
.093-.097	Brown
.104-.108	Green
.115-.119	Black
.126-.130	Purple

NOTE: An oil soaked washer may tend to discolor. It will be necessary to measure washer for its actual thickness.

24. Install remaining front pump attaching bolt and seal. Torque to 20 lb. ft.

REAR EXTENSION HOUSING ASSEMBLY

1. Install extension housing to case gasket on extension housing.

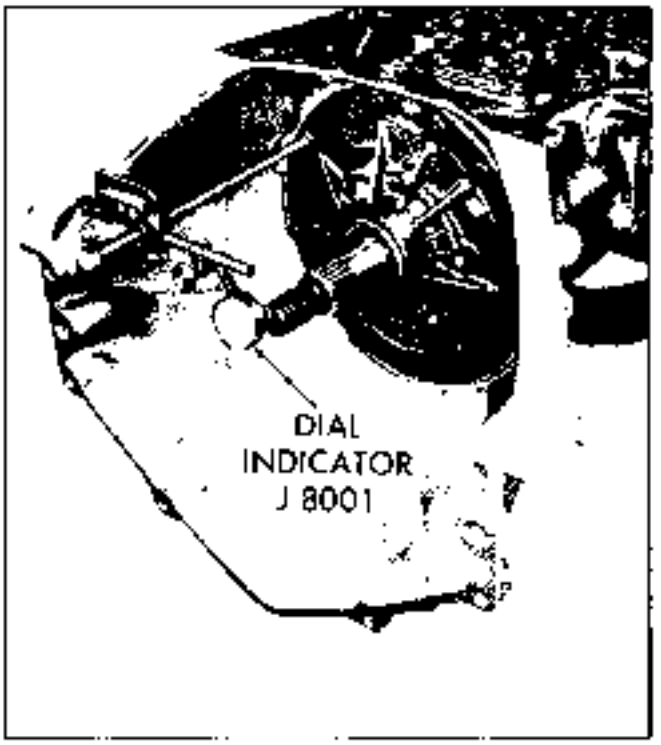


Fig. 7B-154 Checking Front Unit End Play

2. Attach extension housing to case, using attaching bolts. Torque bolts to 22 lb. ft.

3. If necessary, install new seal with tool J 21359 (Fig. 7B-155).

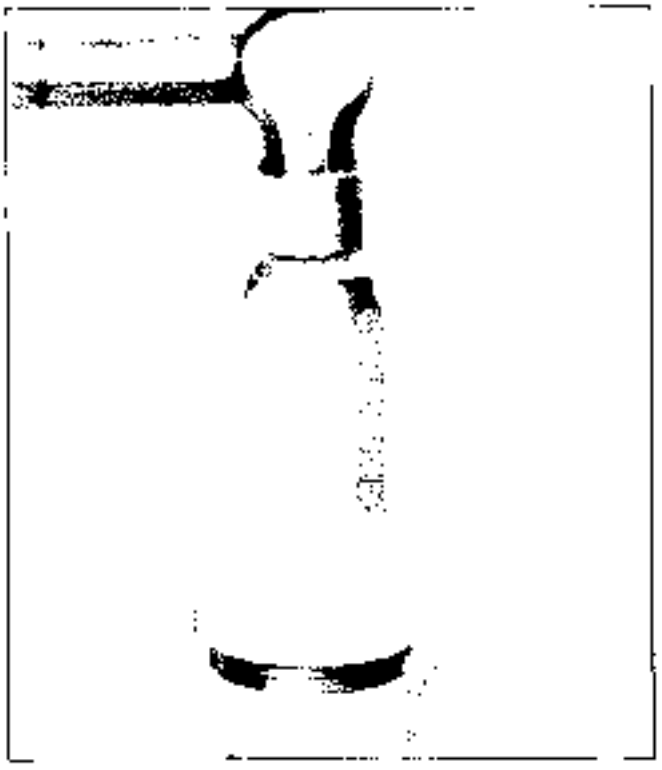


Fig. 7B-155 Installing Rear Extension Seal

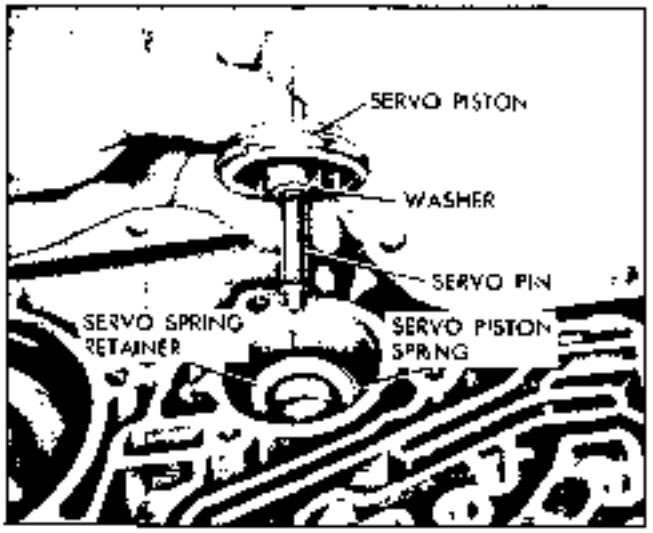


Fig. 7E-156 Installing Front Servo Piston, Washer and Pin

INSTALLATION OF CHECK BALLS, FRONT SERVO, GASKETS, SPACER AND SOLENOID

1. Install front servo spring and retainer into transmission case.

2. Install flat washer on front servo pin, cut end opposite taper.

3. Install pin and washer into case so that tapered end is contacting band.

4. Install oil seal ring on front servo piston. If removed, and install on apply pin so that identification numbers on shoulders are exposed (Fig. 7E-156).

5. Check freeness of piston by stroking piston in bore.

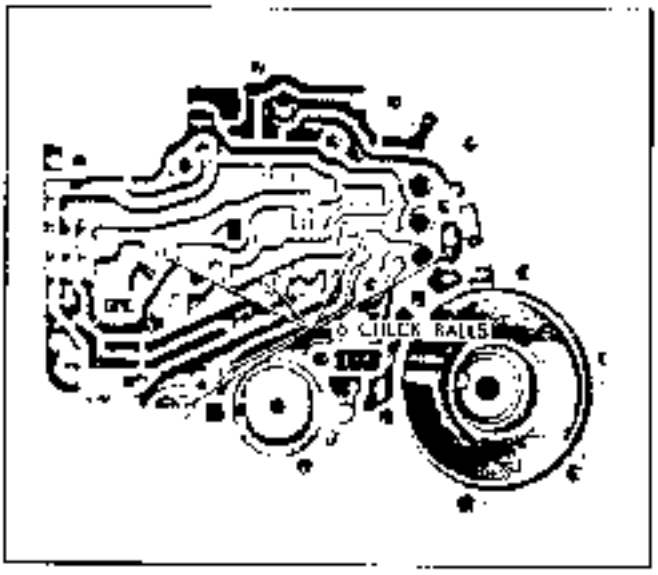


Fig. 7E-157 Location of Check Balls

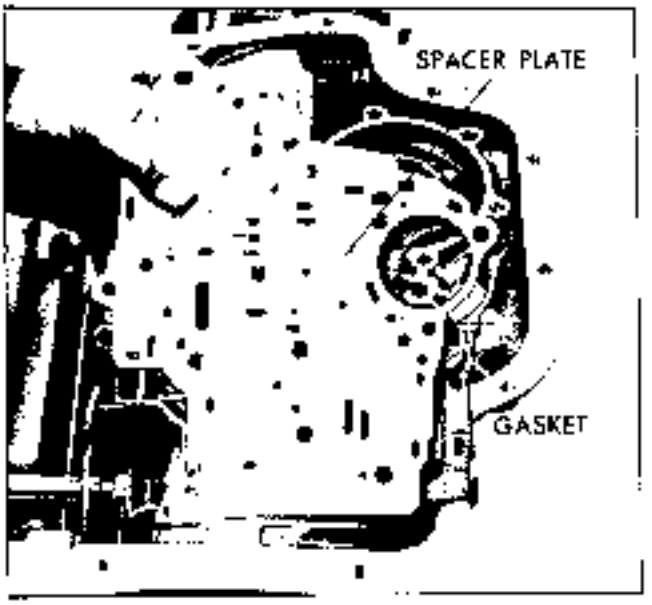


Fig. 7E-158 Installing Control Valve Spacer Plate and Gasket

6. Install six (6) check balls into transmission oil case pockets (Fig. 7E-157).

7. Install valve body spacer to case gasket (gasket with extension for solenoid) (Fig. 7E-158).

8. Install valve body to case spacer plate.

9. Install detent solenoid and gasket, with connector facing outer edge of case (Fig. 7E-159).

NOTE: Do not tighten bolts at this time.

10. Install O-ring seal on solenoid connector.

11. Lubricate and install case connector with lock tabs facing into case, positioning harness tab in notch on side of case (Fig. 7E-160).

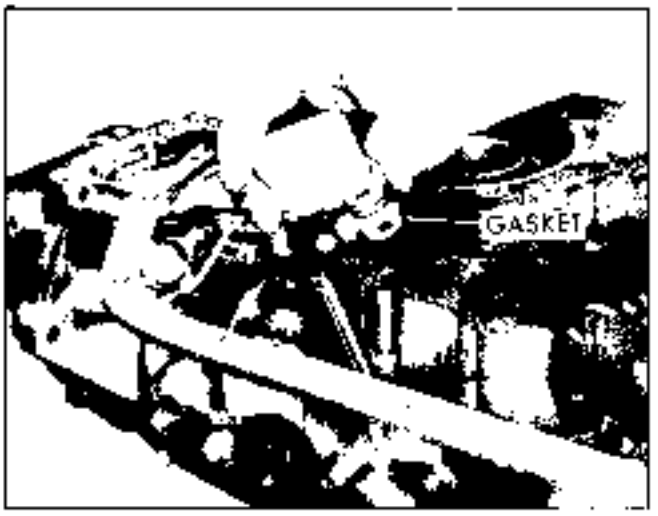


Fig. 7E-159 Installing Detent Solenoid and Gasket

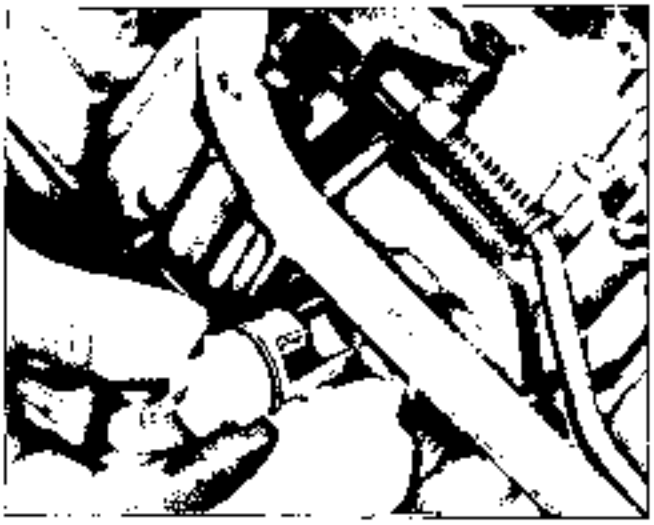


Fig. 7E-160 Installing Case Connector Sleeve and O-Ring Seal

12. Install detent connector into case sleeve connector.

INSTALLATION OF REAR SERVO ASSEMBLY

NOTE: Before installing rear servo, check band apply pin, using tool J 21370-5 and 6 as follows (Fig. 7E-161):

a. Attach band apply pin selection gauge J 21370-6 and J 21370-5 to transmission case (lever pivot pin to rear), with rear servo cover attaching screws.

NOTE: Attach tool attaching screws finger tight and check freeness of selective pin. Torque attaching screws to 15 ft. lbs. and recheck pin to make certain it does not bind.

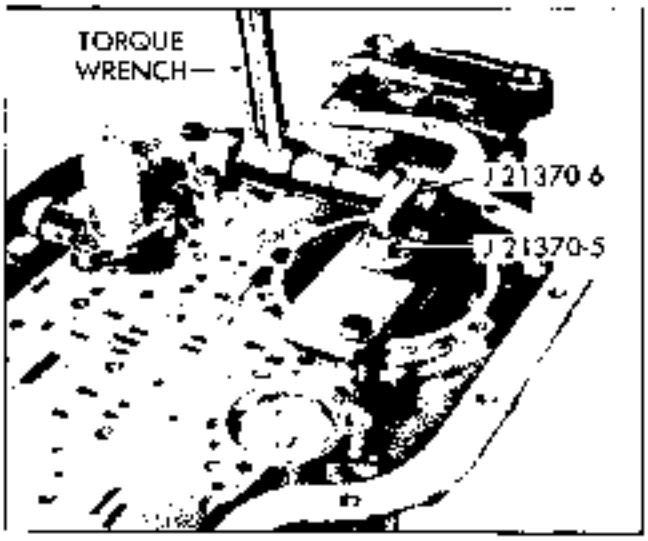


Fig. 7E-161 Checking Rear Band Pin

b. Apply 25 lb. ft. torque and select proper servo pin to be used from scale on tool.

c. Remove tool and make note of proper pin to be used during assembly of transmission.

There are three selective pins identified as follows:

a. If both steps are below the gauge surface, the long pin, identified by 3 rings, should be used.

b. If the gauge surface is between the steps, the medium pin, identified by 2 rings, should be used.

c. If both steps are above the gauge surface, the short pin, identified by 1 ring, should be used.

Identification ring is located on band lug end of pin. Selecting proper pin is equivalent to adjusting band.

1. Install rear accumulator spring into case (Fig. 7E-162).

2. Lubricate and install rear servo assembly into case (Fig. 7E-163).

3. Install rear servo gasket and cover (Fig. 7E-164).

4. Install attaching screws. Torque bolts to 18 lb. ft.

INSTALLATION OF CONTROL VALVE ASSEMBLY AND GOVERNOR PIPES

1. Install control valve to spacer gasket (Fig. 7E-165).

2. Install governor pipes into valve body.

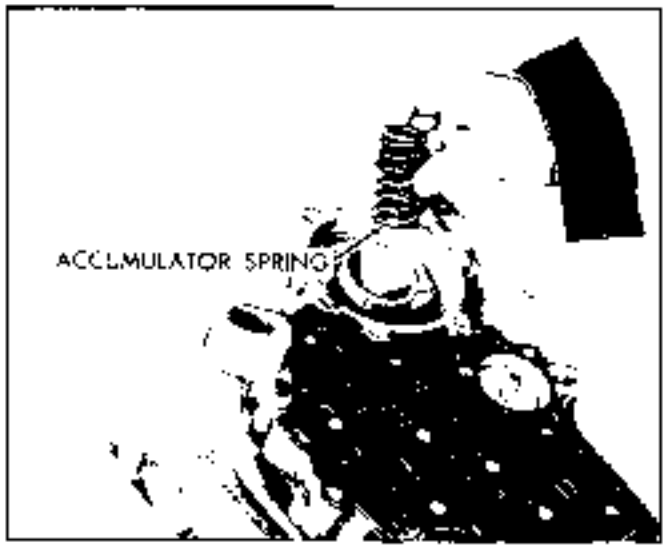


Fig. 7E-162 Installing Rear Accumulator Spring

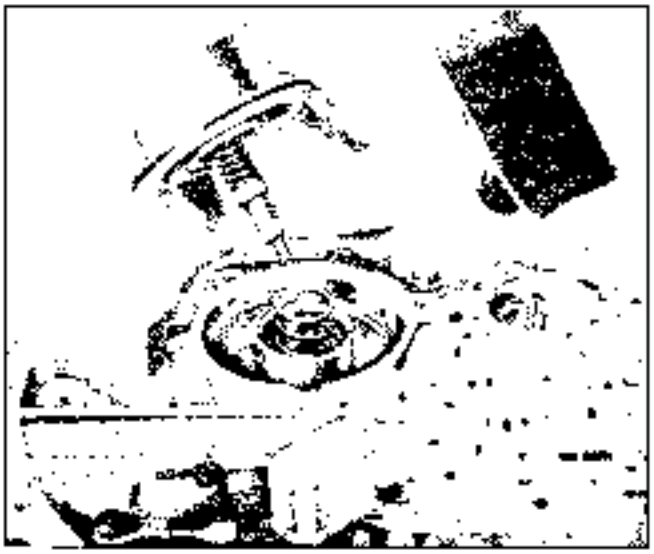


Fig. 7E-163 Installing Rear Servo

3. Install two guide pins (control valve assembly attaching screws with heads removed) (Fig. 7E-166).

4. Install control valve and governor pipes to transmission.

NOTE: Be sure manual valve is properly indexed with pin on manual detent lever and governor pipes are properly installed in case.

5. Install control valve assembly attaching bolts and manual detent and roller assembly (Fig. 7E-167).

6. Tighten detent solenoid and control valve attaching bolts. Torque valve body bolts to 8 lb. ft. and solenoid bolts to 6 lb. ft.

INSTALLATION OF STRAINER AND INTAKE PIPE

1. Install case to intake pipe O-ring seal on intake pipe and assemble new strainer to intake pipe (Fig. 7E-17).

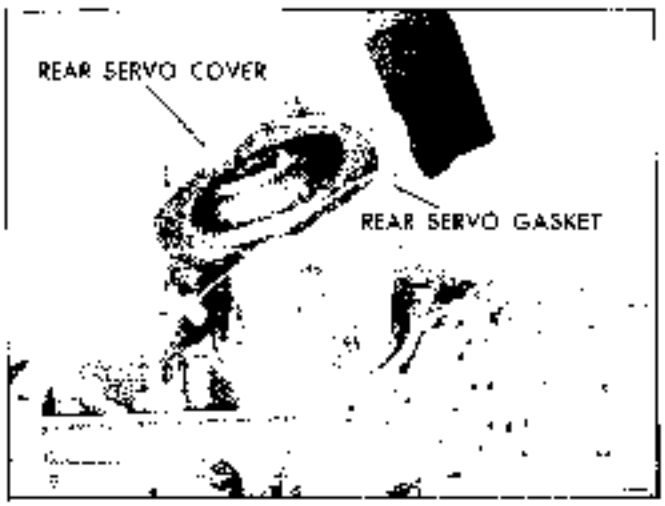


Fig. 7E-164 Installing Rear Servo Cover and Gasket

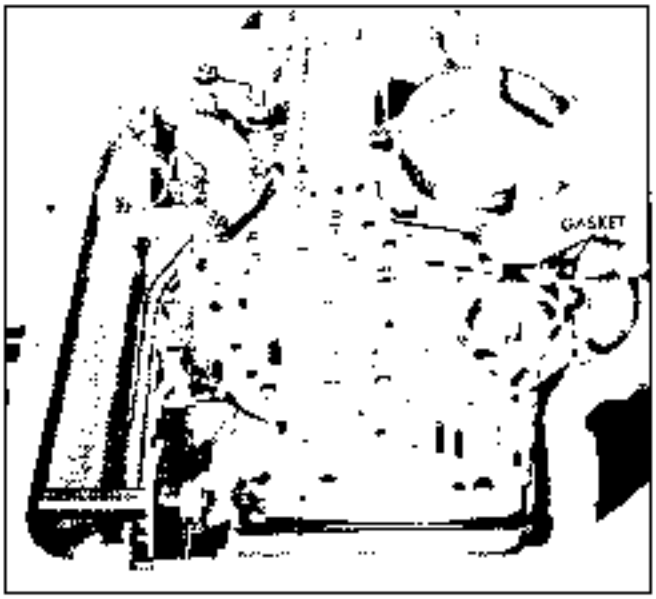


Fig. 7E-165 Installing Control Valve to Spacer Gasket

2. Install strainer and intake pipe assembly, attaching strainer to control valve assembly with the retainer bolt (Fig. 7E-16).

NOTE: After any major repair, the strainer must be replaced.

3. Install new bottom pan gasket and bottom pan with attaching screws. Torque to 12 lb. ft.

INSTALLATION OF MODULATOR VALVE AND VACUUM MODULATOR

1. Install modulator valve into case, stem end out (Fig. 7E-168).

2. Install O-ring seal on vacuum modulator.

3. Install vacuum modulator into case.

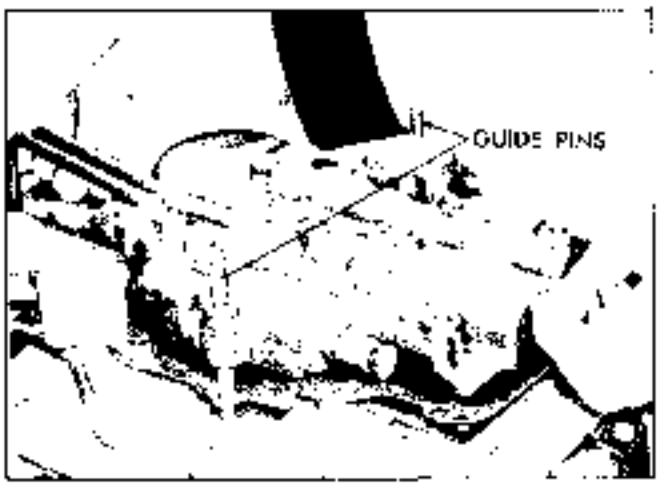


Fig. 7E-166 Installing Control Valve Assembly and Governor Pipes

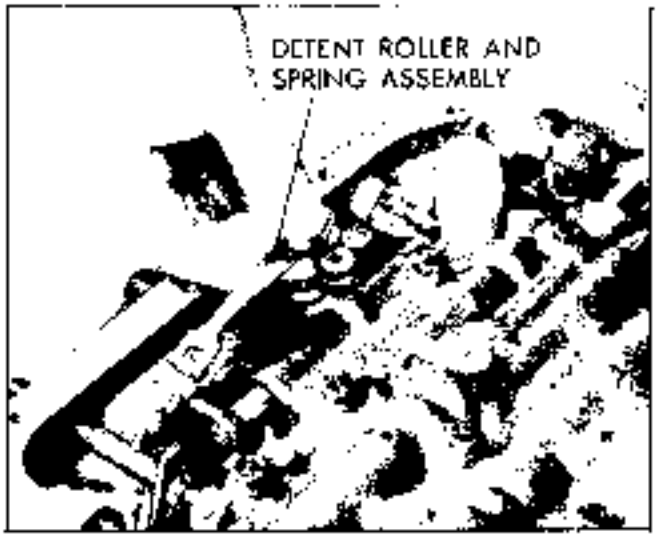


Fig. 7E-167 Installing Detent Roller and Spring Assembly

4. Install modulator retainer and attaching bolt. Torque bolt to 18 lb. ft.

INSTALLATION OF GOVERNOR

1. Install governor into case (Fig. 7E-169).

2. Attach governor cover and new gasket with four (4) attaching bolts. Torque bolts to 18 lb. ft.

INSTALLATION OF SPEEDOMETER DRIVEN GEAR

1. Install speedometer driven gear (Fig. 7E-170).

2. Install speedometer driven gear retainer and attaching bolts.

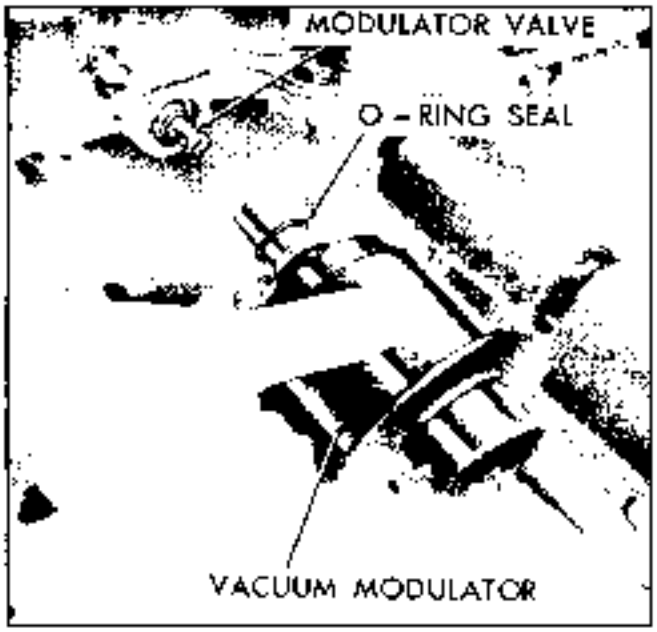


Fig. 7E-168 Installing Vacuum Modulator and Valve

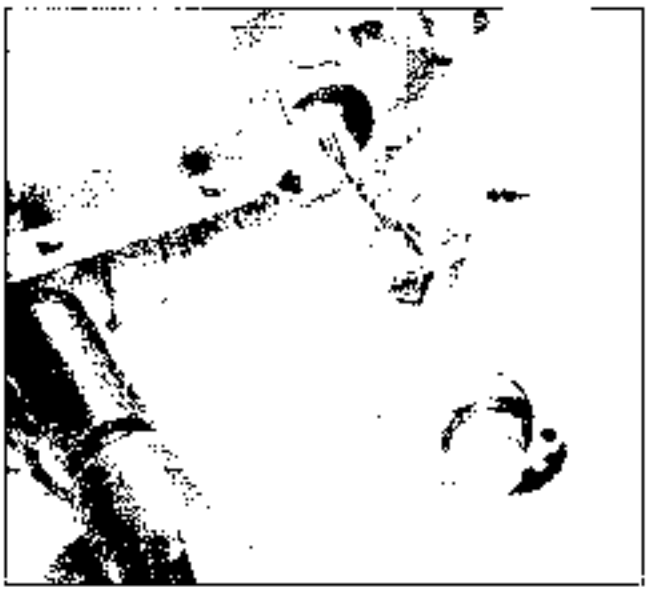


Fig. 7E-169 Installing Governor

INSTALLATION OF CONVERTER ASSEMBLY

With the transmission in cradle or portable jack, install the converter assembly into the pump assembly, making certain that the converter hub drive slots are fully engaged with the pump drive gear tangs and the converter installed fully towards the rear of the transmission.

INSTALLATION OF TRANSMISSION ASSEMBLY

Reverse the procedure for transmission removal as stated on page 7E-12.

Fig. 7E-170 Installing Speedometer Drive Gear and Sleeve

MANUAL LINKAGE

Manual linkage adjustment and the associated neutral safety switch are important from a safety standpoint. The neutral safety switch should be adjusted so that the engine will start in the Park and Neutral positions only.

With the selector lever in the Park position, the parking pawl should freely engage and prevent the vehicle from rolling. The pointer on the indicator quadrant should line up properly with the range indications in all ranges.

ROAD TEST (ATTACH PRESSURE GAUGE TO TRANSMISSION)

The car owner should accompany the tester and the complaint analyzed under the same or simulated conditions.

SHIFT PATTERN CHECK

Check all the shifts in the following manner:

Drive Range:

Position selector lever in Drive Range, accelerating the vehicle from 0 mph. A 1-2 and 2-3 shift should occur at all throttle openings. The shift points will vary with the throttle opening. As the vehicle decreases in speed to 0 mph, the 3-2 and 2-1 shifts should occur.

Super Range:

Position the selector lever in Super Range and accelerate the vehicle from 0 mph. A 1-2 shift should occur at all throttle openings. No 2-3 shift can be obtained in this range. The 1-2 shift point will vary with throttle opening. As the vehicle decreases in speed to 0 mph, a 2-1 shift should occur.

Lo Range:

Position the selector lever in Lo Range. No upshift should occur in this range, regardless of throttle opening.

2nd Gear Overrun Braking:

Position the selector lever in the Drive Range and, with the car speed at approximately 35 mph, move the selector lever to Super Range. The transmission should downshift to 2nd. An increase in engine rpm and an engine braking effect should be noticed. Line pressure should change from 60 psi to approximately 150 psi in 2nd.

1st Gear - Downhill or Overrun Braking:

With the selector lever in Super at approximately 30 mph at constant throttle, reposition the selector lever into Lo Range. An increase in engine rpm and a braking effect should be noticed. Line pressure should be approximately 150 psi (Figs. 171 and 172).

TURBO HYDRA-MATIC TRANSMISSION - OIL PRESSURE CHECK

I. Oil Pressure Check - Road or Normal Operating Conditions

While road testing with the transmission oil pressure gauge attached and the vacuum modulator tube connected, the transmission pressures should check approximately as shown in Fig. 7E-171.

Super Range		Minimum	Maximum
2nd Gear - Steady road load at approximately 25 mph		145 psi	155 psi
Gear	**Selector Lever Position**	**Minimum**	**Maximum**
1st 2nd 3rd	Drive ("Zero" throttle to full throttle)	60	160
3rd	Drive Range, Zero Throttle at 30 mph	60	
Reverse	Rev. (Zero to full throttle)	95	280

Fig. 7E-171 Oil Pressure Check - Road or Normal Operating Conditions

II. Oil Pressure Check - With Car Stationary and Engine at 1200 rpm

With the transmission oil pressure gauge attached and the vacuum modulator tube disconnected, the transmission pressures should check approximately as shown in Fig. 7E-172.

Approximate Altitude (Ft. above sea level)	D,N,P	S or L	R
0	150	150	244
2,000	150	150	235
4,000	145	150	222
6,000	138	150	212
8,000	132	150	205
10,000	126	150	194
12,000	121	150	186
14,000	116	150	176

Fig. 7E-172 Oil Pressure Check - Car Stationary, Vacuum Tube Disconnected

III. Oil Pressure Check - With Car Stationary and Engine at 1000 rpm

With the transmission oil pressure gauge attached and the vacuum modulator tube connected for normal modulator operation, the transmission pressures should check approximately as shown in Fig. 7E-173.

NOTE: Pressures are not significantly affected by altitude or barometric pressure when the vacuum modulator tube is connected.

Drive, Neutral, Park	Super or Lo	Reverse
60	150	107

Fig. 7E-173 Oil Pressure Check - Car Stationary, Vacuum Tube Connected

OIL LEAKS

Before attempting to correct an oil leak, the actual source of the leak must be determined. In many cases, the source of the leak can be deceiving due to wind flow around the engine and transmission.

The suspected area should be wiped clean of all oil before inspecting for the source of the leak. Red dye is used in the transmission oil at the assembly plant and will indicate if the oil leak is from the transmission.

The use of a black light to identify the oil at the source of leak is also helpful. Comparing the oil from the leak to that on the engine or transmission dipstick (when viewed by black light) will determine the source of the leak.

Oil leaks around the engine and transmission are generally carried toward the rear of the car by the air stream. For example, a transmission oil filler tube to case leak will sometimes appear as a leak at the rear of the transmission. In determining the source of an oil leak, it is most helpful to keep the engine running.

POSSIBLE POINTS OF OIL LEAKS

1. TRANSMISSION OIL PAN LEAK

a. Attaching bolts not correctly torqued.

b. Improperly installed or damaged pan gasket.

c. Oil pan gasket mounting face not flat.

2. REAR EXTENSION LEAK

a. Attaching bolts not correctly torqued.

b. Rear seal assembly - damaged or improperly installed.

c. Extension to case gasket—damaged or improperly installed.

d. Porous casting.

3. CASE LEAK

a. Filler pipe O-ring seal—damaged or missing, misposition of filler pipe bracket to engine-loading cam side of O-ring.

b. Modulator O-ring seal—damaged or improperly installed.

c. Governor cover, gasket and bolts—damaged, loose; case face leak.

d. Speedo gear O-ring damaged.

e. Manual shaft seal—damaged, improperly installed.

f. Line pressure tap plug—stripped, shy sealer compound.

g. Parking pawl shaft cup plug—damaged, improperly installed.

h. Vent pipe (refer to item 5).

i. Porous case.

4. FRONT END LEAK

a. Front seal - damaged (check converter neck for nicks, etc., also for pump bushing moved forward); garter spring missing from pump to converter hub seal.

b. Pump attaching bolts and seals—damaged, missing, bolts loose.

c. Converter—leak in weld.

d. Pump O-ring seal—damaged. Also check pump groove and case bore.

e. Porous casting (pump or case).

5. OIL COMES OUT VENT PIPE

a. Transmission over-filled.

b. Water in oil.

c. Pump to case gasket misposationed.

d. Foreign material between pump and case, or between pump cover and body.

e. Case—porous, pump face improperly machined.

f. Pump—shy of stock on mounting faces, porous casting, breather hole plugged in pump cover.

g. Incorrect dipstick.

h. Cut O-ring or grommet on strainer.

TURBO HYDRA-MATIC TRANSMISSION—VACUUM MODULATOR CHECK

1. Vacuum Diaphragm Leak Check

Insert a pipe cleaner into the vacuum connector pipe as far as possible and check for the presence of transmission oil. If oil is found, replace the modulator.

NOTE: Gasoline or water vapor may settle in the vacuum side of the modulator. If this is found without the presence of oil, the modulator should not be changed.

2. Atmospheric Leak Check

Apply a liberal coating of soap bubble solution (obtainable at a 5¢-10¢ store) to the vacuum connector pipe seam, the crimped upper to lower housing seam and the threaded screw seal (Fig. 7E-174). Using a short piece of rubber tubing, apply air pressure to the vacuum pipe by blowing into the tube and observe for leak bubbles. If bubbles appear, replace the modulator.

NOTE: Do not use any method other than human lung power for applying air pressure, as pressures over 5 psi may damage the modulator.

3. Bellows Comparison Check

Using a comparison gauge (Fig. 7E-175), compare the load of a known good Hydra-Matic modulator with the assembly in question:

a. Install the modulator that is known to be acceptable on either end of the gauge.

b. Install the modulator in question on the opposite end of the gauge.

c. Holding the modulators in a horizontal position, bring them together under pressure until either modulator sleeve end just touches the line in the center of the gauge. The gap between the opposite modulator sleeve end and the gauge line

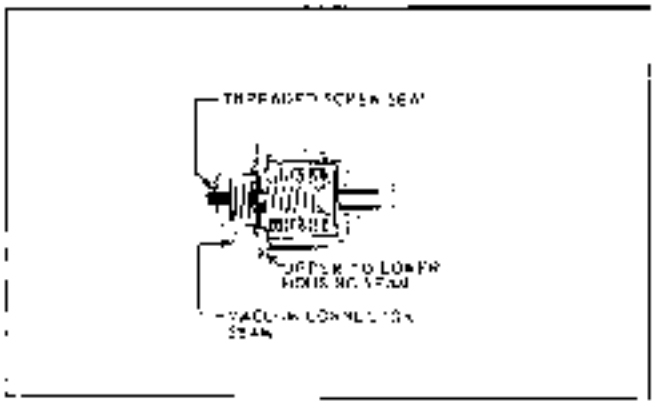


Fig. 7E-174 Cross Section of Vacuum Modulator

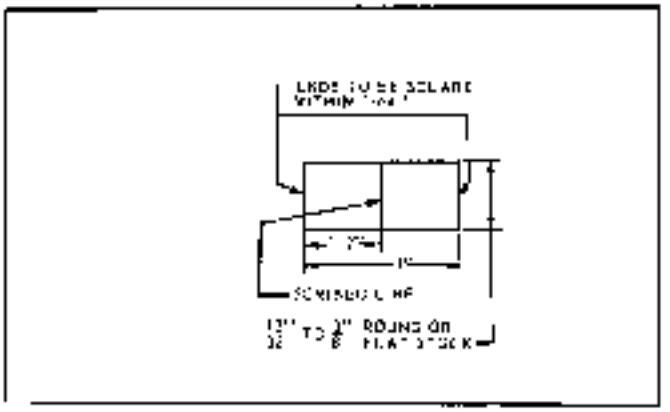


Fig. 7E-175 Comparison Gauge

should then be 1-16" or less. If the distance is greater than this amount, the modulator in question should be replaced.

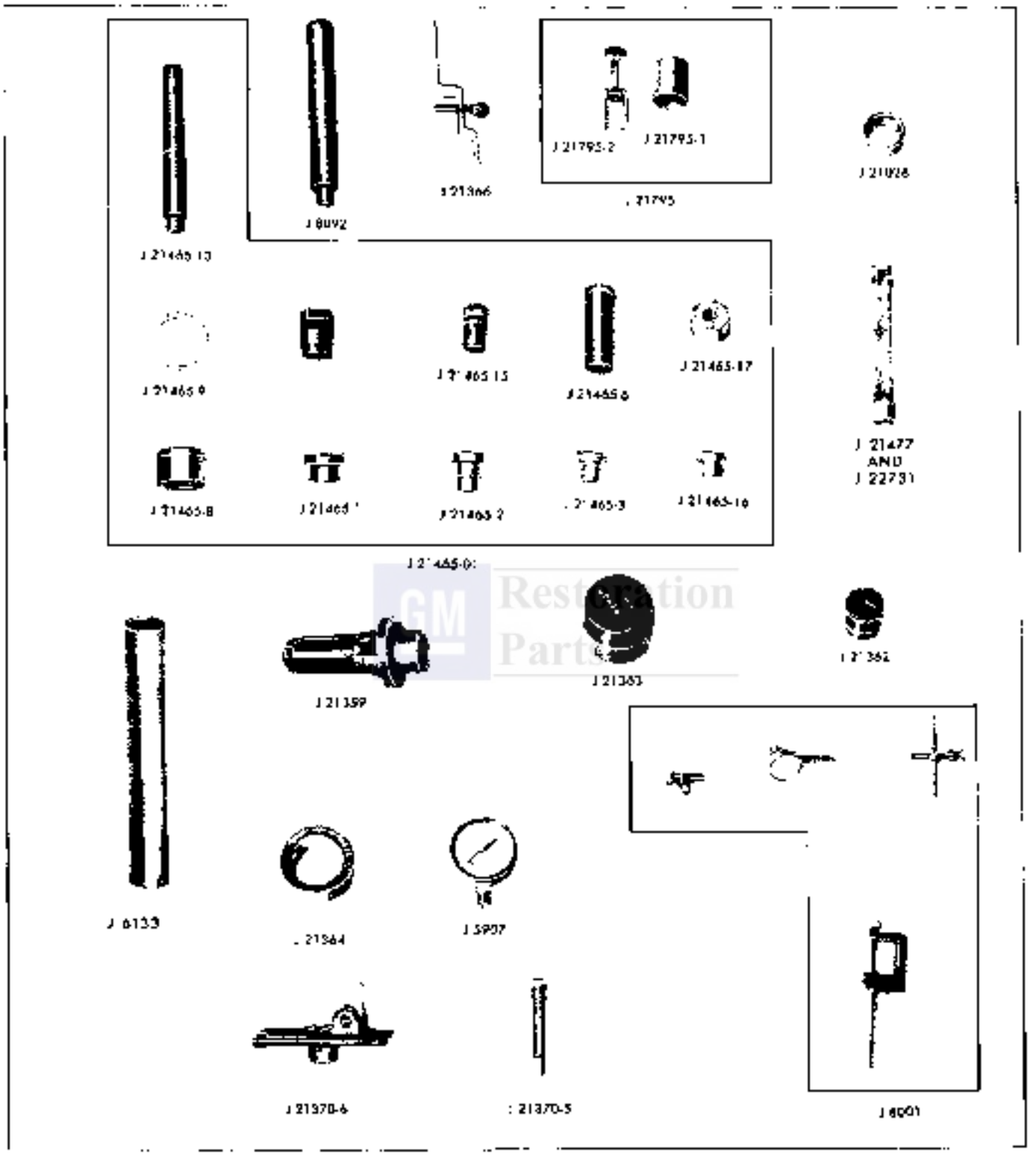
4. Sleeve Alignment Check:

Roll the main body of the modulator on a flat surface and observe the sleeve for concentricity to the can. If the sleeve is concentric and the plunger is free, the modulator is acceptable.

Once the modulator assembly passes all of the above tests, it is an acceptable part and should be re-used.

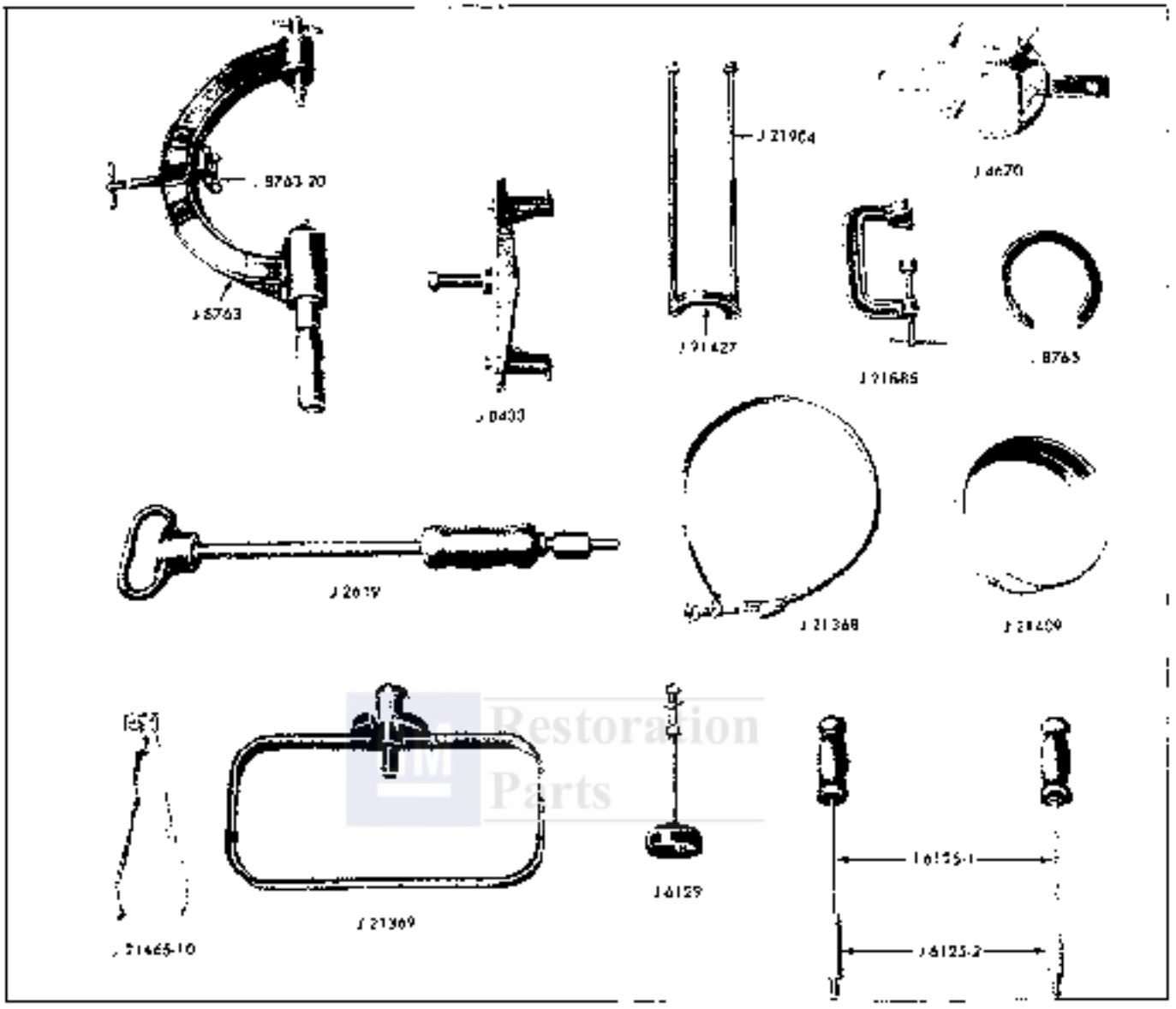
TORQUE SPECIFICATIONS

	Lb. Ft.
Pump Cover Bolts	18
Parking Pawl Bracket Bolts	18
Case Center Support Bolt	22
Pump to Case Attaching Bolts	18
Extension Housing to Case Attaching Bolts	22
Rear Servo Cover Bolts	18
Detent Solenoid Bolts	8
Control Valve Body Bolts	8
Bottom Pan Attaching Screws	12
Modulator Retainer Bolt	18
Governor Cover Bolts	18
Manual Lever to Manual Shaft Nut	30
Linkage Swivel Clamp Nut (Pontiac and GTO)	20
Linkage Swivel Clamp Screw (Firebird)	30
Transmission to Engine Mounting Bolts	40
Rear Mount to Transmission Bolts	30
Rear Mount to Crossmember Bolt	30
Crossmember Mounting Bolts	16
Oil Cooler Line	25
Strainer Retainer Bolt	10



J 5907	Pressure Gage
J 6133	Speece Gear Installer
J 6198	Rear Planet Carrier Bushing Installer
J 8001	Dial Indicator Set
J 8092	Driver Handle
J 21028	Speece Gear Installer Spacer
J 21339	Pump Oil Seal Installer
J 21362	Seal Protector - Forward and Direct Clutch - Inner
J 21363	Seal Protector - Intermediate Clutch - Inner
J 21364	Rear Unit Holding Fixture Adapter
J 21366	Converter Holding Clamp
J 21370-5	Rear Band Apply Pin
J 21370-6	Rear Band Apply Fixture
J 21465-01	Bushing Tool Set
J 21477	Oil Cooler Pipe Wrench - Pontiac Only
J 21795	Gear Train Assembly Holding Tool
J 22731	Oil Cooler Pipe Wrench - Tempest and Firebird

Fig. 7E-176 Special Tools



J 2619	Slide Hammer	J 8765	Clutch Spring Compressor Adapter Ring
J 4670	Clutch Spring Compressor	J 21368	Pump Body and Cover Alignment Strap
J 6125-1	Slide Hammer	J 21369	Converter Pressure Check Fixture
J 6125-2	Adapter	J 21409	Forward Clutch Outer Seal Protector
J 6129	Clutch Spring Compressor	J 21427	Speedo Gear Remover
J 8433	Speedo Gear Remover	J 21465-10	Staking Tool
J 8763	Holding Fixture	J 21685	Accumulator Piston Installer
J 8763-20	Holding Fixture Adapter	J 21904	Speedo Gear Remover Bolts

Fig. 7E-177 Special Tools

TWO SPEED AUTOMATIC TRANSMISSION

CONTENTS OF THIS SECTION

TRANSMISSION IDENTIFICATION

The identification data is located on the right side of the transmission (Fig. 7F-2). The transmission model, model year and the assembly date code appear on the low servo cover. Whenever the servo cover is replaced, it will be necessary to stamp all of the above information on the new cover. Model numbers are as follows:

LA	L-6	1 Bbl. - Tempest
LB	L-6	4 Bbl. - Tempest
LD	L-6	1 Bbl., A.C. - Tempest
LF	L-6	1 Bbl. Firebird
LG	L-6	4 Bbl. - Firebird
LH	L-6	1 Bbl. - A.C. - Firebird
MA	350	2 Bbl. - Tempest & Firebird
MB	350	4 Bbl. - Tempest & Firebird
MC	350	2 Bbl., A.C. - Tempest & Firebird

The car serial number is stamped on the left side of all 1968 Tempest and Firebird transmissions (Fig. 7F-1).

It is very important that any communication concerning a transmission contain all information from the low servo cover and that all transmission parts returned to Pontiac Motor Division be tagged with this information.

ADJUSTMENTS WITH TRANSMISSION IN CAR

NEUTRALIZER SWITCH ADJUSTMENT

Console Shift Controls - (Figs. 7F-3, 7F-4)

Column Shift Controls - (Figs. 7F-5, 7F-6)

If the starter operates in any transmission shift lever position other than PARK and NEUTRAL, the starter neutralizer must be adjusted as follows:

1. Insert blade of any adjusting gauge (J 22701 gauge set) into INSET slot, exerting sufficient pressure to insure full penetration (approx. 0.4") of the blade (View A).

2. Slowly move upper gearshift lever to LOW position and remove the gauge.

3. Insert blade of "O" gauge into ADJUST slot, move shift lever to PARK position and remove adjusting gauge.

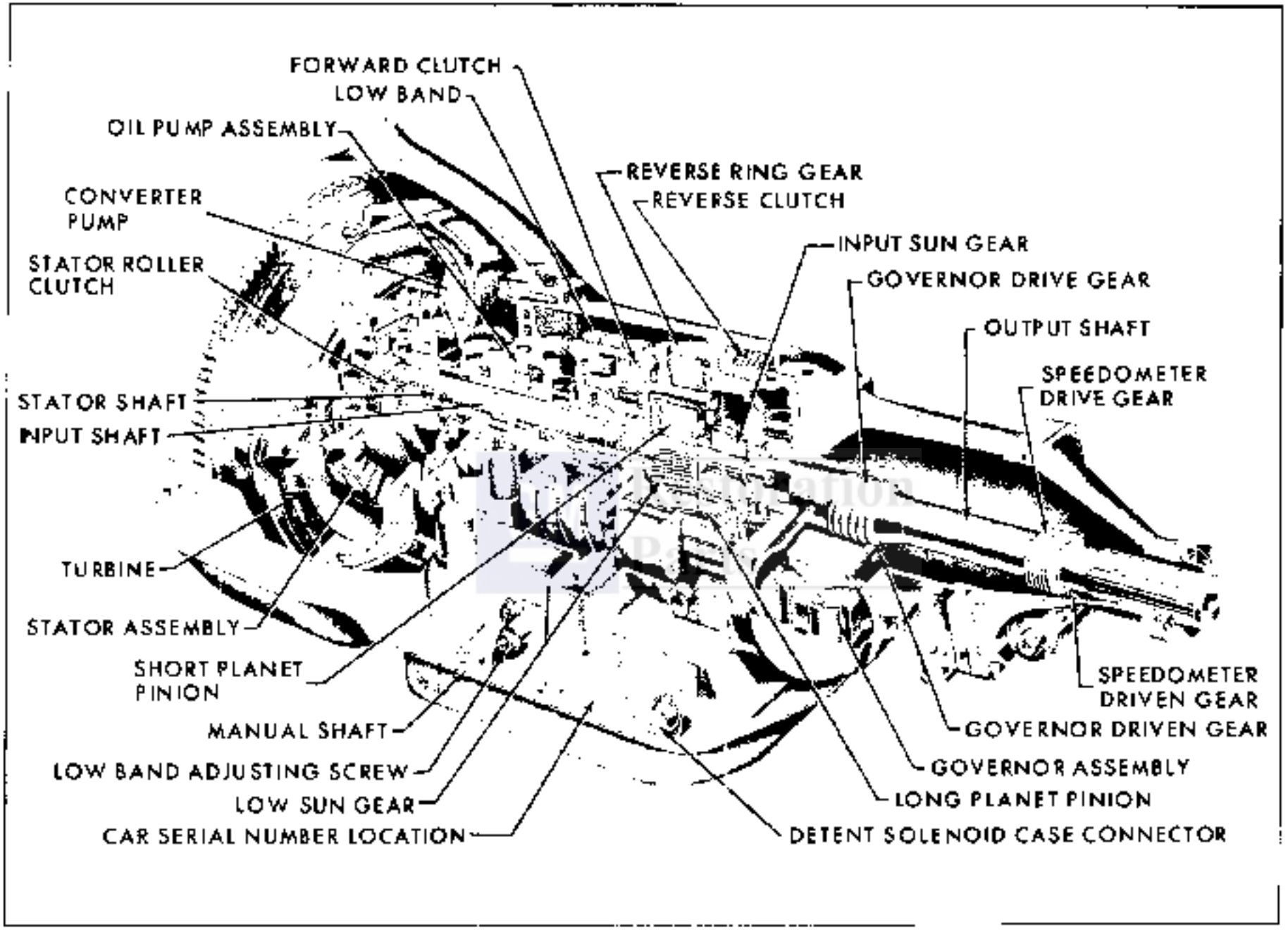


Fig. 7F-1 Cross Section of Two Speed Automatic Transmission

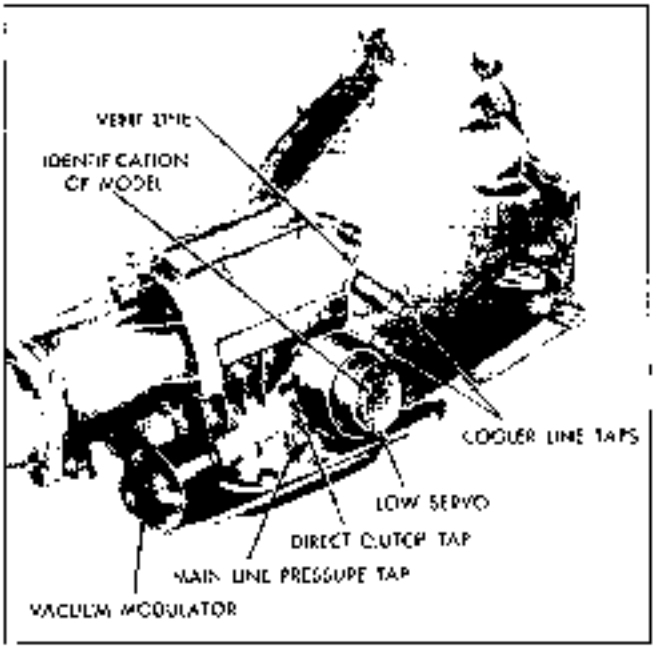


Fig. 7F-2 Transmission Model Identification

4. Check starter operation.

5. If starter operates in:

a. REVERSE, repeat steps 1 thru 3, using "1+" gauge or "2+" gauge until starter will not operate in REVERSE position.

b. DRIVE, repeat steps 1 thru 3, using "1-" gauge or "2-" gauge until starter will not operate in DRIVE position.

SHIFT CONTROL LINKAGE ADJUSTMENT

GEARSHIFT CONTROLS—COLUMN SHIFT (Figs. 7F-5 and 7F-6)

1. Loosen screw (nut - Firebird) on adjusting swivel clamp.

2. Set transmission selector lever in DRIVE detent.

NOTE: Obtain DRIVE position by rotating transmission lever clockwise to PARK position, then counterclockwise three positions to DRIVE position (View B).

3. Set upper gearshift lever against DRIVE stop (View A).

4. Tighten screw on adjusting swivel clamp to 20 lb. ft. (Tempest); tighten nut on adjusting swivel clamp to 30 lb. ft. (Firebird).

GEARSHIFT CONTROLS—CONSOLE SHIFT (Figs. 7F-3 and 7F-4)

1. Disconnect shift cable from transmission selector lever pin.

2. Rotate transmission selector lever clockwise to PARK position and adjust pin on selector lever to dimension shown in View A.

3. Torque selector pin nut to 30 lb. ft., set the gearshift lever in PARK position and connect shift cable to pin.

SERVICE OPERATIONS—TRANSMISSION IN CAR

The 2-speed automatic transmission service operations, that can be performed while transmission is in car, are covered below.

SHIFT LINKAGE

If any components are worn or damaged so that replacement is necessary, refer to the Master Parts Catalog to determine which items are serviced separately and which are serviced in assembly.

PARK LOCK ACTUATOR ASSEMBLY, INNER PARK LOCK AND RANGE SELECTOR LEVER

REMOVAL

1. Drain oil and remove pan.

2. Remove oil strainer.

3. Remove park lock bracket and range selector shaft retainer.

4. Fully loosen nut that retains outer range selector lever to inner park lock and range selector lever.

5. Slide outer range selector lever out of case.

NOTE: Exercise care, when removing lever from case, so that nut doesn't drop down into gear train.

6. Remove inner park lock and range selector lever.

INSTALLATION

1. Installation is the reverse of removal.

SPEEDOMETER DRIVE GEAR, REAR BEARING RETAINER OIL SEAL OR BUSHING REPLACEMENT

Oil Seal

1. Remove propeller shaft (see section 4C).

2. Pry out old seal (Fig. 7F-7).

3. Coat outer casing of new oil seal with gasket sealing compound and drive it into place with installer J 5154 (Fig. 7F-8).

4. Install propeller shaft (see section 4C).

Bushing and/or Drive Gear

1. Remove propellor shaft (see section 4C).

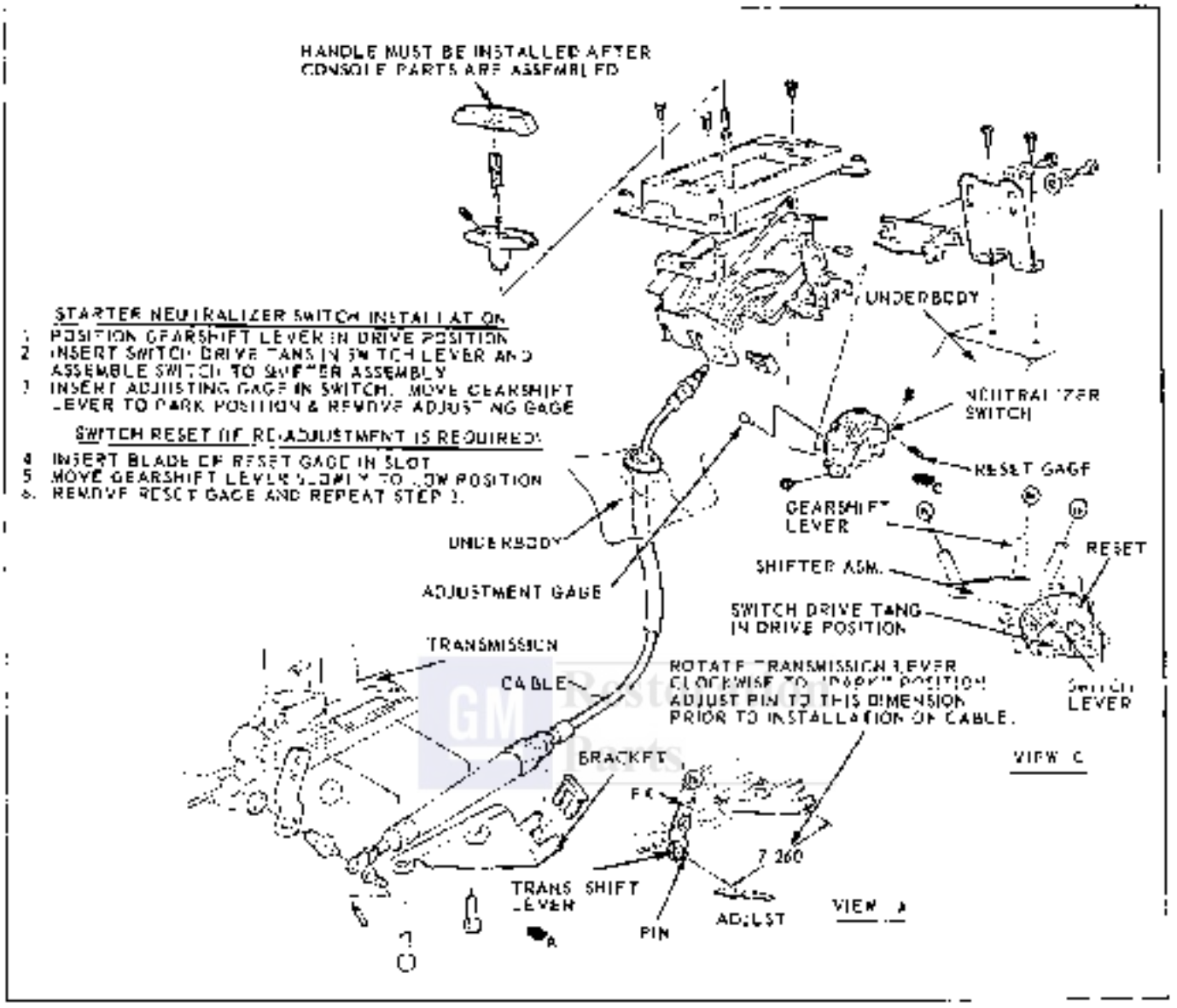


Fig. 7F-3 Tempest Floor Shift Linkage

2. Remove speedometer cable and speedometer driven gear assembly.

3. Remove rear bearing retainer.

4. If necessary, replace speedometer drive gear. Remove by depressing clip (Fig. 7F-27). Install new gear.

5. Pry out old oil seal.

6. Remove old case to rear bearing retainer oil seal.

7. Remove old rear bearing retainer bushing, using bushing chisel J 5400-1 (Fig. 7F-9).

8. Install new bushing from rear, using installer J 21424-1 and handle J 8092 (Fig. 7F-10).

9. Coat outer casing of new oil seal with gasket sealing compound and drive it into place with installer J 5154 (Fig. 7F-8).

10. Install new case to rear bearing retainer oil seal.

11. Install rear bearing retainer. Tighten bolts to 30 lb. ft. torque.

12. Install propeller shaft (see section 4D).

13. Install speedometer driven gear and connect cable.

GOVERNOR

REMOVAL

1. Remove three bolts retaining governor cover to case. Remove cover and gasket.

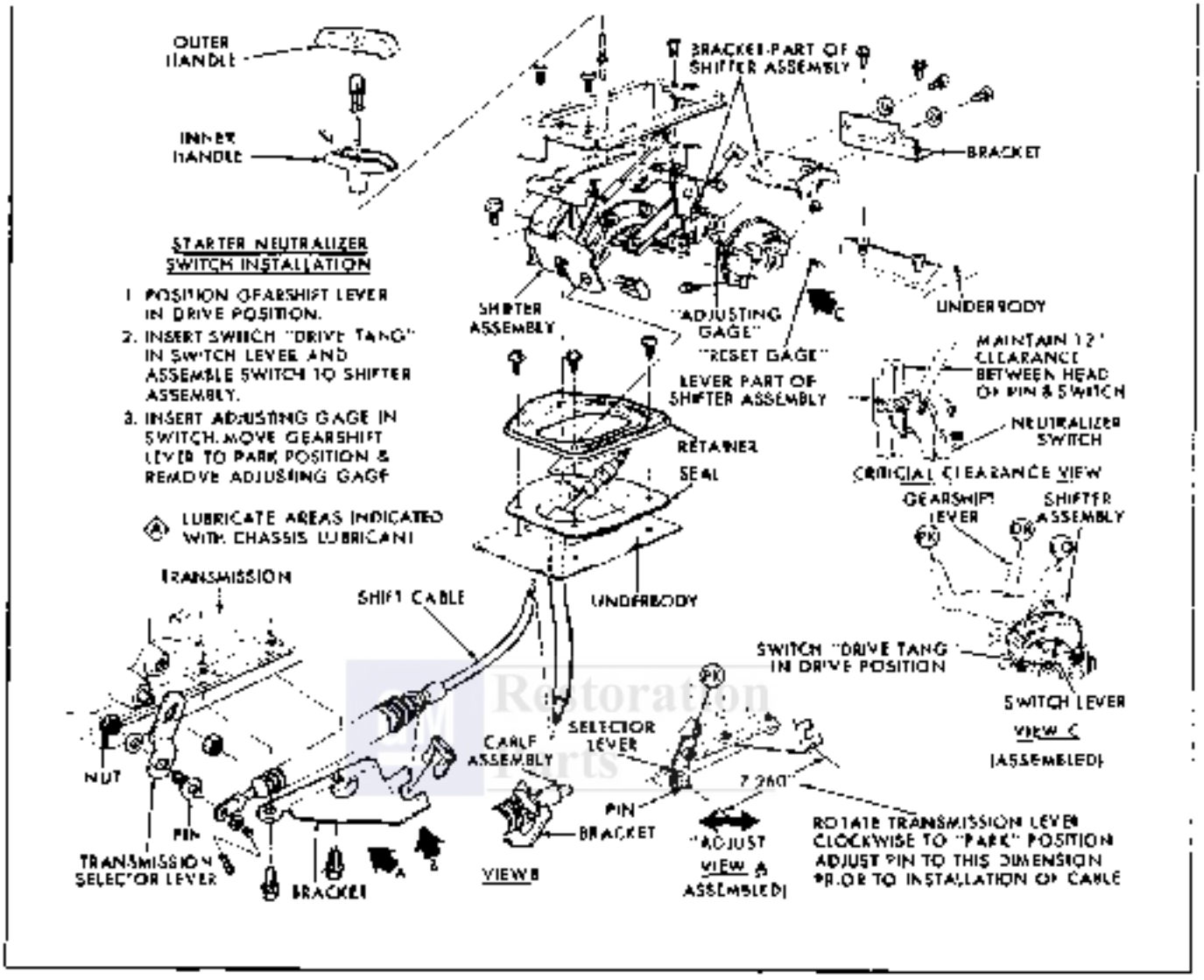


Fig. 7F-4 Firebird Floor Shift Linkage

2. Pull governor out of case bore, allowing governor to twist as driven gear disengages from drive gear teeth machined into output shaft (Fig. 7F-11).

INSPECTION

Check for sticking governor valve, broken or missing governor weight springs, damaged driven gear or worn weight pins.

REMOVAL AND REPLACEMENT OF GOVERNOR DRIVEN GEAR

1. Support governor sleeve on wood block. Remove roll pin with a 1/8" drill rod (Fig. 7F-12).

CAUTION: If wood block is placed under nylon gear, breakage of gear inside governor sleeve will result. Exercise extreme care not to damage machine surfaces of governor sleeve.

2. Remove driven gear. Remove any chips or burrs from inside governor sleeve.

3. Install replacement gear by carefully pressing new gear into sleeve as follows:

a. Use press plate J 6804, with adapters J 6407-1 and J 6407-2 (Fig. 7F-13).

b. Place shim supplied in replacement gear kit between second and third lands of governor sleeve.

c. Make certain new gear is positioned squarely on sleeve and press gear onto sleeve. Gear must be seated against sleeve.

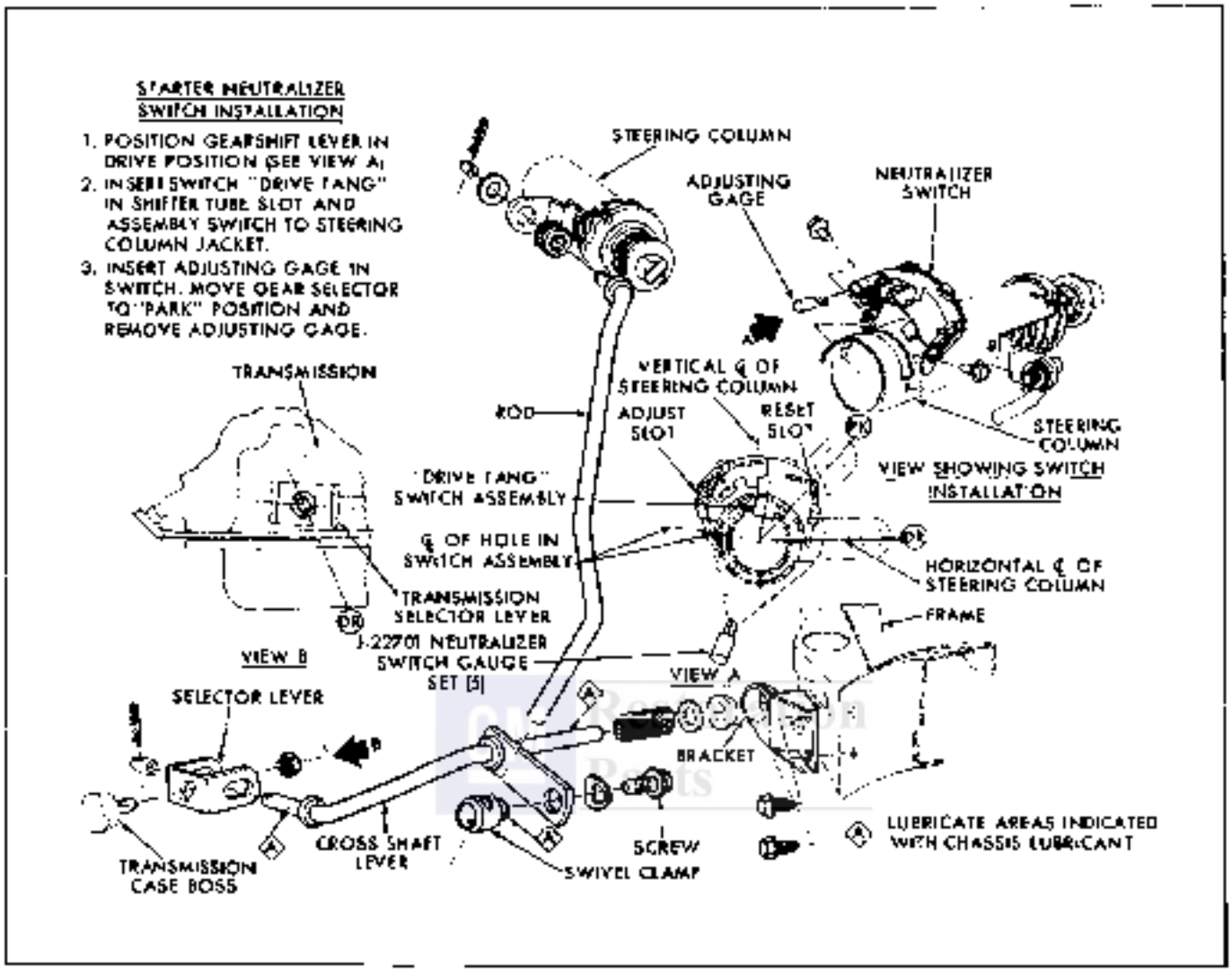


Fig. TF-5 Transmission Column Shift Linkage

CAUTION: Do not support or hammer on rear of governor.

4. Through existing hole in governor sleeve, drill a 1/8" hole half-way through from each end.

NOTE: It is important that hole for roll pin be drilled straight as possible to insure proper relension and installation of roll pin and gear. This can be best accomplished by above method.

5. Support end of governor sleeve (not gear) on a wood block. Install new roll pin; then using small chisel, stake pin in place at both ends of pin to prevent pin from becoming loose (Fig. TF-12).

6. Check for burrs on sleeve and to assure valve is free in bore. Any burrs left on governor sleeve will damage case.

INSTALLATION

1. Insert governor into case bore with slight counterclockwise twist to engage gear teeth.

2. Using new gasket, install cover and retain with three bolts. Tighten bolts to 10 lb. ft. torque.

VACUUM MODULATOR (Fig. TF-14)

Do not replace vacuum modulator before making the pressure check described in TROUBLE DIAGNOSIS at the end of Section TF.

NOTE: Vacuum modulator is not adjustable.

REMOVAL

1. Remove vacuum hose at vacuum modulator.

2. Remove vacuum modulator retainer bolt and retainer.

3. Pull vacuum modulator (Fig. TF-15) and valve assembly (Fig. TF-16) out of case bore.

NOTE: To remove front modulator valve, it may be necessary to use a magnet or "pretriever".

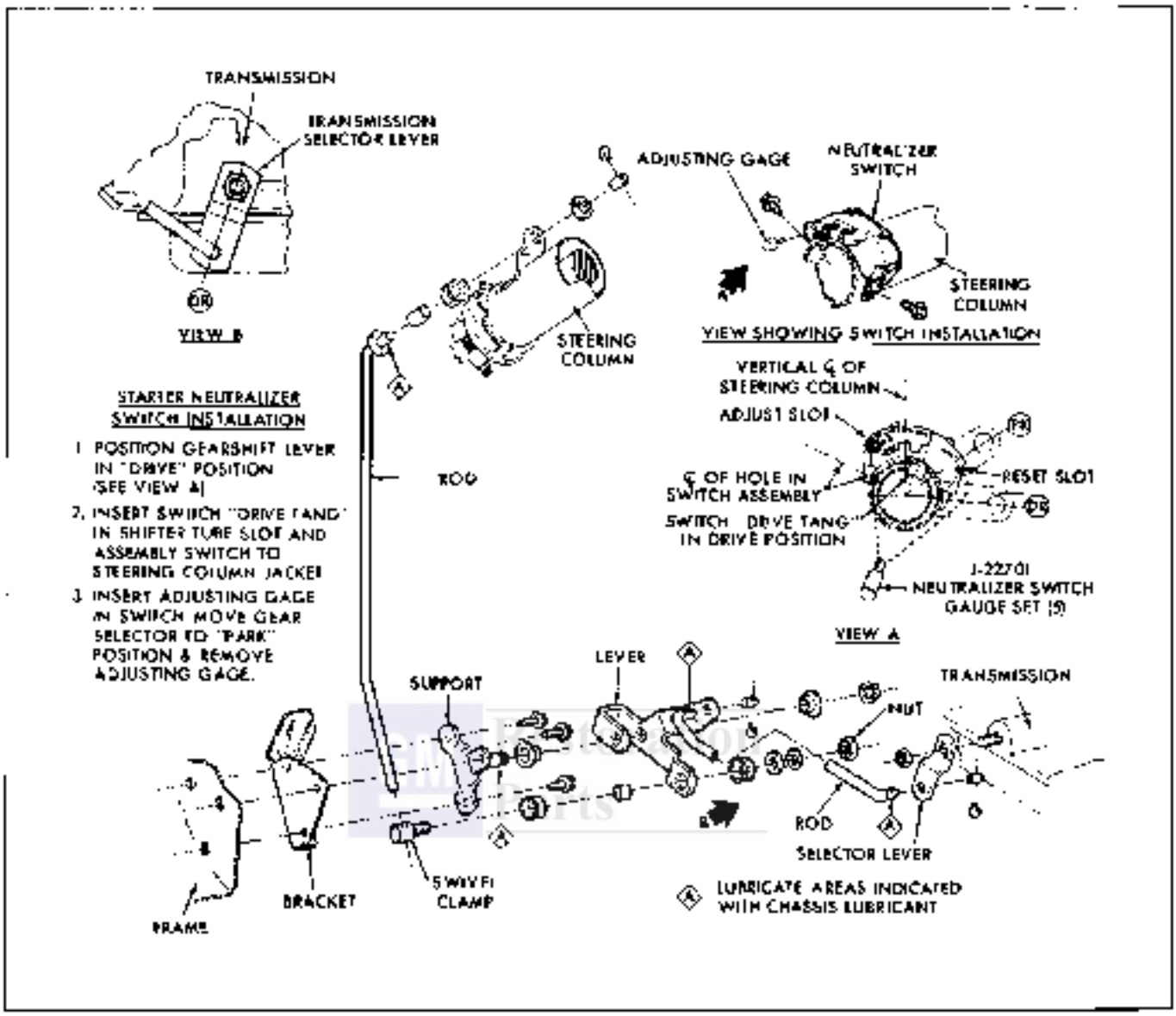


Fig. 7F-6 Firebird Column Shift Linkage

INSPECTION AND REPAIRS

Check modulator valves for burrs. If such minor imperfections cannot be removed with a slip stone, replace valve.

The modulator diaphragm can be checked with vacuum source for leakage. However, diaphragm leakage normally permits transmission oil pull-over, which is evident as smoky exhaust and continually low transmission oil level. No modulator repairs are possible; replace as an assembly.

Inspect case to vacuum modulator oil seal. Discard seal if it is nicked, cut or deteriorated.

INSTALLATION

1. Install modulator valve assembly into case bore. Refer to Fig. 7F-16 for correct assembly sequence.

2. Assemble oil seal on vacuum modulator and install assembly into case bore.

3. Secure modulator assembly with retainer and bolt and tighten bolt 10 lb. ft. torque. Connect vacuum hose.

SPEEDOMETER DRIVEN GEAR AND SLEEVE

REMOVAL

1. Disconnect speedometer cable.

2. Remove speedometer driven gear sleeve retainer bolt.

3. Remove retainer and speedometer driven gear assembly.

Fig. 7F-7 Removing Rear Bearing Retainer Oil Seal

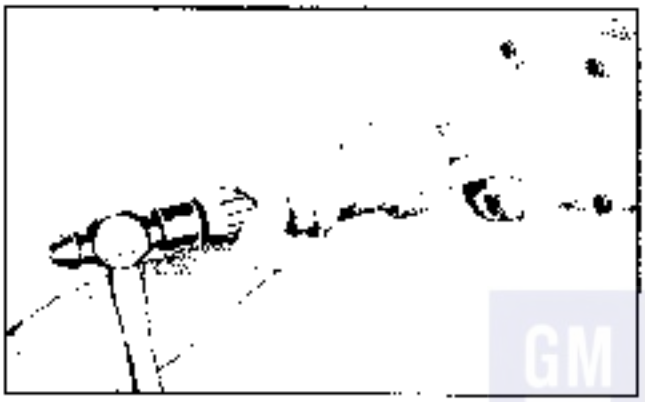


Fig. 7F-8 Installing Rear Bearing Retainer Oil Seal

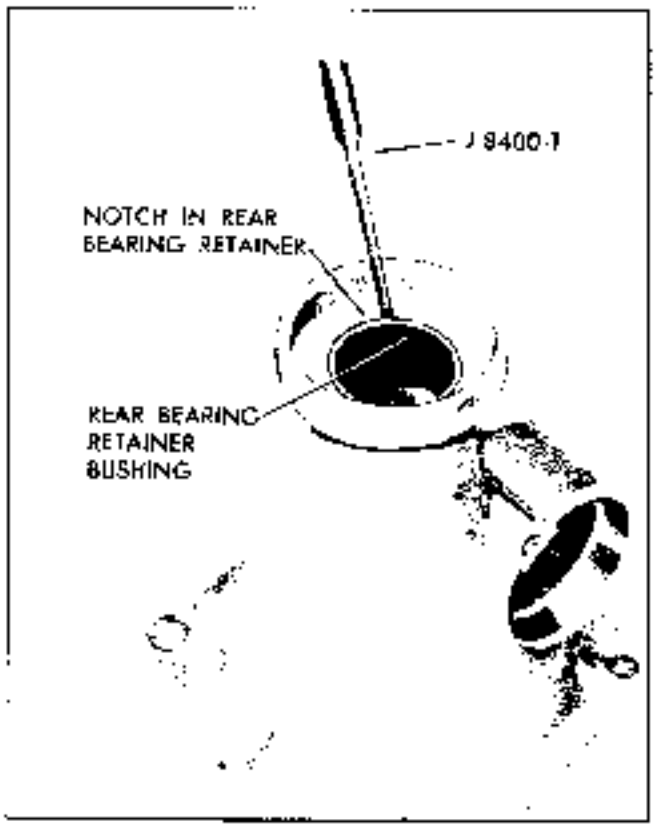


Fig. 7F-9 Removing Rear Bearing Retainer Bushing

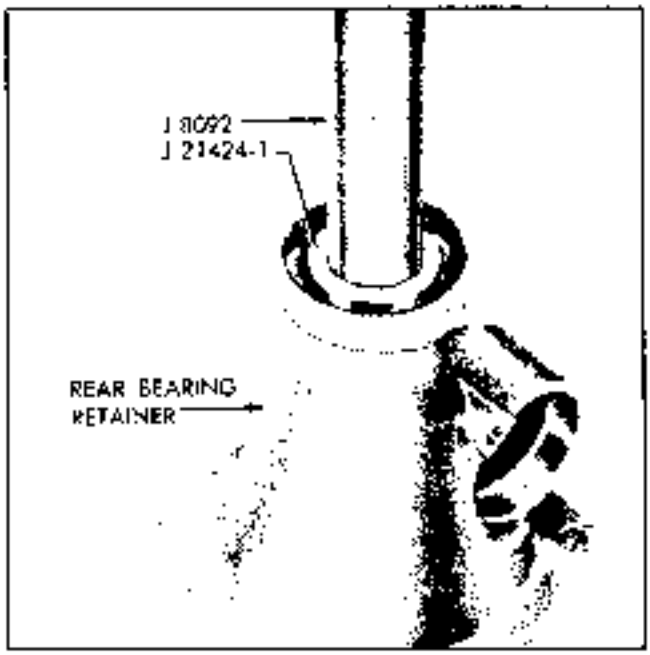


Fig. 7F-10 Installing Rear Bearing Retainer Bushing

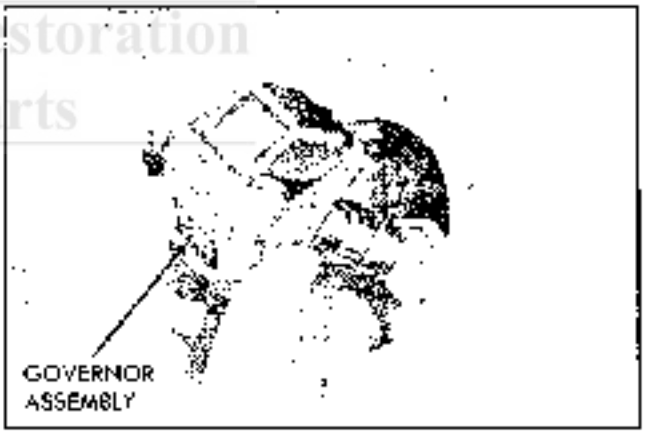


Fig. 7F-11 Removing Governor

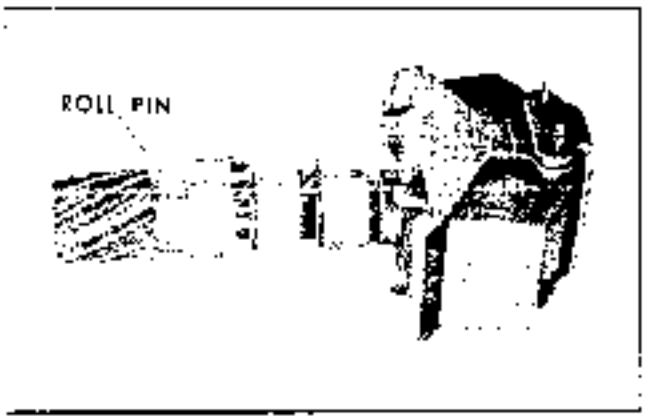


Fig. 7F-12 Supporting Governor

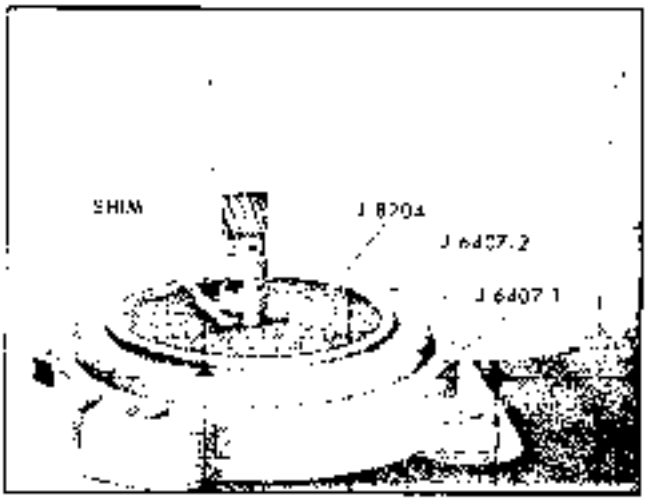


Fig. 7F-13 Installing Driven Gear

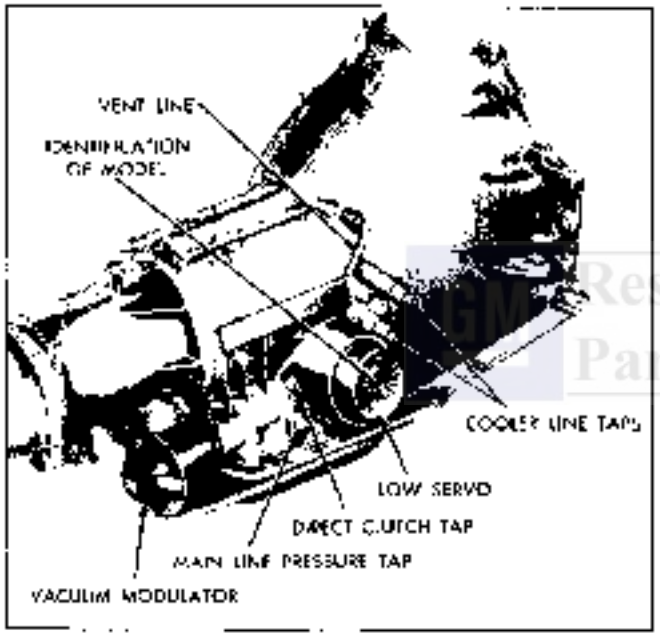


Fig. 7F-14 Right Side of Transmission

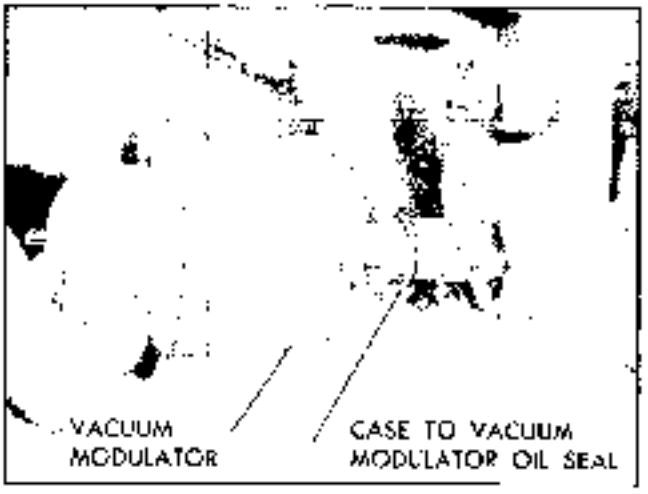


Fig. 7F-15 Removing Vacuum Modulator

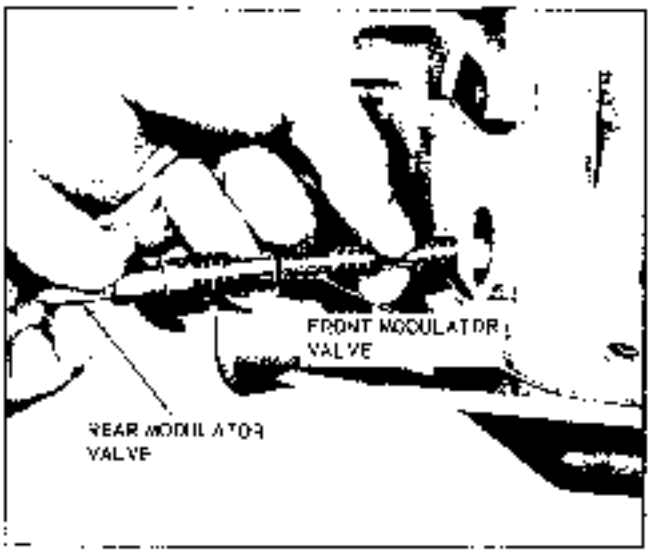


Fig. 7F-16 Removing Vacuum Modulator Valve Assembly

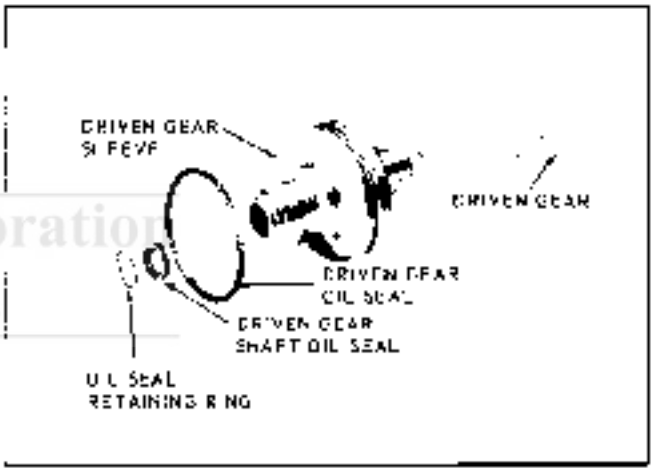


Fig. 7F-17 Speedometer Driven Gear and Sleeve

INSPECTION AND REPAIRS (Fig. 7F-17)

Inspect both oil seals for nicks, cuts or deterioration. Discard damaged seals. Check driven gear for wear or damage; replace if necessary.

INSTALLATION

1. Assemble speedometer gear and sleeve assembly (Fig. 7F-17). Driven gear shaft oil seal lip must face driven gear.

2. Install assembly into case bore and secure with retainer and bolt.

NOTE: Assembly must be rotated to align with retainer.

3. Connect speedometer cable.

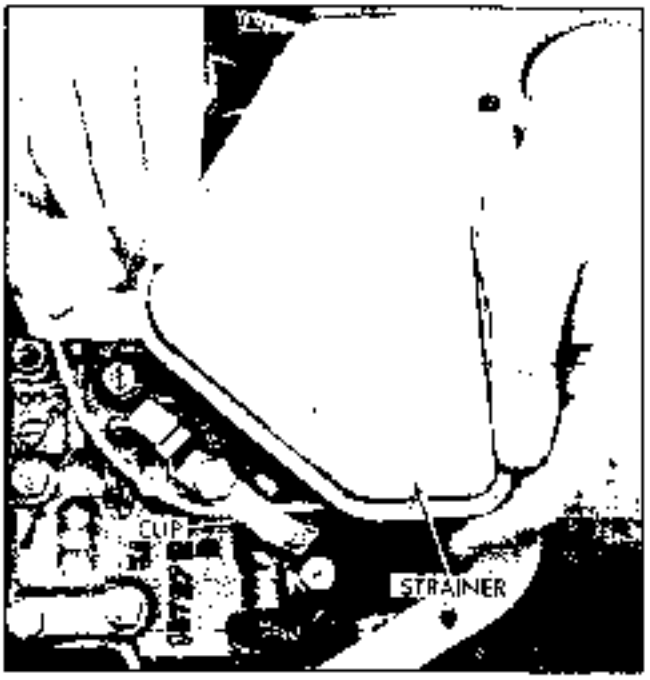


Fig. 7F-18 Transmission - Oil Pan Removed

DOWNSHIFT SOLENOID REPLACEMENT

1. Remove oil pan, gasket and oil strainer.

2. Disconnect solenoid connector from case connector (Fig. 7F-25).

3. Remove solenoid attaching bolts. Remove solenoid and gasket.

4. Install new gasket on solenoid so that gasket notch will face bottom of valve body.

5. Install solenoid on valve body and secure connector to case connector.

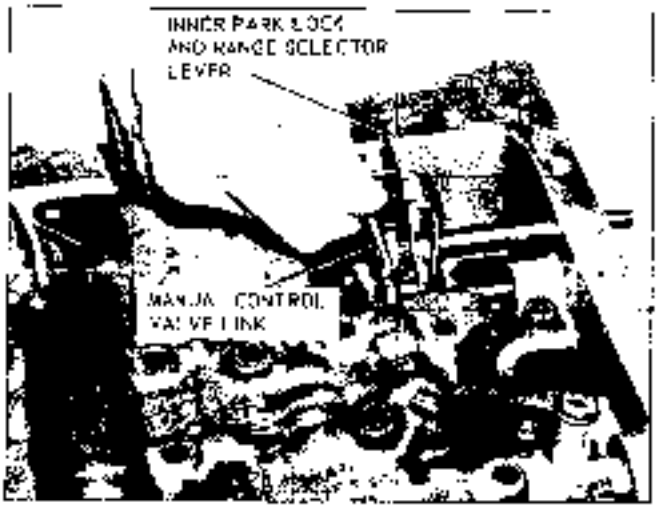


Fig. 7F-19 Disengaging Manual Control Valve Link

6. Install oil strainer (make certain grommet is in good condition) and tighten retaining bolt to 15 lb. ft. torque. Install oil pan, using a new gasket. Tighten oil pan bolts to 12 lb. ft. torque.

VALVE BODY

REMOVAL

1. Remove oil pan and gasket.

2. Remove oil strainer retaining bolt and remove strainer assembly (Fig. 7F-18) using a twisting motion. Discard oil seal.

3. Disconnect solenoid connector from case, (Fig. 7F-25).

4. Remove detent spring from valve body (Fig. 7F-25).

5. Remove remaining valve body bolts and hold valve body in position.

6. Disengage manual control valve link from park lock and range selector inner lever by rotating valve body (Fig. 7F-19).

7. Remove valve body. Remove manual control valve and link from valve body.

8. Remove oil channel support plate (Fig. 7F-25), valve body plate and plate to case gasket.

DISASSEMBLY

1. Remove downshift solenoid, gasket, spring and detent valve (Fig. 5F-20).

2. Depress shift control valve sleeve and remove retaining pin by turning valve body over so pin can fall free (Fig. 7F-21). Remove shift control valve sleeve, shift control valve, spring, washer and shift valve.

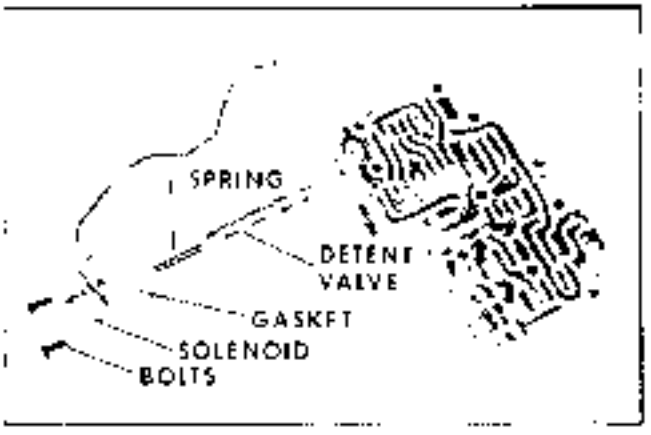


Fig. 7F-20 Downshift Solenoid and Detent Valve

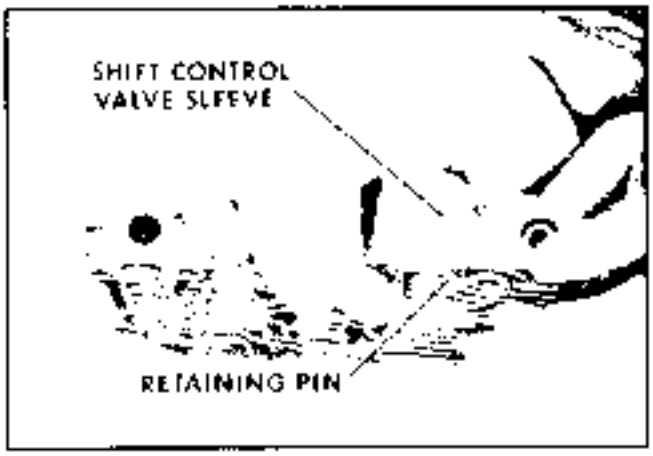


Fig. 7F-21 Removing Shift Control Valve Sleeve

NOTE: Modulator limit valve spring is under moderate pressure. Care should be exercised during removal during step 3 below.

3. Depress modulator limit valve spring and turn valve body over so that retaining pin falls free. Remove spring and valve (Fig. 7F-22). (Needle nose pliers can be used to depress spring and work out pin.)

4. Depress high-speed downshift timing valve spring and remove retaining pin by turning valve body over so that pin can fall free. Remove springs, washer and valve (Fig. 7F-23). (Needle-nose pliers can be used to depress spring and work out pin.)

INSPECTION

As most valve body failures are initially caused by dirt or other foreign material, a thorough cleaning of all parts in clean solvent is mandatory. Check all valves and their operating bores for burrs or other deformities that could cause valve "hang-up".

ASSEMBLY

1. Install high-speed downshift timing valve, washer and springs (Fig. 7F-23). Depress spring with needle-nose pliers and install retaining pin.

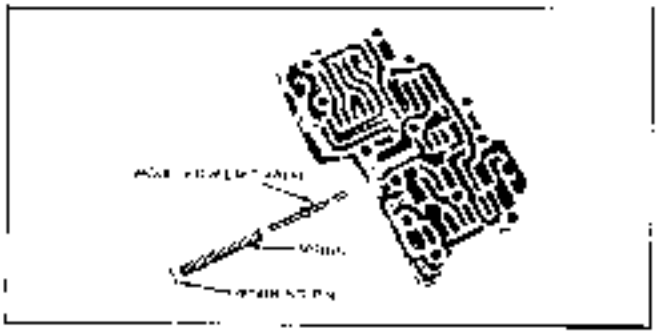


Fig. 7F-22 Modulator Limit Valve

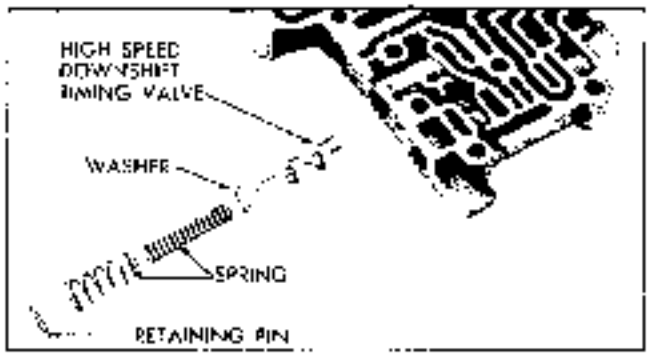


Fig. 7F-23 High Speed Downshift Timing Valve

2. Install modulator limit valve and spring (Fig. 7F-22). Depress spring with needle-nose pliers and install retaining pin.

3. Install spring and shift control valve into sleeve (Fig. 7F-24). Depress spring and valve and insert retainer in groove. Install shift valve and sleeve assembly in valve body and install retaining pin.

4. Install detent valve and spring. Install gasket on downshift solenoid with notch facing bottom of valve body and install downshift solenoid (Fig. 7F-20). Tighten bolts to 10 lb. ft. torque.

INSTALLATION

1. Install new valve body plate to case gasket, using petrolatum to hold it in position. Install valve body plate and oil channel support plate. Install bolts finger tight.

2. Install manual control valve and link into valve body.

3. Engage manual control valve link to park lock and range selector lever (Fig. 7F-19).

4. Install detent spring assembly on valve body (Fig. 7F-25). (Note routing of solenoid wire and wire retaining clip position.)

5. Install remaining valve body to case bolts (except oil strainer retaining bolt) and tighten all bolts to 10 lb. ft. torque.

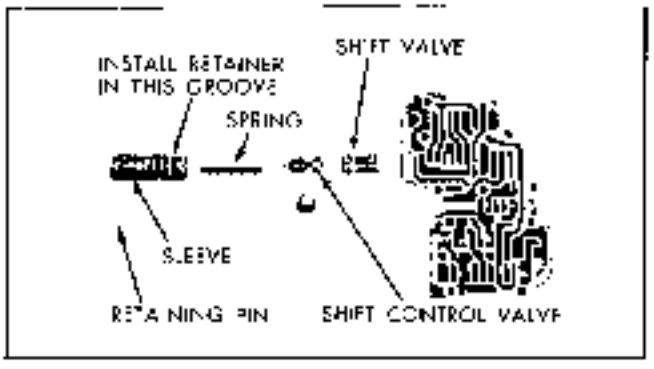


Fig. 7F-24 Shift Valve and Shift Control Valve

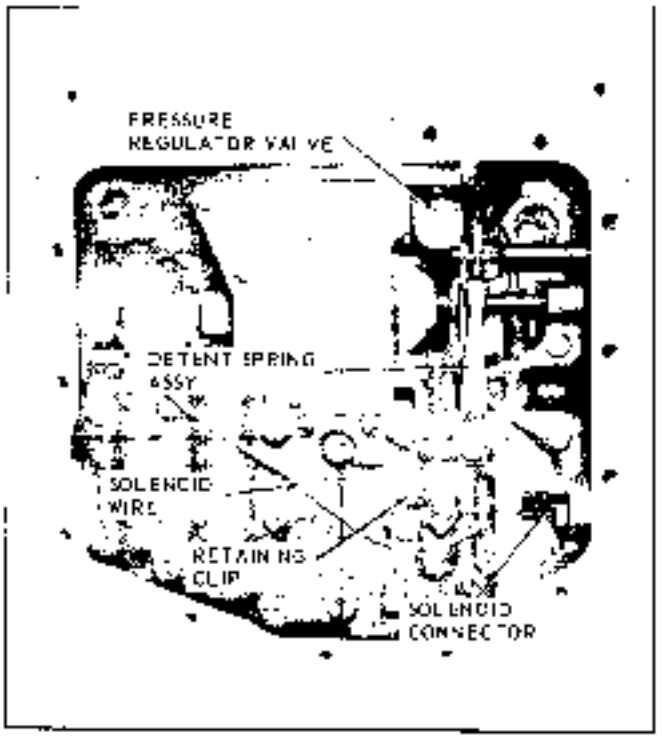


Fig. 7F-25 Transmission - Oil Pan and Strainer Removed

6. Connect solenoid connector to case terminal (Fig. 7F-25). Make certain that case terminal retaining finger engages connector and wire is retained by clip.

7. Install new oil strainer pipe to case seal on oil strainer pipe and lubricate.

8. Install oil strainer assembly and tighten oil strainer bolt to 10 lb. ft. torque.

9. Install oil pan, using a new gasket. Tighten oil pan bolts to 12 lb. ft. torque.

TRANSMISSION REMOVAL AND INSTALLATION

1. Disconnect speedometer cable and remove speedometer drive gear to allow oil to drain during removal procedure.

2. Remove propeller shaft (see section 4C).

3. Disconnect vacuum line and downshift switch lead.

4. Disconnect shift control linkage from outer shift lever.

5. Remove flywheel housing bottom cover.

6. Remove flywheel to converter mounting bolts. After bolts are removed, make certain converter hub is free of crankshaft.

7. Support transmission and remove frame cross member.

8. Lower transmission and engine assembly to gain access to cooler line fittings. Disconnect cooler lines, using a crow foot adapter and suitable extension or using oil cooler pipe wrench J 22731.

NOTE: On some cars it may be necessary to loosen exhaust system.

9. With transmission in lowered position, remove case to engine bolts.

10. Move transmission down and to the rear and install converter holding strap J 21366 to hold converter in position until transmission is to be disassembled.

To install transmission, reverse the above procedure.

TRANSMISSION DISASSEMBLY

Service procedures for rear bearing retainer, speedometer drive gear, governor vacuum modulator, speedometer driven gear assembly, downshift solenoid, pressure regulator and valve body are covered under SERVICE OPERATIONS — TRANSMISSION IN CAR, page 7F-3.

REMOVAL OF VALVE BODY, REAR BEARING RETAINER, SPEEDOMETER DRIVE GEAR, AND LOW SERVO

1. Mount transmission in holding fixture J 8763 (Fig. 7F-26).

2. With transmission in horizontal position, pull out converter.

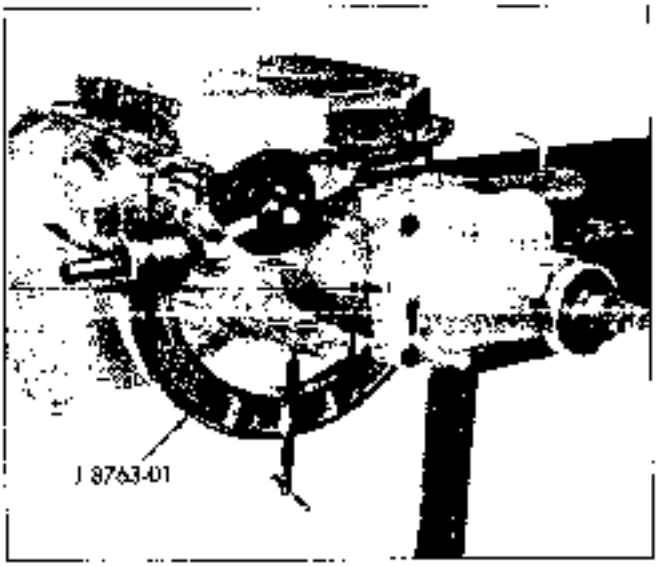


Fig. 7F-26 Transmission Mounted in Holding Fixture

Fig. 7F-27 Removing Speedometer Drive Gear

3. Remove valve body.

4. Remove speedometer driven gear.

5. Remove governor assembly (see page 7F-41.

6. Remove vacuum modulator (see page 7F-9).

7. Remove rear bearing retainer.

8. Remove speedometer drive gear by depressing retainer clip and sliding gear off output shaft (Fig. 7F-27).

REMOVAL OF OIL PUMP, FORWARD CLUTCH, AND LOW BAND

NOTE: Oil pump seal can be replaced without removing pump from case.

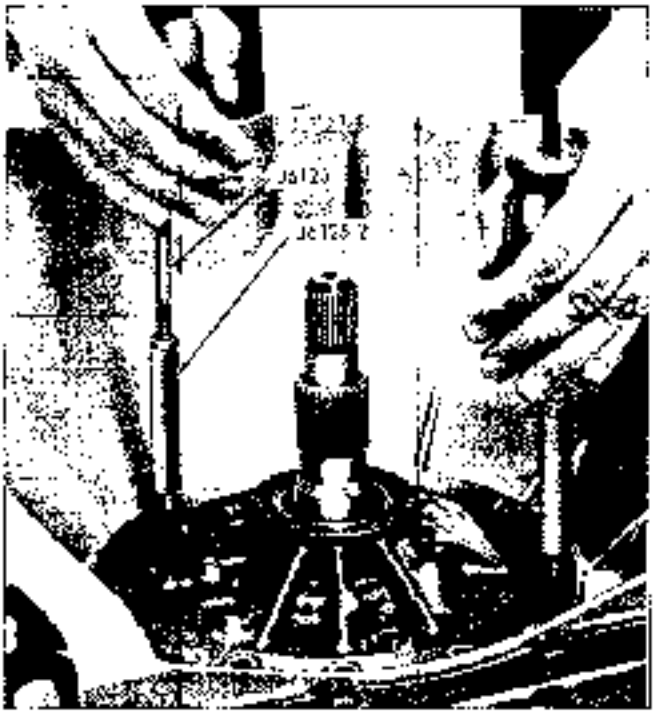


Fig. 7F-28 Removing Oil Pump

a. Pry out old seal.

b. Coat outer casing of new oil seal with gasket sealing compound and drive it into place with installer J 21359.

1. With transmission in vertical position, remove eight oil pump attaching bolts. Instal slide hammers J 6125 and adapters J 6125-2 into threaded holes in pump, loosen pump and remove pump and gasket (Fig. 7F-28).

2. Remove input shaft from forward clutch drum (Fig. 7F-29).

3. Remove forward clutch assembly by pulling straight out of case (Fig. 7F-30).

4. Remove low band and struts from case.

5. Remove low servo cover snap ring, using tool J 22269 to compress low servo cover so that snap ring can be removed with the aid of a punch or screwdriver (Fig. 7F 31).

6. Remove tool J 22269 from case and remove low servo cover. If necessary, tap lightly on low servo assembly piston rod to assist in removal of cover. Discard cover oil seal.

7. Remove low servo assembly from case.

REMOVAL OF PLANETARY GEAR SET, REVERSE CLUTCH AND PISTON, AND PARK LOCK MECHANISM

1. Pull planet carrier assembly from case, using care to avoid damaging case bushing (Fig. 7F-32) and remove reverse ring gear (Fig. 7F-33), thrust bearing and races (Fig. 7F-34).

2. With transmission in vertical position, remove reverse clutch pack snap ring with a screwdriver (Fig. 7F-35).

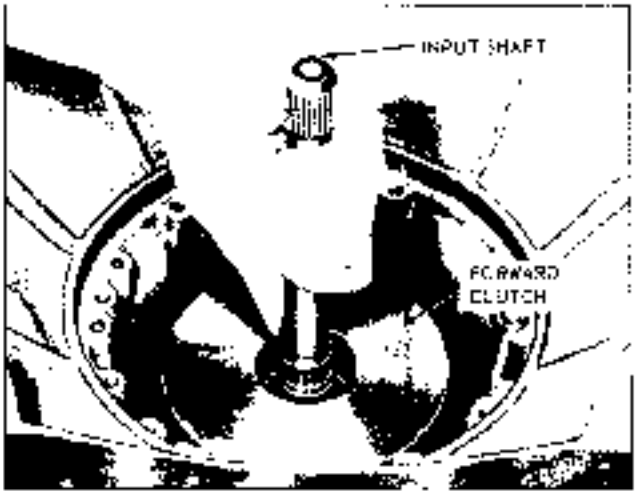


Fig. 7F-29 Removing Input shaft

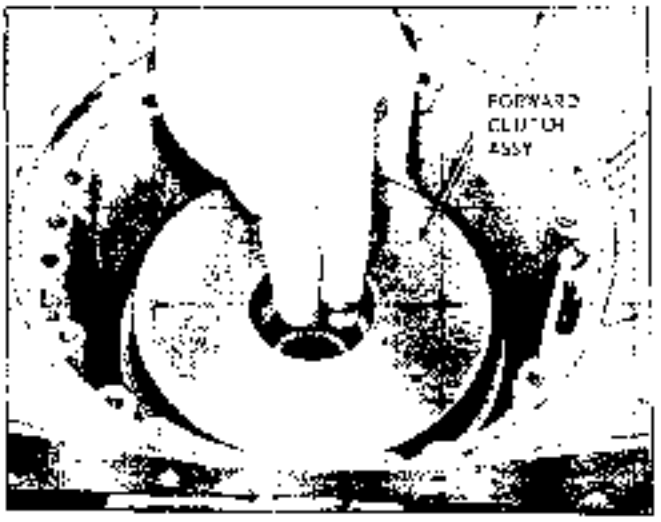


Fig. 7F-30 Removing Forward Clutch

3. Lift reverse clutch pressure plate and clutch pack from case.

4. Compress reverse piston return springs, using spring compressor J 9542 and adapters (Fig. 7F-31).

NOTE: Position spring compressor so that reverse piston return seat snap ring gap is accessible.

5. With return spring fully compressed, remove snap ring.

6. Release pressure on the return springs, being careful that piston return seat does not catch in snap ring groove. Remove return seat and springs.

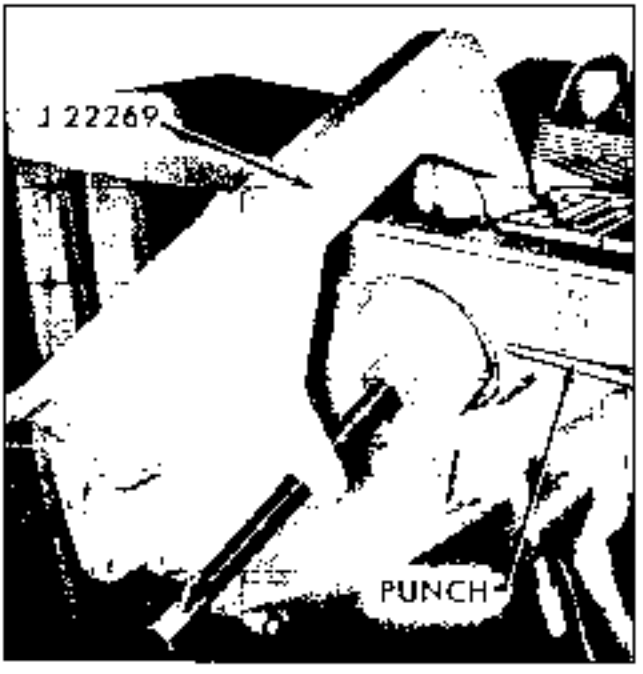


Fig. 7F-31 Removing Low Servo Cover Snap Ring

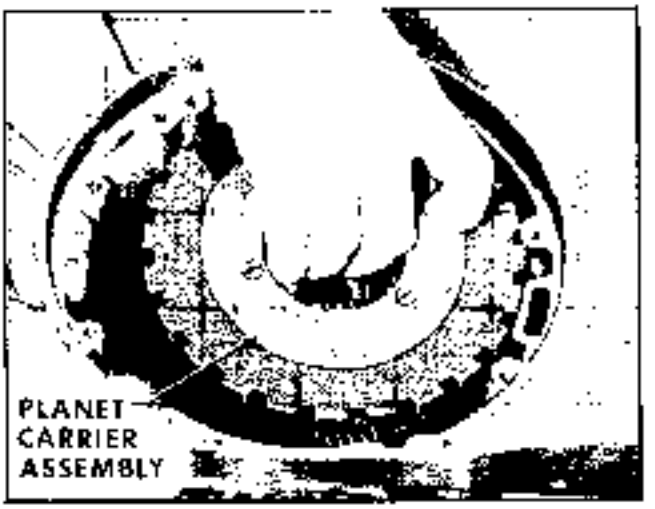


Fig. 7F-32 Removing Planet Carrier

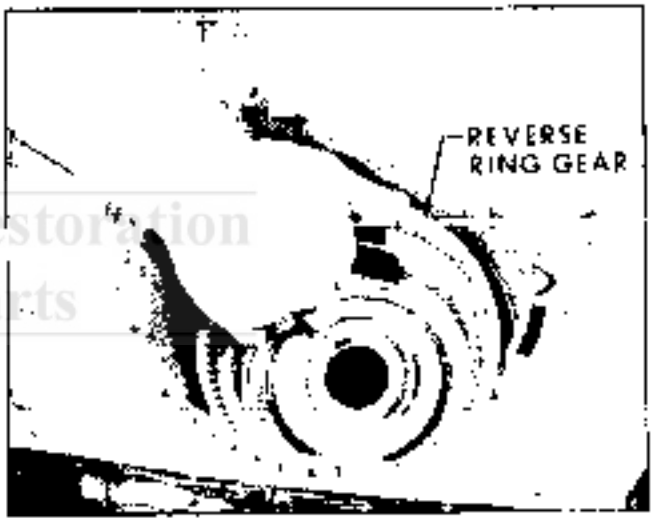


Fig. 7F-33 Removing Reverse Ring Gear

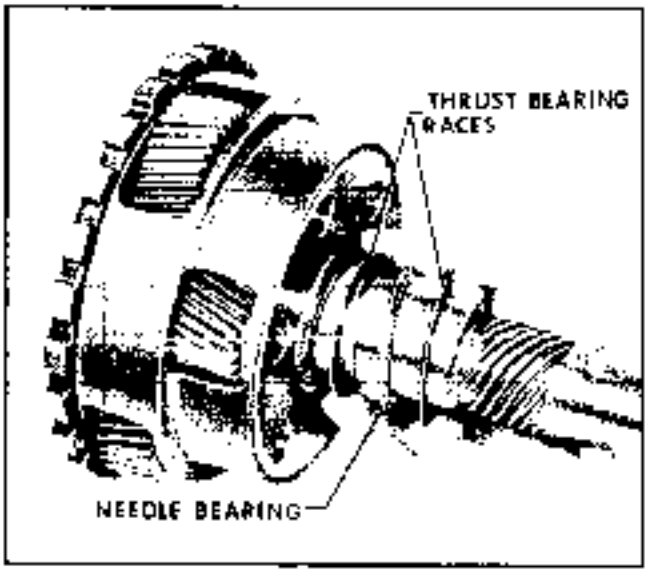


Fig. 7F-34 Removing Planet Carrier Thrust Bearing and Races

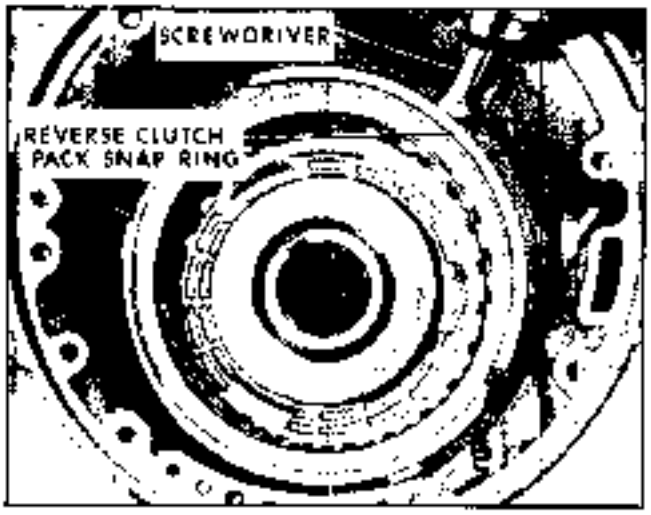


Fig. 7F-35 Removing Reverse Clutch Pack Snap Ring

7. With transmission in horizontal position, apply compressed air to reverse piston apply port to force out reverse piston (Fig. 7F-37).

8. Remove parking lock bracket (Fig. 7F-38).

9. Remove range selector shaft retainer (Fig. 7F-39).

10. Fully loosen nut that retains outer range selector lever shaft to inner park lock and range selector lever (Fig. 7F-40).

NOTE: Before sliding range selector lever shaft out of case, remove any burrs on inner end of shaft that could score case bore or make removal difficult.

11. Slide range selector lever shaft out of case (see NOTE above). Remove nut and inner park lock and range selector lever.

12. Slide parking lock pawl shaft out of parking lock pawl (Fig. 7F-41). Remove parking lock pawl and spring.

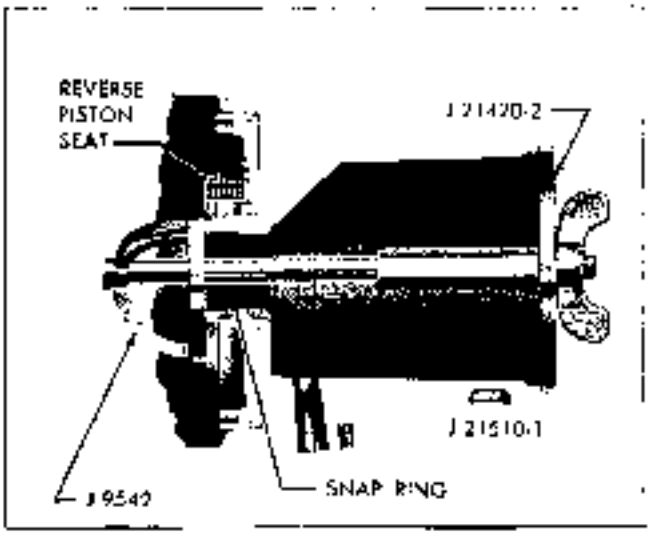


Fig. 7F-36 Compressing Reverse Piston Return Springs

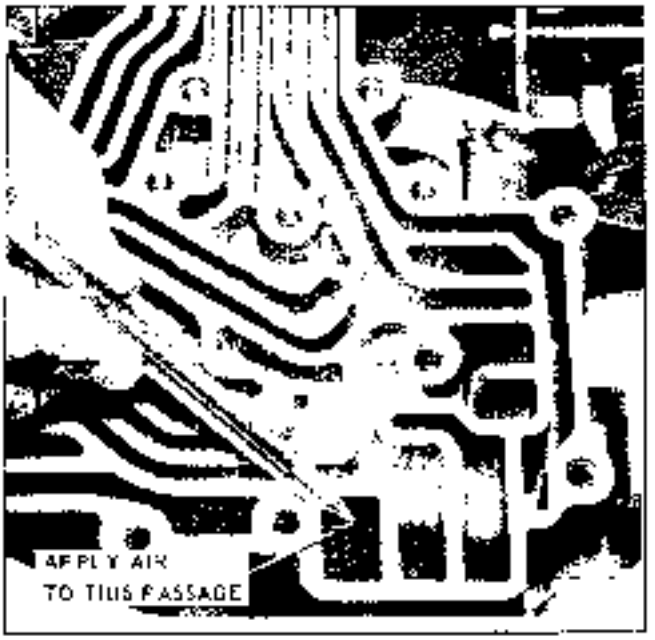


Fig. 7F-37 Reverse Piston Apply Passage

INSPECTION AND OVERHAUL OF INDIVIDUAL COMPONENTS

Service procedures for the rear bearing retainer, governor, vacuum modulator, speedometer driven gear assembly, downshift solenoid, valve body and pressure regulator are covered under SERVICE OPERATIONS—TRANSMISSION IN CAR, page 7F-3.

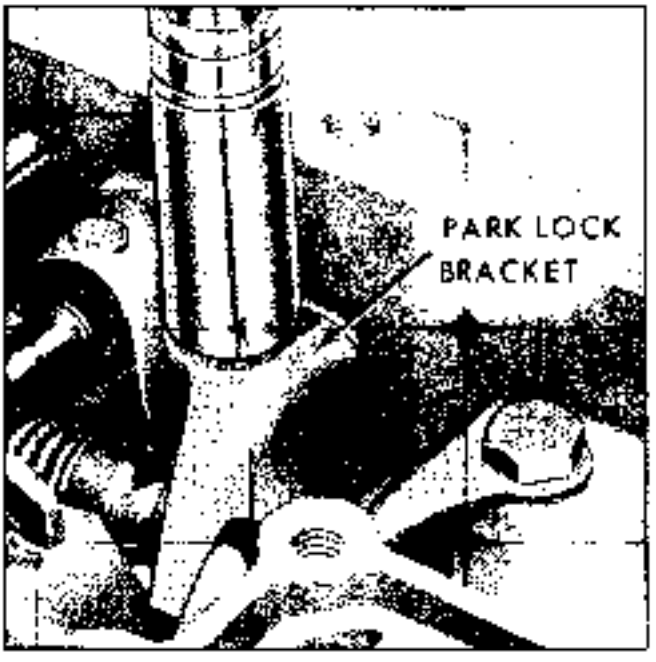


Fig. 7F-38 Removing Parking Lock Bracket

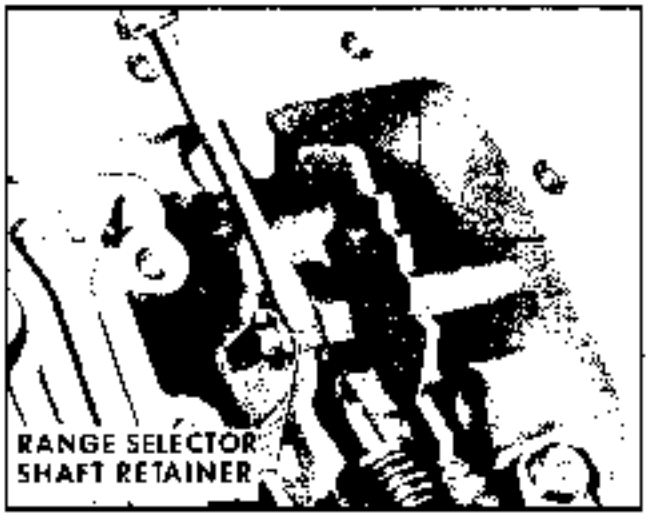


Fig. 7F-39 Removing Range Selector Shaft Retainer

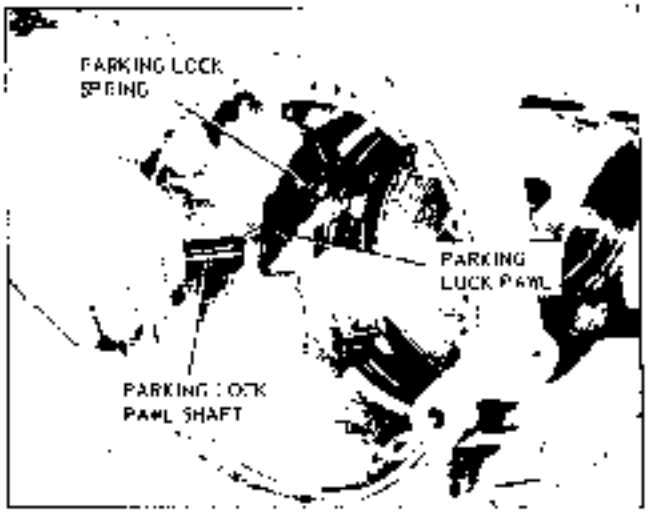


Fig. 7F-41 Removing Parking Lock Pawl Shaft

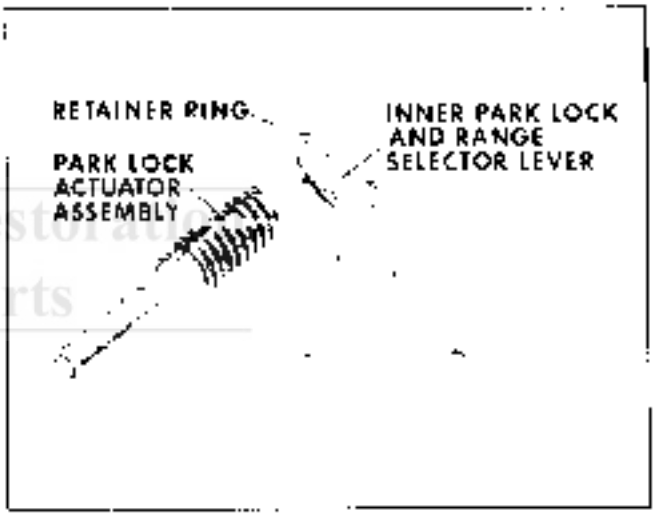


Fig. 7F-42 Park Lock Actuator and Range Selector Lever

TRANSMISSION CASE

INSPECTION

1. Inspect for hairline cracks or oil leaks.

2. Check for interconnected oil passages, using air gun or smoke.

3. Check bolt hole threads for cross threading or stripped condition.

4. Check case bushing for nicks, excessive scoring or wear. If replacement is required, proceed as follows:

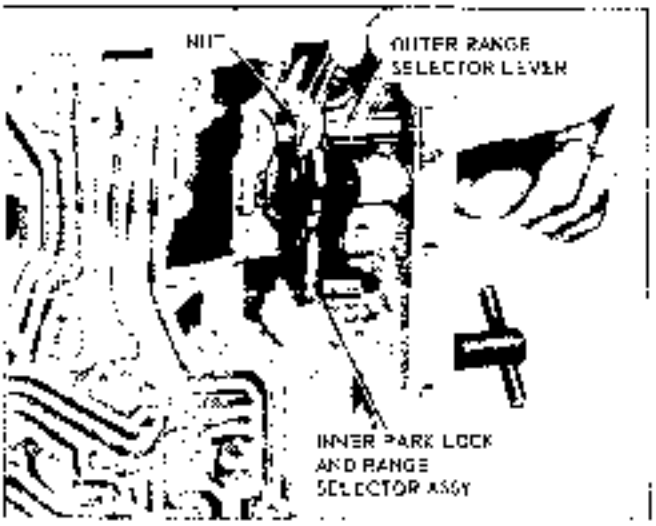


Fig. 7F-40 Removing Range Selector Shaft Nut

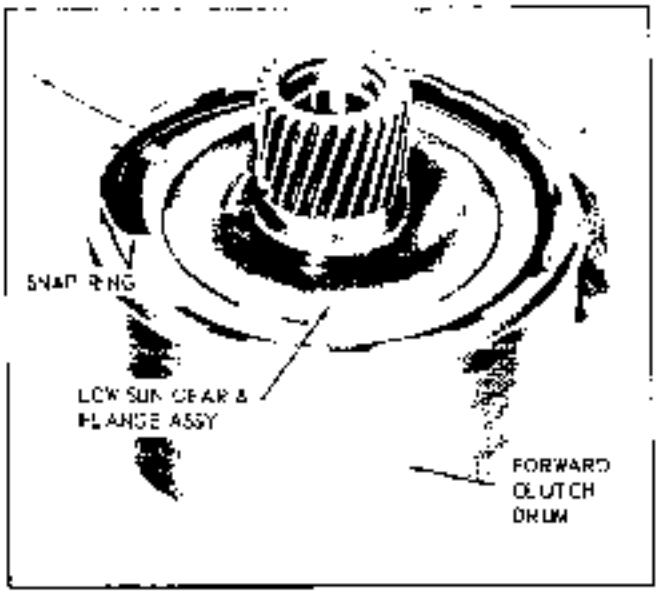


Fig. 7F-43 Removing Low Sun Gear and Flange Assembly Snap Ring

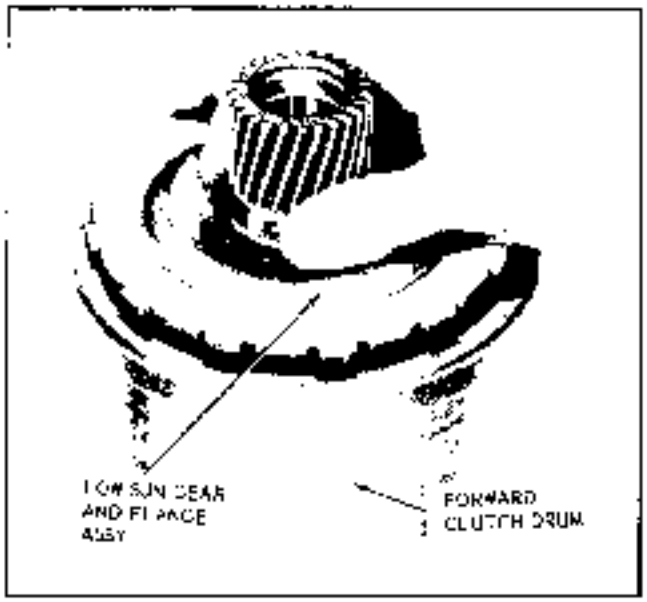


Fig. 7F-44 Removing Low Sun Gear and Flange Assembly

CASE BUSHING REPLACEMENT

1. Remove bushing, using bushing chisel J 8400-1. Avoid damaging bushing bore.

2. Install new bushing, using installer J 21424-2 and handle J 8092.

RANGE SELECTOR SHAFT OIL SEAL REPLACEMENT

1. Pry out old seal.

2. Tap new seal gently until it bottoms in case bore. Use a piece of flat metal or wood to avoid damaging seal.

PARK LOCK ACTUATOR ASSEMBLY AND INNER PARK LOCK AND RANGE SELECTOR LEVER

DISASSEMBLY

Remove retainer ring that holds inner park lock and range selector to park lock actuator assembly (Fig. 7F-42).

INSPECTION

Check for worn or damaged parts and replace as required.

ASSEMBLY

Engage park lock actuator assembly to inner park lock and range selector lever and secure with retainer ring (Fig. 7F-42).

REVERSE CLUTCH AND PISTON

DISASSEMBLY AND INSPECTION

1. Remove and discard reverse piston inner and outer seals.

2. Check for broken piston return springs and make a comparative check of spring heights by standing all springs in a row. If there is appreciable difference in spring height, replace springs.

3. Examine clutch plates for evidence of wear or burning. Discard damaged plates. L-6 clutch pack contains 4 steel and 4 faced plates, V-8 contains 5 steel and 5 faced plates.

4. Check piston for cracks or distortion.

ASSEMBLY

1. Check reverse piston thickness. L-6 piston is 1" thick, V-8 piston is 13/16" thick.

2. Lubricate with transmission oil and install inner and outer seals in reverse piston grooves.

FORWARD CLUTCH

DISASSEMBLY

1. Remove low sun gear and flange assembly snap ring (Fig. 7F-43).

2. Remove low sun gear and flange assembly (Fig. 7F-44).

3. Remove clutch hub rear thrust washer (Fig. 7F-45).

4. Remove clutch hub (Fig. 7F-46).

5. Remove clutch hub front thrust washer (Fig. 7F-47).

6. Remove clutch pack.

7. Using spring compressor J 9542, compress piston return springs (Fig. 7F-48). Remove snap ring.

8. Carefully release pressure, then remove spring retainer and return springs.

9. Remove clutch piston with twisting motion. Remove and discard outer seal on piston and inner seal on clutch drum hub.

INSPECTION

1. Wash all parts in cleaning solvent and air dry.

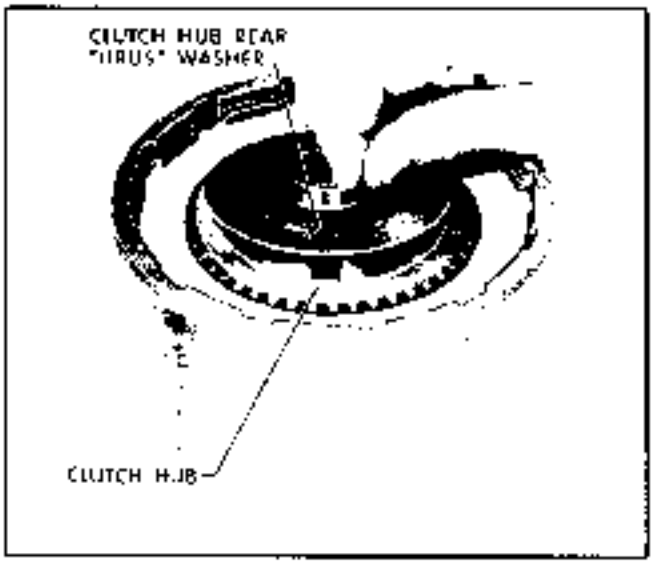


Fig. 7F-45 Removing Clutch Hub Rear Thrust Washer

2. Inspect low band surface of clutch drum for excessive scoring or burning. Check clutch drum bushing for scoring or excessive wear. If bushing replacement is necessary, see Clutch Drum Bushing Replacement below.

3. Check steel ball in clutch drum that acts as a relief valve. Be sure that it is free to move and that orifice in front face of drum is open. If check ball is loose enough to come out, or not loose enough to rattle, replace clutch drum as an assembly. Replacement or restaking of ball should not be attempted.

NOTE: When drum is rotating at high speed with enough fluid trapped in piston apply area, centrifugal force acting on fluid could partially apply the piston and burn clutch pack unless the relief orifice is open. During normal piston application, oil pressure seats the ball and prevents loss of pressure.

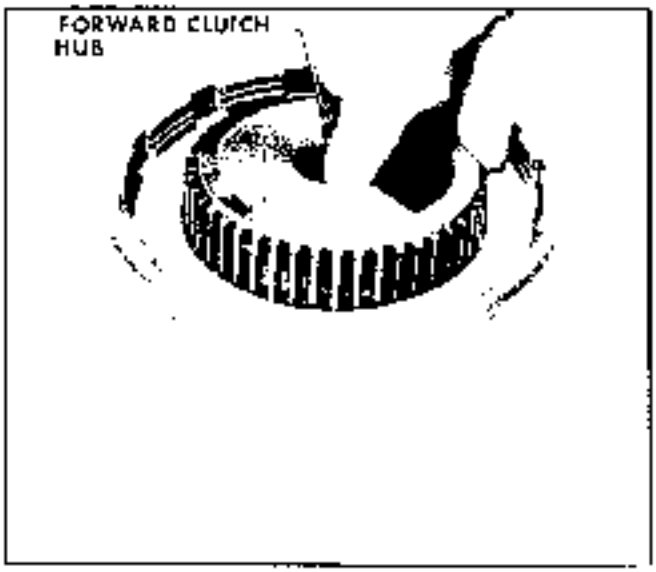


Fig. 7F-46 Removing Clutch Hub

4. Check fit of low sun gear and flange assembly in drum slots. There should be no appreciable radial play. Inspect low sun gear for damage and bushing for wear.

5. Check clutch plates for burning, pitting or metal pick-up. Also check to see that faced plates are a free fit over clutch hub and that steel plates are a free fit in clutch drum slots. Check for excessive wear on friction facing of drive plates. Examine condition of clutch hub splines and mating splines on faced plates.

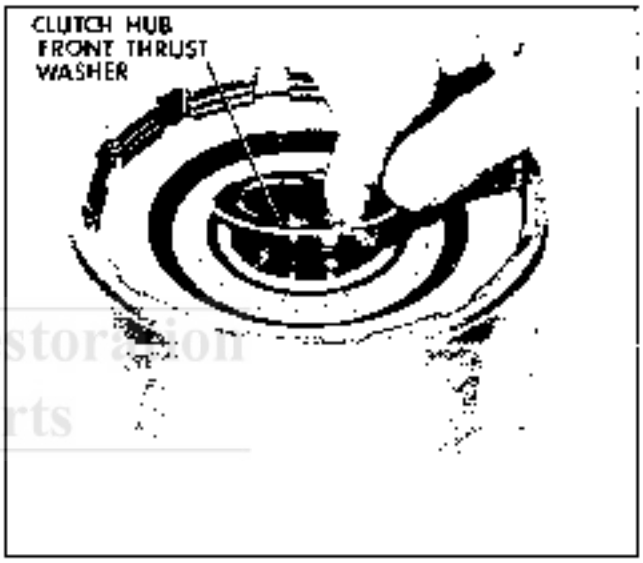


Fig. 7F-47 Removing Clutch Hub Front Thrust Washer

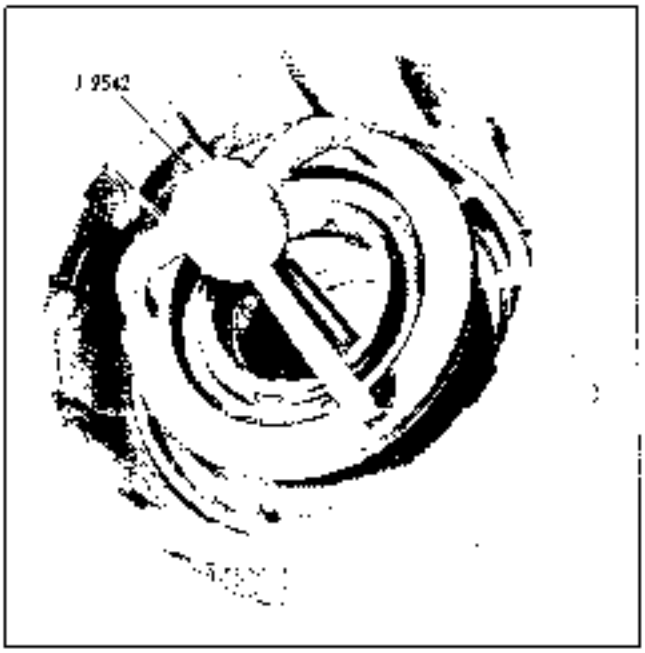


Fig. 7F-48 Compressing Forward Piston Return Springs

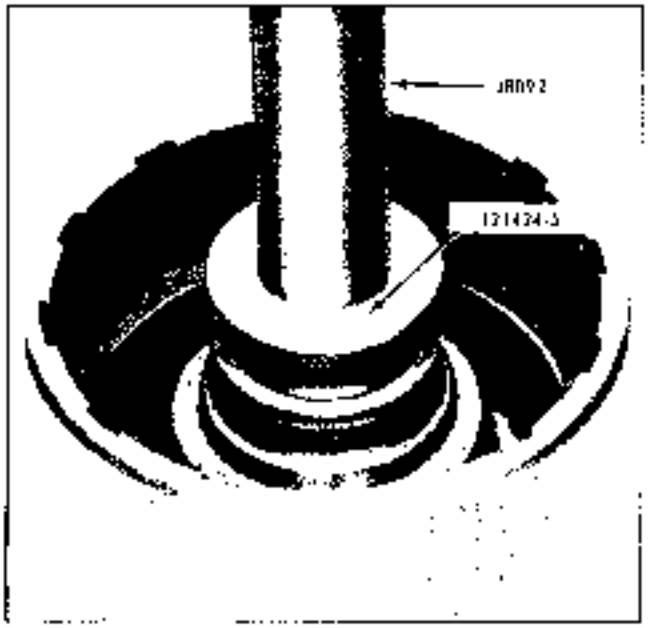


Fig. 7F-49 Removing Clutch Drum Bushing

6. Check piston for cracks or distortion.

CLUTCH DRUM BUSHING REPLACEMENT

1. Remove old bushing, using chisel J 6400-1 or tool J 21424-5 (Fig. 7F-49). Avoid damaging bushing bore.

2. Install new bushing, using tool J 21424-5 (Fig. 7F-50). Press bushing in until tool bottoms front face of drum.

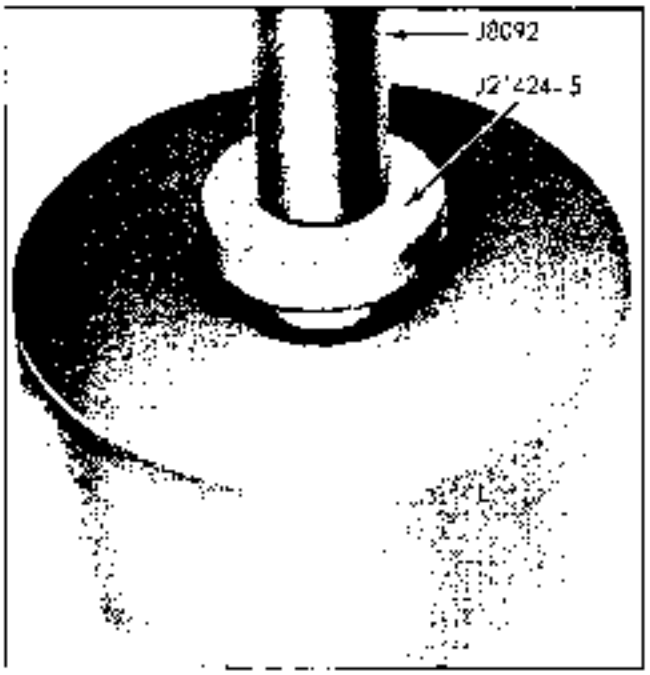


Fig. 7F-50 Installing Clutch Drum Bushing

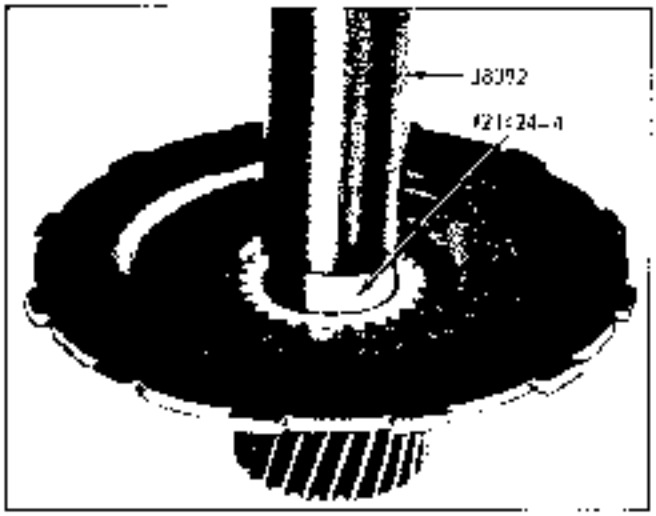


Fig. 7F-51 Removing Low Sun Gear Bushing

LOW SUN GEAR BUSHING REPLACEMENT

1. Remove old bushing, using bushing chisel J 6400-1 or tool J 21424-4 (Fig. 7F-51). Avoid damaging bushing bore.

2. Install new bushing, using tool J 21424-4 (Fig. 7F-52). Press in bushing until tool is flush with face of sun gear.

ASSEMBLY

1. Lubricate a new piston inner seal with transmission oil and install in clutch hub groove with seal lip down (Fig. 7F-53). A satisfactory tool for this operation can be made by crimping a loop of .020" round wire in a short length of copper tubing.

NOTE: Run fingers around seal after it is installed to verify that seal is fully in groove.

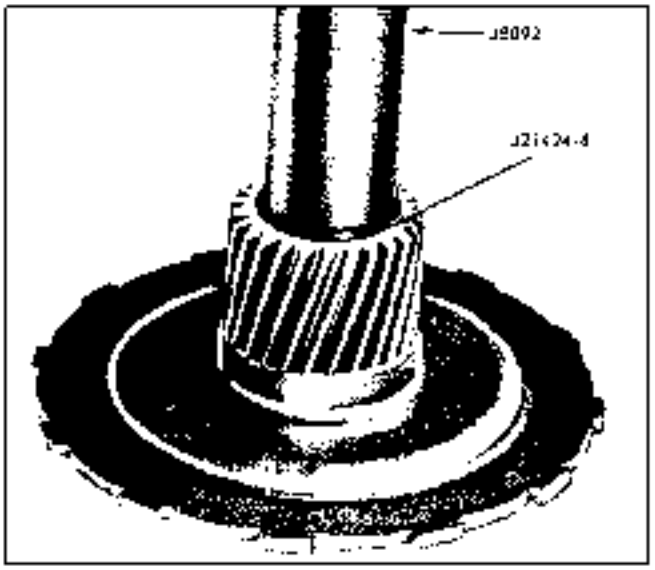


Fig. 7F-52 Installing Low Sun Gear Bushing

Fig. 7F-53 Installing Clutch Piston Inner Oil Seal

2. Check forward clutch piston thickness. 1-6 piston is 1-5/16" thick; V-8 piston is 25/32" thick.

3. Lubricate a new piston outer seal with transmission oil and install on piston groove. Seal lip must face down.

4. Install forward clutch piston into clutch drum, using a loop of smooth wire to start lip of seal into bore.

5. Install piston return springs and spring retainer (Fig. 7F-54). Place snap ring in position on top of retainer.

6. Compress return springs, as shown in Fig. 7F-46, to expose snap ring groove. Install snap ring in clutch drum hub and remove compressor.

7. Install clutch hub from thrust washer on clutch hub (retain with petrolatum), aligning tangs in clutch

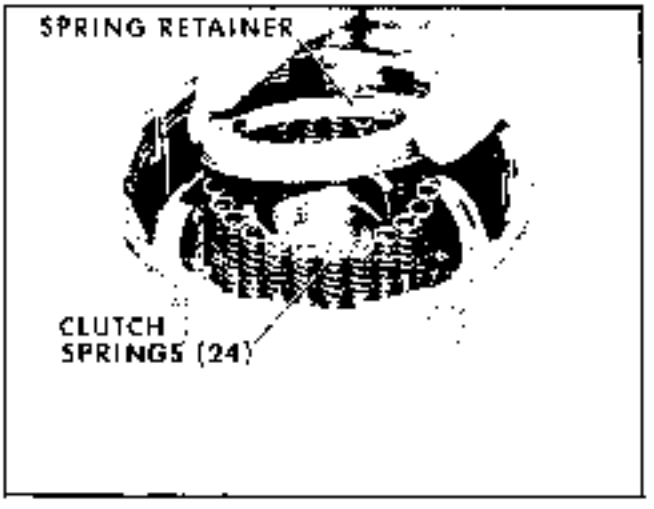


Fig. 7F-54 Installing Spring Retainer

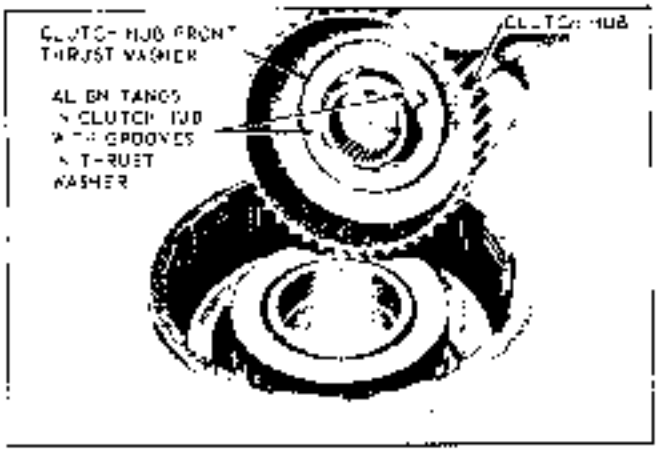


Fig. 7F-55 Installing Clutch Hub From Thrust Washer

hub with grooves in thrust washer (Fig. 7F-55). Install clutch hub.

NOTE: Notches on steel driven plates must be aligned in step 8 below.

8. Install steel driven plates and faced drive plates alternately, beginning with a steel driven plate (Fig. 7F-56).

NOTE: Number of plates used are:
LA, LB, LD, LF, LG, LH — 5 steel and 4 faced
MA, MB, MC — 6 steel and 5 faced

9. Install clutch hub rear thrust washer with flange in bore of low sun gear (Fig. 7F-57).

10. Install low sun gear and flange assembly and secure with snap ring. Position snap ring so that gap is centered between slots in drum.

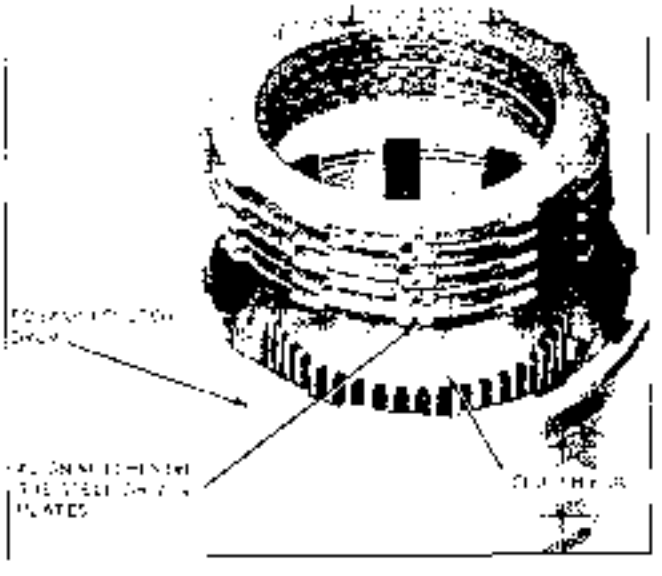


Fig. 7F-56 Installing Clutch Face

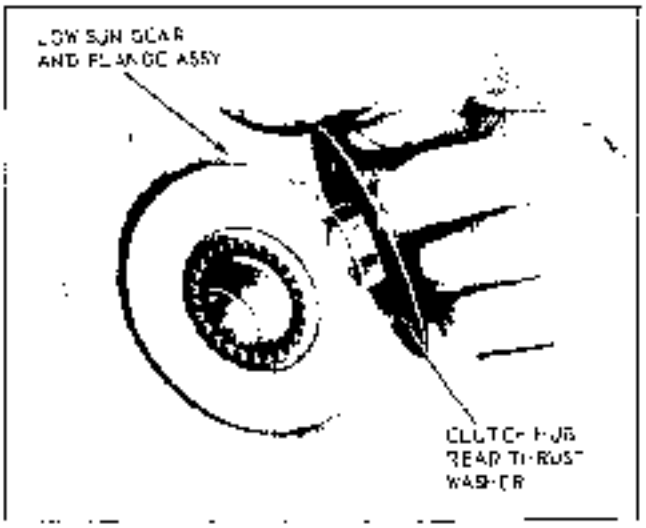


Fig. 7F-57 Installing Clutch Hub Rear Thrust Washer

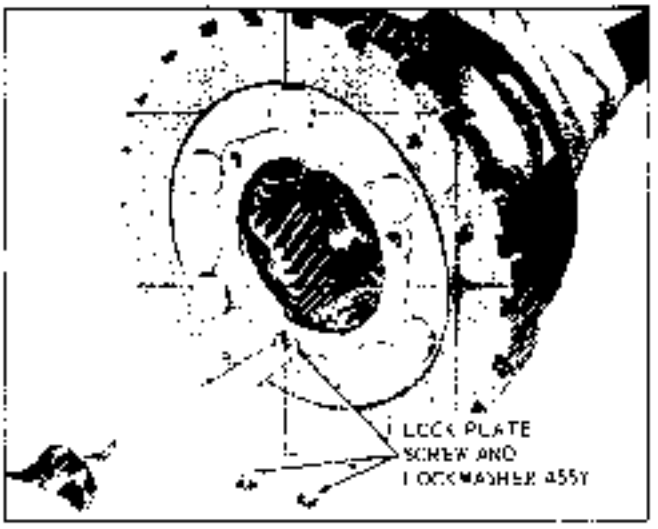


Fig. 7F-59 Removing Lock Plate Screws

PLANET CARRIER

PRELIMINARY INSPECTION

1. Wash planet carrier assembly in cleaning solvent and air dry.

2. Inspect planet pinions for nicks or other tooth damage.

3. Check end clearance of planet pinions. This clearance should be .006 - .030" (Fig. 7F-58).

4. Check input sun gear for tooth damage.

5. Inspect output shaft bearing surface for nicks or scoring.

6. Inspect output shaft splines for nicks or damage. To disassemble the planet carrier to replace worn or damaged parts, proceed as follows:

DISASSEMBLY

1. Remove planet pinion shaft lock plate screws and lockwashers (Fig. 7F-59).

2. Rotate lock plate clockwise and remove.

NOTE: If gears are to be reused, mark them in some convenient way so that they can be reinstalled in their original position, facing original direction. If this is not done, the gear set may be noisy.

3. Starting with a short planet pinion, push out pinion shaft. Remove pinion, needle bearings and thrust washers.

4. Repeat Step 3 to remove the remaining two short pinions.

Fig. 7F-58 Checking Planet Pinion End Clearance

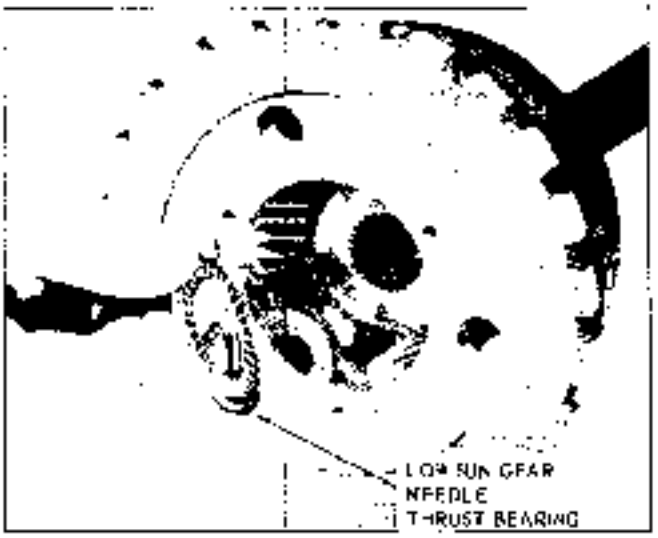


Fig. 7F-60 Removing Low Sun Gear Needle Thrust Bearing

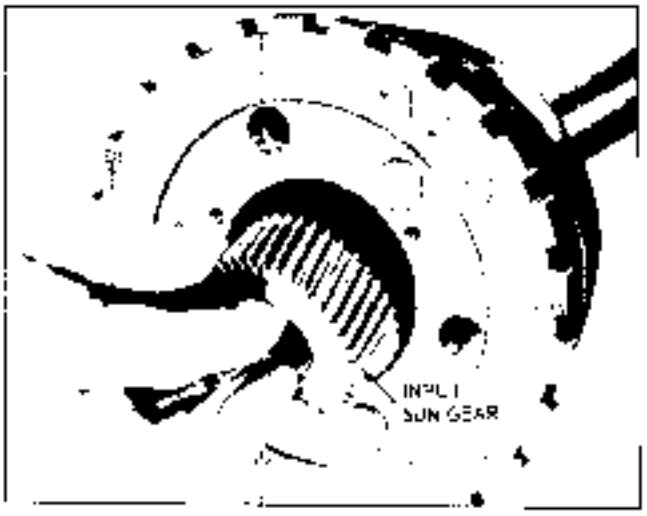


Fig. 7F-61 Removing Input Sun Gear

5. Remove low sun gear needle thrust bearing (Fig. 7F-60).

6. Remove input sun gear (Fig. 7F-61).

7. Remove input sun gear thrust washer (Fig. 7F-62).

8. Remove three long pinion shafts, pinions, bearings and thrust washers.

INSPECTION

1. Wash all parts in cleaning solvent and air dry.

2. Recheck pinions and input sun gear for nicks or other tooth damage. Check needle thrust bearing and all thrust washers for wear. Replace worn or damaged parts.

3. Inspect pinion needle bearings carefully. If worn, all needle bearings must be replaced. Replace worn pinion shafts.

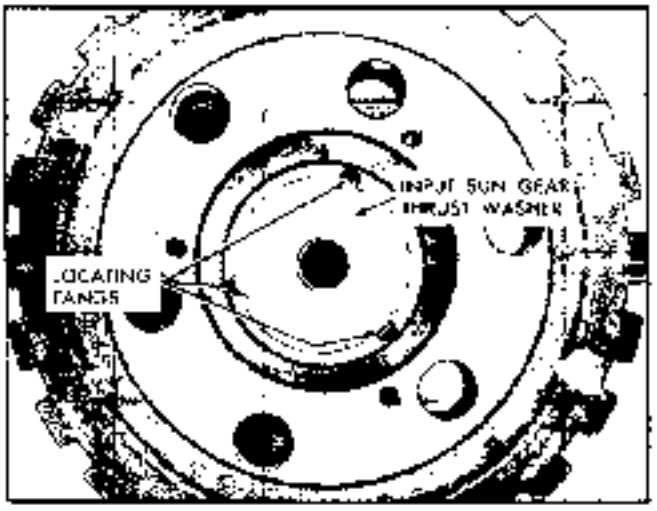


Fig. 7F-62 Input Sun Gear Thrust Washer

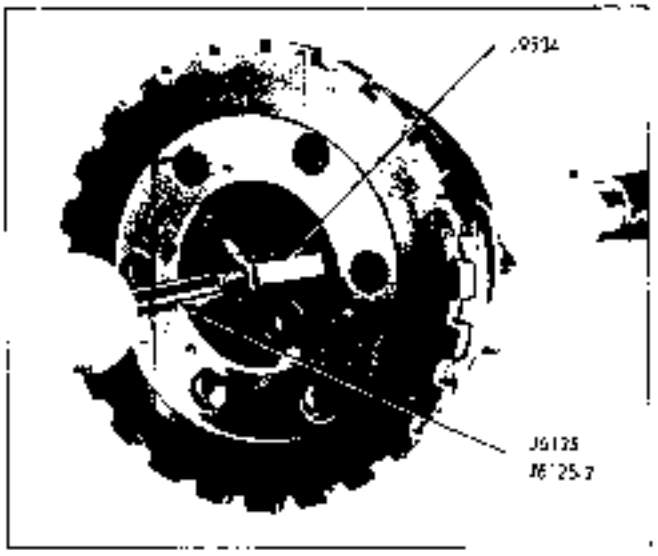


Fig. 7F-63 Removing Output Shaft Bushing

4. Check output shaft bushing for nicks, severe scoring or wear. If replacement is required, proceed as follows:

OUTPUT SHAFT BUSHING REPLACEMENT

1. Install bushing remover J 9634 into bushing. Install slide hammer into J 9634 and remove bushing (Fig. 7F-63).

2. Using installer J 21424-3 and handle J 8092, press new bushing into output shaft until installer touches machined surface of carrier assembly (Fig. 7F-64).

ASSEMBLY

1. Install long pinions first. Install pinion rear thrust washer, retaining it with petrolatum. Oil grooves must face pinion; engage washer tang in hole (Fig. 7F-65).

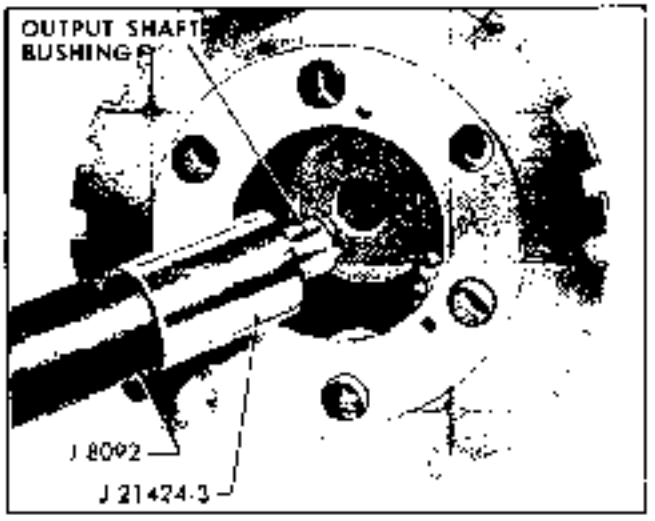


Fig. 7F-64 Installing Output Shaft Bushing

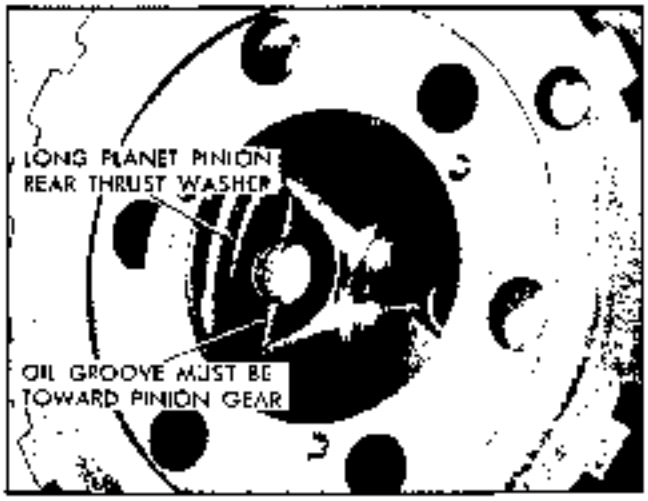


Fig. 7F-65 Long Pinion Rear Thrust Washer

2. Install pinion front thrust washer ("paired" washer), retaining it with petrolatum. Oil grooves must face pinion. (Fig. 7F-66).

3. Install 20 needle bearings, spacer, 20 more needle bearings, and two thrust washers into long pinion (Fig. 7F-67). A small amount of petrolatum will aid in holding needle bearings and washers in place.

4. Hold long pinion and needle bearing assembly in position and install long pinion shaft from front of planet carrier. As shaft is pushed in, make certain that it picks up thrust washers. Turn pinion shaft so that lock plate slot faces center of planet carrier.

NOTE: Repeat steps 1 through 4 above to install remaining two long pinions.

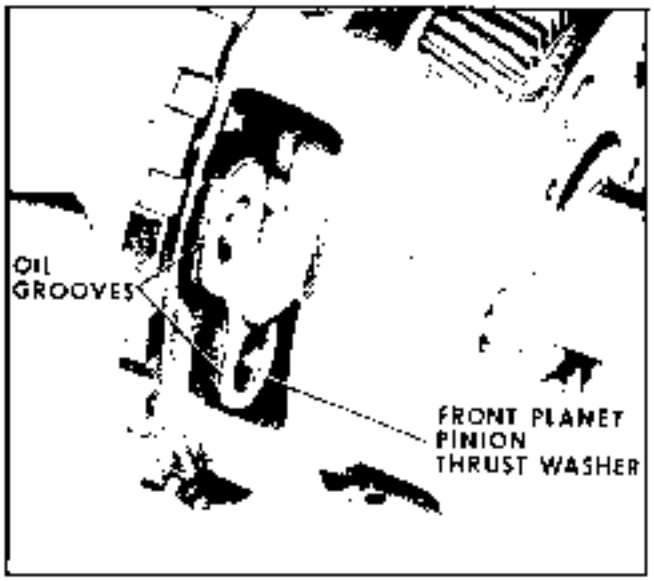


Fig. 7F-66 Installing Long Pinion Front Thrust Washer

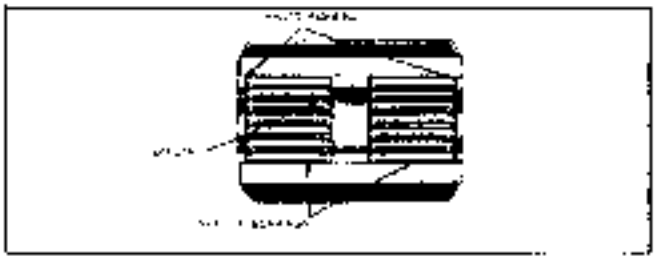


Fig. 7F-67 Long Pinion and Bearing

5. Install input sun gear thrust washer with oil groove facing gear (Fig. 7F-68).

6. Install input sun gear.

7. Install low sun gear needle thrust bearing with bearings facing input sun gear (Fig. 7F-69).

8. Install short pinion thrust washer with oil grooves facing pinion and retain with petrolatum. Position short pinion half of adjacent "paired" thrust washer and retain with petrolatum.

9. Install 20 needle bearings and 2 thrust washers, one washer each end, in short planet pinion. Retain with petrolatum.

10. Hold short pinion and needle bearing assembly in position and install short pinion shaft from front of planet carrier. As shaft is pushed in, make certain that it picks up thrust washers. Turn pinion shaft so that lock plate slot faces center of planet carrier.

NOTE: Repeat steps 8 through 10 above to install remaining two short pinions.

11. Install planet pinion lock plate. Rotate plate so that tabs align with slots in planet pinion shafts and the three attaching screws holes. Install three screws with lockwashers and tighten securely.

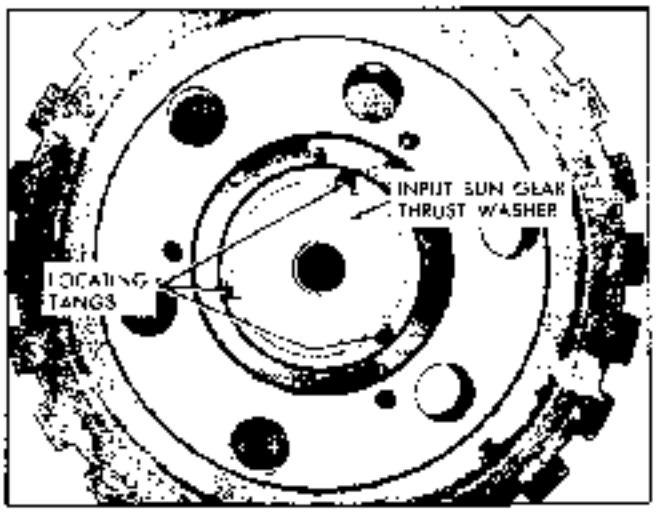


Fig. 7F-68 Input Sun Gear Thrust Washer

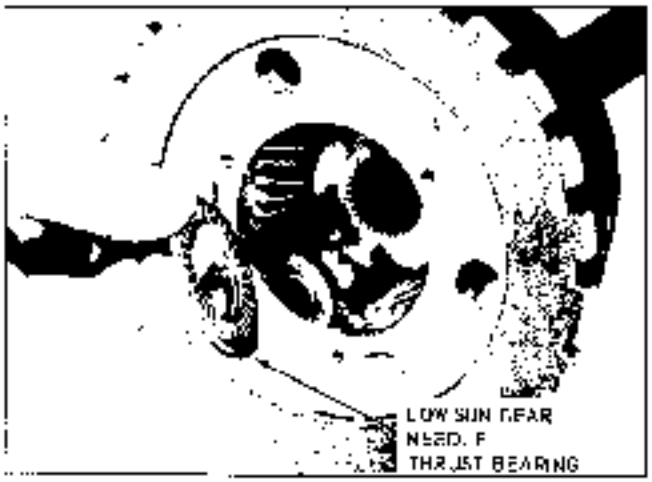


Fig. 7F-69 Installing Low Sun Gear Needle Thrust Bearing

LOW SERVO ASSEMBLY

DISASSEMBLY

CAUTION: The low servo assembly spring force is very high. Use extreme care when disassembling or assembling.

1. Remove low servo secondary piston seal.

2. Mount J 22269 in vise, compress primary piston in J 22269 (Fig. 7F-70) and remove snap ring. Remove primary piston, springs, apply pin and washer from secondary piston assembly.

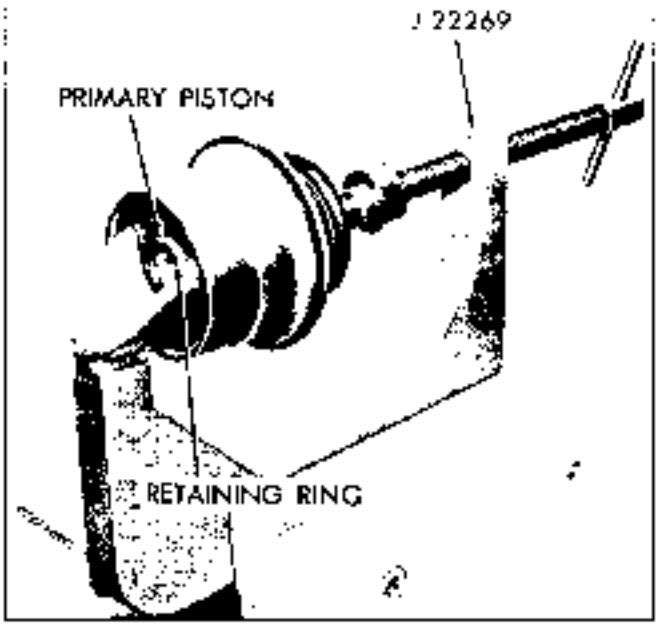


Fig. 7F-70 Compressing Low Servo

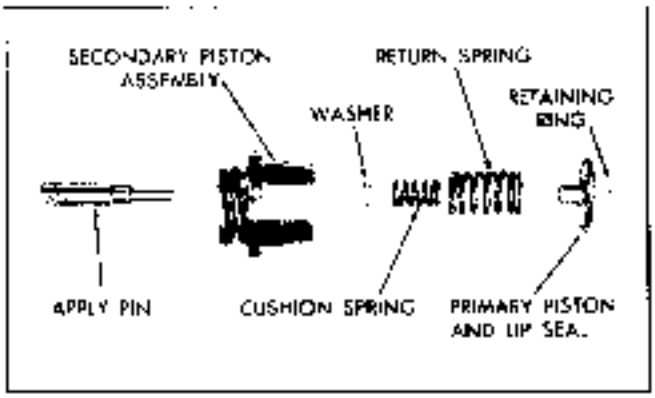


Fig. 7F-71 Low Servo

NOTE: Secondary piston assembly is to be serviced as a unit.

INSPECTION AND REPAIR

Visually examine parts for damage or wear. Discard worn or damaged parts. Remove and discard piston oil seal ring.

ASSEMBLY

1. Install washer into secondary piston assembly (Fig. 7F-71).

2. Install cushion and return springs into secondary piston assembly (Fig. 7F-71).

3. Install apply pin to primary piston by compressing in J 22269 (Fig. 7F-70). Install retaining snap ring.

4. Remove tool and install new secondary piston seal.

OIL PUMP

DISASSEMBLY

1. Remove the two hook-type oil seal rings from pump hub (Fig. 7F-72).

2. Remove pump cover to forward clutch drum thrust washer.

3. Remove and discard oil pump to case seal.

4. Support oil pump on wood blocks. Remove five pump cover bolts and remove pump cover.

5. Identify gear faces so that gears can be reassembled in their original position and remove drive and driven gears.

6. If necessary, remove converter blow off valve. Depress converter blow off valve spring (Fig. 7F-73). Remove retaining pin, spring and valve.

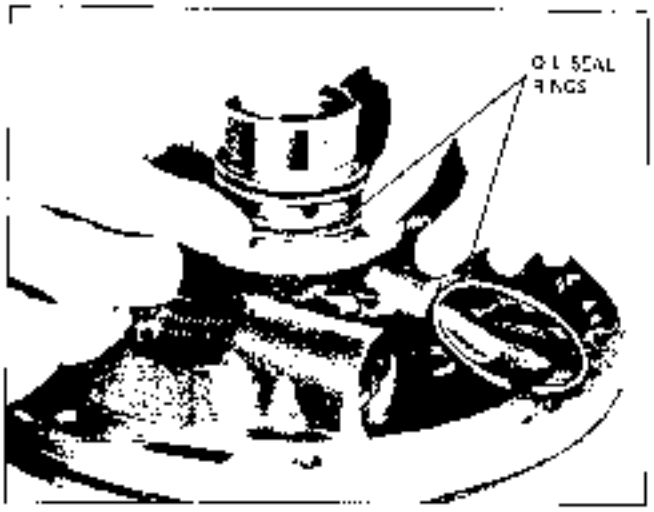


Fig. 7F-72 Removing Oil Seal Rings

CAUTION: Valve spring is under high force. Use extreme care after each ring has been removed in step 7 below.

7. Compress main pressure regulator valve spring by pressing on boost valve sleeve with thumb and remove retaining snap ring (Fig. 7F-74).

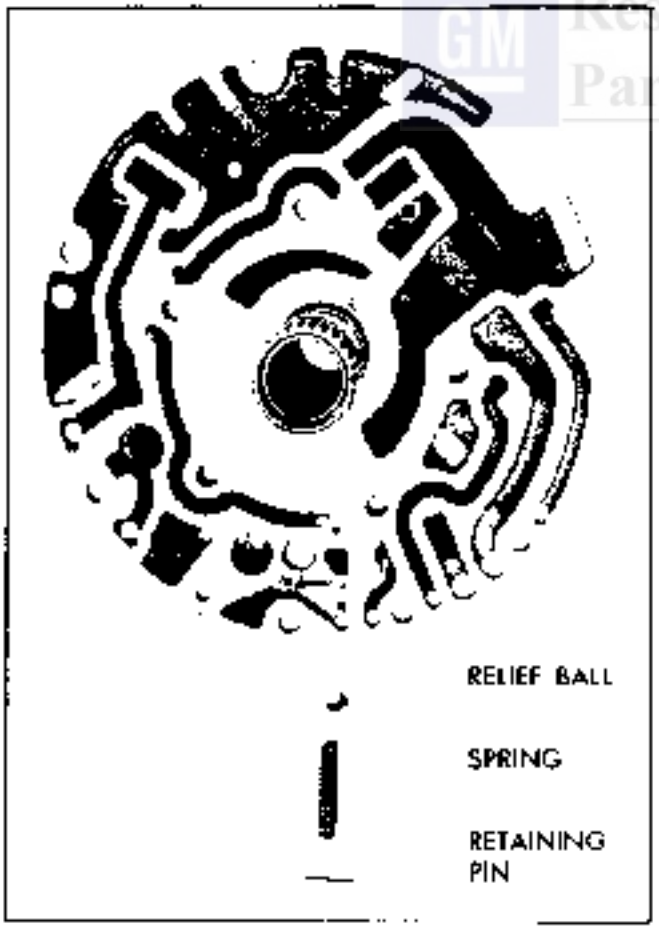


Fig. 7F-73 Converter Blow Off Valve

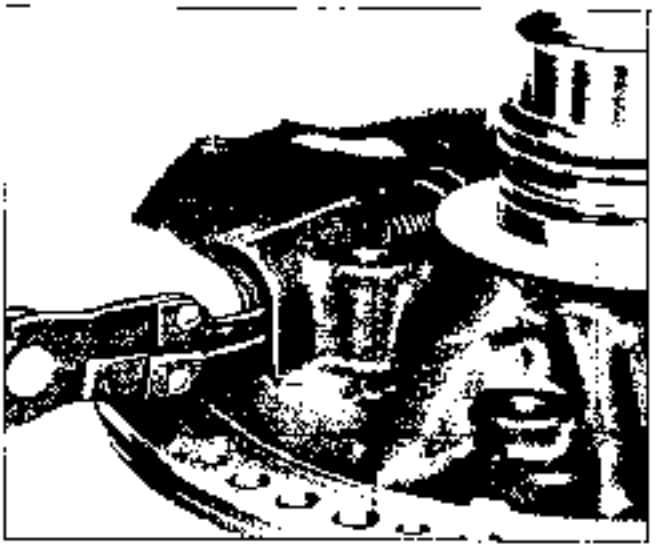


Fig. 7F-74 Removing Boost Valve Sleeve Snap Ring

8. Remove boost valve sleeve, valve, spring, washer and pressure regulator valve (Fig. 7F-75).

9. Remove oil pump seal with a small pry bar and discard seal (Fig. 7F-76).

INSPECTION

1. Check oil pump bushing for nicks, severe scoring or wear.

2. Check stator shaft bushing for nicks, severe scoring or wear. If replacement is necessary, see STATOR SHAFT BUSHING REPLACEMENT below.

3. Inspect pump gears for nicks or damage.

4. Inspect pump body for nicks or scoring.

5. With dial indicator set, check for clearance (Fig. 7F-77). Correct end clearance is .0005" to .0015".

6. Inspect pressure regulator valve and boost valve and sleeve for nicks or burrs.

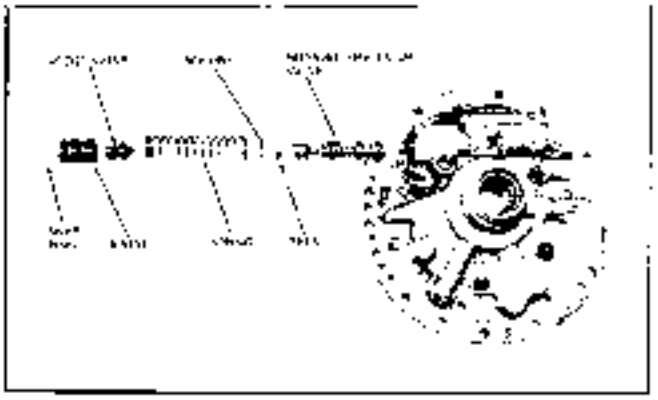


Fig. 7F-75 Main Pressure Regulator

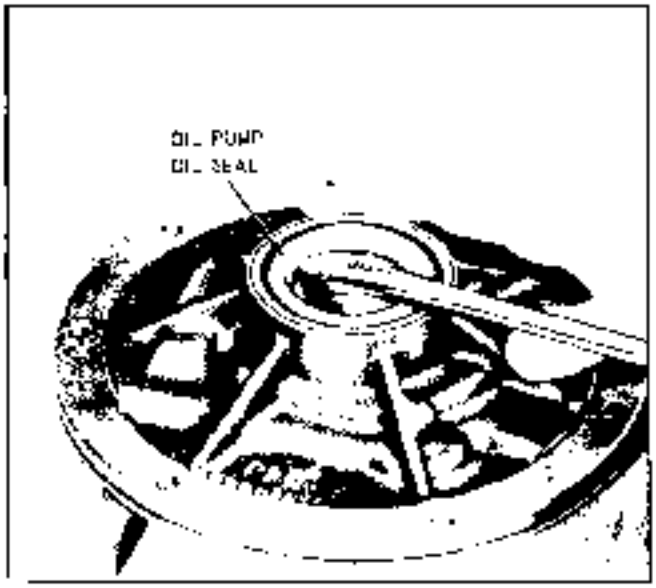


Fig. 7F-76 Removing Oil Pump Seal

STATOR SHAFT BUSHING REPLACEMENT

1. While holding front end of stator shaft in one hand, use tool J 21424-7, a suitable brass drift and a hammer to drive bushing out of front end of stator shaft (Fig. 7F-78).

2. Install stator shaft bushing as follows: Support pump assembly on J 21424-3 before installing bushing. Install bushing into the front end of stator shaft. Using installer J 21424-7 and drive handle J 8092, tap bushing into shaft until it bottoms on shoulder (Fig. 7F-79).

CAUTION: Extreme care must be taken so bushing is not driven past shoulder.

ASSEMBLY

1. Using tool J 21359, install new oil seal (Fig. 7F-80).

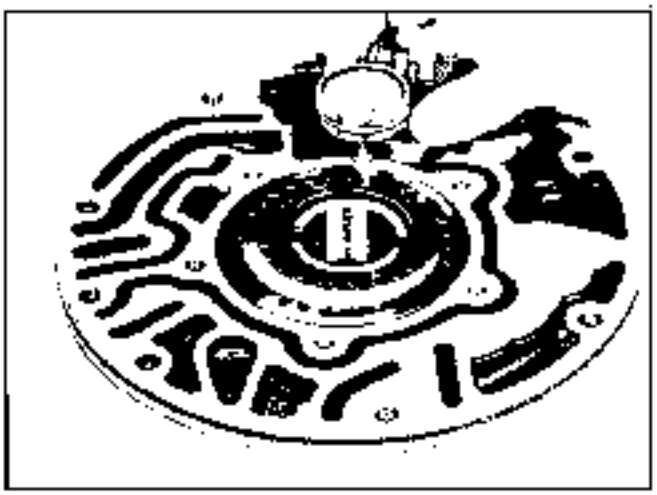


Fig. 7F-77 Checking Gear End Clearance

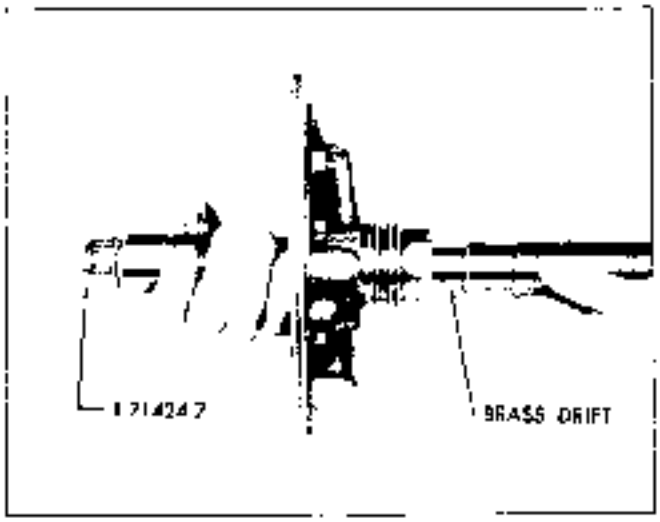


Fig. 7F-78 Removing Stator Shaft Bushing

2. Install new oil pump to case seal.

3. Assemble pressure regulator valve, washer, spring boost valve and sleeve (Fig. 7F-75).

NOTE: Some transmissions incorporate a C type spring washer and may have one or two C type spacers behind the washer. Install the same number of spacers originally removed.

4. Compress pressure regulator valve spring by pressing on boost valve sleeve. Install snap ring.

5. If previously removed, install converter blow off valve and spring in the pump cover. Depress spring and install retaining pin (Fig. 7F-73).

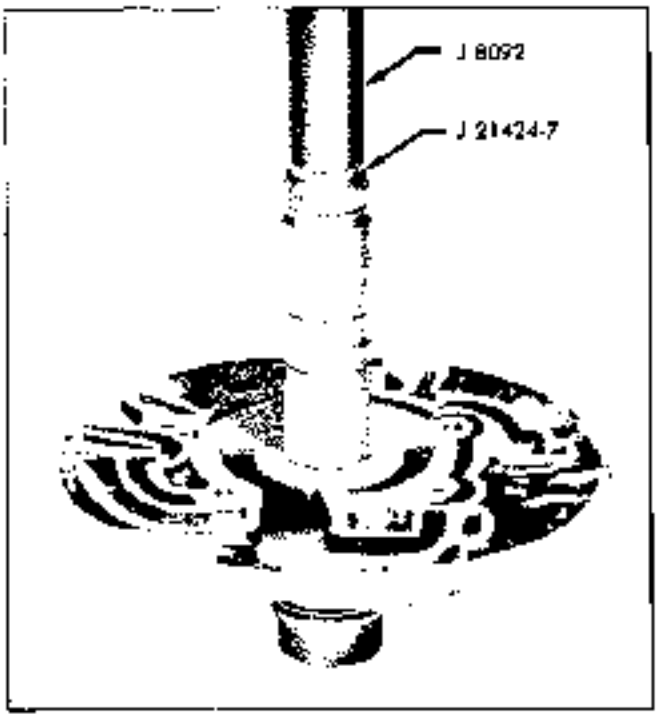


Fig. 7F-79 Installing Stator Shaft Bushing

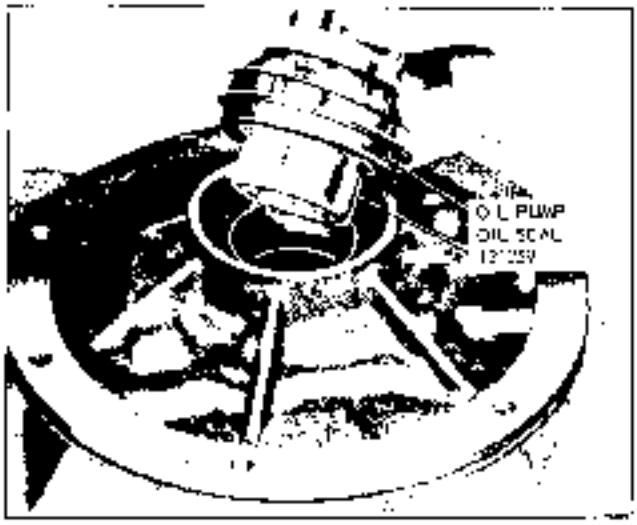


Fig. 7F-80 Installing Oil Pump Oil Seal

NOTE: Thrust washer and oil pump oil sealing rings will be installed during a later operation.

6. Assemble pump body and cover. Install five retaining bolts, but do not tighten. Align pump body and cover with tool J 21368 (Fig. 7F-81). Tighten bolts to 20 lb. ft. torque. Remove tool J 21368.

CONVERTER LEAK TEST

1. Install tool J 21369 and tighten.

2. Fill converter with air at a pressure of 80 psi.

3. Submerge in water and check for leaks.

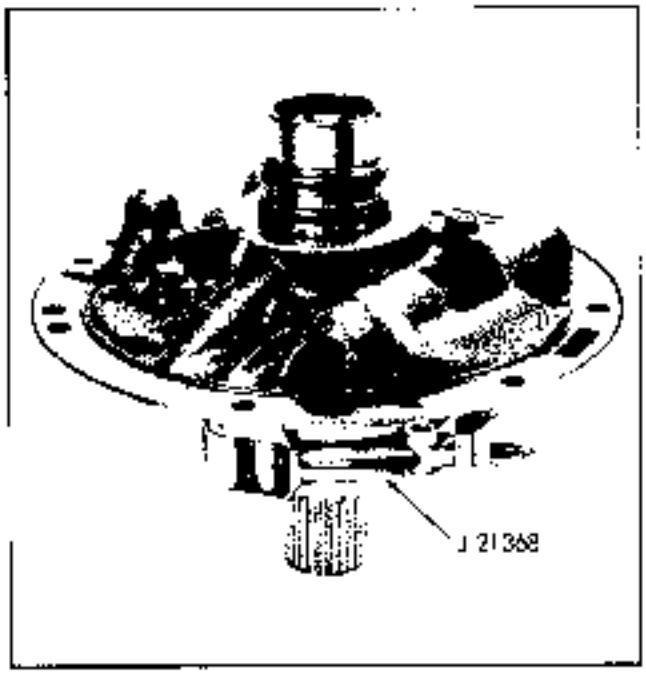


Fig. 7F-81 Aligning Oil Pump and Cover

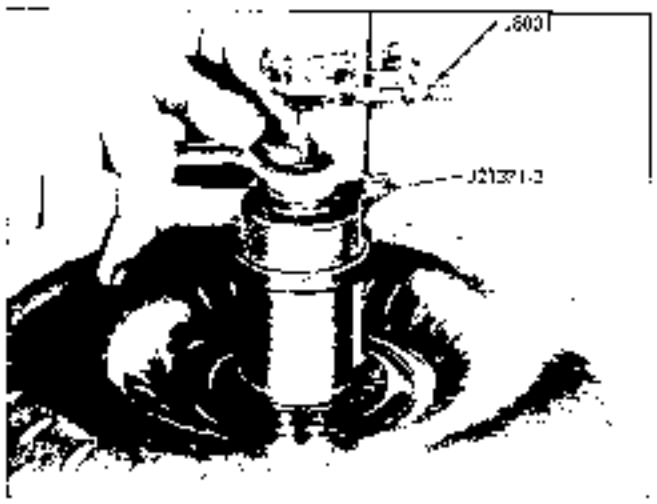


Fig. 7F-82 Checking Converter End Clearance

CONVERTER END PLAY CHECK

1. Fully release collet of tool J 21371 by turning screw clockwise.

2. Install collet end of J 21371 into converter until it bottoms.

3. Tighten brass cap nut to 5 lb. ft., then tighten large hex nut to 3 lb. ft.

4. When hex nut of J 21371 has been tightened firmly, install dial indicator and adjust for zero reading while plunger rests on end of screw (Fig. 7F-82).

5. Loosen hex nut, allowing converter internal assembly to lower until dial indicator shows internal assembly has bottomed. Acceptable end clearance is .005" or less.

TRANSMISSION REASSEMBLY

GENERAL

Before starting to assemble transmission, make certain that all parts are absolutely clean. Keep hands and tools clean to avoid getting dirt into assembly. If work is stopped before assembly is completed, cover all openings with clean cloths.

Lightly coat all moving parts with transmission oil before installation. Thrust washers may be held in place with petrolatum sparingly applied.

Do not take a chance on used gaskets and seals - use new ones to avoid oil leaks.

Use care to avoid making nicks or burrs on parts, particularly at bearing surfaces and surfaces where gaskets are used.

It is extremely important to tighten all parts evenly to avoid distortion of parts and leakage at

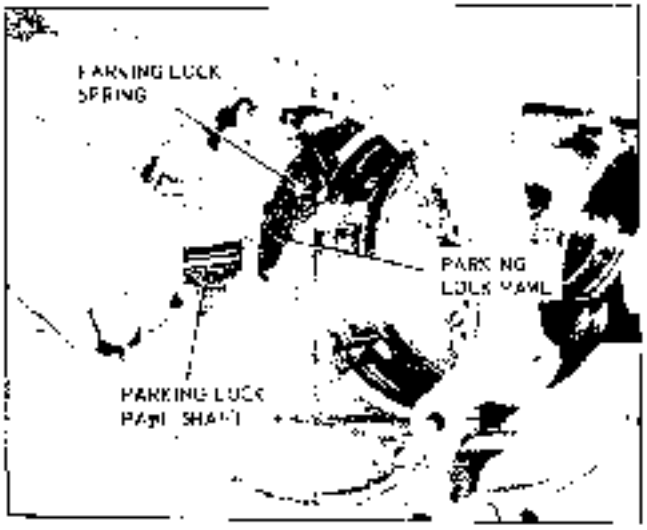


Fig. 7F-83 Installing Parking Lock Pawl Shaft

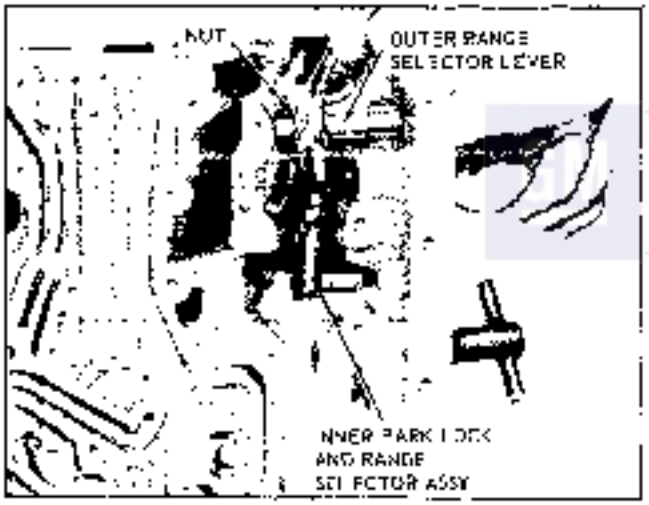


Fig. 7F-84 Installing Inner Park Lock and Range Selector

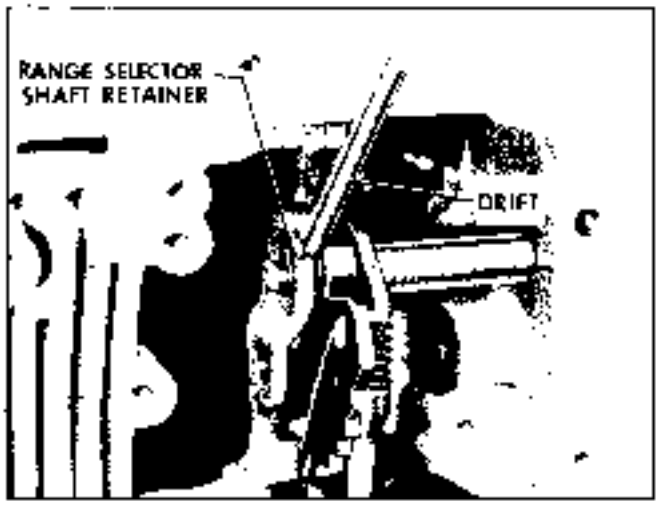


Fig. 7F-85 Installing Range Selector Shaft Retainer

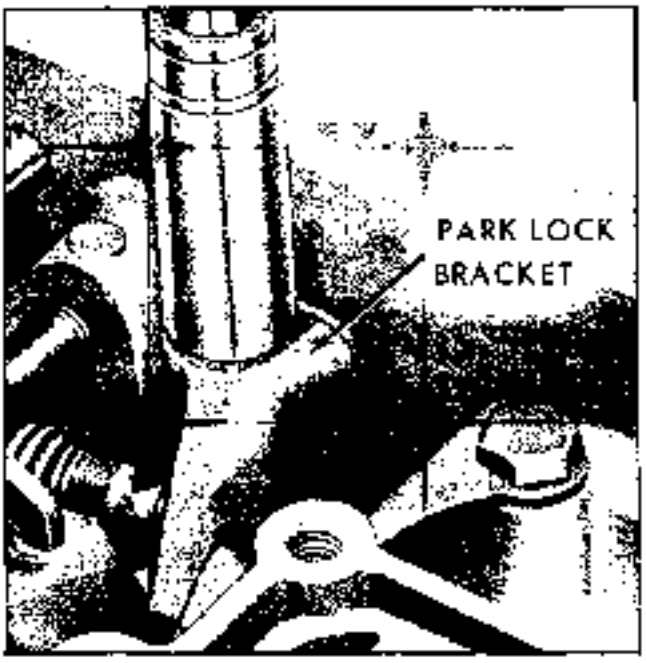


Fig. 7F-86 Installing Park Lock Bracket

gaskets and other joints. Use a reliable torque wrench to tighten all bolts and nuts to specified torque.

INSTALLATION OF RANGE SELECTOR LEVER, SHAFT, AND PARKING LOCK ACTUATOR

1. Hold parking lock pawl and spring in position and retain with parking lock pawl shaft (Fig. 7F-83).

2. Install range selector shaft into case with a twisting motion.

3. Install inner park lock and range selector assembly on range selector shaft and secure with nut (Fig. 7F-84).

NOTE. Make certain flat shorter end of outer lever is to bottom of transmission.

4. Install range selector shaft retainer (Fig. 7F-85).

5. Install parking lock bracket in case and tighten bolts to 10 lb. ft. torque (Fig. 7F-86).

INSTALLATION OF REVERSE PISTON AND CLUTCH

1. Install cushion ring if it was removed (Fig. 7F-88) and with transmission in vertical position, install reverse clutch piston into case, making certain it bottoms in case.

2. Install clutch piston return springs.

3. Position piston return seat on piston return springs. Place snap ring in position on return seat so that ring can be easily installed when seat is compressed with tool.

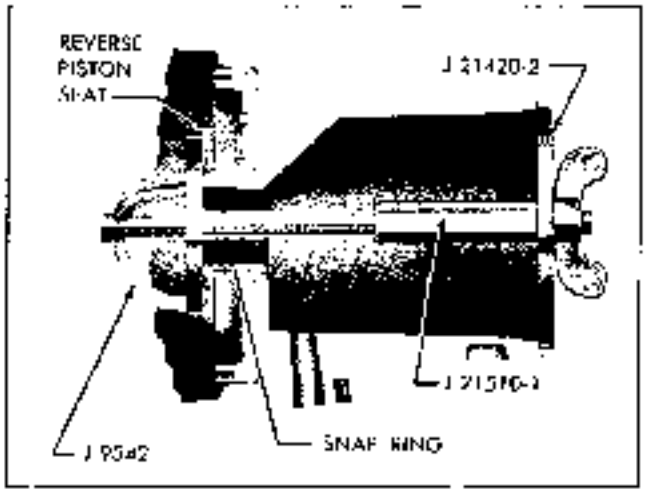


Fig. 7F-87 Compressing Reverse Piston Return Springs

4. Compress reverse piston return springs, using spring compressor J 9542 and adapters until snap ring groove is exposed (Fig. 7F-87). Install snap ring and remove tool.

NOTE: As spring retainer is compressed, make certain inner edge of seal does not hang up on snap ring groove.

5. Install reverse clutch reaction plates and drive plates as shown in Fig. 7F-89. Notched lug in each steel reaction plate is installed so that it is at top of groove at 5 o'clock position in case (Fig. 7F-90).

NOTE: Number of plates used are:
LA, LB, LD, LF, LG, LH - 4 steel and 4 faced MA, MB, MC - 5 steel and 5 faced

6. Install pressure plate (Fig. 7F-91) with the identification mark in the 5 o'clock groove in case.

7. Install reverse clutch pack snap ring.

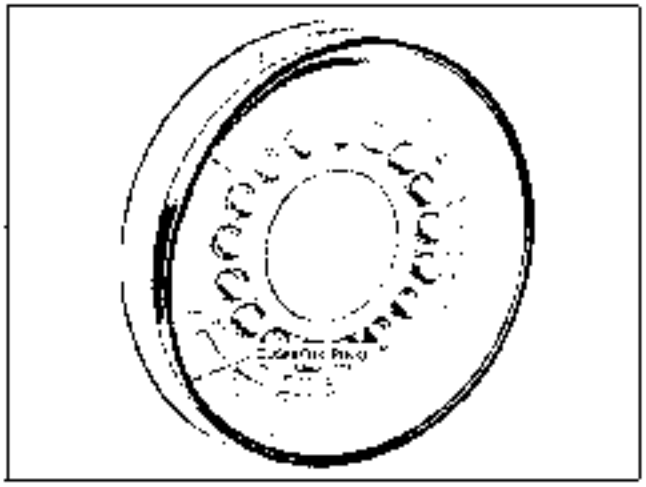


Fig. 7F-88 Reverse Clutch Cushion Ring

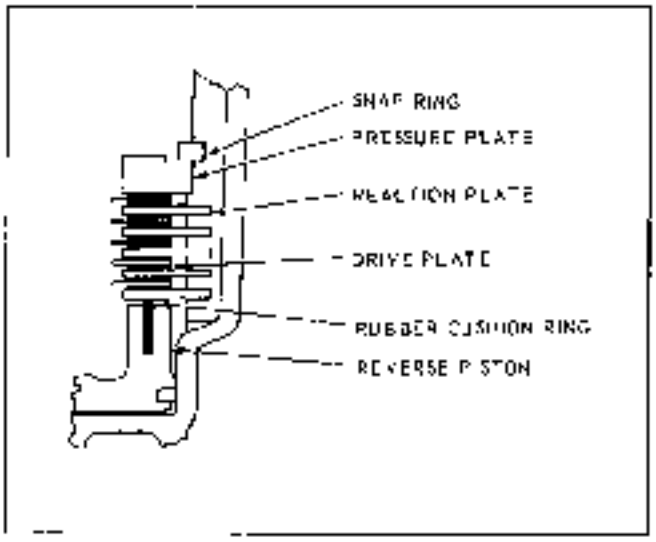


Fig. 7F-89 Reverse Clutch Pack Assembly Sequence

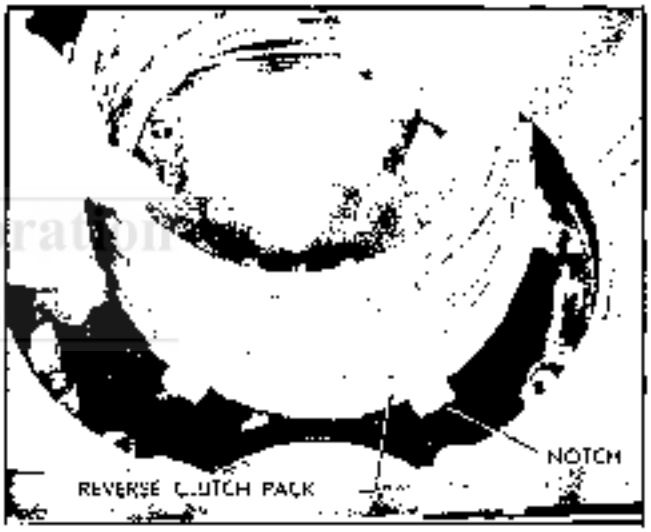


Fig. 7F-90 Installing Reverse Clutch Pack

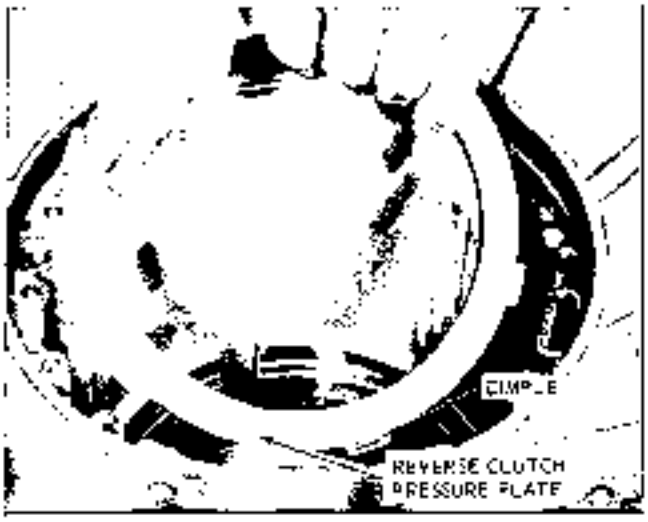


Fig. 7F-91 Installing Reverse Clutch Pressure Plate

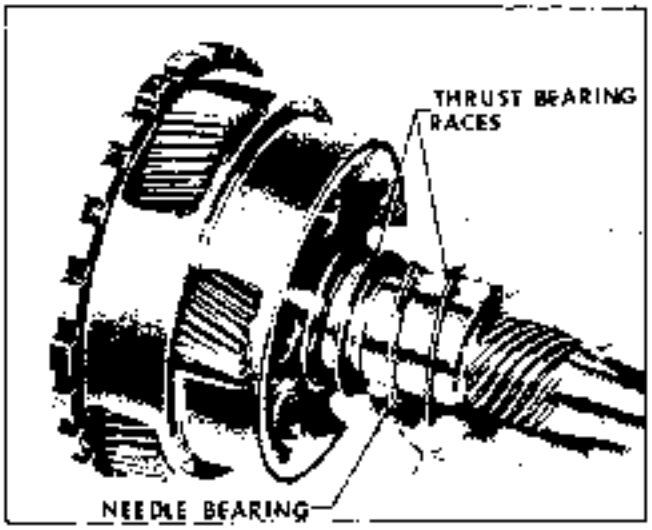


Fig. 7F-92 Installing Planet Carrier Thrust Bearing and Races

INSTALLATION OF PLANETARY GEAR SET

1. Install thrust bearing race with flat, needle bearing and plain race on output shaft (Fig. 7F-92). Retain on rear face of planet carrier with petrolatum (Bearing and races can be installed on case reverse clutch piston hub, if desired).

2. Install reverse ring gear (Fig. 7F-93).

3. Install planetary gear seat.

INSTALLATION OF LOW SERVO ASSEMBLY, LOW BAND, AND FORWARD CLUTCH

LOW SERVO ASSEMBLY

1. Install low servo assembly into case. Position notch to receive low band apply strut.

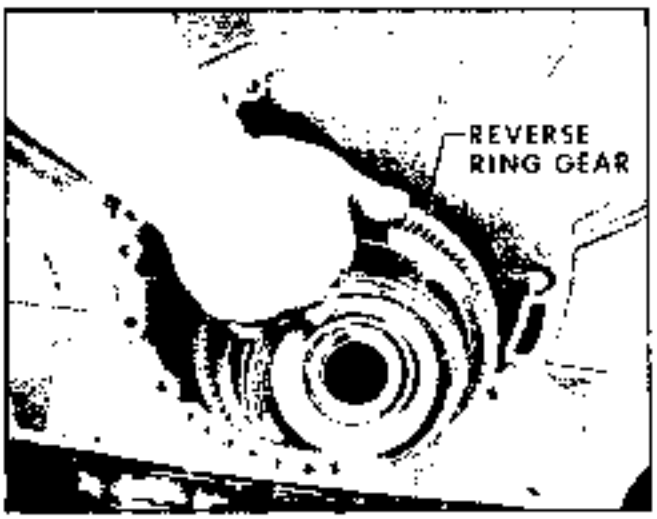


Fig. 7F-93 Installing Reverse Ring Gear

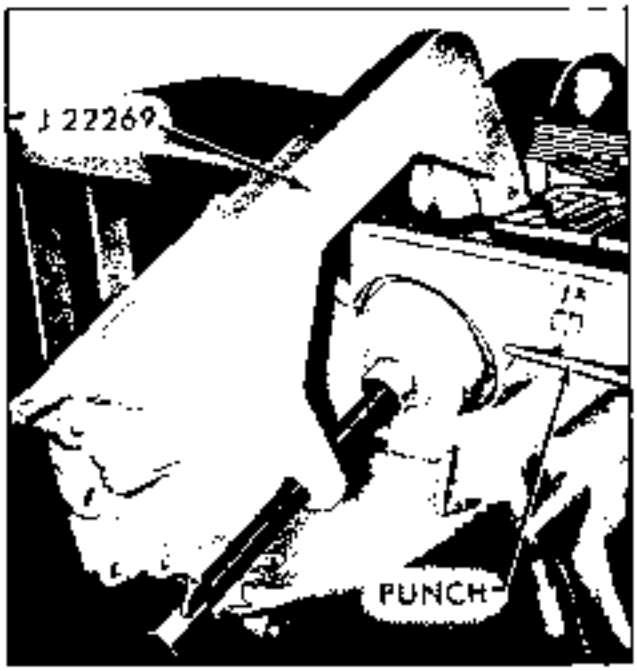


Fig. 7F-94 Installing Low Servo Cover Snap Ring

2. Install new low servo cover oil seal and install cover. Whenever a new servo cover is installed, it will be necessary to stamp the transmission code and model on the new cover.

3. Compress low servo cover with J 22269 and install snap ring (Fig. 7F-94).

4. Remove tool J 22269.

LOW BAND

1. With transmission in vertical position, install band adjusting screw.

2. Install low band (Fig. 7F-95).

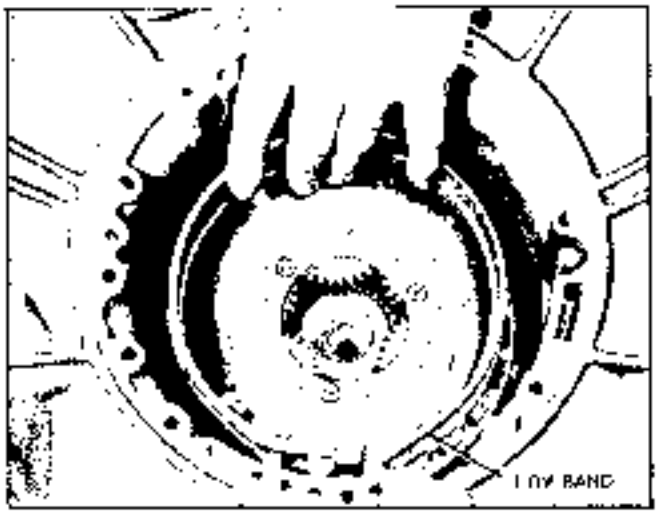


Fig. 7F-95 Installing Low Band

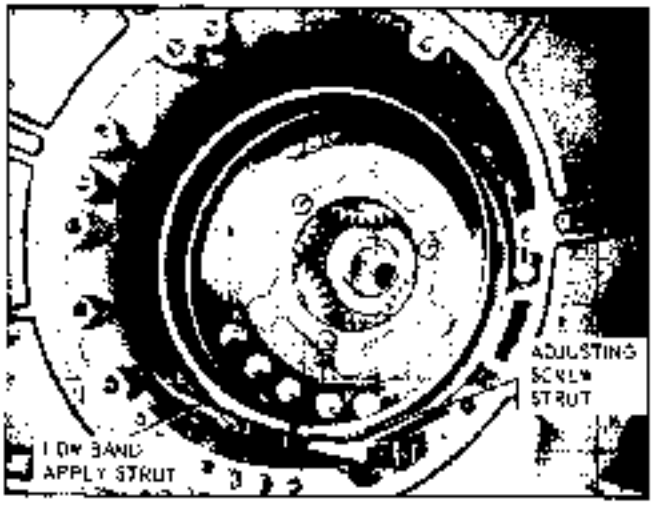


Fig. 7F-96 Low Band Strut Location

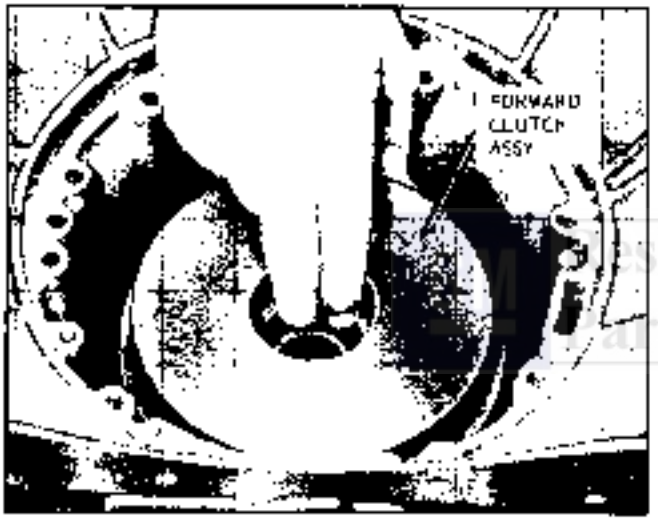


Fig. 7F-97 Installing Forward Clutch

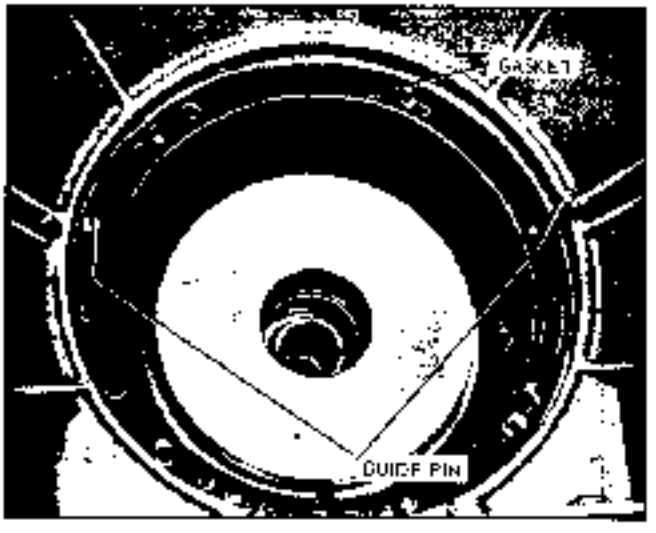


Fig. 7F-98 Guide Pins and Gasket Installed

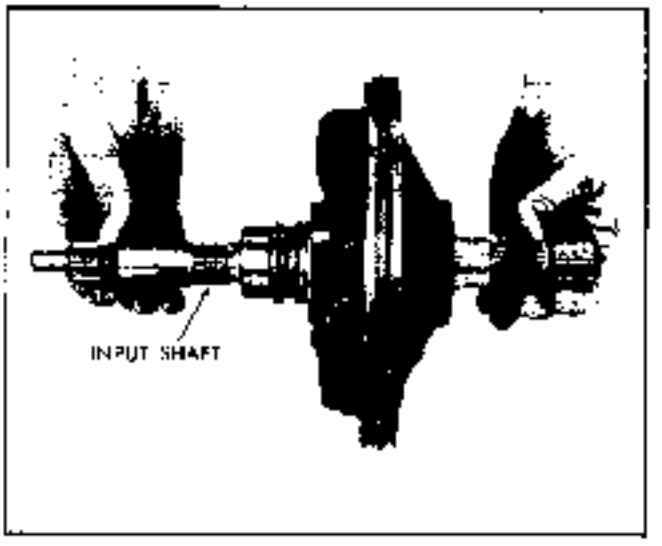


Fig. 7F-99 Installing Input Shaft Into Pump

3. Install low band apply strut and band adjusting screw strut (Fig. 7F-96). After both struts have been installed, tighten low band adjusting screw enough to prevent struts from falling out.

FORWARD CLUTCH

Install forward clutch assembly (Fig. 7F-97). Turn slightly to engage low sun gear with planet pinions.

CAUTION: Make certain that the low sun gear needle thrust bearing assembly and the input sun gear rear thrust washer in the planet carrier are centered before installing the forward clutch assembly.

DETERMINATION OF SELECTIVE THRUST WASHER THICKNESS

The thickness of the oil pump to forward clutch assembly thrust washer is determined as follows:

1. Install guide pins and new pump gasket (Fig. 7F-98).

2. Install input shaft into oil pump (Fig. 7F-99) and install oil pump (less oil seal rings, but with old or .061" thrust washer) into case.

3. Remove guide pins and install at least three oil pump retaining bolts. Tighten bolts to 20 lb. ft. torque.

4. With transmission in a vertical position, install a dial indicator so that its plunger bears on end of input shaft and zero the indicator (Fig. 7F-100).

5. Push up on output shaft and record amount of end play registered on dial indicator.

NOTE: If end play is less than .006", check for improper assembly of parts.

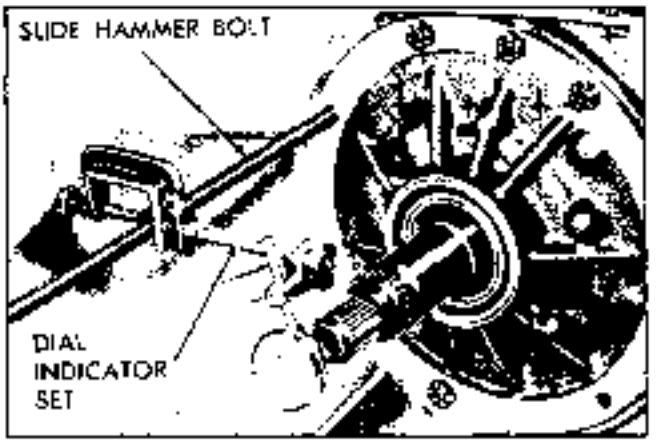


Fig. 7F-100 Checking Front Unit End Play

6. Refer to chart (Fig. 7F-101) and select correct thickness of thrust washer to establish a running clearance of .008"-.051" (If end play is more than .051" with .097" thrust washer installed, check for excessive wear of assembled parts or omitted thrust washers, races or bearings in or behind planet carrier).

NOTE: Selective thrust washers are available in three thicknesses: .061", .079" and .097" (±.002"). Since there are no identifying marks on these thrust washers, it will be necessary to measure thickness with a micrometer if thickness is in doubt.

7. Remove oil pump and input shaft and proceed in accordance with instructions in INSTALLATION OF OIL PUMP below.

If End Play is:	Correct Thrust Washer Thickness is:
.008" to .038"	.061"
.039" to .060"	.079"
.061" to .085"	.097"

Fig. 7F-101 Selective Thrust Washer Chart

INSTALLATION OF OIL PUMP

1. Install selective thrust washer on pump hub with tang down and in slot (Fig. 7F-103). See chart for determination of selective thrust washer thickness (Fig. 7F-101).

2. Install two hook type oil seal rings on pump hub (Fig. 7F-103). Make certain rings are free to move in grooves.

3. Install guide pins and new pump gasket (Fig. 7F-98).

4. Install two input shaft hook type oil seal rings. Make certain two rings are free to move in grooves.

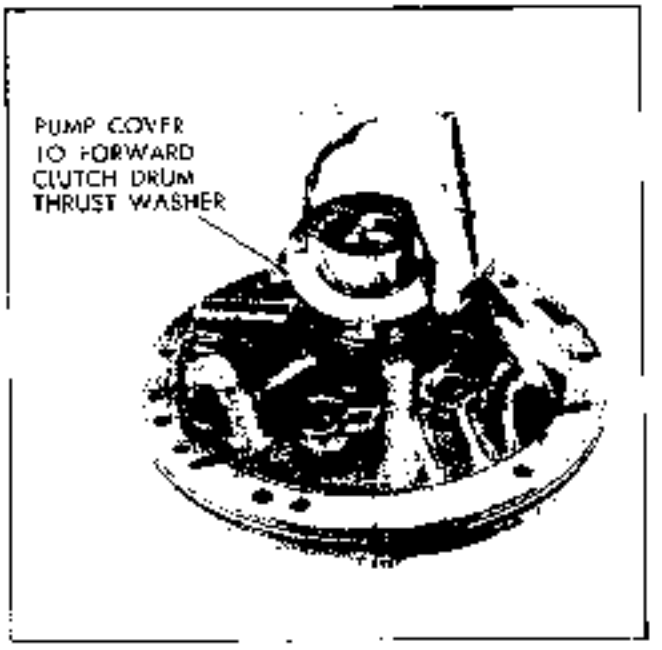


Fig. 7F-102 Installing Thrust Washer

5. Install input shaft into oil pump (Fig. 7F-98) and install oil pump into case (Make certain input shaft turns freely in pump before installing pump into case).

6. Remove guide pins and install oil pump retaining bolts with new washer type seals under each bolt head. Tighten bolts to 20 lb. ft. torque.

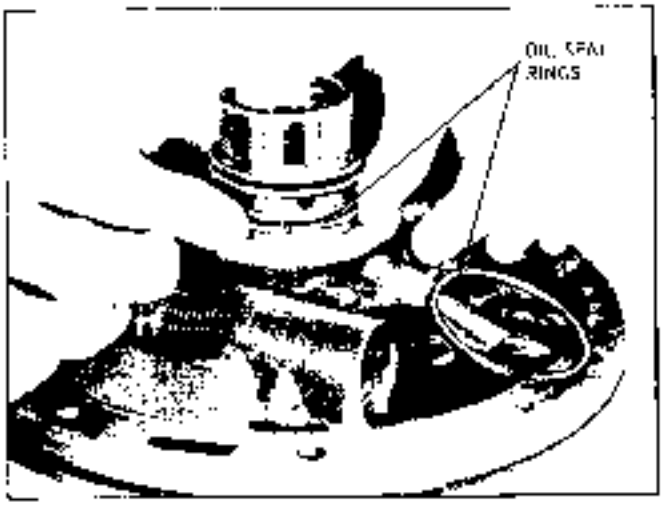


Fig. 7F-103 Installing Oil Seal Rings

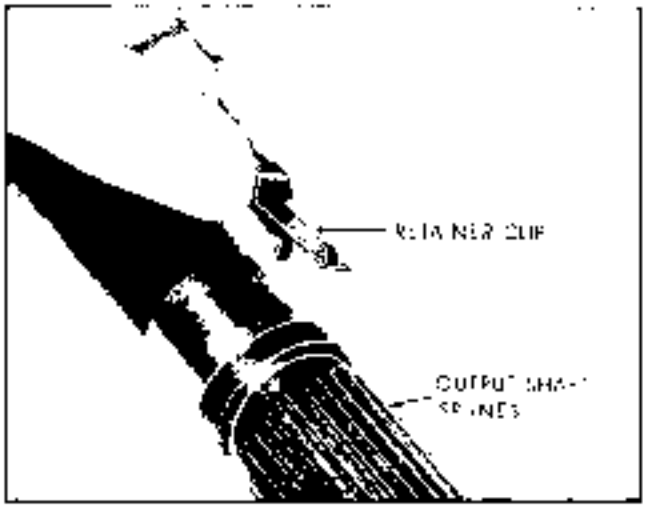


Fig. 7F-104 Installing Speedometer Drive Gear Retaining Clip

LOW BAND ADJUSTMENT

1. Tighten low band adjusting screw to 40 lb. in. torque.

2. Back off adjusting screw four turns.

3. Hold adjusting screw and tighten lock nut.

4. Install adjusting screw cap.

INSTALLATION OF SPEEDOMETER DRIVE GEAR

1. Place retainer into hole in output shaft (Fig. 7F-104).

2. Align slot in speedometer drive gear with retainer clip and slide gear into place (Fig. 7F-105).

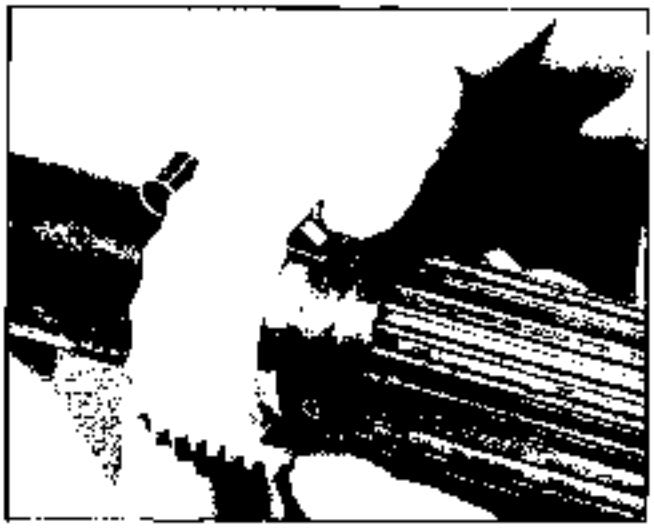


Fig. 7F-105 Installing Speedometer Drive Gear

INSTALLATION OF REAR BEARING RETAINER, GOVERNOR, VACUUM MODULATOR, SPEEDOMETER DRIVEN GEAR AND VALVE BODY

See SERVICE OPERATIONS — TRANSMISSION IN CAR (page 7F-38).

INSTALLATION OF CONVERTER

1. Install converter into transmission, engaging drive lugs of oil pump drive gear.

2. Install converter holding clamp J 21366.

TROUBLE DIAGNOSIS

SEQUENCE FOR DIAGNOSIS

1. Check and correct oil level.

2. Check and correct detent switch.

3. Check and correct vacuum line and fittings.

4. Check and correct manual linkage.

5. Road test car:

a. Install oil pressure gauge.

b. Road test using all selective ranges, noting when discrepancies in operation or oil pressure occur.

c. Attempt to isolate the unit or circuit involved in the malfunction.

d. If engine performance indicates an engine tune-up is required, this should be performed before road testing is completed or transmission correction attempted. Poor engine performance can result in poor shifting or other malfunctions.

OIL CHECK

Before diagnosis of any transmission complaint is attempted, the oil level should be checked. At the same time, it should be observed on dipstick whether oil is solid in texture or aerated. Aerated oil gives an indication of an oil leak in suction line, which can cause erratic operation and slippage. Water in oil imparts a milky, pinkish cast to the oil and can cause spewing.

A. DETERMINING SOURCE OF LEAK

Before attempting to correct an oil leak, the actual source of leak must be determined. In many cases, the source of leak can be deceiving due to "wind blow" around the engine and transmission.

The suspected area should be wiped clean of all oil before inspecting for source of leak. Red dye in

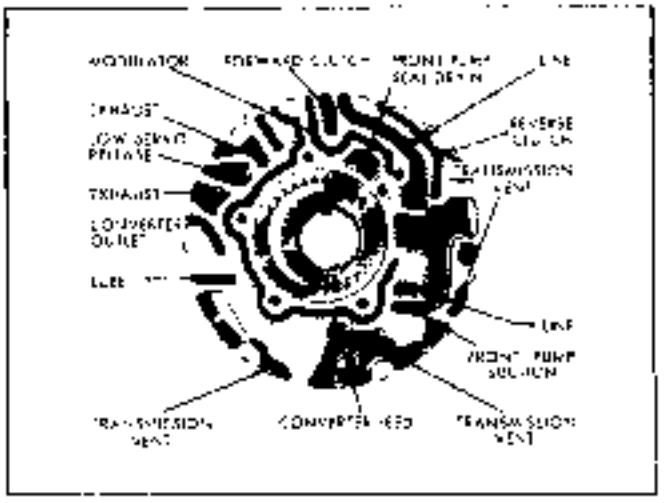


Fig. 7F-106 Pump Passages

used in the transmission oil at the assembly plant and will indicate if oil leak is from transmission.

If available, the use of a "Black Light" to locate point at which oil is leaking is helpful. Comparing oil from leak to that on engine or transmission dipstick, when viewed by black light, will determine source of leak — engine or transmission.

Oil leaks around engine and transmission are generally carried toward the rear of car by the air stream. For example, a transmission oil filler tube to case leak will sometimes appear as a leak at the rear of transmission. In determining source of leak, proceed as follows:

1. Degrease underside of transmission.

2. Road test to get unit at operating temperature.

3. Inspect for leak with engine running.

4. With engine off, check for oil leaks due to the raised oil level caused by drain back.

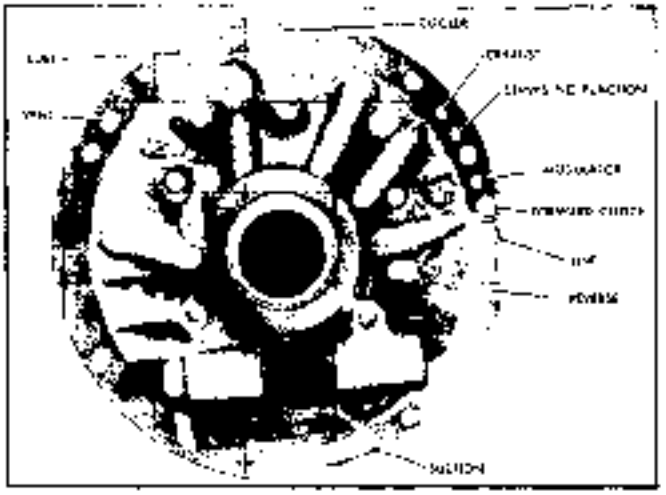


Fig. 7F-107 Pump to Case Passages

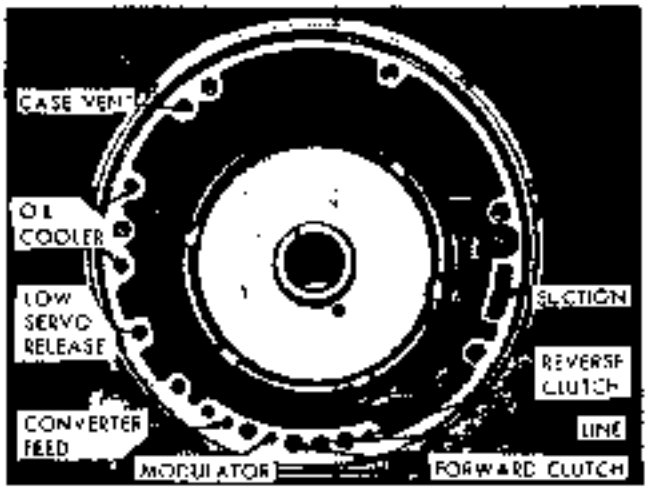


Fig. 7F-108 Case to Pump Passages

B. POSSIBLE POINTS OF OIL LEAKS

1. Transmission Oil Pan Leak

a. Attaching bolts not correctly torqued.

b. Improperly installed or damaged pan gasket.

c. Oil pan gasket mounting face not flat.

2. Rear Bearing Retainer

a. Attaching bolts not correctly torqued.

b. Rear seal assembly damaged or improperly installed.

c. Square seal, extension to case, damaged or improperly installed.

d. Porous castings.

3. Case Leak

a. Filler pipe O-ring seal damaged or missing; misposition of filler pipe bracket to engine.

b. Modulator assembly O-ring seal damaged or improperly installed.

c. Solenoid connector O-ring seal damaged or improperly installed.

d. Governor cover bolts not torqued, gasket damaged or leak between case face and gasket.

e. Speedometer gear O-ring damaged.

f. Manual shaft seal damaged or improperly installed.

g. Line pressure band release tap plug loose.

h. Vent pipe.

f. Porous castings.

4. Leak at Front of Transmission

a. Front pump seal leaks.

(1) Seal lip cut. Check converter hub, etc.

(2) Bushing moved and damaged. Oil return hole plugged.

(3) No oil return hole.

b. Front pump attaching bolts loose or damaged or missing.

c. Front pump housing O-ring damaged or cut.

d. Converter leak in weld area.

e. Porous casting (pump).

5. Oil Comes Out Vent Pipe

a. Transmission over-filled.

b. Water in oil.

c. Foreign material between pump and case or between pump cover and body.

d. Case - porous near converter bosses. Front pump cover or housing oil channels shy of stock near breather.

e. Pump to case gasket misspositioned.

NO DRIVE IN ANY SELECTOR POSITION

1. Check oil level.

2. Check oil pressure.

3. Check manual shift linkage adjustment.

4. Check internal linkage.

5. Check for defective pressure regulator valve.

6. Check for pressure regulator valve retaining ring out of groove.

7. Check for defective front pump.

ERRATIC OPERATION AND SLIPPAGE (Light to Medium Acceleration)

1. Check strainer and suction pipe assembly for leaks.

2. Check suction pipe O-ring.

3. Low oil level.

4. Check for defective modulator.

EXCESSIVE SLIP OR ENGINE FLARE ON COASTING TO A STOP WHEN CORNERING

1. Check engine idle.

2. Check for suction leak.

3. Check low band adjustment.

4. Check for proper modulator can assembly.

NO REVERSE

1. Check reverse clutch piston seals.

2. Check freedom of reverse clutch piston.

3. Check for open feed lines to reverse clutch.

HARSH NEUTRAL TO DRIVE SHIFT AT IDLE

1. Check engine idle speed.

2. Check vacuum line connections.

3. Check for loose or broken engine mounts.

NO UPSHIFT

1. Check freedom of shift valve and detent valve.

2. Check for plugged orifice in detent valve.

3. Check for open detent solenoid and loose attaching bolts.

4. Check for plug in front pump cover assembly.

5. Check clutch piston seals.

6. Check for broken clutch piston oil seal rings.

7. Check clutch lines in front pump cover and stator shaft assembly.

8. Check governor for failed pinion or stuck valve.

LONG SHIFT TIME—SHIFT DOES NOT HAVE POSITIVE ENGAGEMENT

1. Check engine idle.

2. Check for suction leak.

3. Check low band adjustment.

4. Check for proper modulator can assembly.

5. Check for defective modulator can—no bellows load.

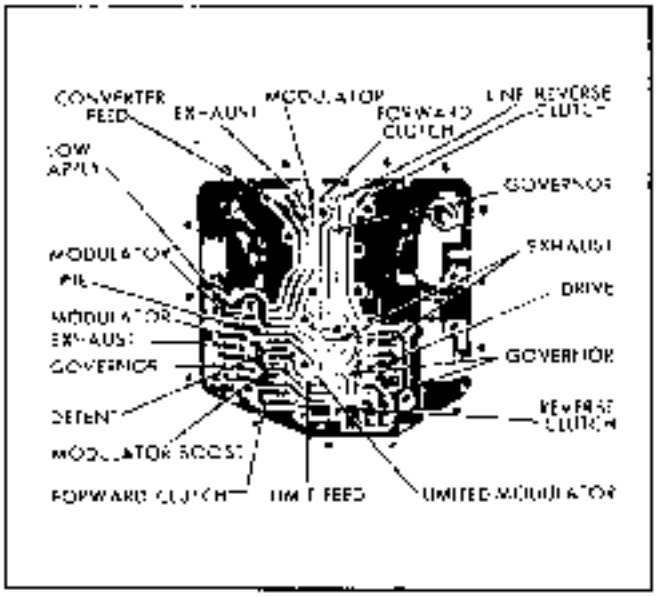


Fig. 7F-109 Case Valve Body Passages

6. Check for leak at inner hole of low servo piston assembly.

ENGINE FLARES ON UPSHIFTS

Refer to Drive Clutch Plates Burned.

LATE UPSHIFT

1. Check vacuum line connections.

2. Stuck detent valve.*

3. Open detent solenoid or loose solenoid attaching bolts.*

4. Sticky shift valve.

5. Check governor assembly.

*Will cause transmission to make only wide open throttle upshift.

UPSHIFTS—DOWNSHIFTS ERRATIC

1. Check for scored governor bore.

NO WIDE OPEN THROTTLE DOWNSHIFT

1. Check detent control switch operation and continuity in wiring (switch is self-adjusting).

2. Check for stuck detent valve and shift valves.

3. Check orifice in detent valve.

4. Check solenoid on valve body.

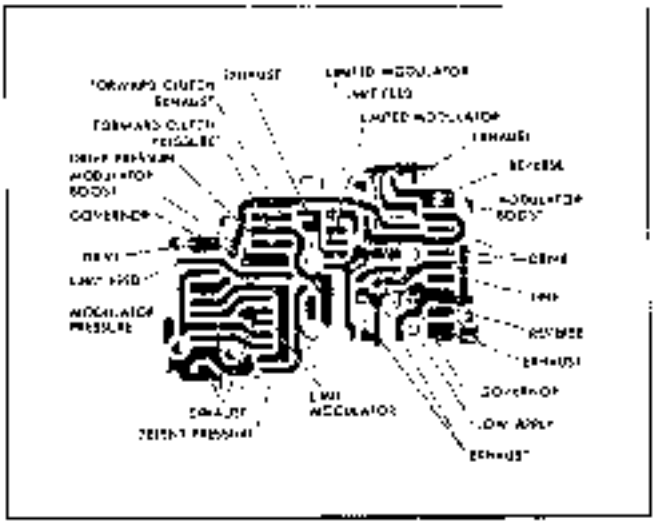


Fig. 7F-110 Valve Body Passages

ENGINE FLARES ON WIDE OPEN THROTTLE DOWNSHIFT

1. Check low band adjustment.

2. Check for restriction in vacuum line or fitting to transmission.

3. Check for correct valve body plate.

DELAYED ENGAGEMENT OF MANUAL LOW

1. Check freedom of 2-piece modulator valve.

DRIVE CLUTCH PLATES BURNED
(Usually low band and reverse clutch good)

1. Check for leakage in clutch circuit.

2. Check ball in forward clutch drum.

3. Check clutch lines in front pump cover and stator shaft assembly.

4. Plug in pump cover assembly missing.

5. Check clutch piston seals.

6. Check clutch feed oil rings.

7. Check for proper number of clutch plates and correct piston.

DRIVE CLUTCH PLATES, LOW BAND AND REVERSE CLUTCH PLATES—All BURNED

1. Check for following causes of low maximum line pressure:

a. Modulator can load check.

b. Check for proper modulator can.

c. Check modulator valve and bore in case for freedom of movement.

d. Check freedom of boost valve in front pump regulator.

2. Valve body bolts loose. Torque specification is 10 lb. ft.

3. Low oil level.

PRESSURE CHECKS

Pressure checks are a useful part of trouble diagnosis. The pressure tap for checking mainline pressure is located above the oil pan rail on the right side of the transmission and to the rear of the low servo.

Tests can be made without driving the vehicle by simply raising rear wheels 3-5 inches from floor on jack stands. With pressure gauge installed, perform following preliminary steps:

1. Establish pressure gauge indicator needle rest position at zero pressure.

2. Thoroughly warm up transmission.

3. Check transmission oil level.

4. Make sure vacuum line connections are tight.

5. Check linkage adjustment.

Mainline pressure will vary from one transmission to another but following statements apply to general.

Line pressure should increase as engine manifold vacuum decreases, at a constant speed.

Line pressure should decrease as car speed increases, at a constant engine manifold vacuum (for example, about 13 psi between 40-60 mph).

Reverse pressure should be about 65 psi at idle to over 200 psi at stall (wide open throttle with brakes on).

NOTE: Do not operate at wide open throttle with brakes on longer than it is necessary to obtain a gauge reading.

MAXIMUM LINE PRESSURE

Maximum line pressure checks are to be made in garage bay with vacuum modulator line disconnected and plugged and with engine speed set at 1000 rpm. See figure 7F-111 for pressures.

MINIMUM LINE PRESSURE

Minimum line pressure checks are to be made while road testing the car with the vacuum modulator line connected. Checks are to be made as follows:

1. Park, Neutral and Drive - 56 psi. Drive - coast at 20-40 mph with foot off throttle. Neutral and Park - check at 1000 rpm.

2. Low - 82 psi; coast at 20-40 mph with foot off throttle.

3. Reverse - 84 psi; coast with foot off throttle.

Altitude	Barometric Pressure	MODEL			
		LA, LB, LF, LG	LD, LH	MA, MB	MC
		D & L ± 4 psi	D & L ± 4 psi	D & L ± 4 psi	D & L ± 4 psi
Sea Level	29.92	155	147	165	153
2,000 ft.	27.82	147	140	157	155
5,000 ft.	24.89	134	128	144	144
Reverse Line Pressure should exceed Drive Pressure by at least 80 psi.					

Fig. 7F-111 Maximum Line Pressure

TORQUE SPECIFICATIONS

Location	Torque Lb. Ft.
Case to Cylinder Block Bolts	40
Flywheel to Converter Bolts	35
Converter Cover Pan to Case Screws	10
Case Cooler Line Fittings	30
Low Band Adjusting Screw Lock Nut	25
Pump Body to Pump Cover Bolts	20
Valve Body to Case Bolts	10
Solenoid to Valve Body Bolts	10
Vacuum Modulator Clamp Bolt	10
Pump Assembly to Case Bolts	20
Rear Bearing Retainer to Case Bolts	55
Oil Pan to Case Bolts	12
Speedometer Sleeve Clamp Bolt	6
Governor Cover Bolts	10
Park Lock Bracket Bolts	10

SPECIAL TOOLS

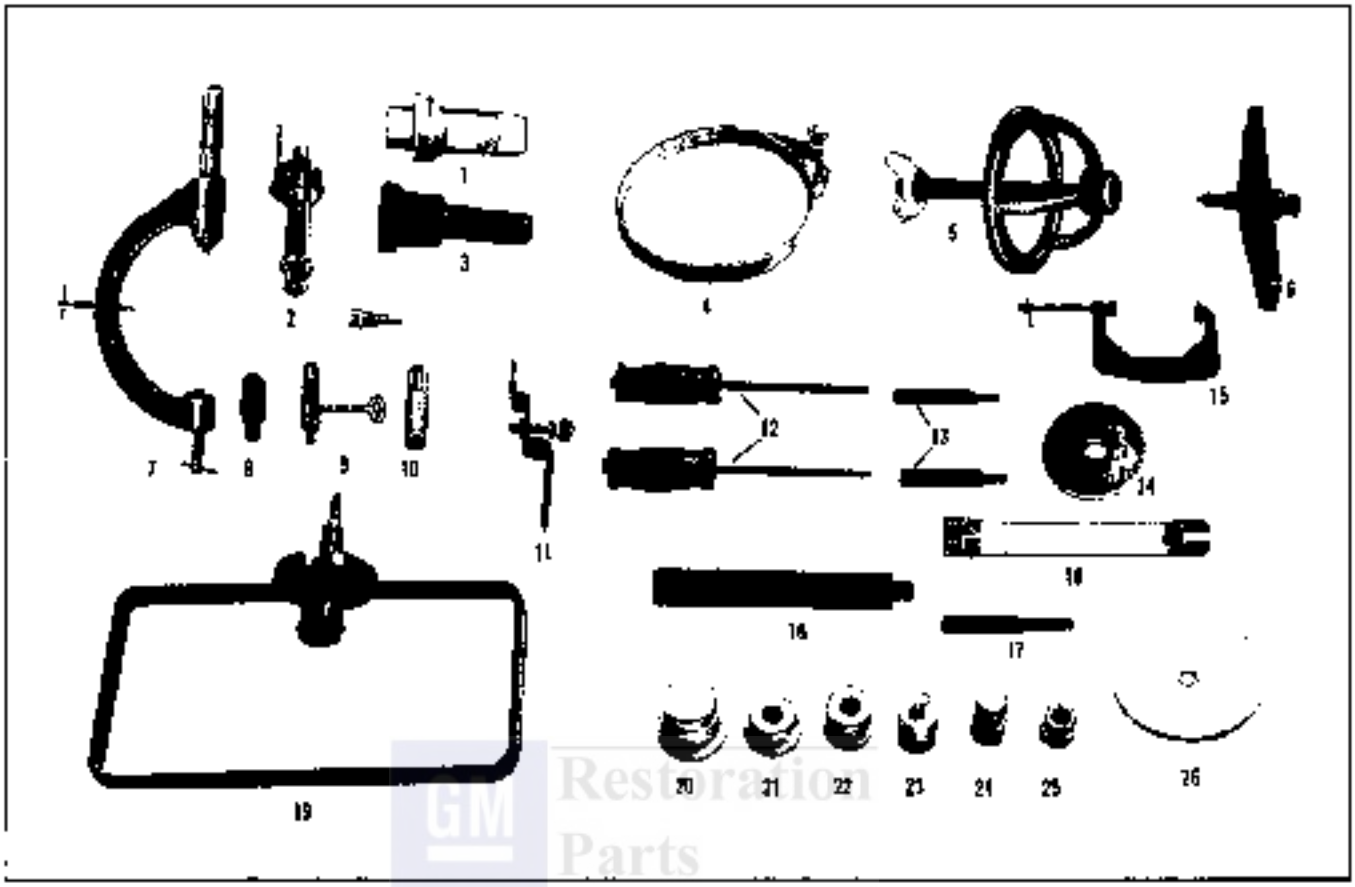


Fig. 7F-12 Special Tools

1. J 21359 Oil Seal Installer
2. J 21371 Converter End Play Fixture
3. J 5154 Oil Seal Installer
4. J 21366 Pump Body and Cover Alignment Band
5. J 9542 Clutch Spring Compressor
6. J 8433 Puller (Use with J 21427)
7. J 8763-01 Transmission Holding Fixture
8. J 9534 Planet Carrier Bushing Remover
9. J 21361 Pump Check Valve Seat Remover
10. J 21358 Check Valve Seat Installer
11. J 21366 Converter Holding Clamp
12. J 6125 Slide Hammer
13. J 6125-2 Slide Hammer Adapter
14. J 9542-4 Forward Clutch Spring Compressor Pilot
15. J 22269 Low Servo Remover and Installer
16. J 8092 Handle
17. J 21510-1 Reverse Clutch Spring Compressor Screw Assy
18. J 22751 O I Cooler Pipe Wrench
19. J 21369 Converter Leak Test Fixture
20. J 21424-5 Forward Clutch Drum Bushing Remover and Installer
21. J 21424-2 Case Bushing Installer
22. J 21424-9 Rear Bearing Retainer Bushing Remover and Installer
23. J 21424-3 Planet Carrier Bushing Installer
24. J 21424-7 Stator Shaft Bushing Remover and Installer
25. J 21424-4 Low Sun Gear and Flange Assembly Bushing Remover and Installer
26. J 21420-2 Reverse Clutch Spring Compressor Pilot

FUEL TANK AND EXHAUST SYSTEM

CONTENTS OF THIS SECTION

FUEL TANK

SERVICE AND REPAIRS

FUEL TANK DRAIN

1. Insert a length of hose (refer to Fig. 8-1 for details) into gas tank, pipe nipple end first, until weighted end of hose rests on bottom of tank.

2. With chuck of air hose inserted into hose slit, a short blast of air will cause gas to flow.

NOTE: The tank can be drained rapidly by raising the rear several feet off the floor when performing the above operation.

FUEL TANK - (STANDARD MODELS) PONTIAC AND TEMPEST (Figs. 8-2 and 8-3)

Removal

1. Drain tank.

2. Disconnect fuel hose at gauge unit.

3. Remove screw retaining ground (black) wire.

4. Remove tan wire from clip on Pontiac and disconnect tan wire from gauge on Tempest.

5. Disconnect vent tube hose from filler neck and rear vent hose on Tempest models.

6. Disconnect support straps and partially lower tank.

7. Disconnect tan wire from fuel gauge tank unit on Pontiac.

8. Complete tank removal.

Installation

1. Replace tank by reversing above steps.

2. Tighten ground screw to 2 lb. ft. torque. Tighten fuel tank retainer strap nuts to 7 lb. ft. torque.

FUEL TANK—REMOVE AND REPLACE (STATION WAGON) PONTIAC AND TEMPEST (Figs. 8-4 and 8-5)

Removal

1. Drain tank and remove left rear wheel.

2. Remove screws retaining baffle under left rear wheel well.

3. Disconnect fuel hose at gauge unit.

4. Disconnect (tan) tank lead (tan wire).

5. Remove screw retaining ground (black) wire.

6. Remove nut holding retainer strap to hook bolt and remove tank, Fig. 8-4 or 8-5.

Installation

1. To replace, reverse removal procedure.

2. Tighten retaining strap nut 7 lb. ft. torque. Tighten ground wire screw 2 lb. ft. torque. Tighten baffle to wheel well screws 2 lb. ft. torque.

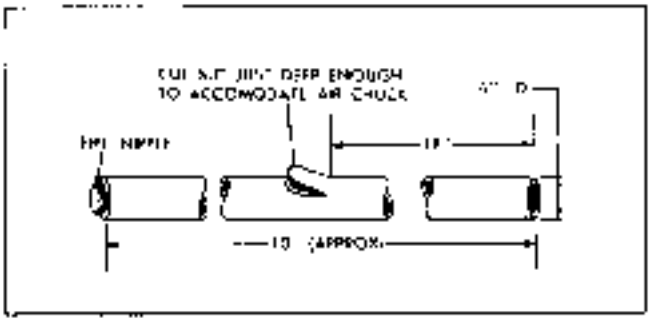


Fig. 8-1 Fuel Tank Drain Hose

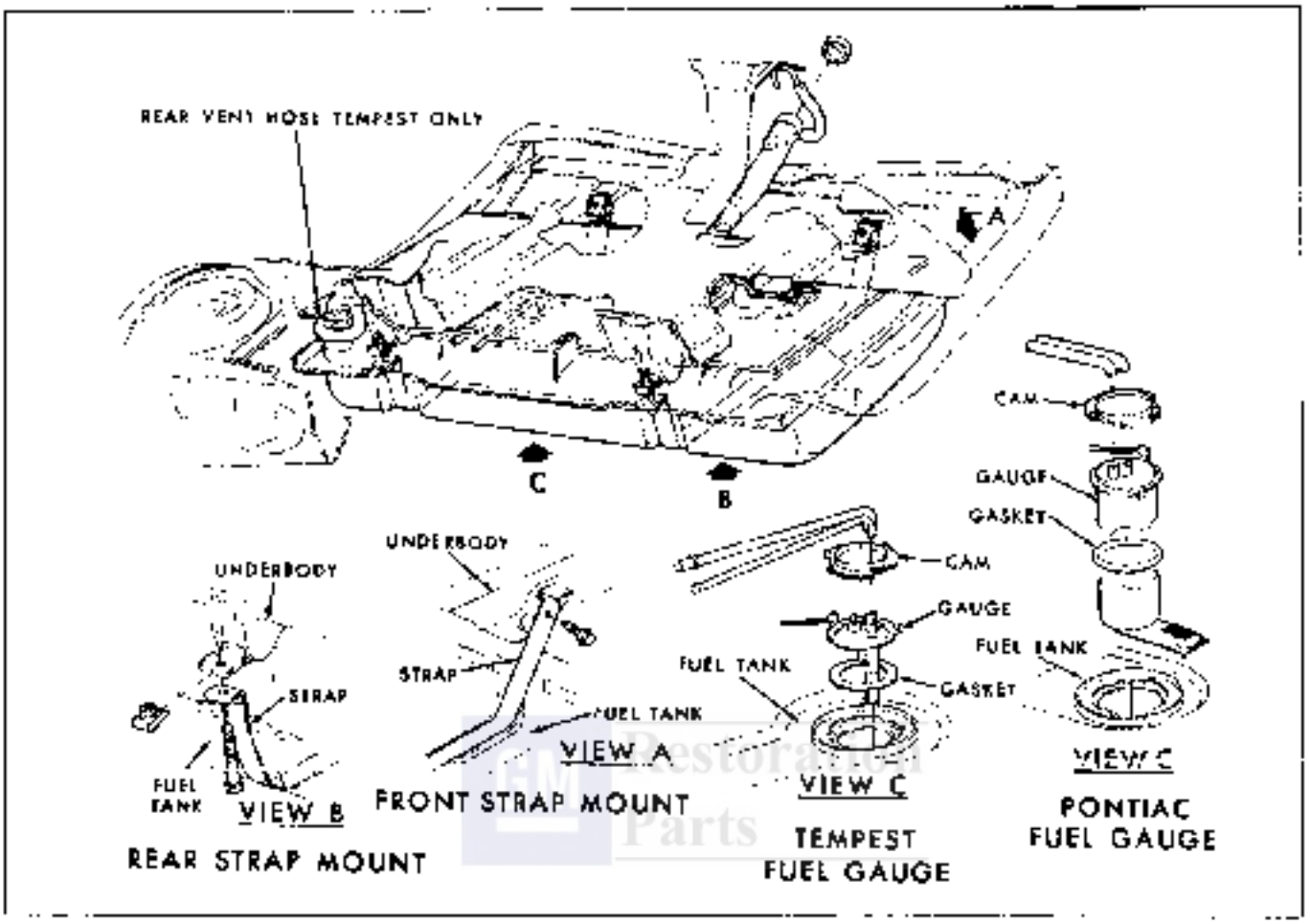


Fig. 8-2 Installation of Fuel Tank Tempest and Pontiac

FUEL TANK—FIREBIRD (Fig. 8-6)

Removal

1 Drain tank.

2. Remove license plate and loosen the two clamps connecting the filler neck hose to fuel tank.

3. Disconnect fuel hose at gauge unit.

4. Remove screw retaining ground (black) wire.

5. Disconnect support straps and partially lower tank.

6. Disconnect tan wire from fuel gauge tank unit.

7 Complete tank removal

Installation

1. Replace tank by reversing above steps.

2. Tighten ground screw to 2 lb. ft. torque. Tighten fuel tank retainer strap nuts to 7 lb. ft. torque.

FUEL GAUGE TANK UNIT—(ALL EXCEPT STATION WAGON) (Figs. 8-7 and 8-8)

Replacement

NOTE: Before removing tank unit be sure it is actually inoperative (see fuel gauge checking procedure).

1. Remove tank as outlined above.

2. Clean away any dirt that has collected around tank unit and tank unit terminal so it will not enter tank when unit is removed

3. Remove tank sending unit by using tool J 22554, Pontiac models and J 21518 Tempest and Firebird models.

4. Replace by reversing the above procedure.

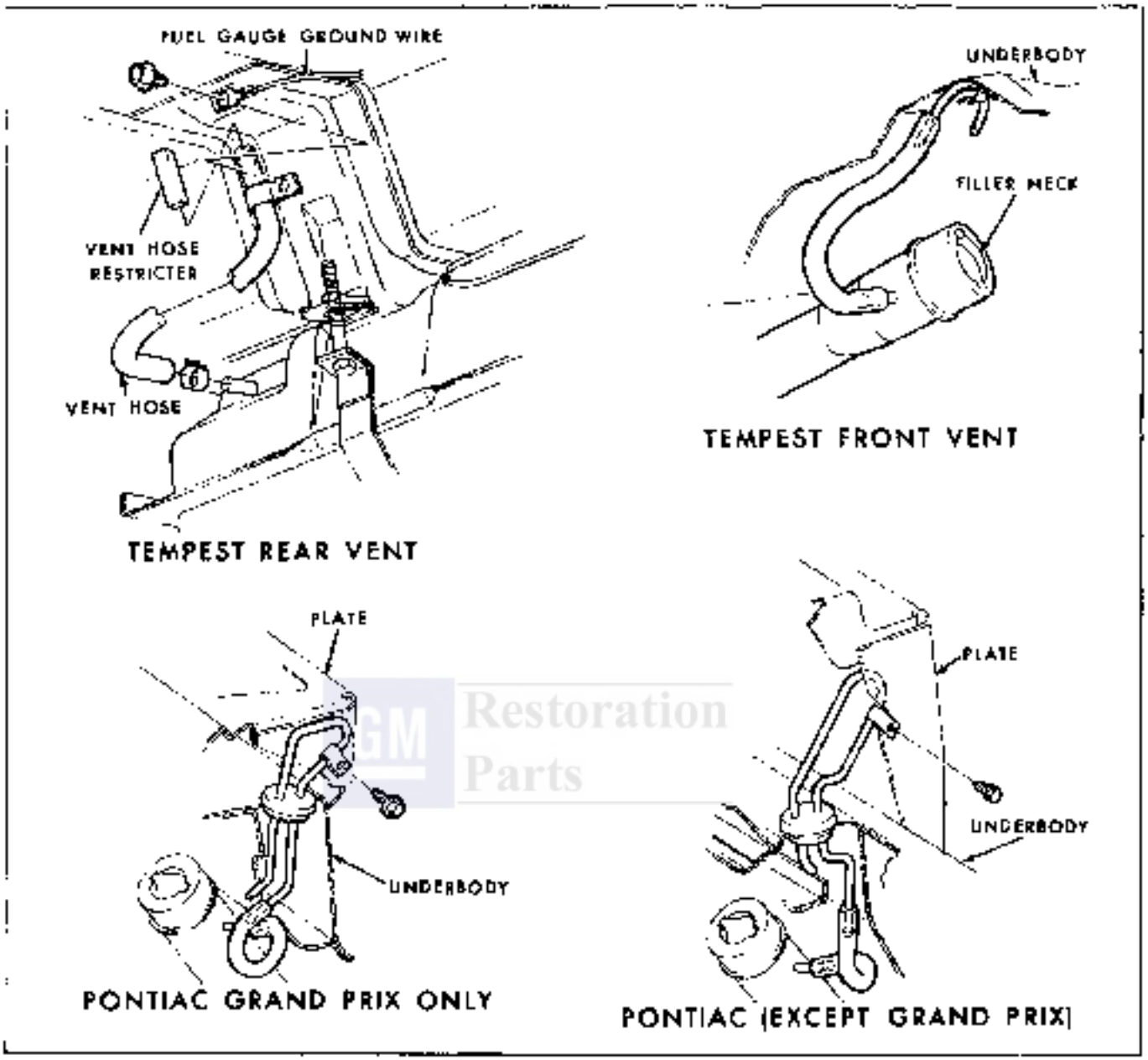


Fig. 8-3 Vent Hose Routing Tempest and Pontiac

FUEL GAUGE TANK UNIT—PONTIAC AND TEMPEST (STATION WAGONS) (Fig. 8-9)

Replacement

NOTE: Before removing tank unit be sure it is actually inoperative (see fuel gauge checking procedure).

1. Remove fuel filler cap and drain fuel tank as necessary to insure fuel level is below point where unit is installed in tank.

2. Remove left rear wheel from automobile.

3. Remove fuel tank front splash shield.

4 Disconnect ground connection and waterproof tank gauge wire connector.

5. Clean away any dirt that has collected around tank unit and tank unit terminal so it will not enter tank when unit is removed.

6. Remove tank sending unit by using tool J 21519.

7. Replace by reversing the above procedures, making sure a new tank sending unit gasket is installed.

NOTE: Before the new unit is installed in the tank, the float arm should be checked for freedom of movement by raising it to various positions and

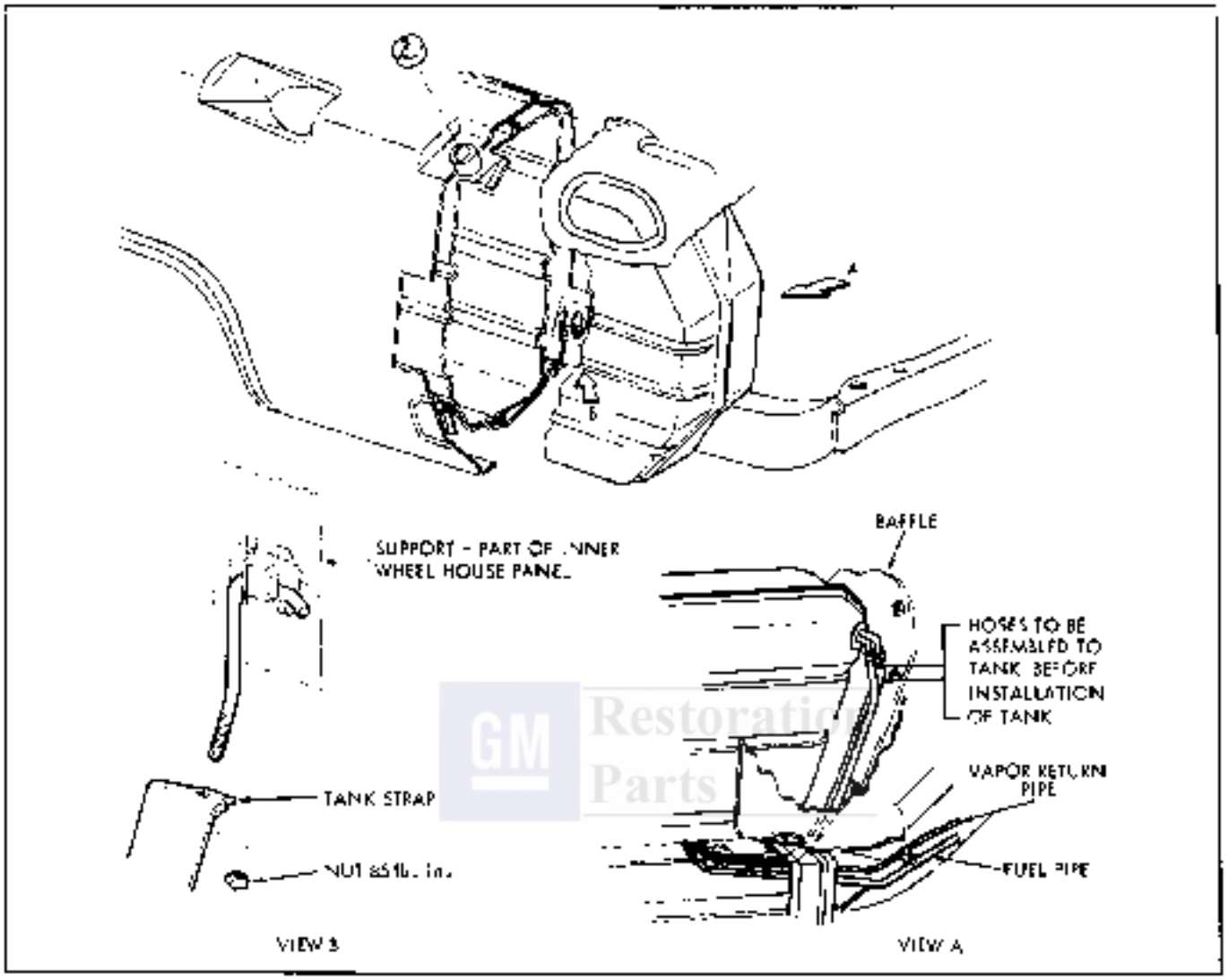


Fig. 8-4 Installation of Fuel Tank Pontiac Station Wagon

seeing if it will always fall to the "empty" position.

FUEL LINES

The fuel pipe from the tank to the engine runs on the left side of the frame on Tempest 8-cylinders and on the right side of the frame on Firebird and Tempest 6-cylinder cars. The Pontiac fuel line runs on the left side of the frame. The gasoline line has two hose connections, one connecting the fuel pump inlet line to the front gasoline line and one connecting the rear gasoline line to the tank gauge unit.

All hoses should be secured to the gasoline lines by wire-type or flat spring type hose clamps.

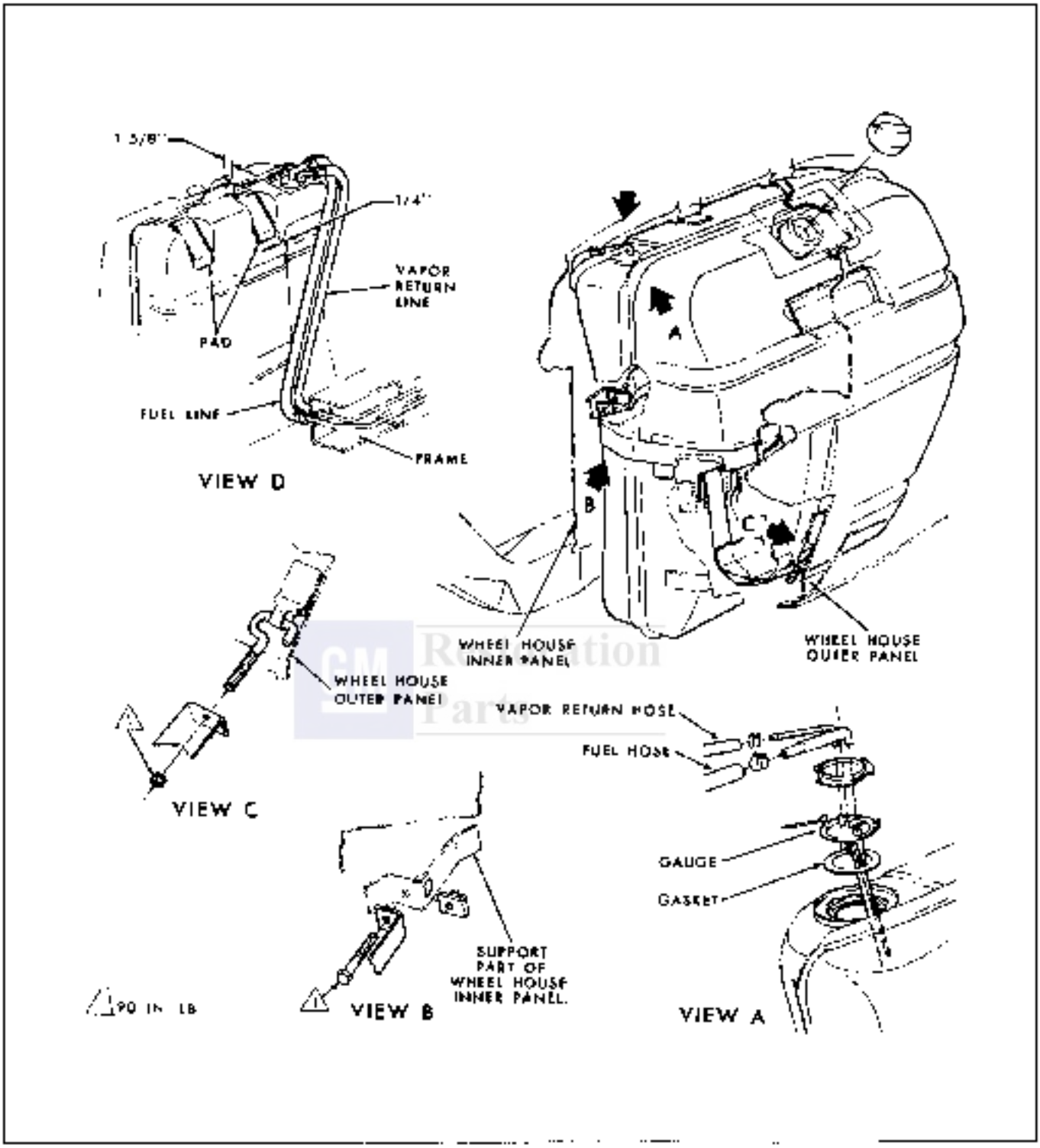


Fig. 8-5 Installation of Fuel Tank Tempest Station Wagon

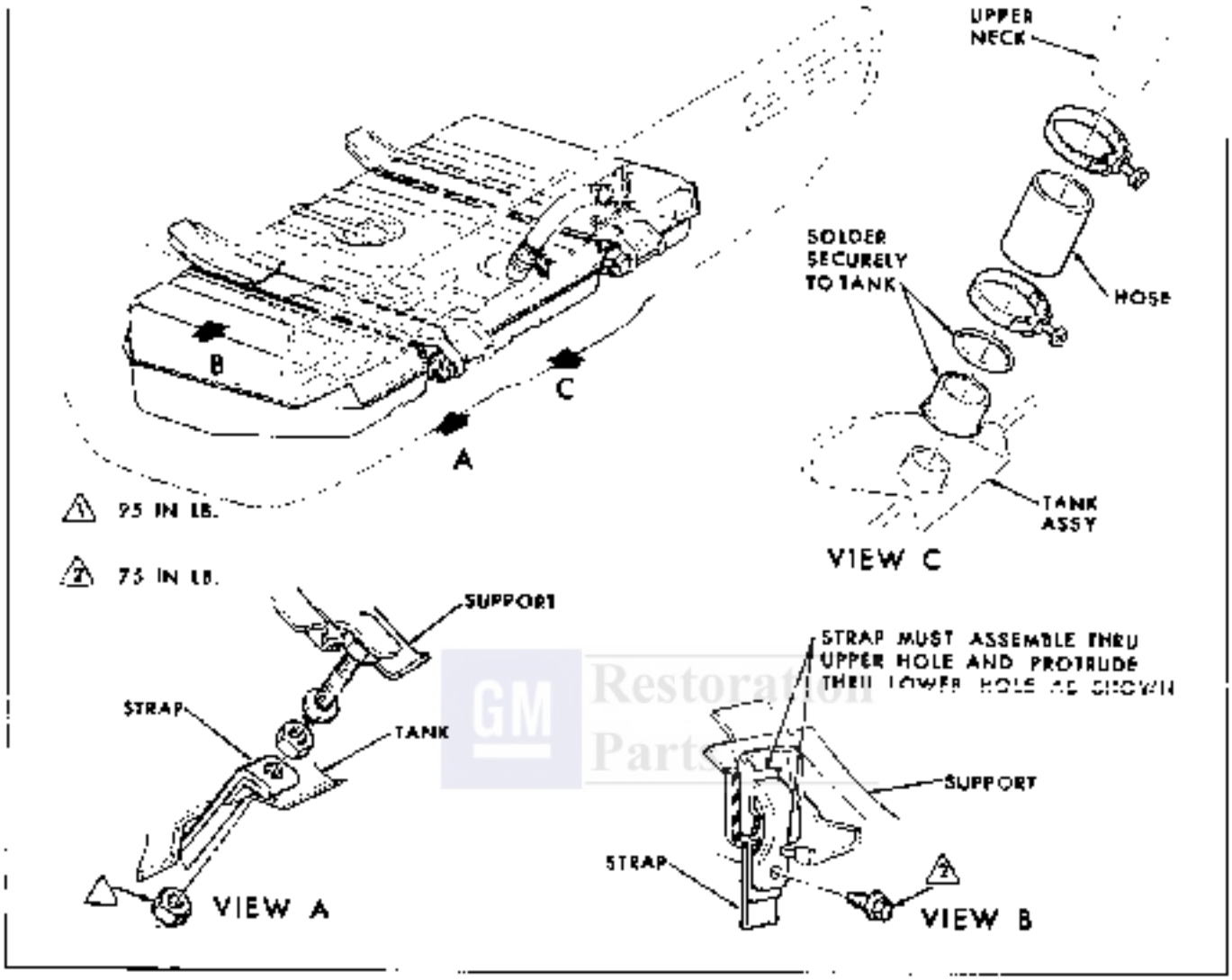


Fig. 8-6 Firebird Fuel Tank Installation

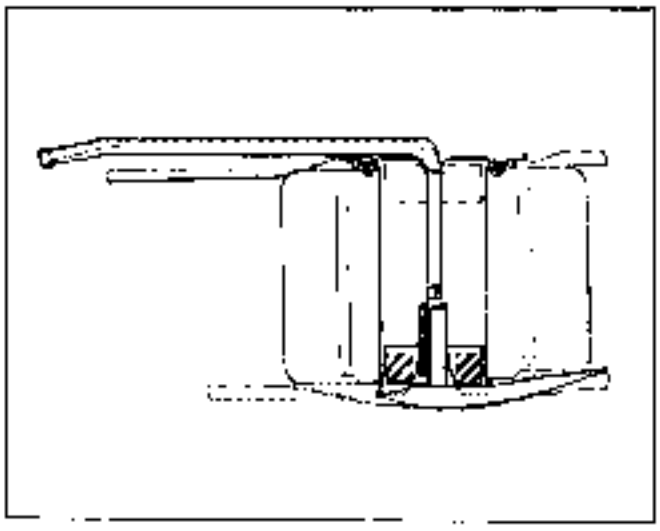


Fig. 8-7 Pontiac Fuel Gauge Tank Unit - All Except Station Wagon

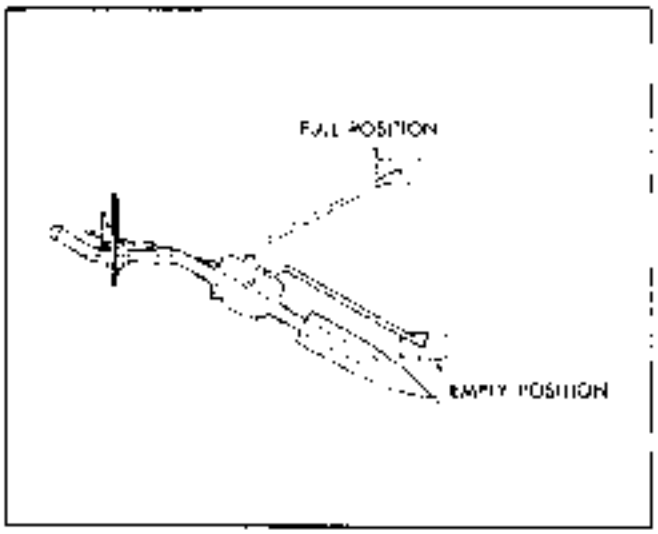


Fig. 8-8 Fuel Gauge Tank Unit—Tempest (Except Station Wagon)

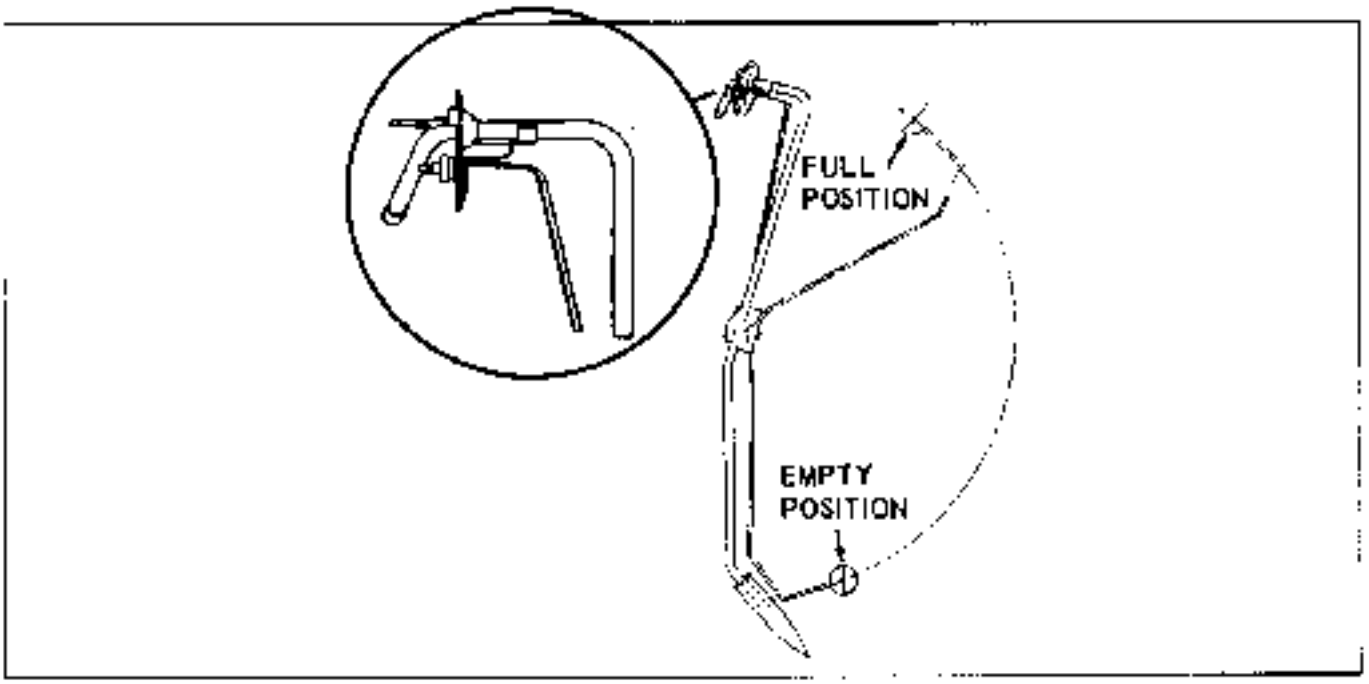


Fig. 8-9 Fuel Gauge Tank Unit—Station Wagon—Typical

TEMPEST AND FIREBIRD EXHAUST SYSTEM

SERVICE PROCEDURES
L-6 ENGINE

SIX CYLINDER STANDARD ENGINE
(Figs. 8-10 and 8-11)

Exhaust Pipe—Remove and Replace

1. Remove two bolts from exhaust pipe flange at manifold.

2. Loosen exhaust pipe to muffler U-bolt clamp on Tempest or intermediate pipe on Firebirds.

3. Remove exhaust pipe from car.

4. Install exhaust pipe by reversing above procedure. Tighten exhaust pipe to manifold bolts 35 lb. ft. torque. Tighten exhaust pipe to muffler U-bolt 18 lb. ft. torque.

NOTE: Coat inside diameter of front muffler opening with sealer before installing exhaust pipe.

Muffler—Remove and Replace

1. Loosen both tailpipe support clamps.

2. Slide tailpipe off rear of muffler on Tempest models only.

3. Loosen U-bolt clamp at front of muffler.

4. Slide muffler off exhaust pipe.

5. Replace muffler by reversing above procedure. Tighten exhaust pipe to muffler front U-bolt clamp 18 lb. ft. torque. Tighten tailpipe front support clamp (behind muffler) 18 lb. ft. torque. Tighten tailpipe rear support clamp 8 lb. ft. torque.

NOTE: Coat inside diameter of front muffler opening and tailpipe flange with sealer before installing muffler.

Tailpipe—Remove and Replace

1. Loosen both tailpipe support clamps. On Firebird models tailpipe must be cut off of muffler. It is a welded connection.

2. Slide tailpipe off rear of muffler and remove.

3. To replace tailpipe, reverse above procedure. Tighten tailpipe front support clamp (behind muffler) 18 lb. ft. torque. Tighten tailpipe rear support clamp 8 lb. ft. torque.

NOTE: Coat inside diameter of tailpipe flange with sealer before installing.

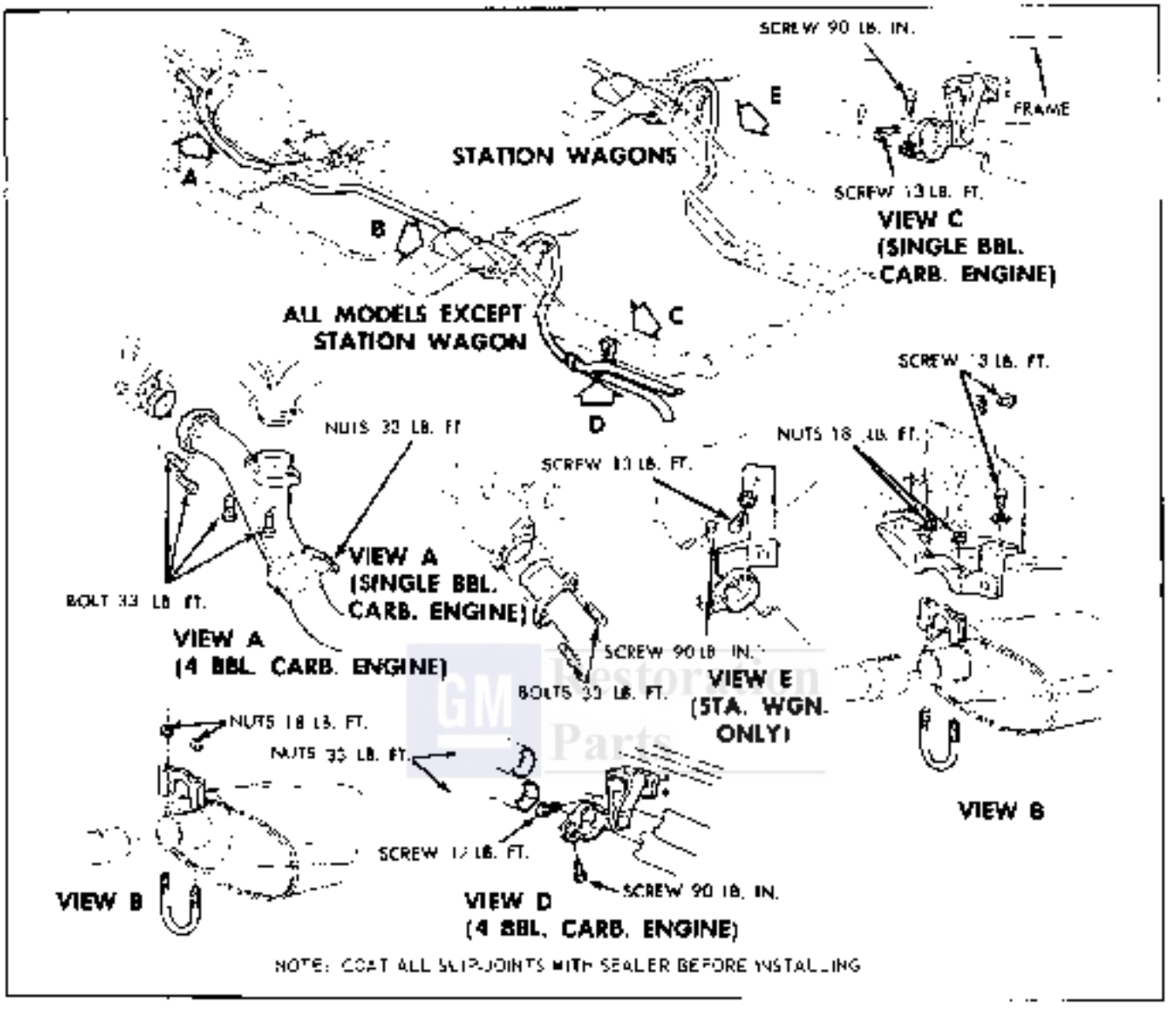


Fig. 8-10 Tempest Six Cylinder Exhaust System

SIX CYLINDER HIGH PERFORMANCE ENGINE
(Figs. 8-10 and 8-11)

Exhaust Pipe Remove and Replace

1. Loosen front (behind muffler) and rear tailpipe support clamps.

2. Loosen exhaust pipe to muffler U-bolt clamp.

3. Disconnect muffler from exhaust pipe by moving muffler and tailpipe assembly rearwards.

4. Loosen U-bolt clamp connecting exhaust pipe to manifold Y pipe and remove exhaust pipe.

5. Remove four bolts holding Y pipe to exhaust manifold and remove Y pipe.

6. To install, reverse above procedure. Tighten Y pipe to manifold bolts 33 lb. ft. torque. Tighten Y pipe to exhaust pipe U-bolt clamp 33 lb. ft. torque. Tighten front muffler U-bolt clamp 18 lb. ft. torque. Tighten tailpipe front U-bolt clamp (behind muffler) 13 lb. ft. torque. Tighten tailpipe to resonator U-bolt clamp 33 lb. ft. torque.

NOTE: Coat inside diameter of front muffler opening with sealer before installing exhaust pipe.

Muffler--Remove and Replace

1. Loosen front (behind muffler) and rear tailpipe support U-bolt clamps.

2. Disconnect tailpipe from muffler.

3. Loosen exhaust pipe to muffler U-bolt and remove muffler.

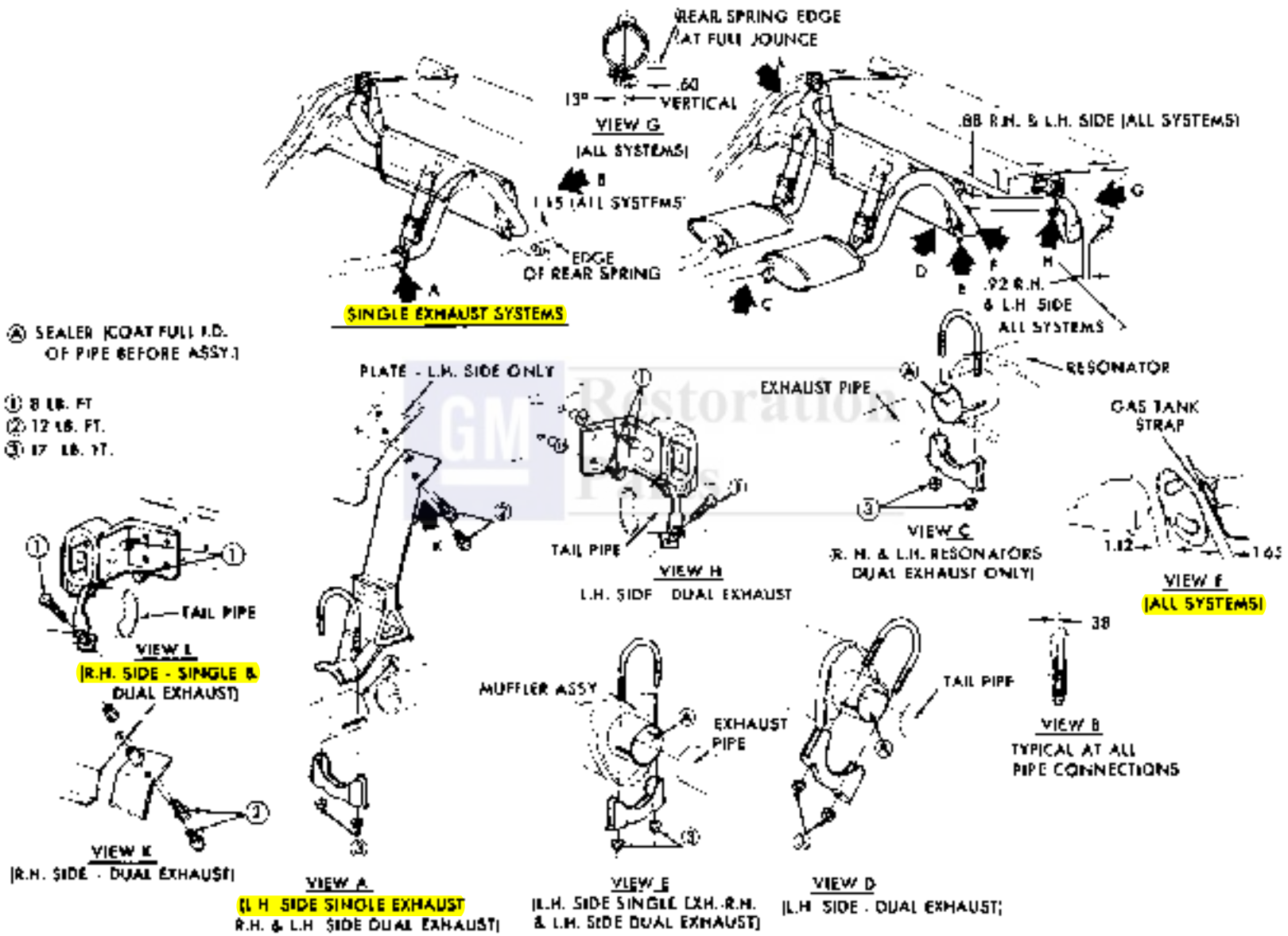


Fig. 8-11 Fiberglass Muffler and Tailpipe Installation

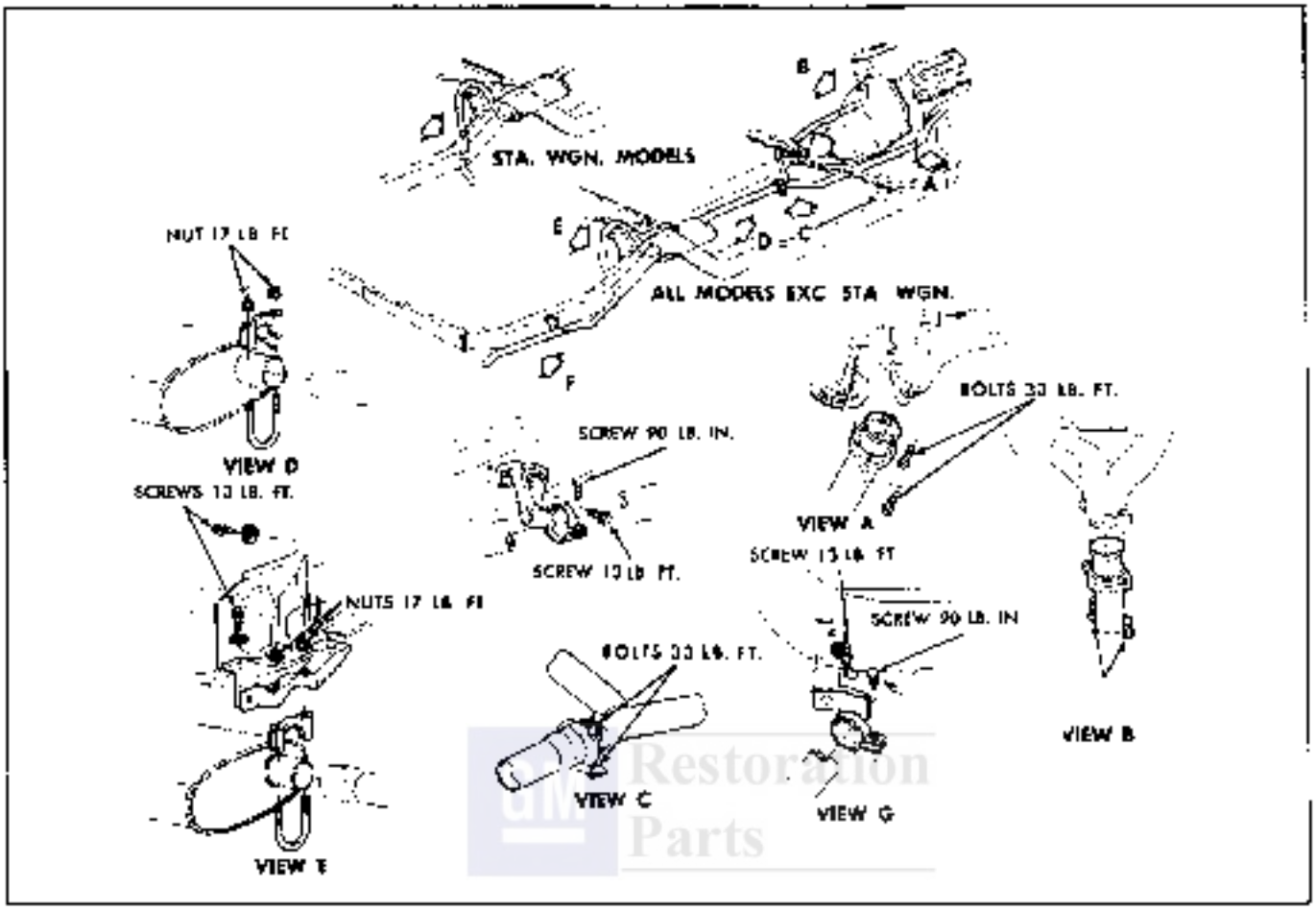


Fig. 8-12 Tempest Single Exhaust System

4. To install, reverse above procedure. Tighten front muffler U-bolt clamp 18 lb. ft. torque. Tighten tailpipe front U-bolt clamp (behind muffler) 18 lb. ft. torque. Tighten tailpipe to resonator U-bolt clamp 33 lb. ft. torque.

NOTE: Coat inside diameter of front muffler opening and tailpipe flange with sealer before installing muffler.

Tailpipe--Remove and Replace

1. Loosen front (behind muffler) tailpipe support clamp, or, Firebird models tailpipe must be cut off of muffler, it is a welded connection.

2. Remove rear tailpipe support U-bolt.

3. Remove tailpipe and, if necessary, disconnect resonator from tailpipe.

4. To install, reverse above procedure. Tighten tailpipe front bracket clamp (behind muffler) 18 lb. ft. torque. Tighten tailpipe to resonator U-bolt clamp 33 lb. ft. torque.

NOTE: Coat inside diameter of tailpipe flange with sealer before installing.

V-8 ENGINE

SINGLE EXHAUST SYSTEM (Figs. 8-12 and 8-13)

EXHAUST MANIFOLD CROSSOVER PIPE— REMOVE AND REPLACE

1. Disconnect crossover pipe at right and left manifold

2. Loosen crossover pipe to exhaust pipe U-bolt clamp.

3. Remove crossover pipe

4. Install crossover pipe by reversing above procedure. Tighten crossover pipe to manifold bolts 33 lb. ft. torque. Tighten exhaust pipe to crossover pipe U-bolt clamp 33 lb. ft. torque.

NOTE: Coat outside diameter of crossover to exhaust pipe flange with sealer before installing.

Exhaust Pipe--Remove and Replace

1. Loosen crossover to exhaust pipe U-bolt clamp.

2. Disconnect crossover pipe from exhaust pipe by

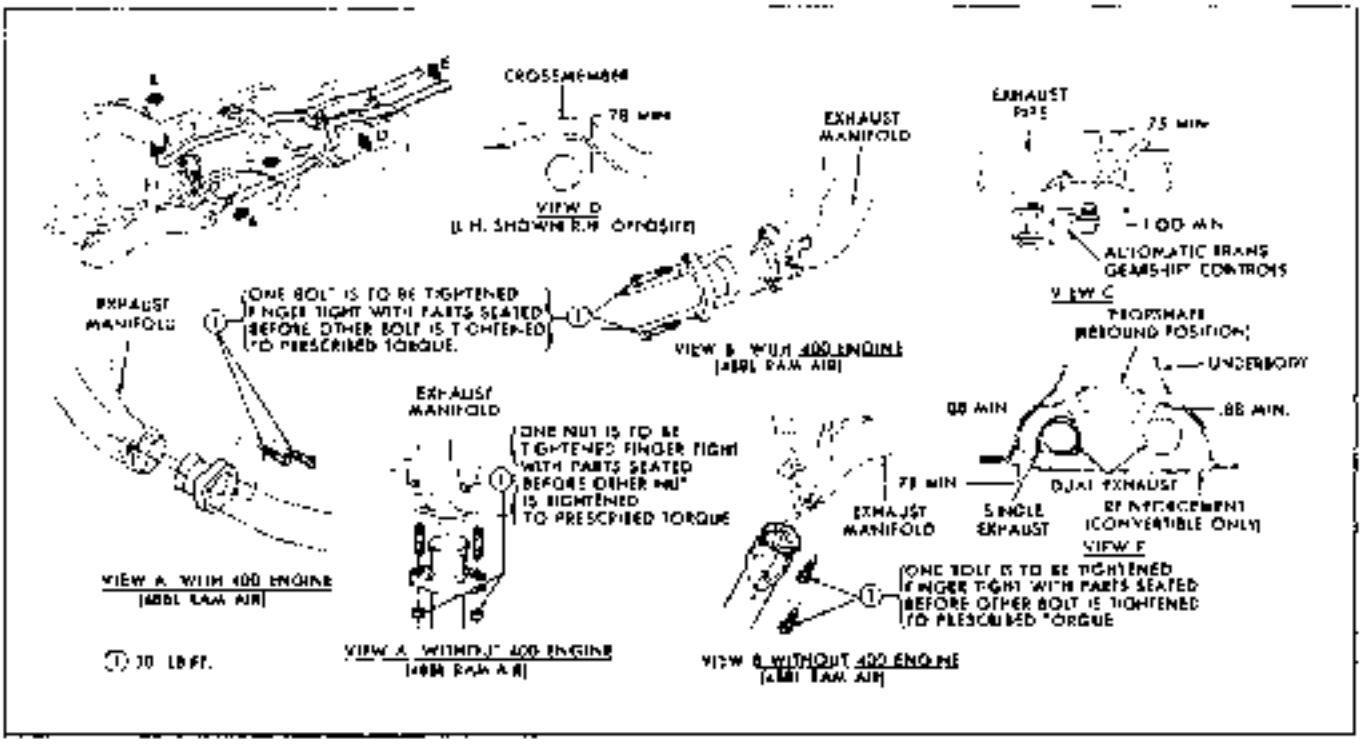


Fig. 8-13 Firebird Single or Dual Exhaust System

moving exhaust pipe and assembly rearward.

3. Loosen front U-bolt clamp on muffler and remove exhaust pipe.

4. Loosen tailpipe to muffler support U-bolt clamp and remove muffler.

5. To install, reverse removal procedure. Tighten tailpipe to muffler support U-bolt clamp 18 lb. ft. torque. Tighten front U-bolt clamp on muffler 18 lb. ft. torque. Tighten crossover to exhaust pipe U bolt 33 lb. ft. torque.

NOTE: Coat inside diameter of front muffler opening, outside diameter of crossover to exhaust pipe flange, and inside diameter of tailpipe to muffler flange with sealer before installing.

Tailpipe - Remove and Replace

1. Loosen front (behind muffler) and rear tailpipe support clamps, on Firebird models tailpipe must be cut off of muffler, it is a welded connection.

2. Slide tailpipe off rear of muffler and remove.

3. To replace tailpipe, reverse above procedure. Tighten tailpipe front support clamp (behind muffler) 18 lb. ft. torque. Tighten tailpipe rear support clamp 8 lb. ft. torque.

NOTE: Coat inside diameter of tailpipe flange with sealer before installing.

DUAL EXHAUST SYSTEM—(Figs. 8-13 and 8-14)

Exhaust Pipe—Remove and Replace

1. Loosen front (behind muffler) and rear (at resonator) tailpipe support U-bolt clamps.

2. Separate tailpipe from muffler.

3. Loosen front muffler U bolt clamp and remove muffler.

4. Disconnect exhaust pipe from manifold and remove.

5. To install exhaust pipe, reverse removal procedure. Tighten exhaust pipe to manifold bolts 33 lb. ft. torque. Tighten front muffler U-bolt clamp 18 lb. ft. torque. Tighten front (behind muffler) tailpipe support U-bolt clamp 18 lb. ft. torque. Tighten rear (at resonator) tailpipe support U-bolt clamp 33 lb. ft. torque.

NOTE: Coat inside diameter of front muffler opening and tailpipe flange with sealer before installing muffler.

Muffler—Remove and Replace

1. Loosen front (behind muffler) and rear (at resonator) tailpipe support U-bolt clamps.

2. Separate tailpipe from muffler.

3. Loosen front muffler U-bolt clamp and remove muffler.

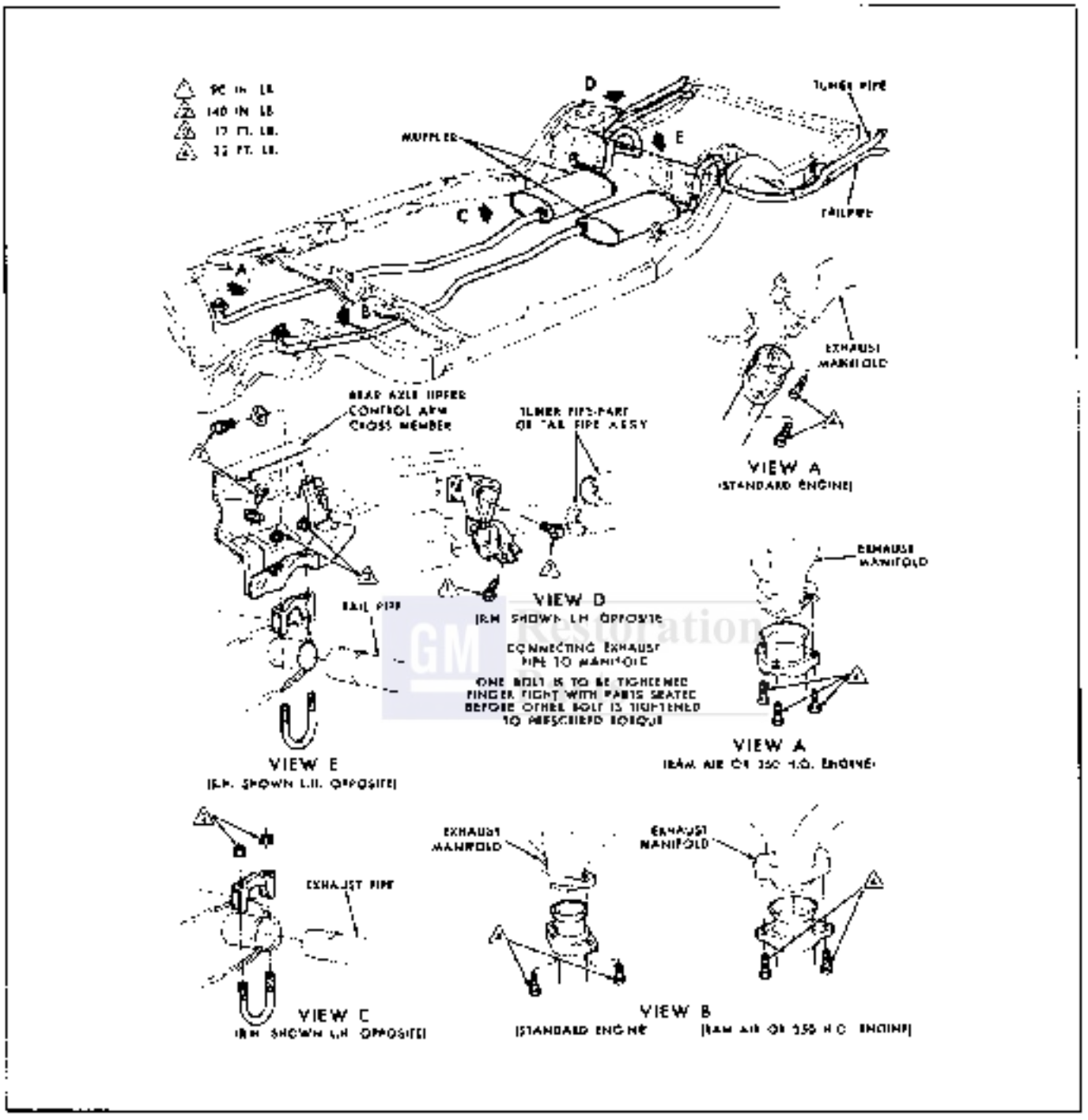


Fig. B-14 Tempest Dual Exhaust System

4. To install muffler, reverse removal procedure. Tighten front muffler U-bolt clamp 18 lb. ft. Tighten front (behind muffler) tailpipe support U-bolt clamp 18 lb. ft. torque. Tighten rear (at resonator) tailpipe support U-bolt clamp 33 lb. ft. torque.

NOTE: Coat inside diameter of front muffler opening and tailpipe flange with sealer before installing muffler.

Tailpipe - Remove and Replace

1. Remove front (behind muffler) and rear tailpipe support U-bolt clamps.

2. Separate tailpipe from muffler and remove.

3. To install tailpipe, reverse above procedure. Tighten front (behind muffler) tailpipe support U-bolt clamp 18 lb. ft. torque. Tighten rear tailpipe support U-bolt clamp 33 lb. ft. torque.

NOTE: Coat inside diameter of tailpipe flange with sealer before installing tailpipe.

PONTIAC EXHAUST SYSTEM

SERVICE AND REPAIRS

SINGLE EXHAUST SYSTEM (Fig. 8-15)

Exhaust Manifold Crossover Pipe—Remove and Replace

1. Disconnect crossover pipe at right and left manifold.

2. Loosen crossover pipe to exhaust pipe U-bolt clamp.

3. Loosen tail pipe front bracket clamp (behind muffler).

4. Loosen tail pipe or resonator assembly rear bracket clamp.

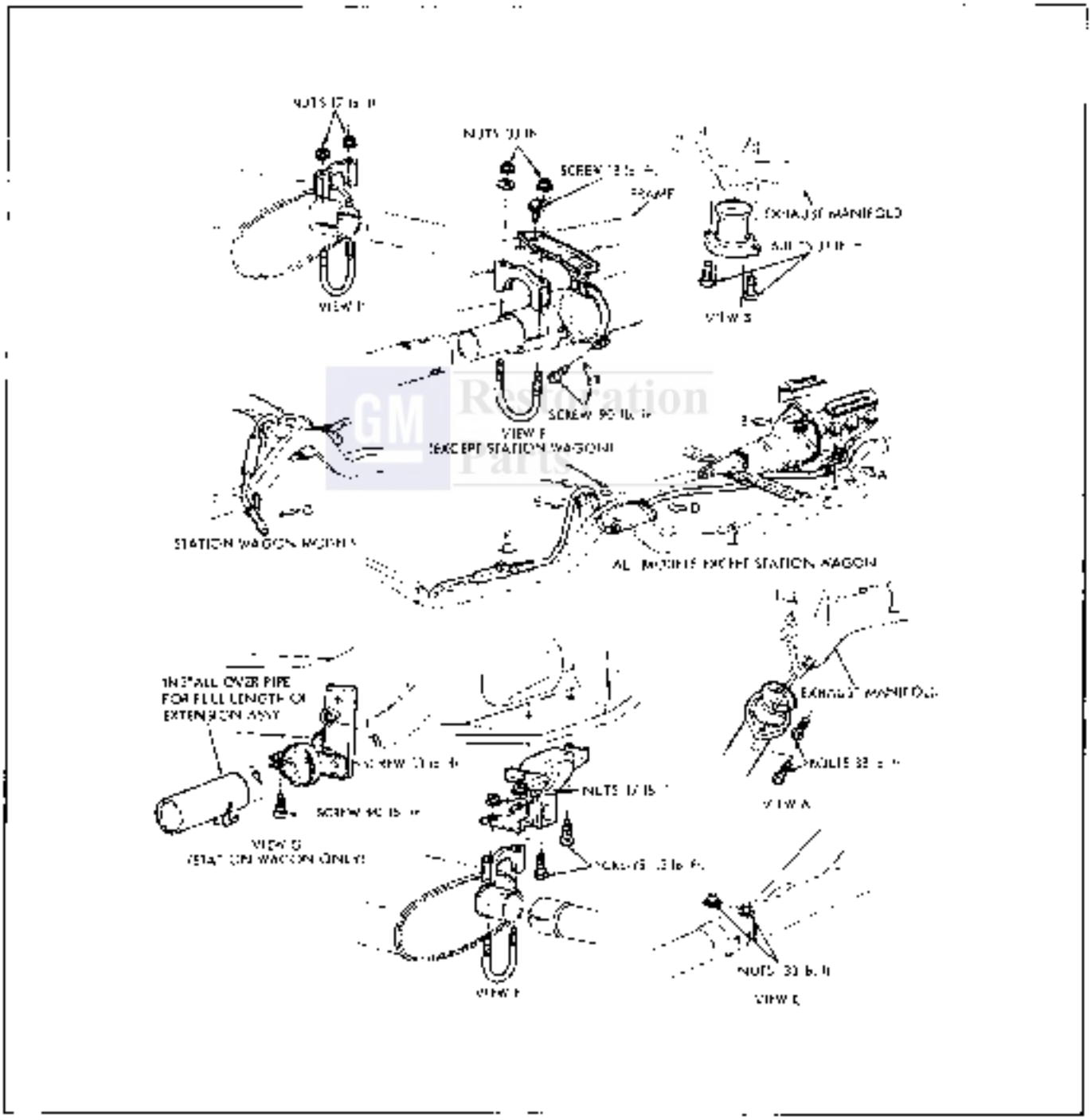


Fig. 8-15 Pontiac Single Exhaust System

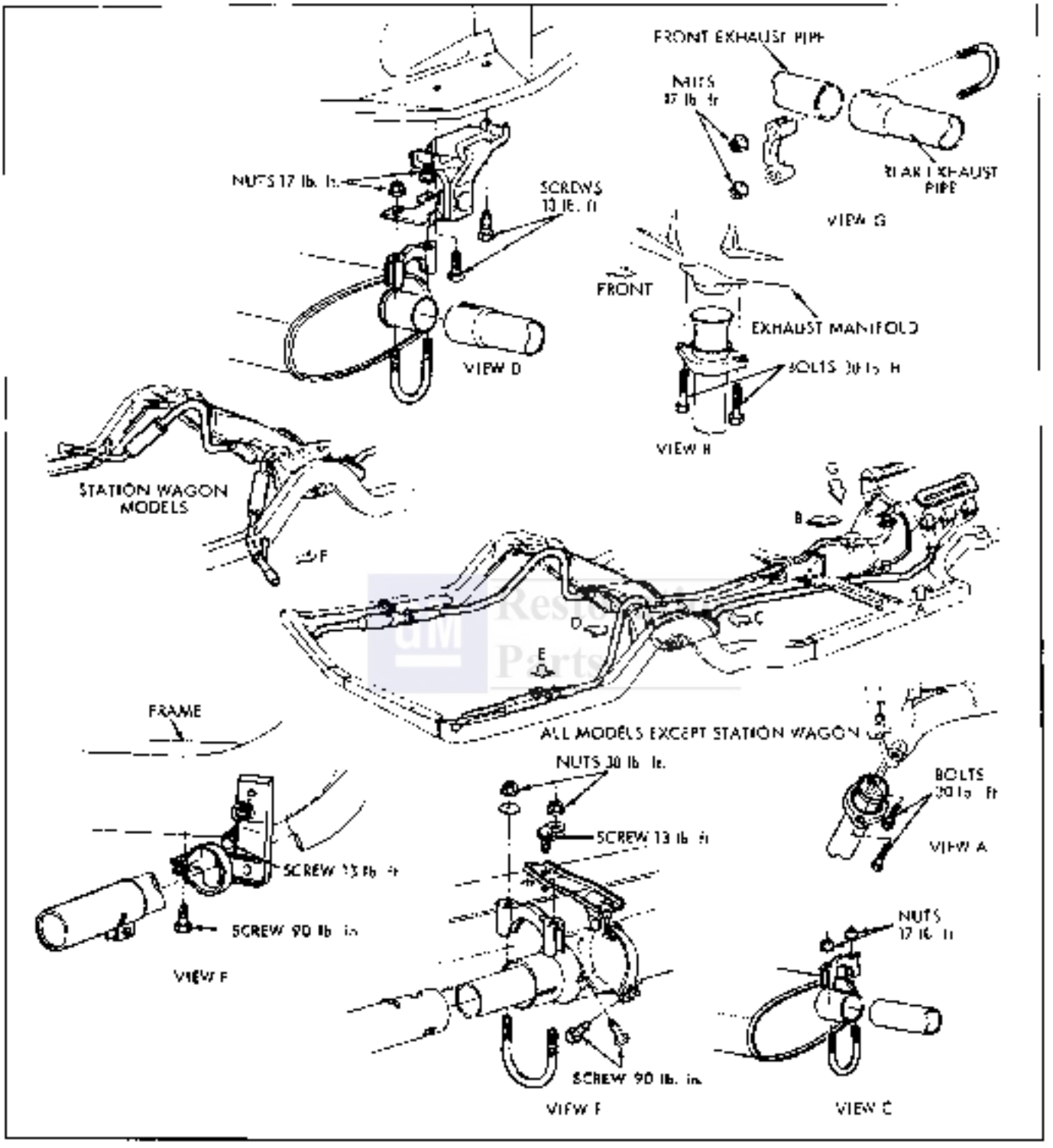


Fig. 8-16 Pontiac Dual Exhaust System Except 428—3/6 Engine

5. Move exhaust pipe, muffler and tail pipe rearwards.

6. Disconnect crossover pipe from exhaust pipe and remove crossover pipe assembly.

7. Install crossover pipe by reversing above procedure. Tighten one (1) bolt finger tight with parts seated before tightening other bolt.

NOTE: No gaskets are used between crossover pipe and manifolds. Tighten crossover pipe to manifold bolts 30 lb. ft. torque. Tighten exhaust pipe to crossover pipe clamp bolts to 30 lb. ft. torque.

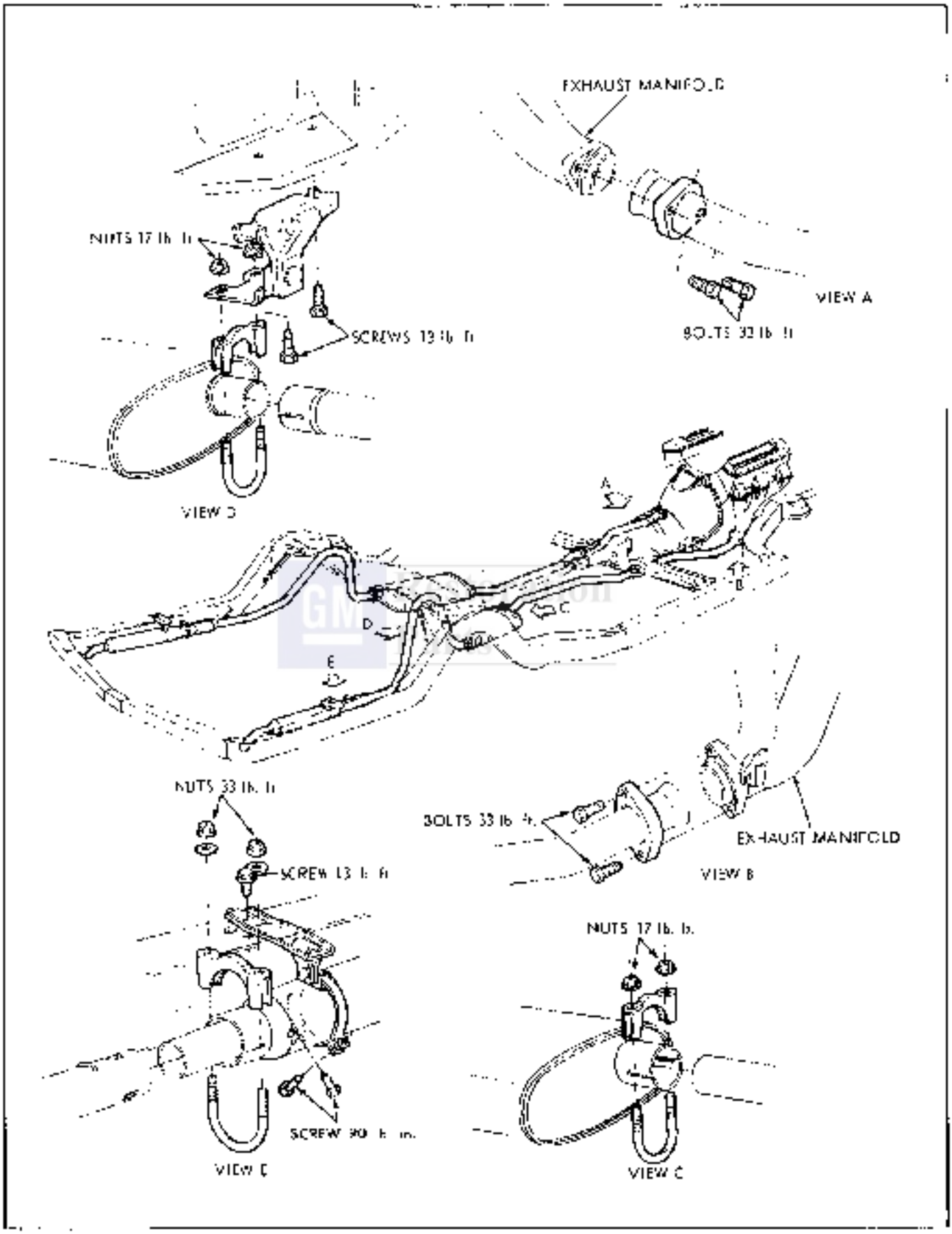


Fig. 8-17 Pontiac Dual Exhaust System 428—376 Engine

Exhaust Pipe--Remove and Replace

1. Loosen crossover pipe to exhaust pipe U-bolt clamp

2. Loosen exhaust pipe to muffler front U bolt clamp.

3. Loosen tail pipe front bracket clamp (behind muffler).

4. Loosen tail pipe or resonator assembly rear bracket clamp.

5. Move exhaust pipe, muffler and tail pipe rearwards.

6. Remove exhaust pipe from crossover pipe and muffler.

7. To install, reverse above procedure. Coat inside diameter of exhaust pipe with sealer before installing on crossover pipe. Coat inside diameter of muffler opening with sealer before installing exhaust pipe. Tighten exhaust pipe to crossover pipe clamp bolts 30 lb. ft. torque. Tighten muffler to exhaust pipe clamp bolts 14 lb. ft. torque.

Muffler--Remove and Replace

1. Loosen U-bolt clamp at front of muffler.

2. Loosen tail pipe front bracket clamp (behind muffler)

3. Loosen tail pipe or resonator assembly rear bracket clamp.

4. Move exhaust pipe, muffler and tail pipe rearwards.

5. Remove muffler.

6. Replace muffler by reversing steps. Coat muffler openings with sealer before installing muffler over exhaust pipe and tail pipe. Tighten exhaust pipe to muffler front U-bolt clamp 14 lb. ft. torque. Tighten tail pipe front bracket clamp (behind muffler) 14 lb. ft. torque.

Tail Pipe--Remove and Replace

1. Jack rear of car up to allow clearance between frame and rear axle housing.

2. Loosen tail pipe front bracket clamp (behind muffler).

3. Loosen tail pipe or resonator assembly rear bracket clamp.

4. Remove tail pipe

5. Replace tail pipe by reversing above procedure.

NOTE: Coat outside diameter of rear muffler opening with sealer before installing tail pipe. Tighten tail pipe front bracket clamp bolts 14 lb. ft. torque. Tighten tail pipe rear bracket screw 13 lb. ft. torque.

Resonator—Remove and Replace

1. Loosen resonator assembly to tail pipe clamp.

2. Loosen resonator assembly rear bracket clamp.

3. Remove resonator assembly.

4. Replace resonator assembly by reversing removal procedure. Tighten resonator to tail pipe clamp to 30 lb. ft. torque. Tighten resonator to frame bracket 8 lb. ft. torque.

DUAL EXHAUST SYSTEM (Figs. 8-16 and 8-17)

Exhaust Pipes--Remove and Replace

1. Disconnect exhaust pipe from manifold, loosen front muffler clamp and slide exhaust pipe forward and remove

2. To install, reverse above procedures.

NOTE: Coat inside diameter of front muffler opening with sealer before inserting exhaust pipe.

Muffler - Remove and Replace

Follow same procedure used for single exhaust system.

Tail Pipe- Remove and Replace

Follow same procedure used for single exhaust system.

Resonator--Remove and Replace

Follow same procedure used for single exhaust system.

GENERAL SPECIFICATIONS

Fuel Tank Capacity (approx.)

Firebird	18.5	U.S. gals.
Tempest	20	U.S. gals.
Pontiac (Except Station Wagon)	26	U.S. gals.
Pontiac Station Wagons	25	U.S. gals.

STEERING

CONTENTS OF THIS SECTION

The steering system consists of a steering wheel, steering column, steering linkage and standard or power steering gear.

Standard steering with 24:1 gear ratio is basic equipment on all models; however with certain optional or accessory equipment the gear ratio will vary from this.

Power steering, available as an option on all models, has ratios of 17.5:1 on Tempest, Firebird, and Pontiac Catalina models; on all other Pontiac models a new variable ratio of 16:1 on center and 12.2:1 at full turn is used.

On power steering gears the repair procedures are basically the same except for some adjustments. An oil pump is provided to supply the power steering system with pressurized oil.

STANDARD AND DELUXE STEERING WHEEL

REMOVE AND REPLACE (Fig. 9-1)

1. Lift to remove ornament.

2. Remove nut and washer from shaft.

3. Remove horn bar (deluxe wheel) or extension and switch (standard wheel).

4. Remove steering wheel using puller J 3044-01. Do not hammer on end of steering shaft.

5. To replace, reverse above procedure, making sure steering wheel is in straight ahead position (Fig. 9-2). Tighten steering wheel nut to 35 lb. ft. torque and stake. To prevent damage to turn signal switch, be sure switch is in neutral position and hazard flasher knob in off position prior to steering wheel installation.

ON CAR REPAIRS TO ENERGY ABSORBING STEERING COLUMN

REPLACE TURN SIGNAL SWITCH, UPPER BEARING, SHIFT BOWL, OR TURN SIGNAL SWITCH HOUSING— (Non Tilt Column)

REMOVAL

1. Remove steering wheel using tool J 3044-01. Do not hammer on end of steering shaft.

2. Remove upper bearing preload spring and turn signal cancelling cam off steering shaft.

3. Remove turn signal lever screw and lever. On Tempest and Firebirds with automatic transmission and column shift remove shift indicator bezel by

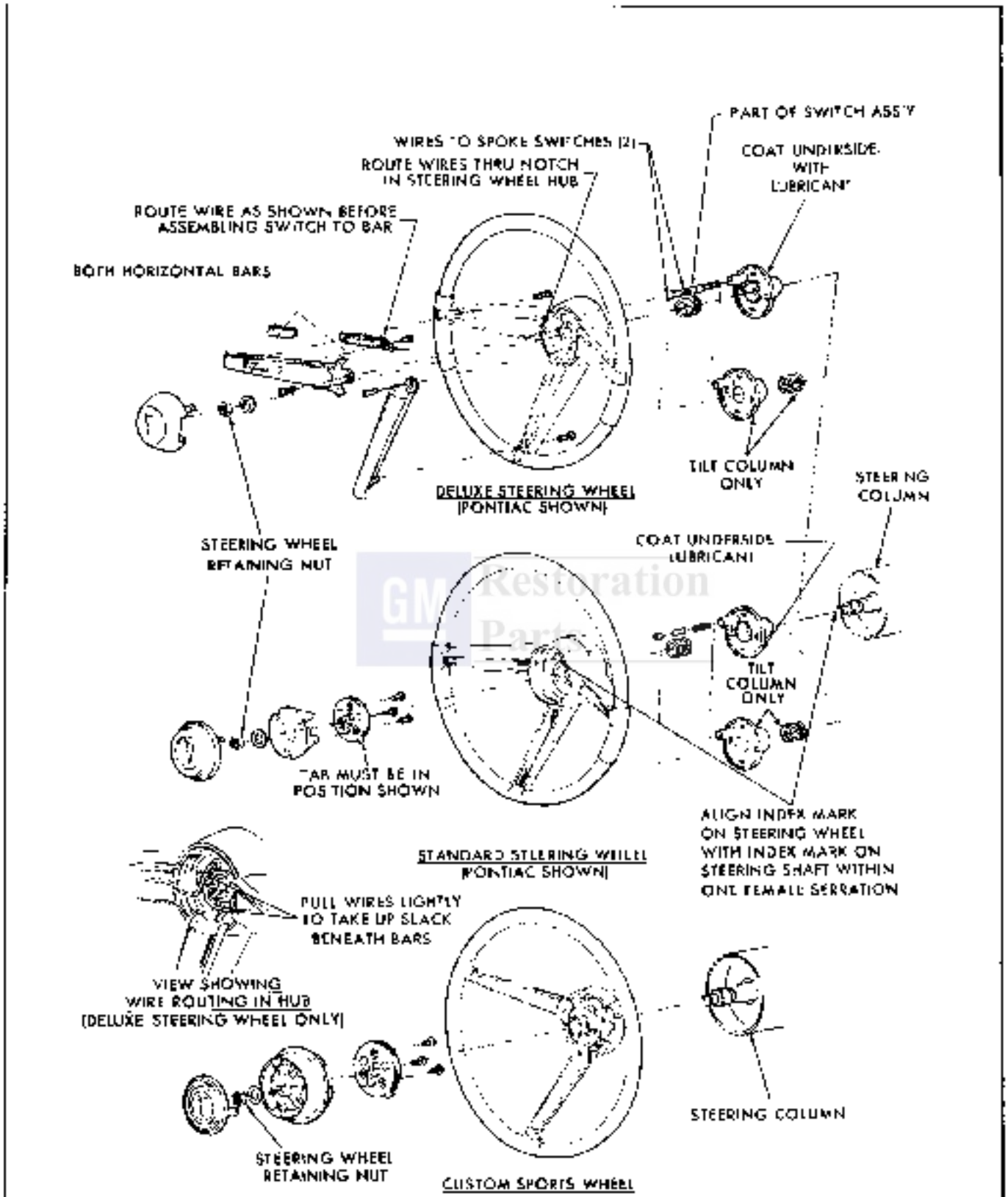


Fig. 9-1 Exploded View of Steering Wheel and Horn Button

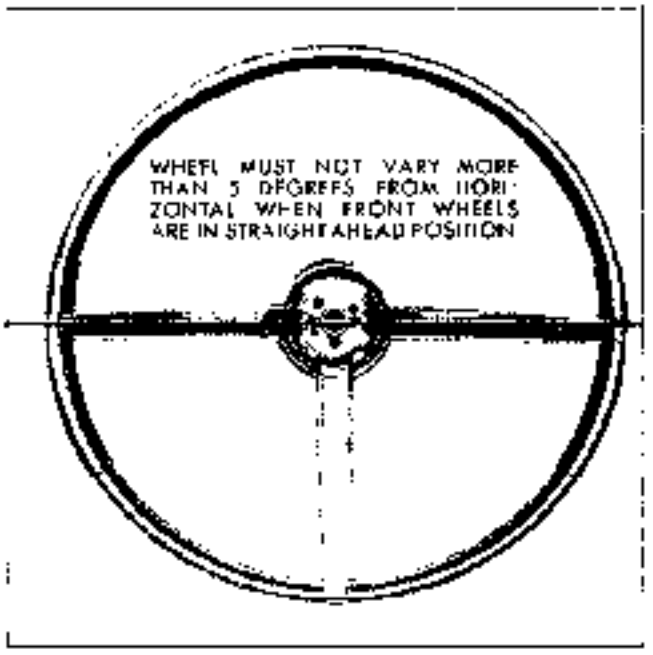


Fig. 9-2 Locating Steering Wheel Position

removing two retaining clips between bezel and inside of switch cover.

4. Push in hazard warning knob and unscrew knob.

5. Remove snap ring from upper steering shaft by sliding sideways out groove with tool J 22569. Do not pry against switch (Fig. 9-3).

6. Slide thrust washer and wave washer off upper steering shaft (Fig. 9-4).

7. Disconnect turn signal switch wiring harness at connector under instrument panel.

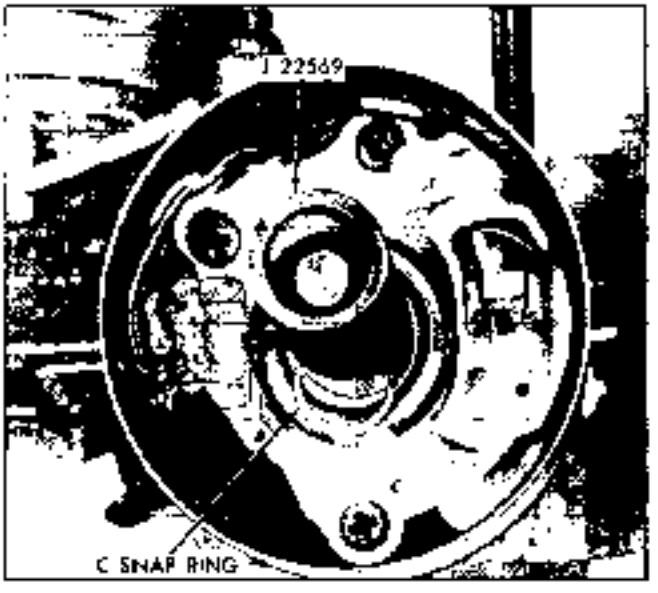


Fig. 9-3 C-Snap Ring Removal

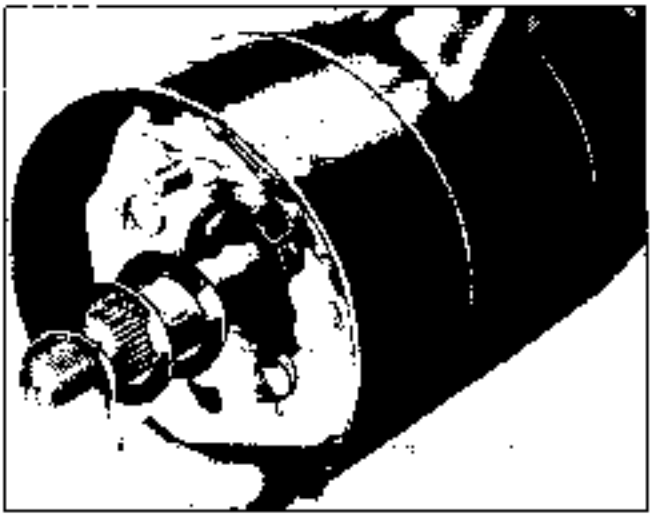


Fig. 9-4 C-Snap Ring, Thrust Washer, Wave Washer

8. Remove the steering column mounting bracket from the steering column to provide clearance so that the wiring and curved connector can be removed. This can be accomplished by removing the four short bolts attaching bracket to steering column, also remove two nuts and wedge bolt that attaches bracket to the instrument panel. Remove wedge shaped shim placed between bracket and instrument panel brace.

NOTE: Always hold the steering column against the instrument panel when mounting bracket is removed. Do not allow the steering column to drop downward.

Fig. 9-5 Removing Wiring Harness Cover

9. With mounting bracket removed, pry wiring harness cover off steering column and allow wiring harness to hang free (Fig. 9-5).

10. Position mounting bracket back under the instrument panel and install two nuts holding the bracket to the instrument panel. This will support the steering column properly during remaining steps of this repair procedure.

11. Loosen three switch mounting screws until cover can be rotated counterclockwise. It may be necessary to push on top of screws to loosen. For simpler reassembly, do not completely disengage screws. Rotate cover counterclockwise and pull straight off top of jacket (Figs. 9-6 and 9-7).

12. If the turn signal switch, or upper bearing assembly is to be serviced, remove three mounting screws completely from engagement with the lock plate. Be careful of three springs which may be lost during this action.

13. If necessary to remove the bowl centering spring, the spring thrust ring and bowl bearing washer, pry the spring retainer shell off upper bearing assembly.

14. Pull switch and housing from cover.

15. If shift bowl, shift lever spring or shift lever is to be replaced, remove shift bowl from steering column jacket. The shift lever or spring can be replaced by driving out the shift lever pivot pin, removing the shift lever. The shift lever spring can then be pryed out of shift bowl (Fig. 9-8). Do not reuse shift lever spring.

INSTALLATION

Apply a thin coating of lithium soap grease to all friction surfaces.

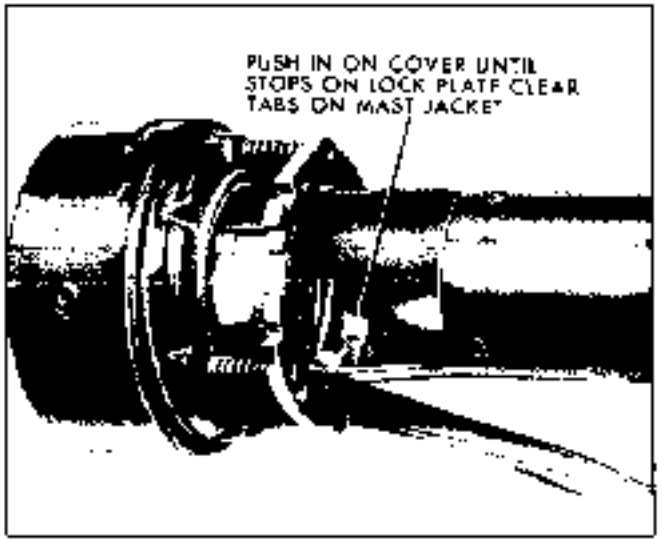


Fig. 9-6 Removal of Head Assembly

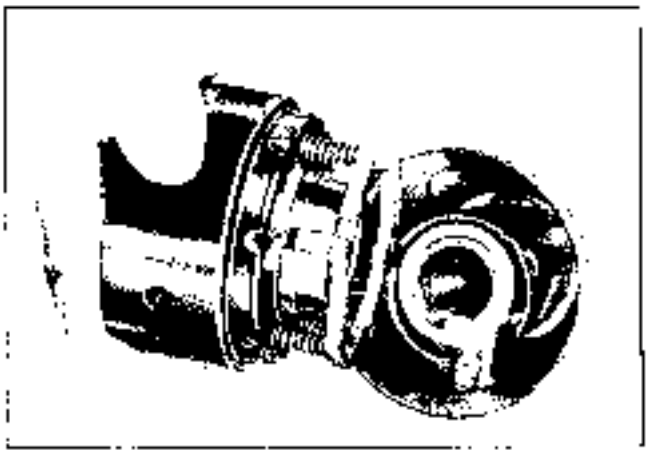


Fig. 9-7 Head Assembly Removed from Column

1. Press new upper shift lever spring into bowl pocket (Fig. 9-8), and install shift lever by driving pivot pin back into shift bowl if shift bowl was replaced.

2. Assemble spring and thrust ring (and on SM only, the bowl bearing washer) into shell and press shell into place on housing. Assemble over bowl spring until parts bottom, if bearing assembly was serviced.

3. Set switch assembly on top of housing assembly and feed switch wires through switch cover.

4. Align switch housing and cover holes and install three mounting screws through holes.

5. Slide three springs onto screws and start screws into lock plate (three turns for ease of assembly into column jacket).

6. Feed switch wires through shift bowl and place shift bowl onto steering column.

7. Place head assembly on top of jacket, making sure that the tangs on the ID of the lock plate are aligned with the slots in the jacket.

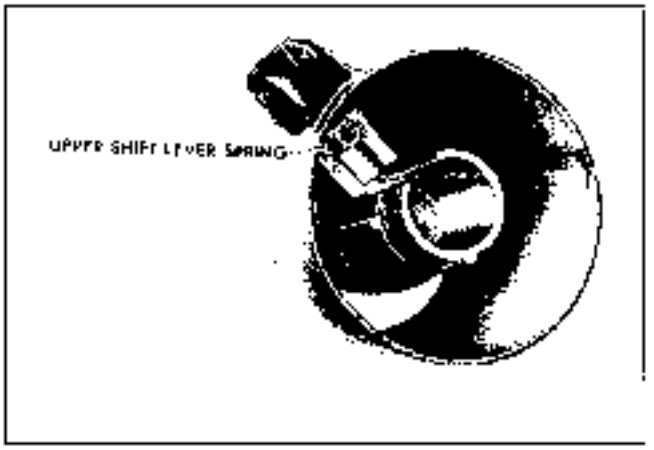


Fig. 9-8 Upper Shift Lever Spring

8. Push down on head assembly and rotate fully clockwise.

9. Torque the three turn signal mounting screws in turn to 35 in. lbs.

10. Remove two nuts attaching the steering column mounting bracket to instrument panel and remove bracket.

NOTE: Always hold steering column against the instrument panel when mounting bracket is removed. Do not allow steering column to drop downward.

11. Pull wiring harness flat against jacket and install harness cover and wire protector. Do not damage wires with cover or protector during installation.

12. Install steering column mounting bracket using two nuts that attach bracket to instrument panel and four short bolts which attach the bracket to the steering column. Tighten attaching nuts to 20 ft. lb. and bolts to 15 ft. lb.

13. Install wedge shaped shim only far enough to fill space between mounting bracket and instrument panel brace. Install wedge bolt and tighten bolt to 20 ft. lb. Do not force shim into space.

14. Slide wave washer and thrust washer over steering shaft and against upper bearing.

15. Start C washer on steering shaft taper and slide washer down shaft using tool J 22569 until it slips into groove.

IMPORTANT: Slide C washer sideways into groove and completely seat washer.

16. Install turn signal lever and screw, tighten screw to 4 in. lb. of torque.

17. Install hazard warning knob, tighten knob to 4 in. lb. On Tempest and Firebirds with automatic transmission and column shift install shift indicator bezel by installing two retaining clips between bezel and inside of switch cover.

18. Slide cancelling cam and upper bearing preload spring onto steering shaft.

NOTE: Prior to installing cancelling cam be sure that turn signal switch is in neutral position and hazard flasher is in the off position. This will prevent damage to the switch and cancelling cam when steering wheel is installed.

19. Install steering wheel, tighten retaining nut to 35 ft. lb. of torque.

20. Install horn ornament and any trim around steering column which might have been removed during repair.

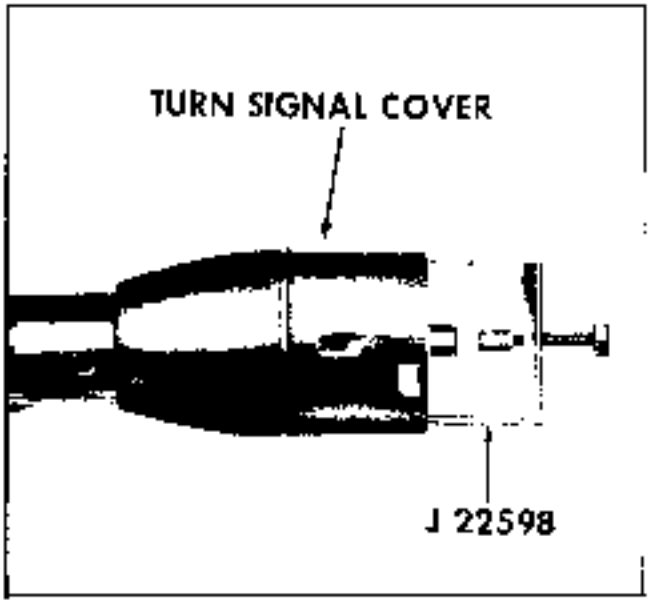


Fig. 9-9 Removing Turn Signal Switch Cover

REPLACE TURN SIGNAL SWITCH (Tilt Column)

REMOVAL

1. Remove steering wheel using tool J 3044-01. Do not hammer on end of steering shaft.

2. Remove turn signal cancelling cam and cancelling cam spring.

3. Remove tilt release lever and turn signal lever. On Tempest and Firebirds with automatic transmission and column shift remove shift indicator bezel by removing two small attaching screws on each side of bezel.

4. Push in hazard flasher knob, remove knob and remove turn signal cover using tool J 22596 (Fig. 9-9).

5. Remove steering column mounting bracket from steering column; this will provide clearance so that the wiring harness and curved connector can be removed. This can be accomplished by removing four short bolts attaching bracket to steering column, also remove two nuts and wedge bolt that attaches bracket to instrument panel. Remove the wedge shaped shim between bracket and instrument panel brace.

NOTE: Always hold steering column against instrument panel when mounting bracket is removed. Do not allow steering column to drop downward.

6. With mounting bracket removed pry wiring harness off steering column and allow wiring to hang free (Fig. 9-5).

7. Position the mounting bracket back underneath instrument panel and install two nuts attaching

bracket to instrument panel. This will support steering column properly during remaining steps of this repair procedure.

8. Unplug wiring harness from body harness and disconnect curved connector from wiring harness using tool J 21681 or a suitable tool. Be sure to note exact location of each wire prior to removing wiring from connector body.

9. Remove the three turn signal attaching screws and withdraw a wiring harness from steering column.

INSTALLATION

1. Install turn signal wiring harness through upper bearing housing and shift bowl.

2. Connect curved connector to wiring harness; be sure wires are connected in the same way they were prior to repair and plug wiring harness into body wiring harness under instrument panel.

3. Remove two nuts attaching steering column mounting bracket to instrument panel and remove bracket.

NOTE: Always hold steering column against instrument panel when mounting bracket is removed. Do not allow steering column to drop downward.

4. Pull wiring harness flat against jacket, install harness cover and wiring protector. Do not damage wiring during installation.

NOTE: Be sure that there is some slack or play left in signal switch wiring inside switch housing prior to installing harness cover, this will prevent wiring from being too tight when column head is in the full up position.

5. Install steering column mounting bracket using two nuts that attach bracket to instrument panel and four short bolts that attach bracket to steering column. Tighten the nuts to 20 ft. lb. and bolts to 15 ft. lb.

6. Install wedge shaped shim only far enough to fill space between mounting bracket and instrument panel brace. Install wedge bolt and tighten to 20 ft. lb. Do not force shim into space.

7. Install signal switch and tighten three attaching screws to 35 in. lb. Be sure that the shortest attaching screw is located in the topmost position above the lock shoes.

8. Install turn signal switch cover using tool J 21853 (Fig. 9-10).

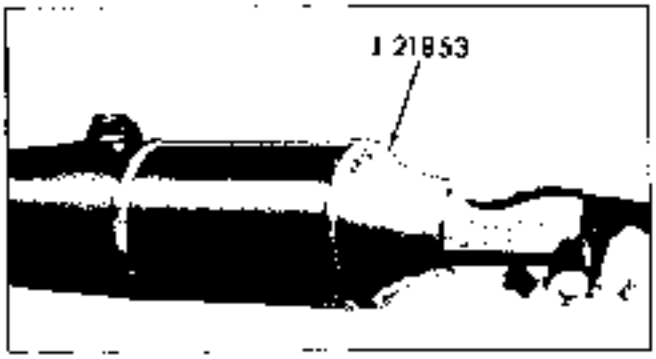


Fig. 9-10 Installing Turn Signal Switch Cover

9. Install signal switch lever and hazard flasher knob; tighten to 4 in. lb. On Tempest and Firebirds with column shift and automatic transmission install shift indicator bezel using two attaching screws.

10. Slide cancelling cam and spring onto steering shaft.

NOTE: Prior to installing cancelling cam be sure that turn signal switch is in the neutral position and hazard flasher knob is in the off position, this will prevent damage to the switch when steering wheel is installed.

11. Install steering wheel, tighten retaining nut to 35 ft. lb. of torque.

12. Install horn ornament and any trim around steering column which might have been removed during repair.

REMOVAL AND INSTALLATION OF STEERING COLUMN

REMOVAL

NOTE: When the steering column is removed from the car, it is extremely susceptible to damage. Dropping the column assembly on its end could collapse the steering shaft or loosen the plastic injections which maintain column rigidity. Leaning on the mast jacket could cause the mesh section to bend or deform. Such damages could impair the column's collapsible design. If it is necessary to remove the steering wheel, use standard wheel puller J 3044-01. Do not hammer on end of shaft, as hammering could loosen plastic injections which maintain column rigidity.

1. Remove both attaching nuts securing flexible coupling to steering shaft (Fig. 9-11). On Tempest model with H.O. exhaust manifolds the steering shaft flange must be removed at this time.

2. On column shift cars, disconnect shift linkage from shift levers.

3. Disconnect all electrical connectors from steering column.

4. Remove screws securing toe pan cover halves to floor and loosen cover clamping nuts. On Tempest

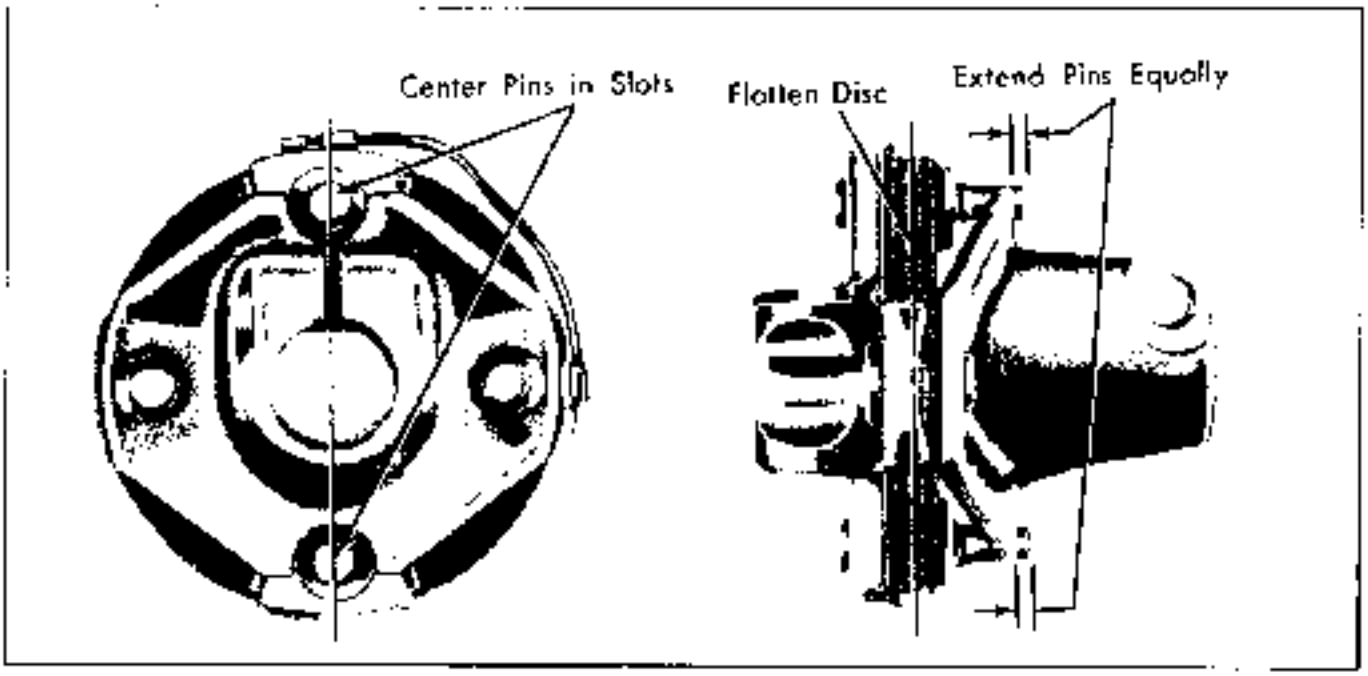


Fig. 9-11 Installing Steering Shaft to Flexible Coupling

models, remove the floor pan trim and insulator cover prior to removing the toe plate screws.

5. Remove instrument panel escutcheon screws on Firebird and Pontiac models.

6. Remove two nuts and one bolt securing mounting bracket to instrument panel and carefully withdraw column.

NOTE: A wedge-shaped shim will be inserted between the mounting bracket and instrument panel. This shim will be reused when column is installed in car.

INSTALLATION

Make sure this procedure is followed in exactly this order.

1. Install column into position and loosely attach mounting bracket to instrument panel with two mounting nuts.

2. Attach steering shaft to flexible coupling at steering gear, torque attaching nuts to 20 lb. ft. (Fig. 9-11).

3. Tighten two nuts securing mounting bracket to instrument panel. Torque nuts to 20 lb. ft.

CAUTION: Do not over-torque nuts because correct torque is necessary to insure breakaway action of the bracket and capsules in event of a collision.

4. Pontiac and Firebird models. Install wedge shim to fill space and tighten front instrument panel mounting bolt to 20 lb. ft. torque. Do not force wedge shim into gap.

5a. Tempest. Position the left (outboard) toe plate against floor pan and start a screw in lower right hole of toe plate. Install and tighten a screw in upper right slotted hole of toe plate. This will properly locate toe plate to floor pan.

b. Pontiac. Position the right (inboard) toe plate against floor pan. Install and tighten two upper right toe plate screws.

c. Firebird. Position both toe plates against floor pan. Install and tighten screws holding the toe plates to floor pan.

6. Position the remaining toe plate against the floor pan on Pontiac and Tempest models. Install and tighten two clamping screws holding toe plate around the steering column, torque the screws to 40 in. lb.

7. On Pontiac and Firebird models loosen the screws, tightened in step 5b or 5c. This will enable steering column to position itself in a neutral position between the instrument panel and flexible coupling.

8. On Pontiac and Tempest models, install all remaining toe plate screws. All the toe plate screws must be tightened to 40 in. lb. of torque. On Tempest models install the wedge shaped shim into gap at front instrument panel brace and mounting bracket. Install wedge shim attaching bolt and tighten bolt 20 in. lb. of torque. Do not force wedge shim into gap.

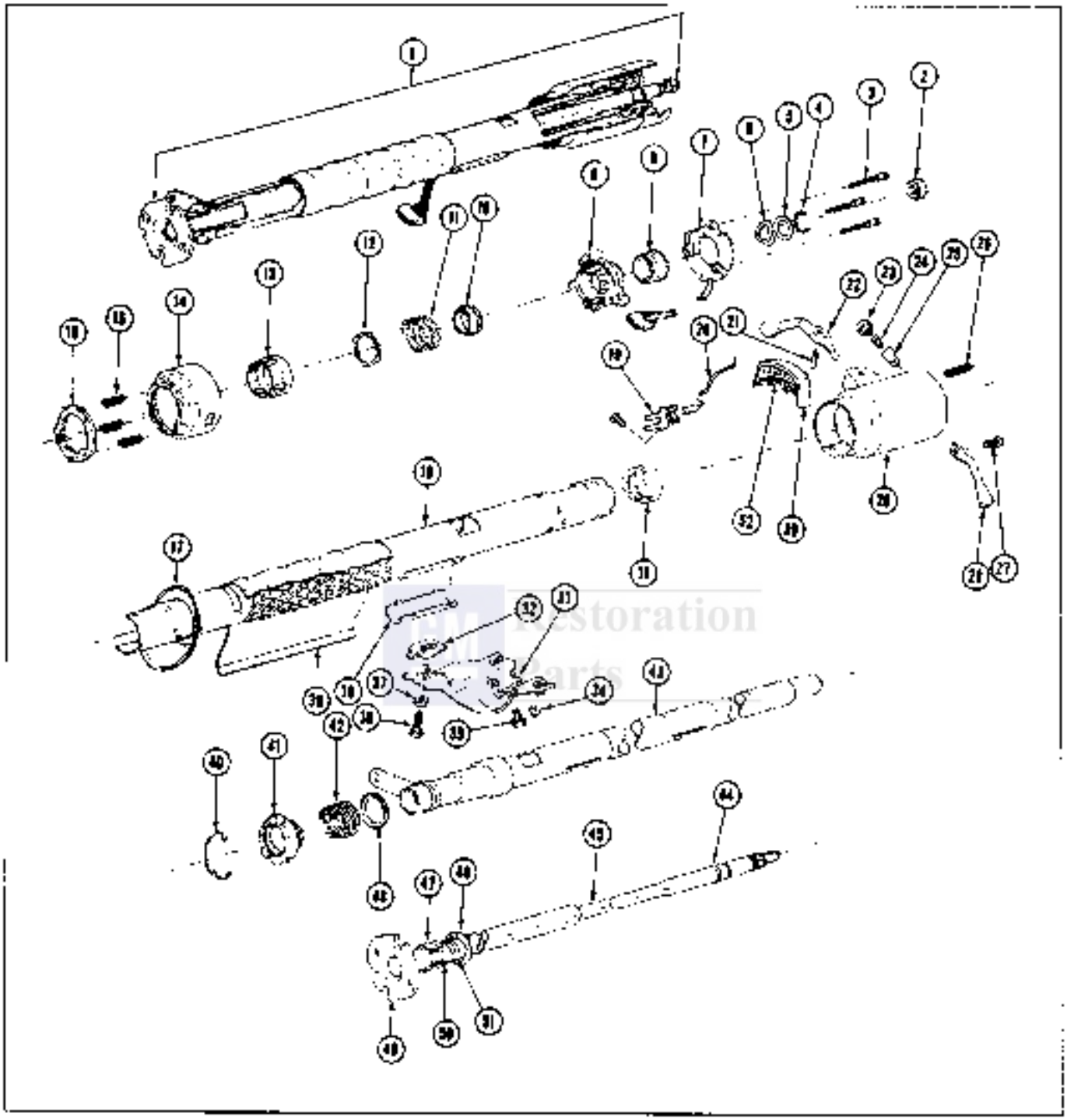


Fig. 9-12 Exploded View of Typical Regular Column - Automatic Transmission

1. Steering Column Assembly
2. Steering Wheel to Steering Shaft Nut
3. Direction Signal Switch Mounting Screw
4. Ring, Upper Bearing Retaining
5. Steering Shaft Upper Thrust Washer
6. Steering Shaft Upper Washer—Wave
7. Direction Signal Switch Assembly
8. Steering Shaft Bearing—Upper
9. Direction Signal Control Housing
10. Shift Bowl Bearing—Upper
11. Shift Bowl Centering Spring
12. Spring Thrust Ring
13. Spring Retainer Shaft
14. Switch and Housing Assembly Direction Signal Cover
15. Switch Cover Retaining Spring
16. Lock Plate
17. Steering Column Toe Plate Grommet
18. Steering Column Jacket
19. Indicator to Shift Tube Clamp
20. Gearshift Indicator Pointer
21. Gearshift Lever Pivot Pin
22. Gearshift Control Lever Assembly—Upper
23. Traffic Hazard Switch Knob
24. Hazard Switch Knob Screw
25. Traffic Hazard Switch Knob Cap
26. Gearshift Lever Bowl Spring
27. Lever to Switch Screw
28. Direction Signal Control Lever Assembly
29. Gearshift Lever Bowl
30. Gearshift Indicator Lens Retainer
31. Shift Bowl Bearing—Lower
32. Steering Column to Support Bracket Adj. Wedge
33. Steering Column Support Bracket Assembly
34. Support to Support Bracket Nut
35. Column to Support Bracket Bolt
36. Support Bracket to Mounting Bracket Bolt
37. Support Bracket to Mounting Bracket Washer
38. Direction Signal Control Wire Protector
39. Jacket Mask Cover
40. Lower Bearing Adapter Clip
41. Steering Shaft Lower Bearing Adapter
42. Reaction and Shift Tube Return Spring
43. Steering Column Reaction and Shift Tube Assembly
44. Upper Steering Shaft Retaining Ring
45. Steering Shaft Assembly w/Flange
46. Steering Shaft Bearing—Lower
47. Steering Shaft Lower Sleeve
48. Reaction and Shift Tube Thrust Washer
49. Lower Steering Shaft Flange
50. Lower Steering Shaft Plunger
51. Lower Steering Shaft Bearing Spring
52. Gearshift Indicator Lens (Tempest)

Fig. 9-12 Exploded View of Typical Regular Column — Automatic Transmission

9. Reconnect all electrical connections and install any trim which has been removed.

10. Connect all transmission linkage, if linkage or neutral switch requires adjusting refer to Section 7 of this manual for the procedure.

MAJOR REPAIRS
(Steering Column Removed From Car)

The following procedures cover the complete disassembly and assembly of steering columns after their removal from car and should only be used to the extent necessary for replacement of steering shaft, lower bearing, shift bowl bearing, shift tube, column jacket or other internal parts.

DISASSEMBLY AND ASSEMBLY OF REGULAR COLUMN (Non Tilting)— AT. ST. OR FLOORSHIFT MODELS (Figs. 9-12 and 9-13)

A. Disassemble Upper End

1. Remove four 5/16" bolts holding column bracket. Set bracket aside to protect breakaway capsules (Fig. 9-14).

2. Remove wire protector, wire clip and/or cover. Do not pry against wires – insulation may be damaged (Fig. 9-5).

3. Mount column in vise, using tool J 22373 (Fig. 9-15) or by clamping one tapping plate in a vise (Fig. 9-16). On Tempest models disconnect lower shaft and pot joint from upper shaft by removing clamp (Fig. 9-17) if pot joint is to be serviced.

CAUTION: Never clamp on the jacket without special tool.

4. Remove steering wheel using standard wheel puller J 3044-01. Do not hammer end of steering shaft.

5. Slide upper bearing preload springs and turn signal cancelling cam off steering shaft.

6. Remove turn signal lever screw and lever.

7. Push hazard warning knob in and then unscrew knob.

8. Drive out upper shaft lever pivot pin and remove upper shift lever. This is not necessary unless repairs are needed on shift bowl, shift lever, or shift lever spring, and on column shift only.

9. Remove C-snap ring from upper steering shaft by sliding snap ring sideways out of groove with J 22569. Do not pry against switch parts (Fig. 9-3).

10. Slide thrust washer and wave washer off upper steering shaft (Fig. 9-4).

NOTE: It is recommended that the steering shaft be removed at this time to eliminate the possibility of it sliding out the lower end of the column and being damaged. Steps 11 through 16 are not required if steering shaft or lower bearing is the only part to be replaced.

11. Loosen three switch mounting screws until the cover assembly can be rotated counterclockwise. It may be necessary to push on top of screws to loosen assembly. For simpler reassembly, do not completely disengage screws. Rotate cover assembly counterclockwise and pull straight off top of jacket (see Figures 9-6 and 9-7).

12. Remove three mounting screws completely from engagement with the lock plate, only if

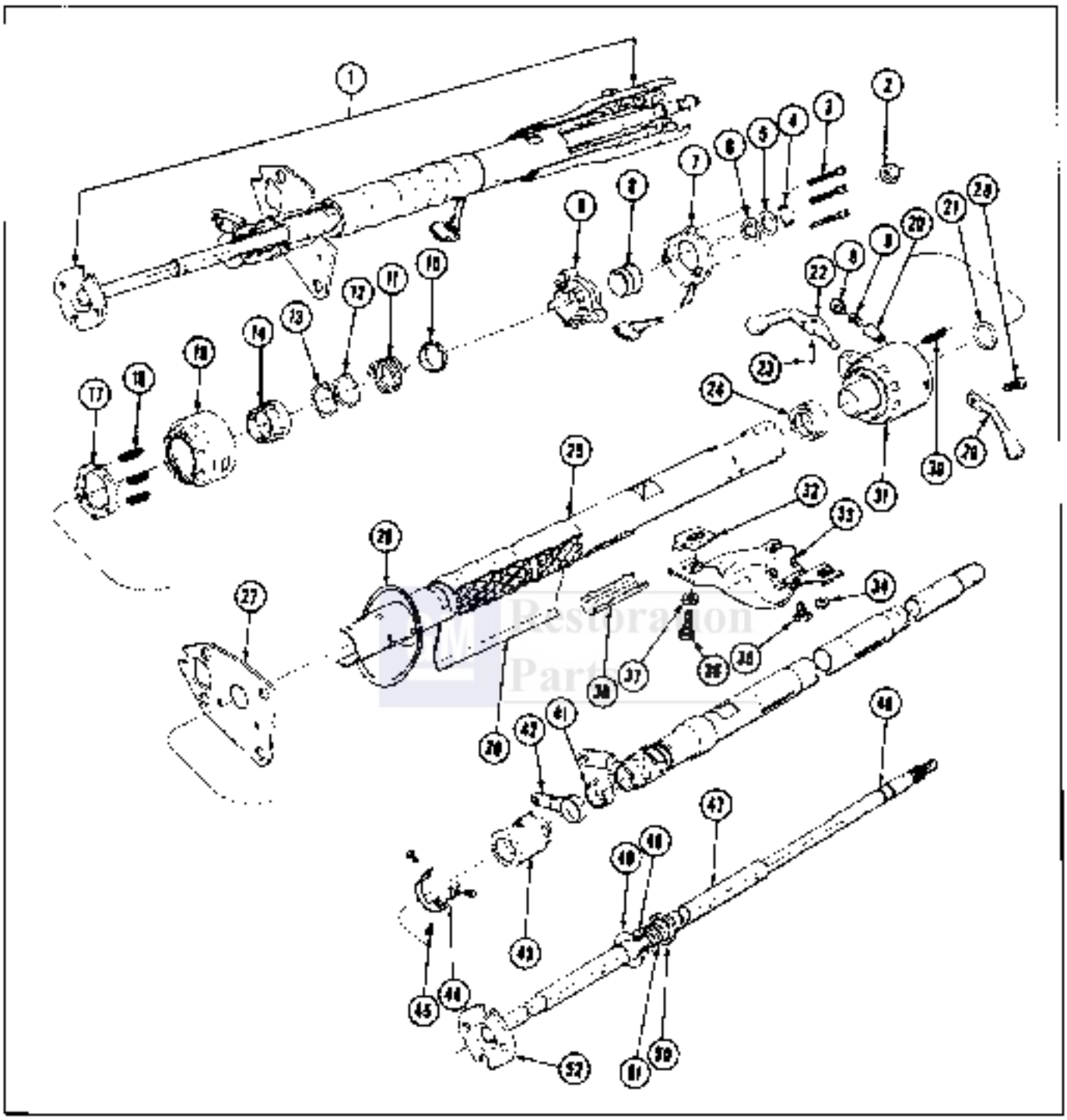


Fig. 9-13 Exploded View of Typical Regular Column - Standard Transmission

1. Steering Column Assembly
2. Steering Wheel to Steering Shaft Nut
3. Directional Signal Switch Mounting Screw
4. Upper Bearing Retaining Ring
5. Steering Shaft Upper Thrust Washer
6. Steering Shaft Upper Wasner Wave
7. Direction Signal Switch Assembly
8. Steering Shaft Bearing—Upper
9. Direction Signal Control Housing
10. Shift Bowl Bearing—Upper
11. Shift Bowl Centering Spring
12. Spring Thrust Ring
13. Bowl Bearing Washer
14. Spring Retainer Shell
15. Cover, Switch and Housing Assembly, Direction Signal
16. Switch Cover Retaining Spring
17. Lock Plate
18. Traffic Hazard Switch Knob
19. Hazard Switch Knob Screw
20. Traffic Hazard Switch Knob Cap
21. Bowl Spring Thrust Washer
22. Gearshift Control Lever—Upper
23. Gearshift Lever Pivot Pin
24. Shift Bowl Bearing—Lower
25. Steering Column Jacket
26. Steering Column Lock Plate Grommet
27. Steering Column Cover Plate Seal
28. Lever to Switch Screw
29. Direction Signal Control Lever Assembly
30. Shift Lever Bowl Spring
31. Gearshift Lever Bowl
32. Steering Column to Support Bracket Adj. Wedge
33. Bracket Assembly, Steering Column Support
34. Support to Support Bracket Nut
35. Column to Support Bracket Bolt
36. Support Bracket to Mounting Bracket Bolt
37. Support Bracket to Mounting Bracket Washer
38. Directional Signal Control Wire Protector
39. Steering Column Cover Plate Seal
40. Steering Column Reaction and Shift Tube Assembly
41. Lower Shift Lever Anti-Rattle Spacer
42. Gearshift Lever—1st and Reverse
43. Steering Shaft Lever Bearing Adapter and Sleeve
44. Lower Bearing Reinforcement Ring
45. Lower Bearing Adapter and Sleeve Bolt
46. Upper Steering Shaft Retaining Ring
47. Steering Shaft Assembly w/Flange
48. Lower Steering Shaft Plunger
49. Steering Shaft Lower Sleeve
50. Steering Shaft Bearing—Lower
51. Lower Steering Shaft Bearing Spring
52. Steering Shaft Flange

Fig. 9-13 Exploded View of Typical Regular Column — Standard Transmission

necessary to service components of the cover assembly. Be careful of three springs which may be lost during this action.

13. Pull switch and bearing housing from cover.

14. To remove the bowl centering spring, the spring thrust ring and bowl bearing washer, pry the spring retainer shell off the upper bearing housing.

15. If required to replace, pry upper shaft lower spring from bowl. See Figure 9-6. Do not reuse this spring.

B. Disassemble Lower End

Steering wheel, spring, cancelling cam, C-ring, flat washer and wave washer must be removed prior to disassembly of lower end. Follow instructions above.

1. Remove steering shaft from bottom of column, unless this was done previously.

2. Remove the two nuts holding back-up and neutral-start lamp switch and remove switch.

Perform steps 3, 4 and 5 on all cars except those equipped with column shift manual transmissions.

3. Remove bearing adapter clip.

4. Remove bearing adapter, bearing and shift tube spring and thrust washer.

5. Remove shift indicator wire and clip on Pontiac models.

Perform steps 6 and 7 on all cars equipped with column shift manual transmission.

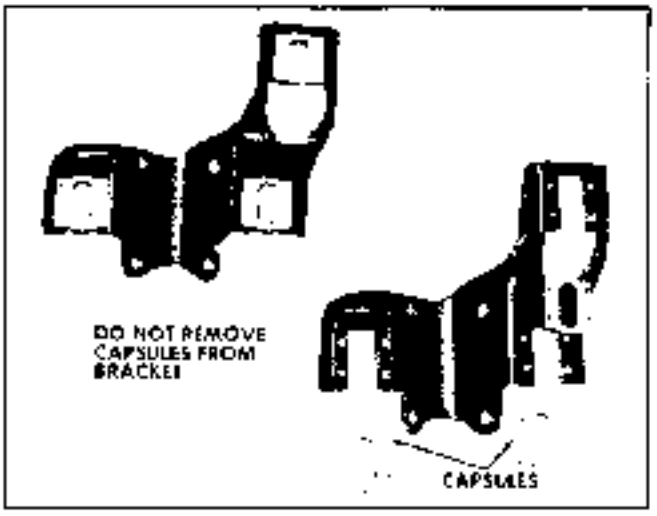


Fig. 9-14 Mounting Bracket Assembly

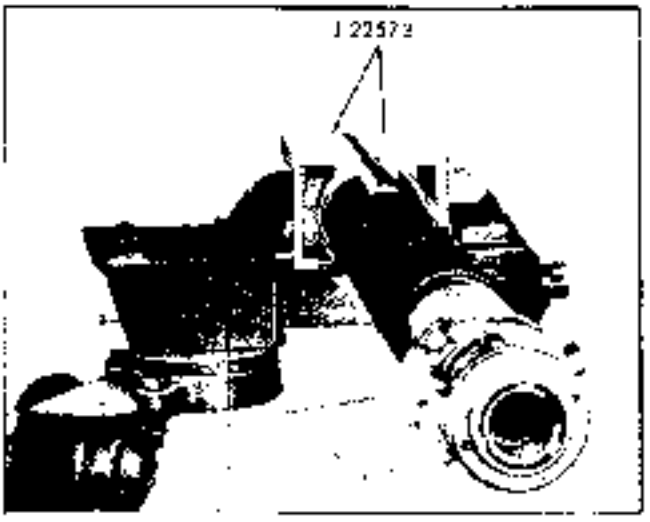


Fig. 9-15 Mounting Column in Vise

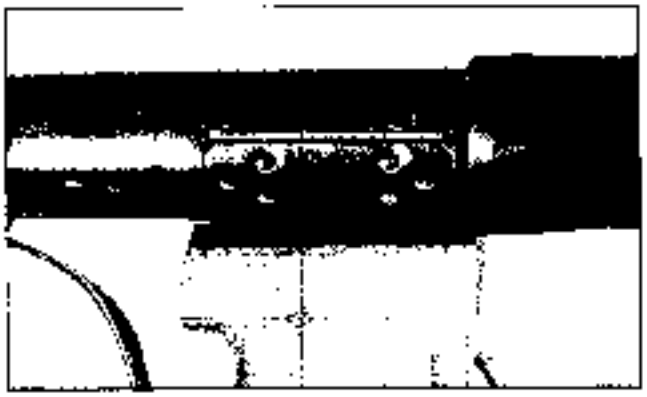


Fig. 9-16 Mounting Column in Vise by Tapping Plate

6. Remove the three bolts and the alignment plate just above the lower gearshift levers (see Figure 9-18).

7. The adapter and bearing, first and reverse lever and lever spacer may be withdrawn from the lower end.

8. The shift tube may now be withdrawn from the lower end.

9. Remove the lower bowl bearing with a long wooden handle such as a broomstick, push out from the bottom. NOTE: The lower bowl bearing may be reused only with this jacket.

10. Press the lower bearing out of the adapter, if necessary.

11. Cut and unwrap mesh cover, if required.

C. Assemble Lower End

Apply a thin coating of lithium soap grease to all friction surfaces.

1. Rewrap mesh cover. Use friction tape to hold in place.

2. Press the lower bearing into the adpater.

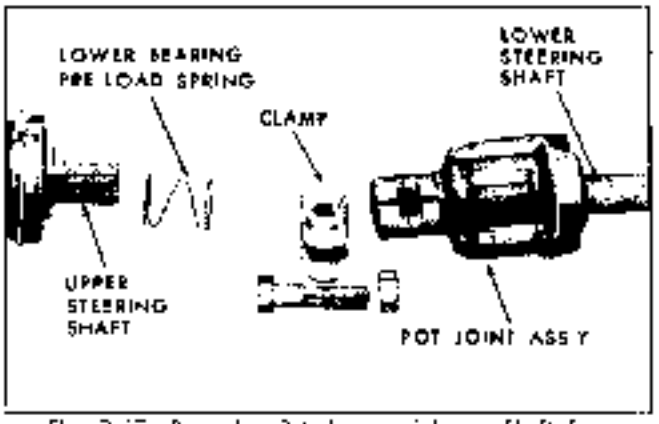


Fig. 9-17 Removing Pot Joint and Lower Shaft from Upper Steering Shaft (Tempest Only)

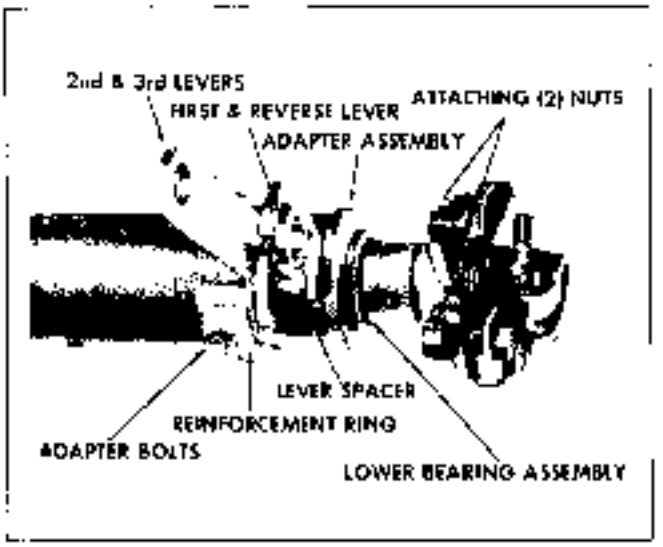


Fig. 9-18 Lower Shift Levers and Adapter (Pontiac Shown)

3. Install lower shift bowl bearing by pressing into jacket with tool J 22572 (Fig. 9-19).

Perform steps 4 through 8 on all cars equipped with column shift manual transmission.

4. Install shift tube and assemble the lever spacer, first and reverse lever, adapter assembly and alignment plate to the lower end of the jacket and loosely assemble the three bolts.

CAUTION: Friction surfaces of lower levers and mating bearing surfaces must be greased.

5. Place a .005" maximum shim on each side of steering shaft between either lever and the spacer (Fig. 9-20). By using two shims the possibility of cocking the lever is eliminated.

6. Rotate the lower bearing adapter assembly clockwise viewed from the bottom with tool J 22568 until levers are bottomed out.

NOTE: Standard spanner wrench holes are located at the bottom end of the adpater assembly.

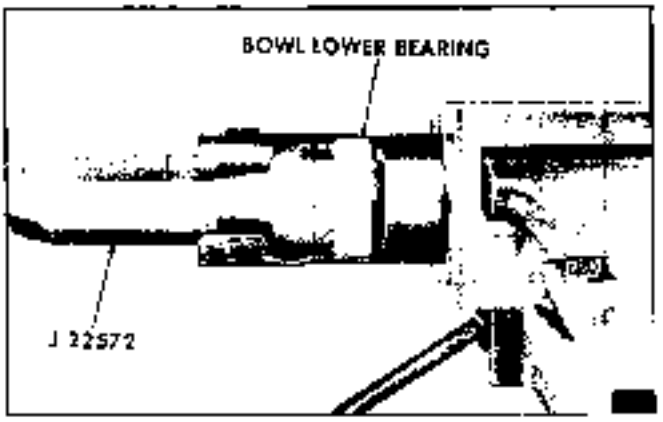


Fig. 9-19 Installing Lower Bowl Bearing

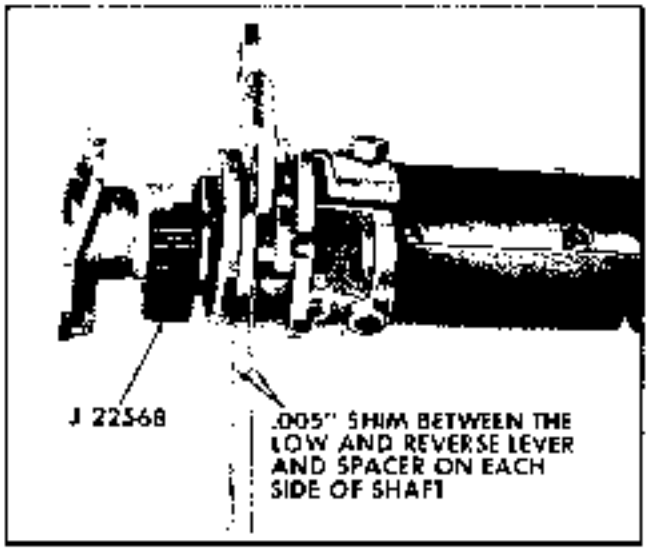


Fig. 9-20 Adjusting Lower Shift Lever Clearance

7. Tighten the three bolts to 10 lb. ft.

8. Remove both .005 maximum shims.

Perform steps 9 to 10 on all models except cars equipped with column shift manual transmission.

9. Install thrust washer, bearing adapter and shift tube spring on shift tube assembly and slide into jacket.

10. Install bearing adapter retainer.

Perform steps 11 and 12 on automatic transmission equipped cars with column shift.

11. Install the back-up or neutral-start switch loosely to the jacket assembly. This will be tightened to the jacket during assembly to the car after aligning lower levers.

NOTE: Use only No. 8-32 x 7/32" screws.

CAUTION: Screw must not be longer than 1/4" or damage to the shift tube will occur.

12. Install shift indicator wire and clip on Pontiac models.

D. Reassembly of Upper End

Apply a thin coating of lithium soap grease to all friction surfaces.

1. Press new upper shift lever spring into bowl pocket (Fig. 9-6).

2. Assemble spring and thrust ring (and on manual transmission column shift only, the bowl bearing washer) into shell and press shell into place on housing. Assemble housing over bowl spring until parts bottom.

3. Set switch on top of bearing housing and feed switch wires through switch cover.

4. Align bearing housing switch and cover holes and install three mounting screws through holes.

5. Slide three springs onto screws and start screws into lock plate (three turns for ease of assembly into column jacket).

6. Run switch wire through shift bowl and place upper end assembly on top of bowl.

7. Place the shift bowl and head assembly on top of jacket, making sure that the tangs on the ID of the lock plate are aligned with the slots in the jacket.

8. Push down on head assembly and rotate fully clockwise.

9. Torque the three turn signal mounting screws to 35 lb. in.

10. Pull wires flat against jacket and install wire clip, cover, and wire protectors. Do not mutilate wires with clip, cover or protector during installation.

Perform step 11 on Pontiac and Firebird only.

11. Place tolerance ring and spring on steering shaft and insert shaft from the lower end. If a new tolerance ring is installed (due to replacement of steering shaft, housing or bearing adapter), place bearing saver J 22686 over the end of the steering shaft and screw on steering wheel nut finger tight. Adjust tolerance ring to fill gap between snap ring and lower bearing and fuse adjuster and sleeve together securely in three equally spaced points. Remove bearing saver.

12. Install steering shaft and slide wave washer and thrust washer over steering shaft and against bearing.

13. Start C washer against steering shaft taper and slide down steering shaft with tool No. J 22569 until it snaps into groove.

IMPORTANT: Slide C washer sideways into groove and completely seat it.

14. Install turn signal lever and screw. Torque to 20 lb. in.

15. Install hazard warning knob. Torque to 4 lb. in.

16. Slide cancelling cam and upper bearing spring on shaft.

17. Install steering wheel. Torque steering wheel nut to 35 lb. ft.

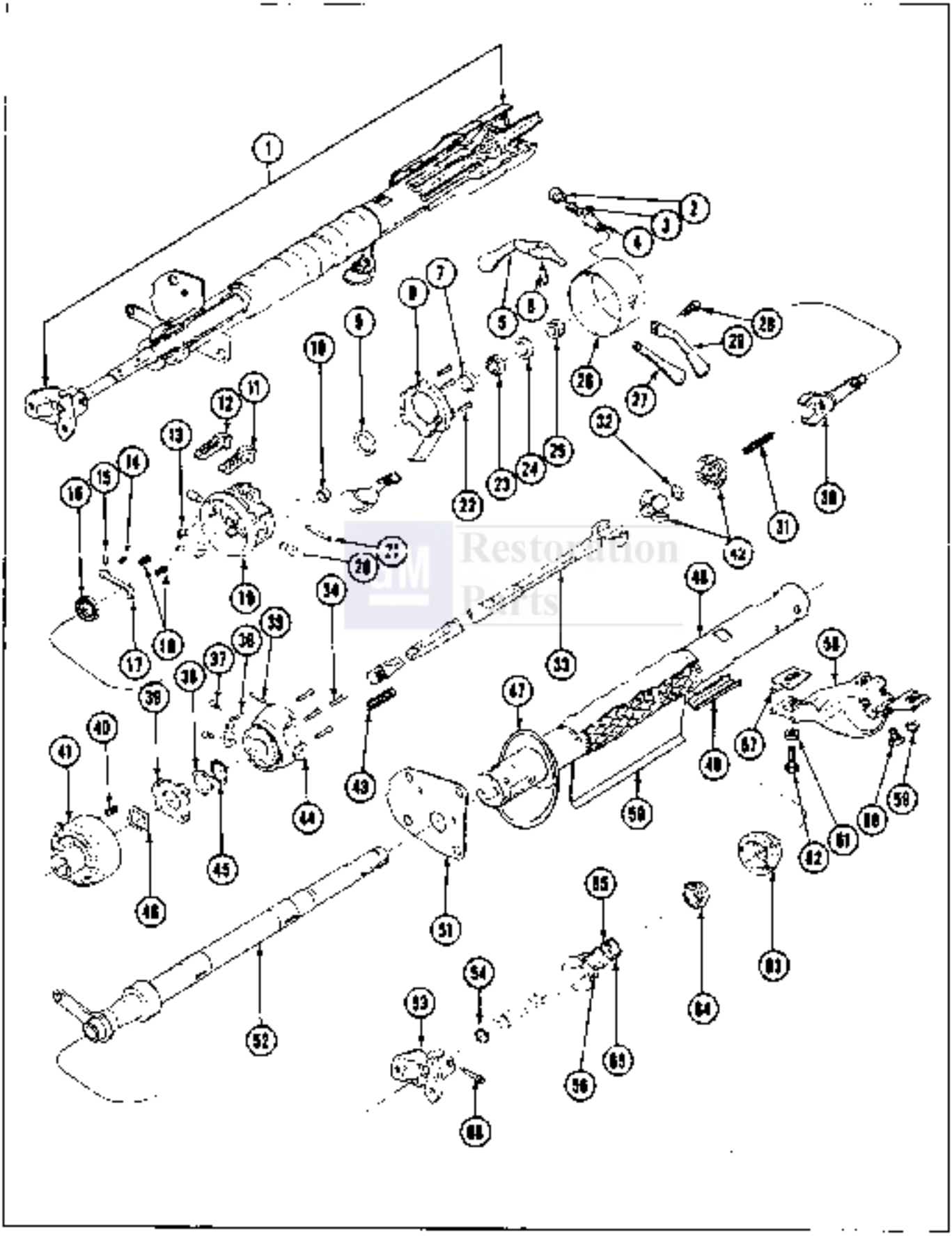


Fig. 9-21 Exploded View Typical Tilt Column

1. Steering Column Assembly
2. Traffic Hazard Switch Knob
3. Screw, Hazard Switch Knob
4. Cap, Traffic Hazard Switch Knob
5. Gearshift Control Lever Assembly—Upper
6. Gearshift Lever Pivot Pin
7. Steering Shaft Upper Bearing Race—Inner
8. Direction Signal Switch Assembly
9. Steering Shaft Bearing—Upper
10. Bearing Housing Spring Retainer
11. Steering Wheel Lock Shoe—4 Position
12. Steering Wheel Lock Shoe—3 Position
13. Bearing Housing Bumper
14. Tilt Release Lever Spring
15. Tilt Shoe Release Lever Pin
16. Steering Shaft Bearing—Upper
17. Steering Shaft Shoe Release Lever
18. Steering Wheel Tilt Shoe Spring
19. Steering Shaft Upper Bearing Housing Assembly (With Bearings)
20. Bearing Housing Pivot Pin
21. Bearing Housing Dowel Pin
22. Signal Switch Mounting Screw
23. Steering Shaft Upper Bearing Race Seat—Inner
24. Steering Shaft Upper Bearing Lock Nut
25. Steering Wheel to Steering Shaft Nut
26. Steering Housing Cover
27. Steering Wheel Release Lever
28. Lever to Switch Screw
29. Direction Signal Control Lever Assembly
30. Steering Shaft Assembly—Upper (w/Bearing Race)
31. Steering Shaft Joint Preload Spring
32. Centering Sector Wave Washer
33. Steering Shaft Assembly—Lower
34. Upper Bearing Housing Support Screw
35. Support Assembly Dowel Pin
36. Steering Column Shift Shoe Plate
37. Shoe Plate Mounting Screw
38. Thrust Washer
39. Steering Column Lock Plate
40. Gearshift Lever Bowl Spring
41. Gearshift Lever Bowl
42. Steering Shaft Centering Spacer
43. Bearing Housing Wheel Tilt Spring
44. Steering Shaft Upper Bearing Housing Support Assembly
45. Upper Reaction and Shift Tube Retaining Ring
46. Upper Steering Column Wave Washer
47. Steering Column Toe Plate Grommet
48. Steering Column Jacket
49. Direction Signal Control Wire Protector
50. Steering Jacket Mast Cover
51. Steering Column Cover Plate Seal
52. Steering Column Reaction and Shift Tube Assembly
53. Steering Shaft Flange—Upper
54. Lower Spring Thrust Washer Retainer Ring
55. Lower Steering Shaft Plunger
56. Lower Steering Shaft Sleeve
57. Steering Column to Support Bracket Adjusting Wedge
58. Steering Column Support Bracket Assembly
59. Support to Support Bracket Nut
60. Column to Support Bracket Bolt
61. Support Bracket to Mounting Bracket Washer
62. Support Bracket to Mounting Bracket Bolt
63. Steering Shaft Lower Bearing Adapter
64. Steering Shaft Bearing—Lower
65. Lower Steering Shaft Bearing Spring
66. Upper Flange Clamping Bolt

Fig. 9-21 Exploded View Typical Tilt Column

18. Install horn button.

19. Re-install column bracket with the four 5/16" bolts previously removed. Do not use a different length bolt. Torque bolts to 15 lb. ft.

NOTE: On Tempest models assemble lower steering shaft and pot joint to upper steering shaft. Tighten clamping nut to 32 lb. ft. (Fig. 9-17).

20. To assemble column in car, see "Removal and Installation of Column Assembly".

WARNING: Make certain that column is never unsupported when either the toe pan, dash mounting, or gear mounting is connected.

21. See Sec. 7 for proper adjustment of neutralizer switch.

DISASSEMBLY AND REASSEMBLY OF TILT COLUMN (Fig. 9-21)

DISASSEMBLY

1. Remove four 5/16" bolts securing column mounting bracket to column and remove bracket.

CAUTION: Set the bracket aside to protect breakaway capsules (Fig. 9-14).

2. Remove all signal switch wire clips and wire protectors from the mast jacket. The wire protector between the tapping plates can be removed by prying out carefully with a screwdriver (Fig. 9-15). If a wire cover is present, it can be removed like the wire clip by squeezing the edges together.

CAUTION: Do not pry against wires as insulation could be damaged.

3. Mount column in vise using tool J 22573 (Fig. 9-15) or by clamping the tapping plate in a vise (Fig. 9-16). On Tempest models disconnect lower shaft and pot joint from upper shaft by removing clamp (Fig. 9-17).

CAUTION: The mast jacket of the steering column assembly should never be clamped in the vise.

4. Remove steering wheel using wheel puller J 3044-01.

a. Remove turn signal cancelling cam and turn signal cancelling cam spring.

CAUTION: Do not hammer on end of steering shaft, as hammering could collapse steering shaft or otherwise loosen plastic injections which maintain column rigidity.

5. Remove two nuts securing neutralizer switch to column and remove switch on cars with column shift and automatic transmission.

6. Remove tilt release lever and turn signal lever. On Tempest and Firebird models with column shift and automatic transmission remove shift indicator

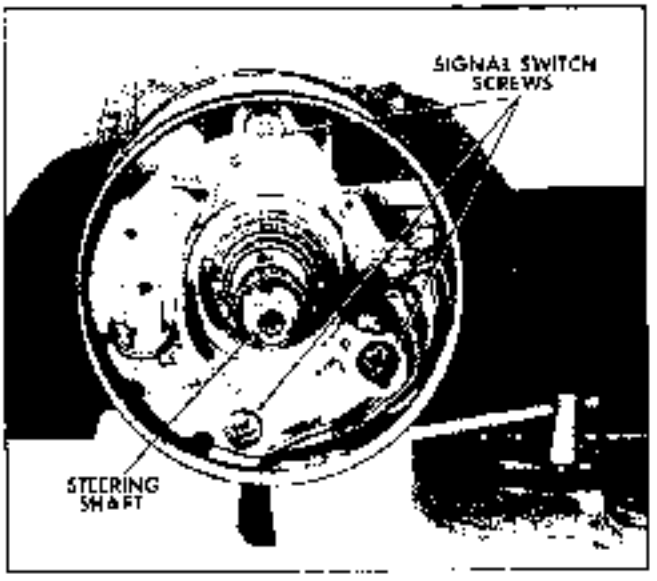


Fig. 9-22 Signal Switch Removal

bezel by removing two attaching screws on each side of bezel.

7. Push in hazard warning knob, remove knob and remove turn signal cover using special tool No. J 22598 (Fig. 9-9).

8. Remove the three signal switch screws with a Phillips screwdriver and let the signal switch assembly hang by its wires (Fig. 9-22).

NOTE: On some columns, the clearance between the bowl and mast jacket is sufficient to allow removal of the signal switch at this time.

9. Install tilt release lever and place column in full up position. Remove tilt spring retainer using screwdriver blade that just fits into slot opening. Insert screwdriver and press in approximately 3/16". Rotate retainer 1/8 turn clockwise until ears align with grooves in housing and remove retainer and spring.

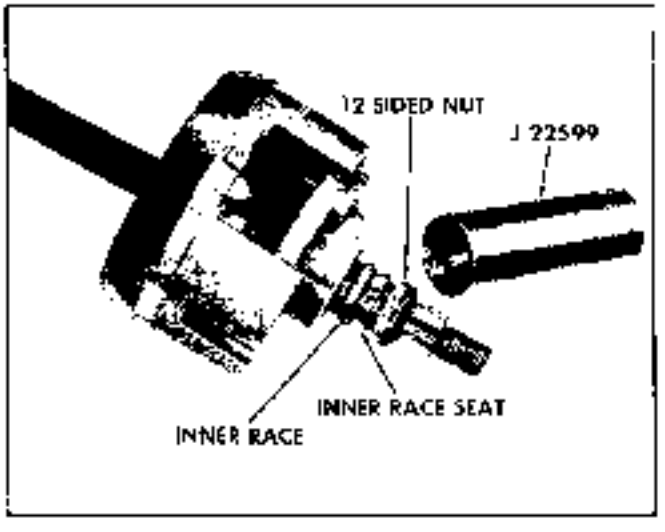


Fig. 9-23 Removal of 12-Sided Nut

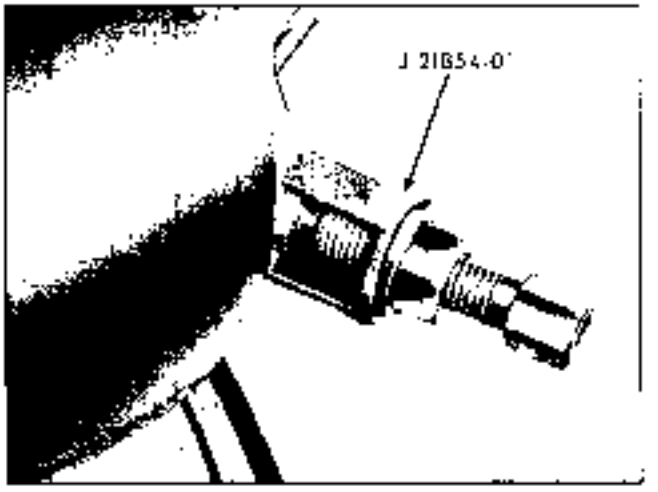


Fig. 9-24 Removing Pivot Pin

WARNING: Care should be taken when releasing tilt spring due to high compression rate of spring.

10. While holding end of steering shaft remove the 12-sided bearing lockout, inner race seat and inner race with tool J 22599 (Fig. 9-23).

11. Remove two pivot pins using tool J 21854-01 (Fig. 9-24).

12. Pull up on tilt release lever to disengage lock shoes and lift off bearing housing. Remove tilt release lever and remove bearing from housing assembly.

13. To service lock shoes, release springs or shoe release, drive lock shoe pin flush with housing face if there is not enough clearance for driving the release pin out of the housing. Hold the shoe springs in compression by rocking lock shoes in to relieve the load on the shoe release lever, as the release

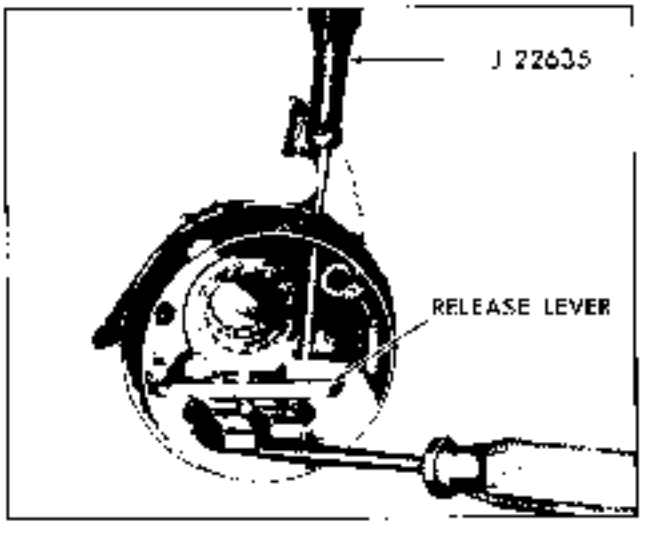


Fig. 9-25 Removing Tilt Release Lever Pin

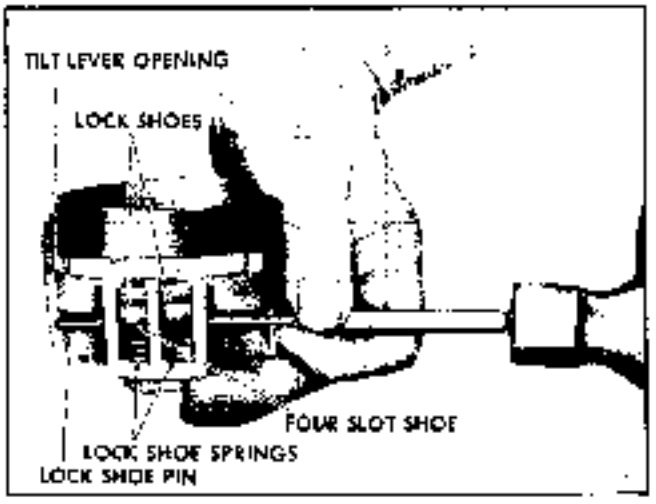


Fig. 9-26 Removing Lock Shoe Pin, Shoes and Springs

lever pin is driven out with tool J 22735 (Figs. 9-25 and 9-26). To remove shoes, drive lock shoe pin completely out.

14. Remove lower steering shaft flange from lower end of steering shaft on Pontiac and Firebird models.

15. Remove steering shaft from column by sliding shaft out upper end of column. On Pontiac and Firebird models it will be necessary to remove a snap ring, plastic tolerance ring and lower bearing preload spring prior to removing steering shaft (Fig. 9-27).

NOTE: Do not attempt to service the spheres of the steering shaft. These parts are a machined unit and very close tolerances exist. If there is looseness present, replace complete steering shaft.

16. Remove four screws securing the support assembly to the lock plate and mast jacket and take off support assembly.

17. Remove shift tube retainer ring with screw driver. Remove thrust washer.

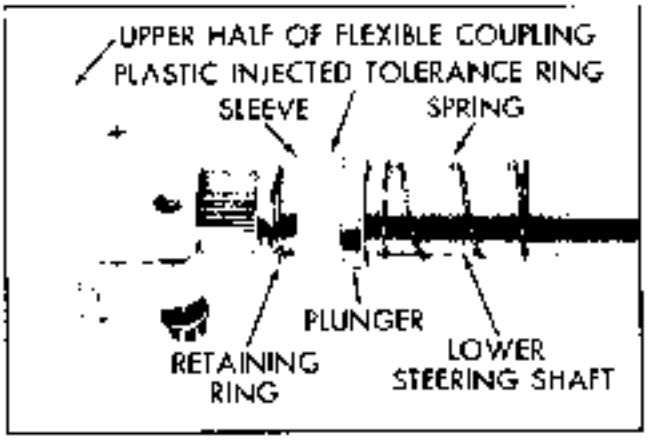


Fig. 9-27 Removal of Lower End

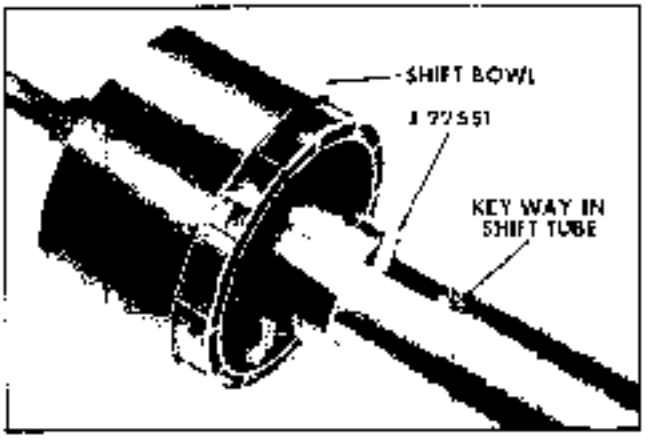


Fig. 9-28 Installing Tool J 22551

18. At lower end of column assembly, pry up on plastic fingers of lower bearing adapter and remove adapter assembly.

19. Remove shift tube assembly from bowl with tool J 22551. Insert the blade end of the tool in the notch of shift tube which is below the bowl key. Pilot sleeve on upper end of shift tube. Force shift tube out of bowl by turning nut (Figs. 9-28 and 9-29). If the shift tube is not completely freed from the bowl when tool J 22551 is removed, finish removal by hand and withdraw shift tube from lower end of mast jacket.

NOTE: Care should be taken not to turn the lower shift lever into the T slot on the lower end of the mast jacket while removing shift tube assembly from automatic transmission type columns.

CAUTION: Do not hammer or pull on lower shift tube as the plastic injections may be sheared or loosened.

20. Lift off lock plate, wave washer and bowl from mast jacket.

NOTE: Lock plate may be removed by sliding it

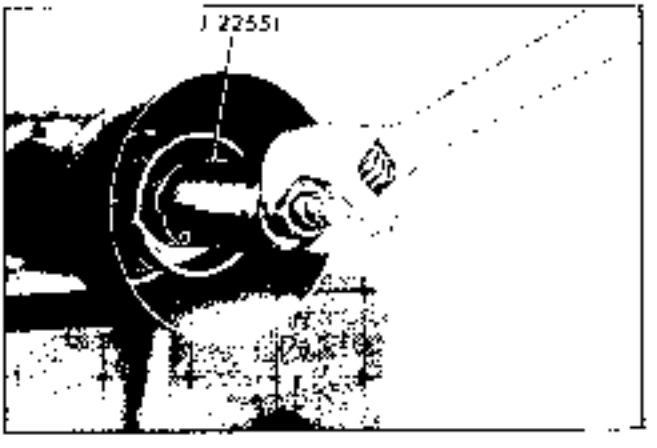


Fig. 9-29 Shift Tube Removal from Bowl

Fig. 9-30 Upper Shift Lever Spring

out of the jacket notches, tipping it down toward the bowl hub and 12 o'clock position and under the jacket opening.

21. Cut and unwrap mesh cover from mast jacket, if replacement is required.

22. Remove the upper shift lever spring by winding it up with pliers and lifting it out of the shift bowl (see Figure 9-30), if shift bowl is being replaced.

B. Assembly

1. Apply a thin coat of lithium grease to all friction surfaces.

2. When installing lock shoes in bearing housing, use special tool No. J 22635 or a .180 diameter rod to line up shoes for pin installation if upper bearing assembly has been serviced.

NOTE: With tilt lever opening on the left side, shoes facing up, the fore slot shoe is on the left (Fig. 9-29).

NOTE: Install shoe pin flush with housing face on release lever pin side.

Perform steps 3 through 6 if shift bowl was removed.

3. Install signal switch wire harness through the bearing housing and shift bowl, prior to assembling of the bowl and mast jacket.

4. Install wave washer and slide lock plate into notches in jacket inside the bowl. Carefully install shift tube in lower end of mast jacket. Lock plate will only fit into mast jacket one way so that threaded holes in lock plate will align with holes in support assembly.

5. Align keyway in shift tube with key in shift bowl and use tool J 22549 to pull the shift tube into the bowl (Figs. 9-26 and 9-29).

CAUTION: Do not push on top or end of shift tube assembly.

6. Pull the shift bowl up to compress the wave washer and install thrust washer and retaining ring.

7. Install support assembly aligning V in support assembly with V notch in mast jacket, torque support attaching screws to 50 lb. in.

8. Paint lower bearing adapter on shift tube and snap adapter into jacket.

9. Assemble steering shaft assembly in shift tube from upper end, taking care not to tear or push out foam seal cemented inside lower end of the shift tube.

10. Install external tilt release lever to hold lock shoes in disengaged position as the pivot pin holes of the bearing housing assembly are aligned with the pivot pin holes in the support assembly. Secure bearing housing assembly in position by pressing in the pivot pins.

11. Position housing in full up position and install the tilt spring (tapered end first) and retainer.

12. Install signal switch and tighten the three screws to 35 lb. in.

NOTE: Locate the short screw in topmost position, above the lock shoes.

13. Reassemble upper bearing, race, seat and 12-sided nut and tighten nut.

Pontiac and Firebird Models Only—

NOTE: Install the plastic tolerance ring, lower bearing spring and retaining snap ring onto lower end of steering shaft. If the steering shaft, mast jacket, upper bearing housing, and/or support have been replaced a new service replacement tolerance ring should be used and adjusted. The tolerance

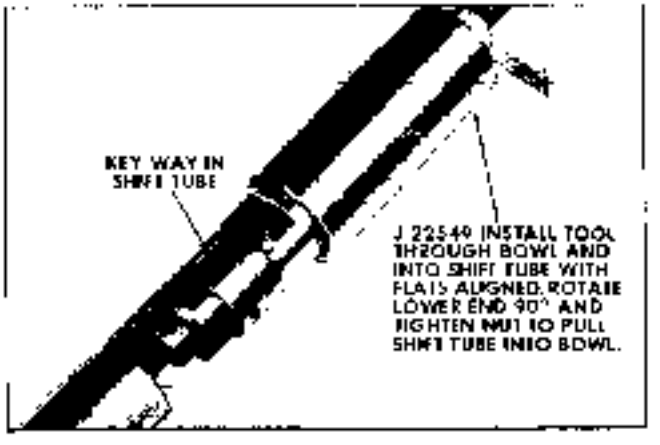


Fig. 9-31 Installing Tool J 22549 into Shift Tube

ring adjustment is performed by lengthening the tolerance ring until the space between the retaining snap ring and lower bearing is filled and then loosening the tolerance ring 1/4 to 1/2 turn. After adjustment is completed stake the tolerance ring in 3 equally spaced places with a soldering iron.

14. Retighten the 12-sided nut until the torque required to rotate the steering shaft, with the housing in the mid position, is 15 oz. in.

NOTE: This specification may be obtained by placing the steering wheel on the shaft, attaching an ounce spring scale to a spoke 5" from center and obtaining a reading of 3 ounces.

15. Remove tilt release lever and install cover using tool J 21853 (see Figure 9-33).

NOTE: Be sure the hazard warning knob is pushed in to allow clearance for the cover and to avoid damage to switch.

CAUTION: Tilt or slack should be left in signal switch wires when clamped to underside of steering column so that the column head is free to move in full up position.

16. Install tilt release lever, signal switch lever, hazard warning knob to proper torque. On Tempest and Firebird models with automatic transmission and column shift install the shift indicator bezel using the two attaching screws.

17. Slide cancelling cam and cancelling cam spring on upper steering shaft prior to steering wheel installation.

NOTE: Prior to installing cancelling cam be sure that turn signal switch is in neutral position and hazard flasher is in OFF position, this will prevent damage to the switch when steering wheel is installed.

18. Rewrap the mesh cover if removed or replaced.

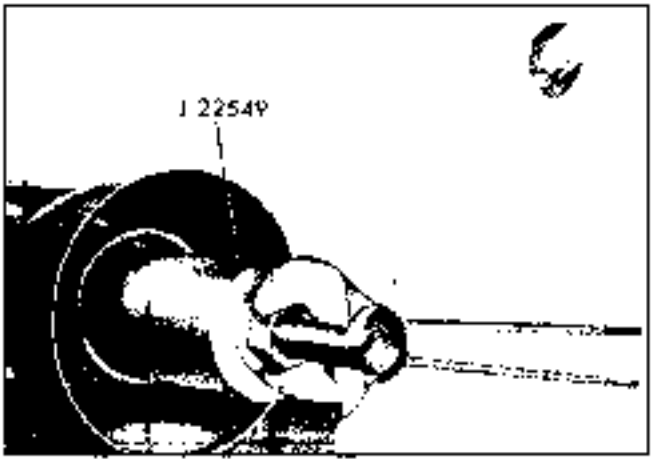


Fig. 9-32 Installing Shift Bowl and Shift Tube

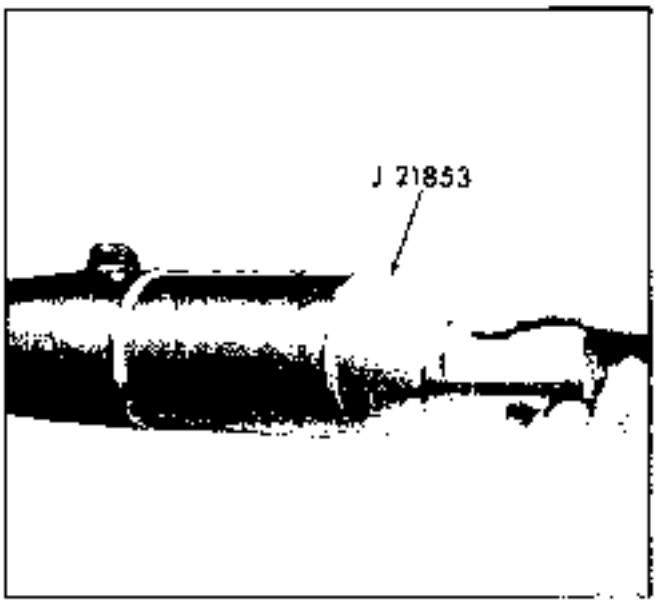


Fig. 9-33 Installing Turn Signal Switch Cover

NOTE: The mesh cover can be reassembled to the mast jacket with electrician's tape.

19. Install mounting bracket and torque bolts to 15 lb. ft.

CAUTION: Do not use substitute bolts.

20. Install neutral-start and back-up light switch, it will be readjusted in the car.

CAUTION: Do not use substitute screws for neutralizer switch.

NOTE: See Section 7 for proper adjustment of neutralizer switch.

21. Install lower flange on steering shaft and torque bolt to 30 lb. in. On Tempest models install lower shaft and pot joint to upper shaft, tighten clamping nut to 32 lb. ft.

DISASSEMBLY AND ASSEMBLY OF STEERING SHAFT POT JOINT— TEMPEST MODELS ONLY (Fig. 9-34)

NOTE: The pot joint need only be disassembled if there is looseness or binding in the assembly.

DISASSEMBLY

1. Remove steering column from car as outlined previously.

2. Scribe a mark on housing and lower steering shaft.

3. Remove wire retaining clip around inside of housing. Care must be taken not to cut rubber boot around lower shaft.

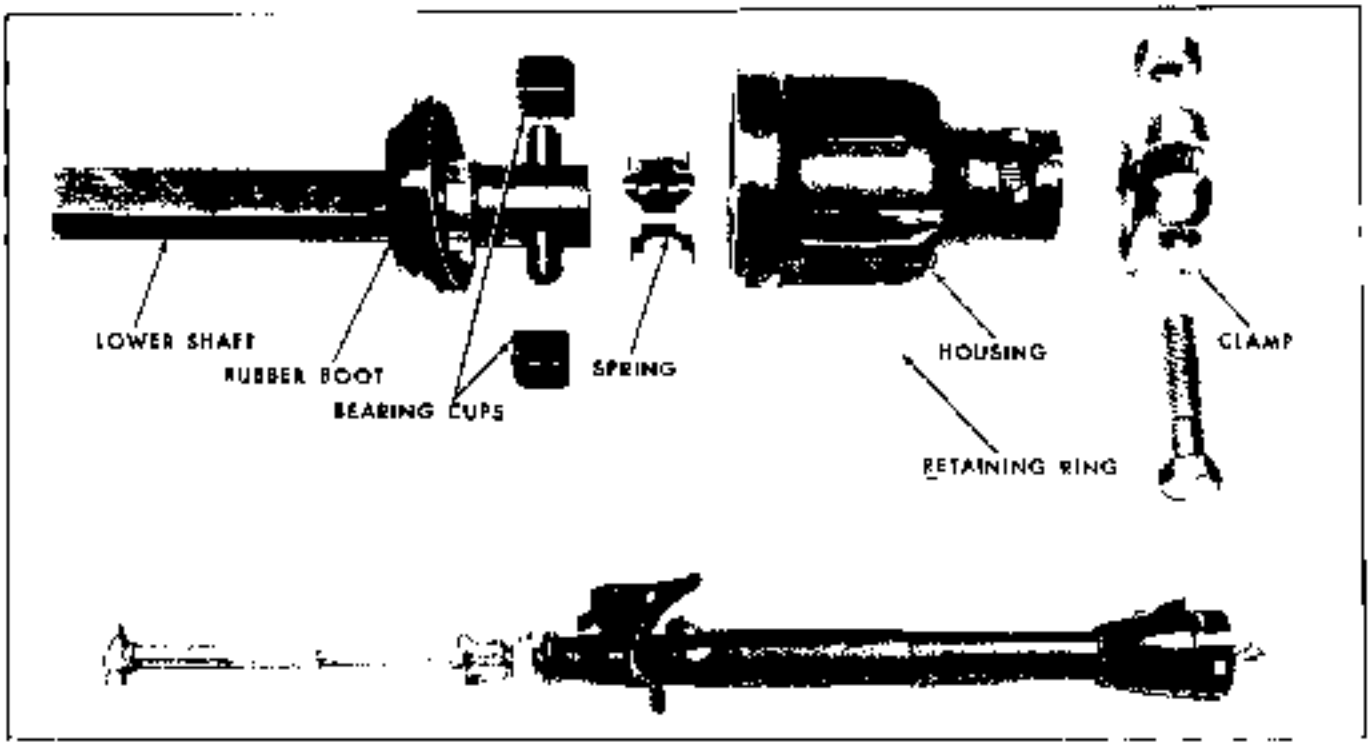


Fig. 9-34 Exploded View of Pot Joint (Tempest Only)

4. With slight pressure pull on lower steering shaft, this will separate shaft from housing.

5. Remove bearing cups and clip from steering shaft.

NOTE: If the rubber boot or cross shaft in lower steering shaft is damaged do not attempt to remove these parts from the steering shaft. These parts are serviced with the lower steering shaft.

ASSEMBLY

1. Reverse disassembly procedure.

2. When assembling lower steering shaft into joint housing be sure scribe marks are lined up. Also use care not to cut rubber boot when installing wire retaining clip.

NOTE: To provide proper lubrication of this assembly coat all surfaces with lithium soap grease. Do not over fill assembly with grease.

REPLACE STEERING LINKAGE

Steering connecting rod may be removed from both tie rods, pitman arm and idler arm by removing the ball shaft nut (Fig. 9-35 and 9-36). Since connecting rod is a solid shaft, it may be replaced by installing a new rod and connecting it to pitman arm, tie rods, and idler arm.

After steering connecting rod is removed the pitman arm may be removed from pitman shaft by removing nut and lock washer and by using puller J 5504-01. To install pitman arm or pitman shaft, replace arm, lock washer and nut and tighten to 140 lb. ft. torque.

After steering connecting rod is removed, idler arm may be removed by removing two bolts which retain idler support to frame. Install assembly on frame with two attaching bolts and washers and tighten to 40 lb. ft. torque.

Tie rod assembly may be removed from car by removing cotter pin and castellated nut on tie rod ends at steering arms. To separate tie rod and tie rod end, loosen two bolts on sleeve and clamp assembly, and thread out part to be replaced. To reassemble, thread new part into tube and clamp assembly to approximate original location, place tie rod end with dust cover in steering arm, tighten castellated nut securely, and install new cotter pin.

When new tie rods or tie rod ends are installed it is necessary to check toe-in. Check clamp bolts on tie rod adjuster sleeve assembly for tightness (17 ft. lb. torque) and bolts are to rear. Assemble tie rod clamps as shown in Fig. 9-35 for Tempest and Pontiac, Fig. 9-36 for Firebird models.

Whenever work is done on steering linkage it should be lubricated.

NOTE: When installing complete linkage assembly, tighten pitman arm to shaft nut before tightening idler arm to frame.

STANDARD STEERING GEAR SERVICE

LUBRICATION

Periodic service consists of periodical lubrication as outlined in GENERAL LUBRICATION Section. The addition of the lubricant is to be made by removing the center side cover bolt.

ADJUSTMENTS ON CAR

Correct adjustment on the steering gear is extremely important. Before any adjustments are made in the steering gear in an attempt to correct such conditions as shimmy, hard or loose steering and road shocks, careful check should be made to determine that front end alignment, shock absorbers, wheel balance and tire pressure are correctly adjusted and/or operating satisfactorily.

There are two adjustments on the recirculating ball-type steering gear:

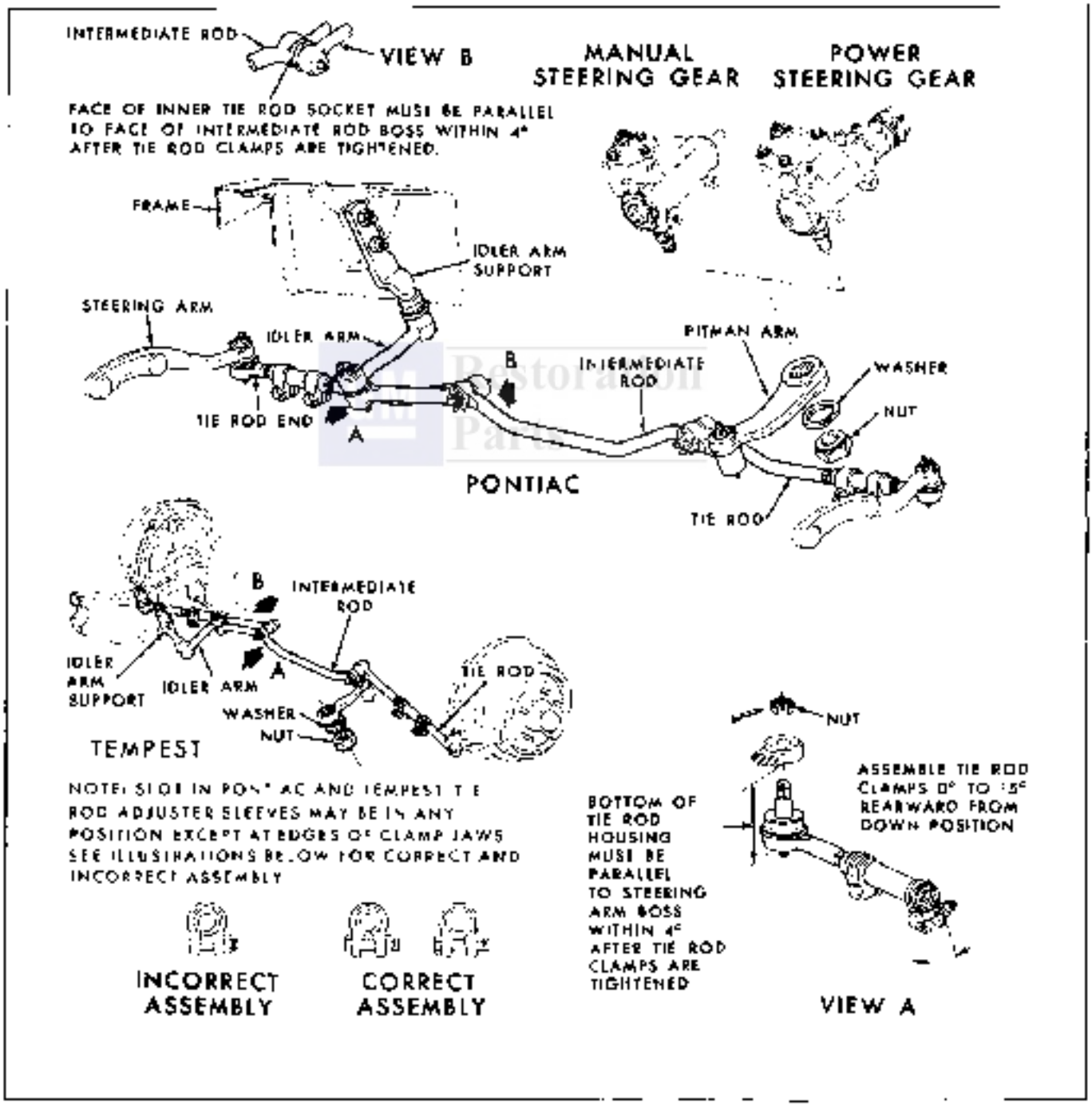


Fig. 9-35 Part of the Tempest Steering Linkage

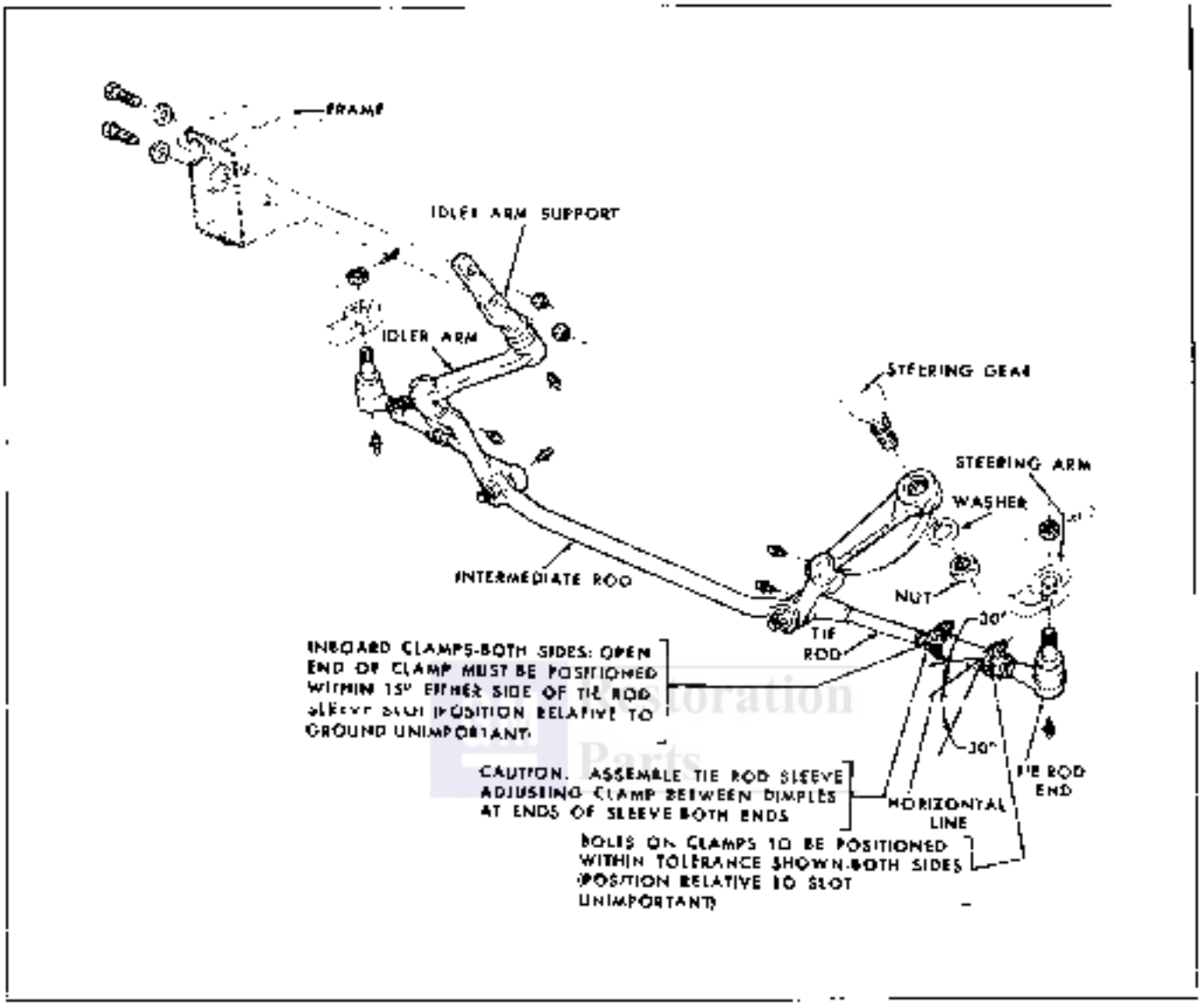


Fig. 9-36 Firebird Steering Linkage

1. Worm bearing preload adjustment.

2. Sector and ball nut end back lash adjustment.

CAUTION: It is very important when adjusting steering gear that adjustments be made in above sequence. Failure to do so will result in damage to steering gear.

ADJUST WORM BEARING PRELOAD

1. Raise vehicle and disconnect steering connecting rod from pitman arm (Fig. 9-35 and Fig. 9-36), using tool J 5504-01.

2. Loosen pitman shaft adjusting screw lock nut and back off adjusting screw a few turns (Fig. 9-37).

3. Remove horn button or horn ring on steering wheel.

4. With lb. in. torque wrench measure and record at least 30° off center (Fig. 9-38).

NOTE: Do not use torque wrench having maximum torque reading of more than 200 pounds inch. When taking following torque readings, take reading pulling torque wrench to right and reading pulling torque wrench to left. Total both readings and take one-half of this total as average torque.

5. Torque required should be 7 in. lb. To correct, loosen worm bearing adjuster lock nut with brass drift and turn adjuster to bring torque within limits.

6. Retighten lock nut when adjustment is correct and recheck as in step 4 above.

ADJUST SECTOR AND BALL NUT BACKLASH

1. When worm bearing preload has been adjusted

Fig. 9-37 Adjusting Pitman and Ball Nut Backlash

correctly, pitman shaft adjusting screw should be turned clockwise until a pull equal to worm bearing preload plus 7 in. lb. is required to turn the wheel through center.

Total thrust bearing adjustment, pitman shaft adjustment, and drag not to exceed 14 in. lb. on Pontiac, Tempest and 16 in. lb. on Firebird.

2. Tighten pitman shaft adjusting screw lock nut to 23 ft. lb. torque and recheck adjustment.

3. Reassemble steering connecting rod to pitman arm. Set spokes of steering wheel in straight ahead position. If road wheels are not straight ahead, adjust steering tie rods.

REMOVAL OF STEERING GEAR

1. Raise vehicle and disconnect pitman arm from pitman shaft using 5504-31.

2. Disconnect lower steering shaft flange from flexible coupling.

3. Remove three steering gear housing to frame bolts and withdraw gear from car.

DISASSEMBLE STEERING GEAR
(Fig. 9-39)

Disassemble and assemble steering gear and subassemblies on a clean work bench, preferably while the assembly is mounted on holding fixture (J 5205 or J 6448-01).

CAUTION: DO NOT clamp housing in vise. Cleanliness is of utmost importance; therefore, bench, tools, and parts must be kept clean at all times.

Before disassembling gear, thoroughly clean exterior with suitable solvent and drain as much fluid as possible.

1. Mount steering gear on holding fixture J 5205.

2. Rotate wormshaft with flexible coupling until coupling is in center of travel. Remove three side cover screws and adjusting screw nut.

3. Remove side cover and gasket by turning adjusting screw clockwise through cover (Fig. 9-40).

4. Remove adjusting screw from slot in end of pitman shaft. Make sure shim found on adjusting screw remains with screw (Fig. 9-41).

5. Remove pitman shaft from housing using care that threads do not damage seal in housing.

6. Loosen worm bearing adjuster lock nut with brass drift and remove adjuster and lower bearing.

7. Scribe a mark on flexible coupling and worm shaft. Remove coupling from shaft.

8. Push worm and shaft assembly, with ball nut assembly, through bottom of housing and remove upper bearing.

9. Clean grease from worm and shaft assembly and also from inside gear housing.

10. Remove ball nut return guide clamp by removing three screws, remove guides, turn ball nut over and remove balls. Rotating shaft slowly from side to side will aid in removing balls.

11. Remove ball nut from worm.

NOTE: Unless all balls are removed nut cannot be removed.

CLEANING AND INSPECTION

1. Remove gear housing from holding fixture.

2. Wash all parts in clean kerosene or other suitable solvent.

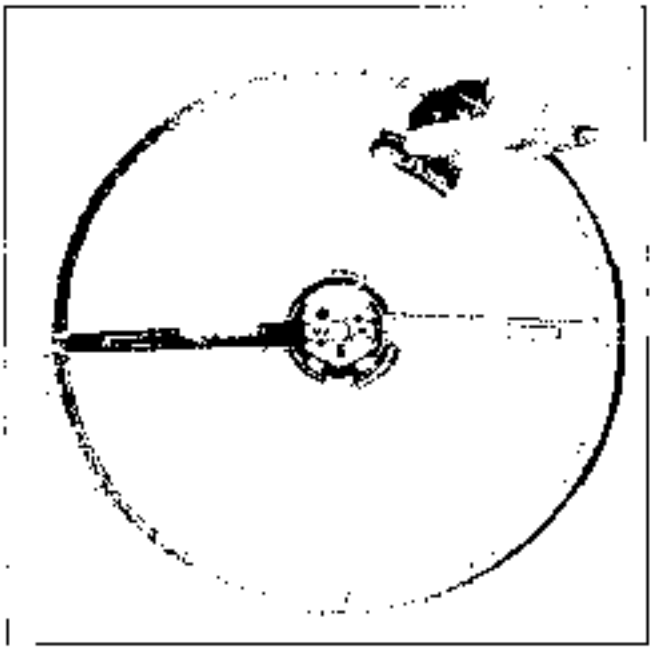
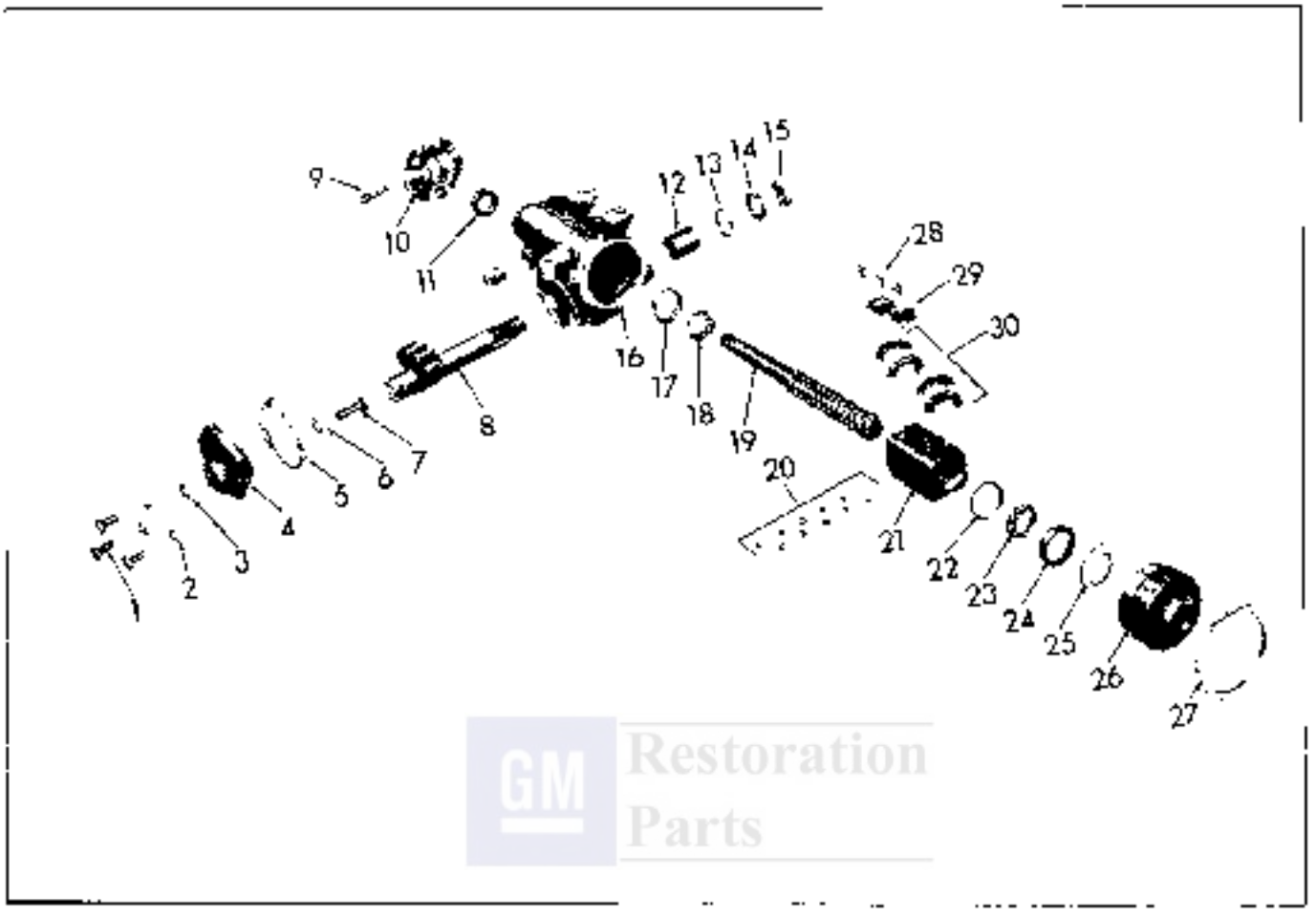


Fig. 9-38 Checking Steering Gear Adjustment



1. Side Cover Bolts
2. Side Cover Bolt Washers
3. Adjusting Screw Lock Nut
4. Side Cover
5. Side Cover Gasket
6. Adjusting Screw Shim
7. Adjusting Screw
8. Pitman Shaft
9. Flange Bolt
10. Coupling and Lower Flange
11. Steering Shaft Seal
12. Pitman Shaft Bushing
13. Pitman Shaft Seal
14. Pitman Shaft Nut Lock Washer
15. Pitman Shaft Nut
16. Steering Gear Housing
17. Upper Bearing Cup
18. Upper Bearing
19. Worm and Steering Shaft
20. Balls
21. Ball Nut
22. Lower Bearing Retainer
23. Lower Bearing (Worm Thrust)
24. Lower Bearing Cup (Worm Thrust)
25. Belleville Washer
26. Worm Bearing Adjuster
27. Worm Bearing Adjuster Lock Nut
28. Ball Return Guide Clamp Screws
29. Ball Return Guide Clamp
30. Ball Return Guides

Fig. 9-39 Exploded View of Standard Steering Gear

3. Inspect all bearings, bearing cups, worm groove, bushings, seals, teeth for scoring, wear, pitting which would necessitate replacement.

4. Inspect housing and cover for sand holes or cracks.

5. If pitman shaft bushing seal, upper and lower bearing cups, steering gear housing or flexible coupling are worn excessively or damaged, replace parts.

REPLACE PITMAN SHAFT BUSHING

1. Remove pitman shaft seal by prying seal out of housing bore with screwdriver.

2. Drive out bushing with tool J 1814 (Fig. 9-42).

3. To install new bushing with same tool, drive bushing in towards center of gear housing. Inner end of bushing must be flush with inside surface of housing at seal seat.

4. Install new pitman shaft seal using suitable socket as driver.

REPLACE PITMAN SHAFT SEAL

1. Remove pitman shaft seal by prying seal out of bore with screwdriver or suitable tool.

2. Install new seal using suitable socket as driver.

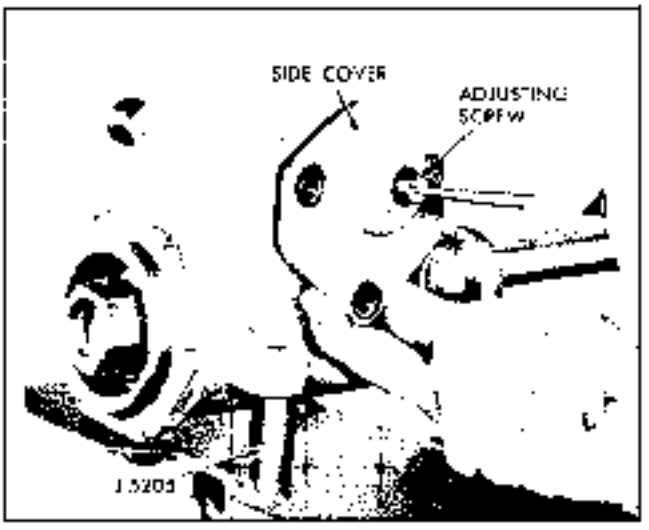


Fig. 9-40 Removing Side Cover

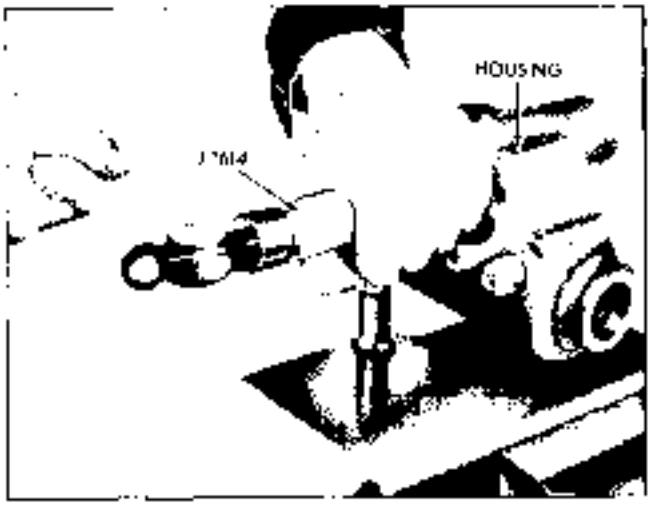


Fig. 9-42 Removing Pitman Shaft Bushing

REPLACE UPPER OR LOWER BEARING CUPS

UPPER CUP

Remove gear housing upper seal assembly. Then using suitable punch, remove upper cup from gear housing. Install bearing cup in housing using J 9755, replace worm shaft seal.

LOWER CUP

1. Remove lower bearing retainer from bearing adjuster. Bearing cup is a slip fit and will come out with lower bearing and Belleville washer.

2. Install Belleville washer, bearing cup, lower bearing and retainer in worm bearing adjuster.

ASSEMBLE STEERING GEAR

NOTE: All seals, bushings and bearings should be prelubricated before assembly.

1. Position ball nut on shaft so that deep side of teeth are located as shown in Fig. 9-43.

2. Install 19 balls in each circuit of ball nut (rock steering shaft slightly to aid in installing balls) and insert 6 balls in each return guide using petrolatum to hold balls in place. Install return guide clamp and screw.

CAUTION: Do not rotate worm shaft while installing balls, since balls may enter crossover passage between circuits. This will cause improper operation of ball nut.

3. Place upper bearing on worm shaft. Center ball nut on worm, then slide worm shaft, bearing and nut into housing.

4. Install adjuster in housing.

NOTE: Adjuster should be installed just tight enough to hold bearing races in place. Install adjuster lock nut loosely.

5. Slip flexible coupling assembly on shaft and turn steering gear from one extreme to the opposite to make certain there are no unusual binds and remove flange assembly.

NOTE: Never allow ball nut to strike ends of ball races in worm due to possibility of damage to ball guides.

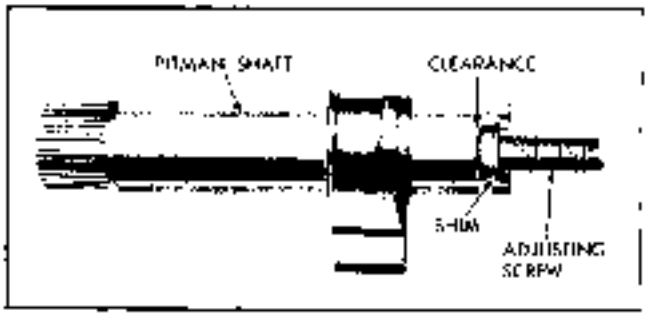


Fig. 9-41 Pitman Shaft and Adjusting Screw

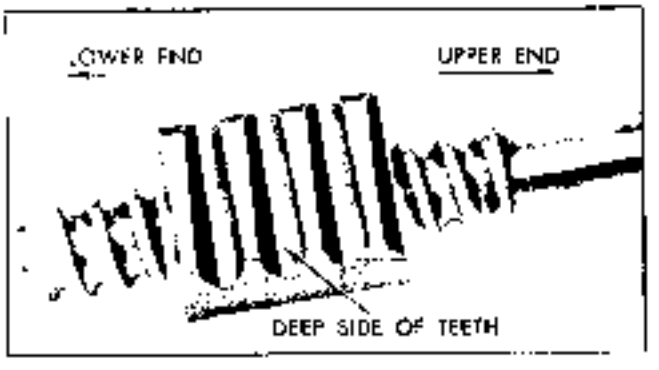


Fig. 9-43 Ball Nut Properly Installed on Shaft

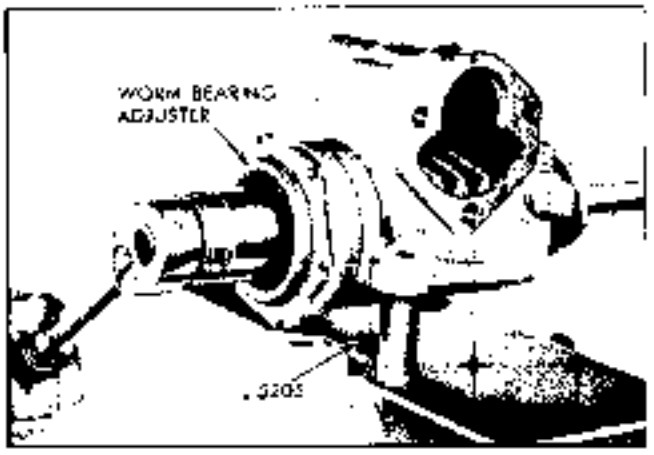


Fig. 9-44 Adjusting Worm Bearing Preload

a. Using a 11/16"-12 point deep socket and inch pound torque wrench, measure torque required to turn worm shaft, keep wrench in motion when off high point of gear. Torque required should be 7 in. lb.

b. If torque does not meet above specifications loosen worm bearing adjuster lock nut (Fig. 9-44) and turn adjuster to bring torque within 7 in. lb. limits.

c. Tighten lock nut and recheck torque.

d. Remove 11/16" socket and torque wrench.

6. Install pitman shaft adjusting screw and selective shim in pitman shaft (Fig. 9-41).

NOTE: Screw must be free to turn, but have no more than .002" end play. If end play of screw in slot is too tight or too loose, select new shim to give proper clearance. Shims are furnished in four thicknesses: .063", .065", .067", and .069".

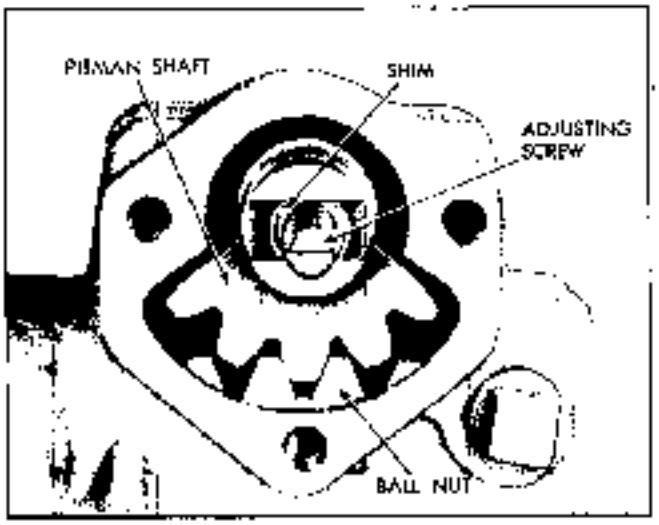


Fig. 9-45 Position of Pitman Shaft and Ball Nut

7. Position pitman shaft seal on pitman shaft and seat seal using suitable socket as a driver.

8. Install pitman shaft and adjusting screw with sector and ball nut teeth positioned as shown in Fig. 9-45.

9. Install side cover and gasket on adjusting screw, turning screw counterclockwise until it projects through side cover 5/8" to 3/4".

10. Install two cover attaching bolts. Tighten to 35 ft. lb.

11. Tighten pitman shaft adjusting screw so that teeth on shaft and ball nut engage but do not bind. Final adjustment will be made later.

12. Fill steering gear with all-season steering gear lubricant and install third cover attaching bolt. Tighten to 35 ft. lb.

13. Adjust sector preload and ball nut backlash as follows:

a. Place a 11/16"-12 point socket and in. lb. torque wrench over end of worm shaft.

b. Tighten pitman shaft adjusting screw as necessary to obtain a reading of 7 in. lb. torque, in excess of total thrust bearing preload, and

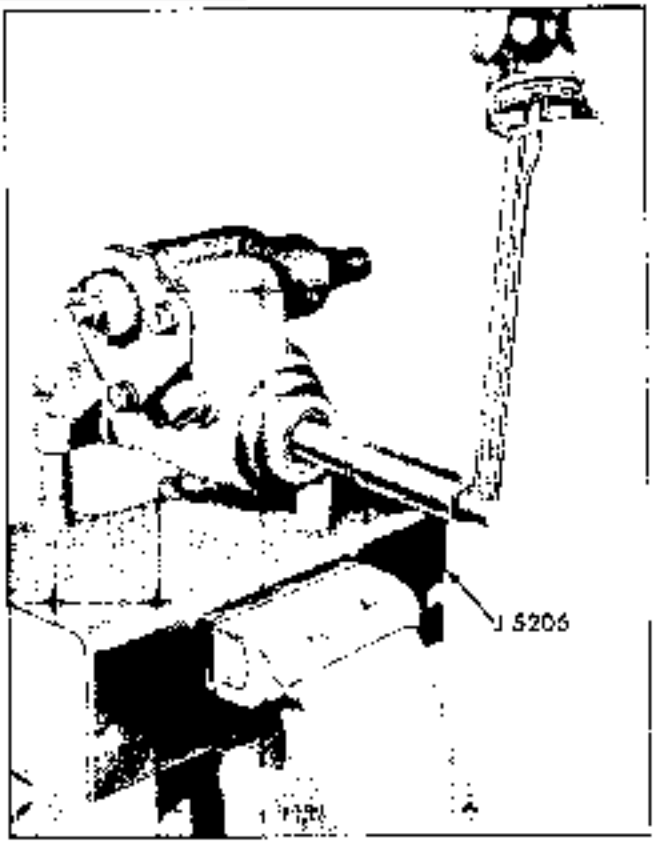


Fig. 9-46 Adjusting Worm Gear Through High Point (In Fixture J 5206) - Gear Mounted

seal drag, when the worm gear is turned through the center high point (Fig. 9-46). Total thrust bearing adjustment, and seal drag not to exceed 14 in. lb. on Pontiac and Tempest, 16 in. lb. on Firebird.

c. Tighten pitman shaft adjusting screw lock nut to 23 ft. lb. and re-check adjustment.

14. Install flexible coupling on worm shaft and tighten clamping bolt to 30 ft. lb. Be sure the scribe marks are aligned.

INSTALLATION OF STEERING GEAR

1. Align scribe marks on steering and worm shaft flange with flexible coupling.

2. Position steering gear in car.

NOTE: Metal to metal contact between flanges on worm shaft and steering shaft assembly will transmit and amplify gear noise to drive.

3. Install steering housing to frame bolts and tighten housing to frame bolts to 75 ft. lb. torque.

4. Install pitman arm and secure with lock washer and nut. Tighten nut 140 ft. lb. torque.

5. Install two flange attaching nuts and lock washers and tighten to 20 ft. lb.

6. Be sure pins are properly positioned (Fig. 9-11). If pins are not positioned properly loosen flexible coupling at worm shaft and reposition or align steering column.

POWER STEERING

PERIODIC SERVICE RECOMMENDATIONS

Since the steering gear is constantly lubricated, it is only necessary to periodically check the level in the pump reservoir. See Specifications Section for system capacity.

MINOR REPAIRS TO STEERING GEAR

The following procedures may be performed with the steering gear in the car.

Before making adjustments to the power steering gear to correct conditions such as shimmy, hard or loose steering, road shock, wander or weave; a check should be made of front end alignment, shock absorbers, wheel balance, or for tight front wheel bearings, loose steering rod ends or loose pitman arm. Also, check diagnosis guide at the end of Section 9, in the Pontiac Diagnosis Manual.

STEERING GEAR ADJUSTMENTS

CAUTION: Prior to checking gear make certain that the steering shaft is not binding or tight in the steering column. On cars with tilt column be sure steering is in straight position and not tilted.

NOTE: All checks and adjustments must be made in the order listed in step 1.

1. Raise vehicle and disconnect steering gear connecting rod from pitman arm using tool J 9504-01.

2. Remove horn button from steering wheel.

3. With inch pound torque wrench attached to a 5/8"-12 point socket, measure through an angle not to exceed 20° and record readings taken from the following steering gear positions (Fig. 9-39).

NOTE: DO NOT use torque wrench having maximum torque reading of more than 100 in. lb. When taking following torque readings, take a reading pulling torque wrench to right and a reading pulling torque wrench to left. Total both readings and take one half of this total as average torque.

a. One and one half turns (Pontiac) or one turn (Tempest and Firebird) off center high point. This reading represents the thrust bearing preload plus friction due to seals and bearings. It should not exceed 7 in. lb. torque on Tempest, Firebird, and Pontiac Catalina models without air conditioning, 8 in. lb. torque on all other Pontiac models. If the reading is below 3 in. lb. torque, it may indicate some lash in the thrust bearing.

NOTE: If reading for "a" is not in specification, correct thrust bearing preload as follows: Loosen adjuster plug lock nut, using a drift or similar tool, and move flexible coupling (by turning steering wheel) as necessary to permit installation of tool J 7624 on adjuster plug (Fig. 9-40). Tighten plug to obtain proper bearing preload and retighten adjuster plug lock nut.

b. One half turn off center high point. This reading represents resistance from "a" above plus worm to rack-piston preload as determined by the size of the balls used in the rack-piston nut and the concave high point ground on the worm. This reading should be 0.5 to 3.0 in. lb. torque higher than the reading in "a" (and a max. of 10 in. lbs. torque) for Tempest, Firebird and Catalina models without air conditioning and 1.5 to 4.5 in. lb. torque higher than the reading in "a" (and a max. of 12.5 in. lb. torque) for all other Pontiac models.

NOTE: If after obtaining proper thrust bearing preload in "a" and torque reading in "b" is not

within specifications, then DO NOT remove gear assembly to refit rack-piston balls to correct a complaint of loose or hard steering. Such complaints can often be corrected by a thrust bearing adjustment ("a") and an overcenter adjustment ("c"). If not, then the rack-piston nut and worm assembly should be checked for excessive lash on excessive load overcenter and also for roughness along the worm.

c. Through the center high point. This reading represents the combined resistances of thrust bearing preload "a", worm to rack-piston preload "b" and overcenter (pitman shaft) preload "c". This reading should be 4-8 in. lb. torque higher than the reading in ("b") and should not exceed 18 in. lb.

4. If the reading in step "3c" is not within specification, loosen the pitman shaft adjusting screw lockout and thread the adjusting screw out to the limit of its travel through the pitman shaft side cover and then turn the pitman shaft adjusting screw back in 1/2 turn. **Tighten** the pitman shaft adjusting screw using a 5/32 Allen wrench while rotating the input shaft with an inch-pound torque wrench through the center of travel (at least 1/2 turn each side of center) until the torque is within the specifications noted in "3c". Tighten the pitman shaft adjuster screw lockout to 32 ft. lb. torque and recheck the over-center torque.

5. Reassemble horn button or horn ring to steering wheel.

6. Reassemble connecting rod to pitman arm. Tighten nut to 140 ft. lb.

REPLACEMENT OF PITMAN SHAFT SEALS WITH GEAR IN CAR

NOTE: Removal of seals can be accomplished with steering gear in car, using hydraulic pressure from gear assembly to force seals out of pitman shaft bore.

1. Raise vehicle and remove pitman arm retaining nut and lockwasher.

2. Remove pitman arm using tool J 5504-01.

3. Remove pitman shaft outer dust seal retaining ring, using Truarc pliers.

4. Remove outer dust seal, using screwdriver or similar tool and place a cloth around housing and pitman shaft to absorb oil leakage from seal bore.

5. Hold a clean dry pan under gear housing and with engine running, momentarily turn steering gear to extreme left position for not more than two seconds. This will build up pressure on upper side of piston and in pitman shaft chamber, forcing seals and inner back-up washer out of bore.

NOTE: If pressure of oil does not remove seals, turn off engine, remove steering gear from car, and disassemble gear, refer to procedures outlined further in this section.

6. Clean seal bore of housing, pitman shaft and inspect housing bore for any burrs which might damage seals during installation.

7. Wrap a piece of thin tape around splines of pitman shaft, this will prevent damage of seals during installation. Use only one layer of tape to allow for clearance of seals to pass over taped area.

8. Lubricate seals thoroughly and install seals using tool J 6219. Install inner single lip seal, then backup washer, then the other seal, then backup washer and retaining ring. Be sure that inner seal does not bottom in housing bore. Install seals only far enough to provide clearance for backup washers and retaining ring.

9. Fill pump reservoir to proper fluid level. Start engine and allow engine to idle for about three minutes without turning steering wheel. Then turn steering wheel to the left and inspect for leaks.

10. Remove tape from pitman shaft and install pitman arm.

REMOVAL OF STEERING GEAR

1. Disconnect pressure and return hose assemblies from housing.

2. Raise vehicle and disconnect pitman arm from pitman shaft, using J 5504-01.

3. Scribe mark on steering shaft worm shaft flange and disconnect flexible coupling from steering shaft.

4. Remove gear housing to frame bolts, noting number and location of gear to frame shims (if any).

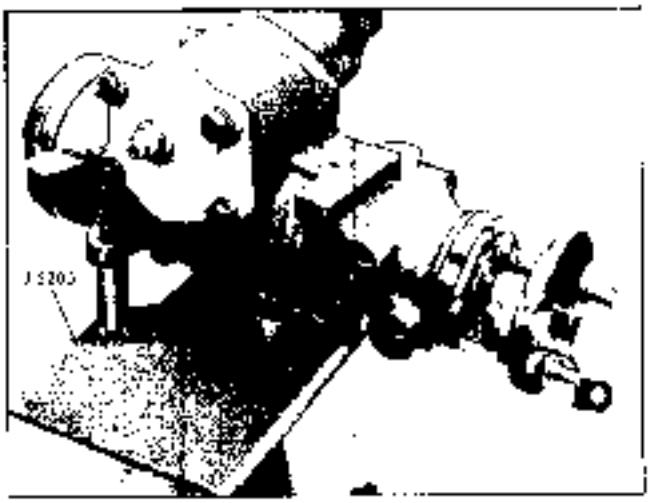


Fig. 9-47 Steering Gear Mounted on Tool J5205

On Pontiac models a brake hose bracket must be removed prior to removing frame bolts.

5. Remove steering gear assembly.

MAJOR REPAIRS
(Steering Gear Removed From Car)

DISASSEMBLE STEERING GEAR

Disassemble and reassemble steering gear and sub-assemblies on a clean work bench, preferably while the assembly is mounted on a holding fixture (J 5293 or J 6448-01) as shown in Fig. 9-47.

CAUTION: DO NOT clamp housing in vise.

Cleanliness is of utmost importance; therefore bench, tools, and parts must be kept clean at all times.

Before disassembling gear, thoroughly clean exterior with suitable solvent and drain as much fluid as possible. Assist draining by turning gear flange through its entire range two or three times.

REMOVING HOUSING LOWER END PLUG AND RACK-PISTON NUT END PLUG

1. Remove end plug retaining ring as shown in Fig. 9-48.

2. Rotate gear flange to left and force end plug out of housing and discard end plug O-ring seal.

CAUTION: DO NOT turn flange any farther than absolutely necessary or balls from ball nut and worm circuit may escape from this circuit and lay loose inside rack-piston nut chamber.

3. Remove rack-piston nut end plug retainer, using 1/2" square driver (from socket set). To aid in loosening end plug, tap end plug with brass drift.

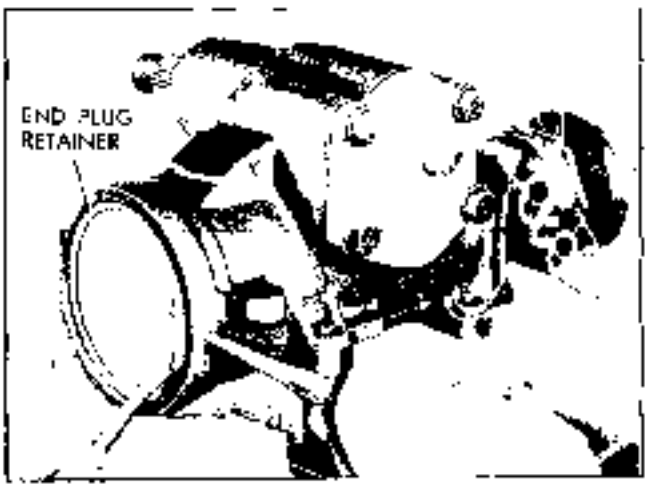


Fig. 9-48 Removing End Plug Retaining Ring

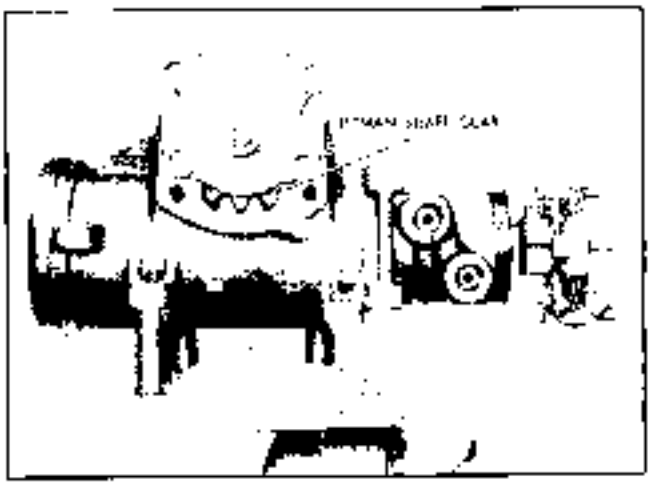


Fig. 9-49 Position of Pitman Shaft Gear for Removal

REMOVE PITMAN SHAFT GEAR AND SIDE COVER

1. Remove side cover retaining screws and washers.

2. Rotate cover as necessary to see when pitman shaft is centered in gear housing opening while rotating gear flange (Fig. 9-49).

3. Remove pitman shaft and cover assembly.

4. Remove side cover O-ring seal and discard.

REMOVE RACK-PISTON NUT

1. Holding arbor tool J 7539 against end of steering worm, rotate stub shaft flange to left until rack-piston is free from worm (Fig. 9-50).

2. With arbor in rack-piston, withdraw rack-piston nut from housing bore.

NOTE: The arbor prevents balls from falling out of rack-piston nut.

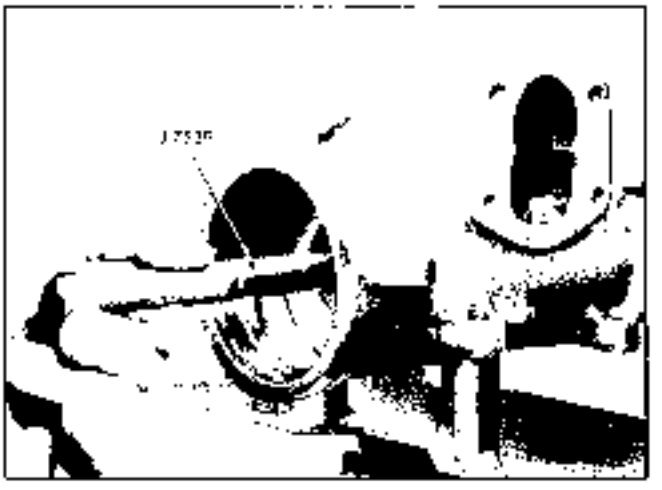


Fig. 9-50 Arbor J 7539 Against End of Steering Worm

Fig. 9-51 Removing Adjuster Plug Assembly

REMOVE ADJUSTER PLUG ASSEMBLY, ROTARY VALVE WITH WORM SHAFT AND PIN ASSEMBLY AS AN INTEGRAL UNIT

1. Remove flexible coupling locking bolt and remove coupling.

2. Remove adjuster plug lock nut, using punch or suitable spanner wrench such as J 7624.

3. Remove adjuster plug assembly, using a spanner as shown in Fig. 9-51.

4. Push on end of worm shaft with a hammer handle while pulling on stub shaft with slight rotary motion. This will remove the entire upper unit.

5. Remove adjuster plug from rotary valve and torsion bar by pulling straight out (Fig. 9-52).

6. Separate worm shaft and valve assembly by pulling apart.

7. Remove lower bearing and discard torsion bar cap to worm O-ring seal (on the Rotary Valve). See Fig. 9-52.

8. Remove lower bearing races and bearing (these parts may come out with worm shaft or remain in housing).

9. Remove adjuster plug O-ring seal and discard.

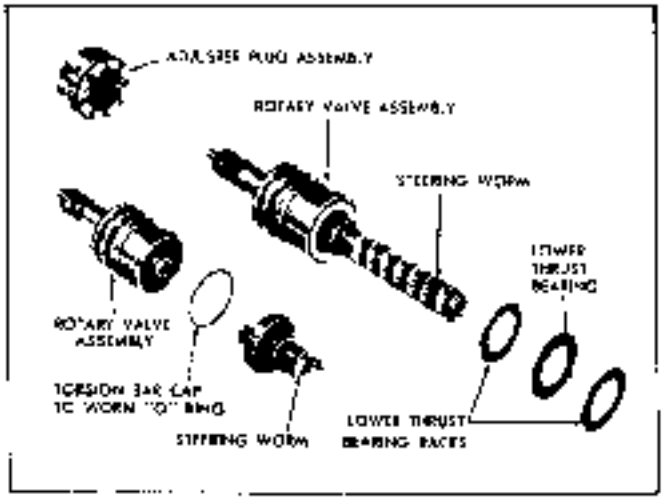


Fig. 9-52 Adjuster Plug and O Ring Removal

DISASSEMBLE PITMAN SHAFT GEAR AND SIDE COVER

1. Hold lash adjuster with 7/32" allen wrench and remove lash adjuster nut and discard.

2. Screw lash adjuster out of side cover.

NOTE: Do not disassemble pitman shaft and component parts as these are serviced as an assembly (Fig. 9-53).

DISASSEMBLE RACK-PISTON NUT

1. Place the rack-piston nut assembly on a clean cloth.

2. Remove arbor tool J 7539 ball return guide, and balls, making sure all of the balls are caught on the cloth (11 bright and 11 black).

3. Remove and discard Teflon ring and back-up seal from rack-piston nut.

DISASSEMBLE ROTARY VALVE OR REPLACE VALVE SPOOL DAMPENER O-RING—(REPLACE O-RING ONLY IF NECESSARY DUE TO "SQUAWK" IN GEAR)

The rotary valve assembly includes the valve body, valve spool and the stub shaft assembly. All these parts are precision units and are hydraulically balanced at the factory.

Under no conditions are parts in this unit to be replaced or interchanged with other parts or units.

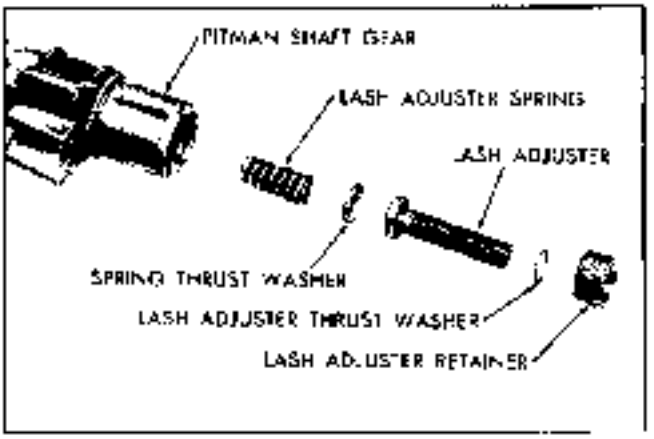


Fig. 9-53 Parts in End of Pitman Shaft Gear - DO NOT DISASSEMBLE

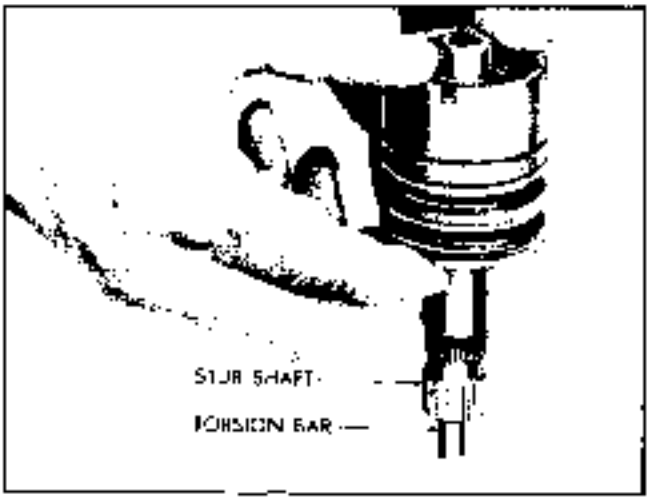


Fig. 9-54 Tapping In Loose Valve Spool

If unit parts are scored or damaged the entire rotary valve assembly is to be replaced.

NOTE: If the valve spool dampener O-ring requires replacement, perform the following operations.

1. Work spool spring onto bearing diameter of stub shaft and remove spool spring.

2. Tap end of stub shaft assembly gently against workbench to remove valve spool (Fig. 9-54).

CAUTION: The diametrical clearance between the valve body and spool may be as low as .0021". The slightest cocking of spool may jam it in valve body (Fig. 9-55).

If slight sticking occurs, make a gentle attempt to reverse the removal procedure. If this does not free the spool, it has become cocked in valve body bore and may be removed later.

3. Remove and discard valve spool dampener O-ring.

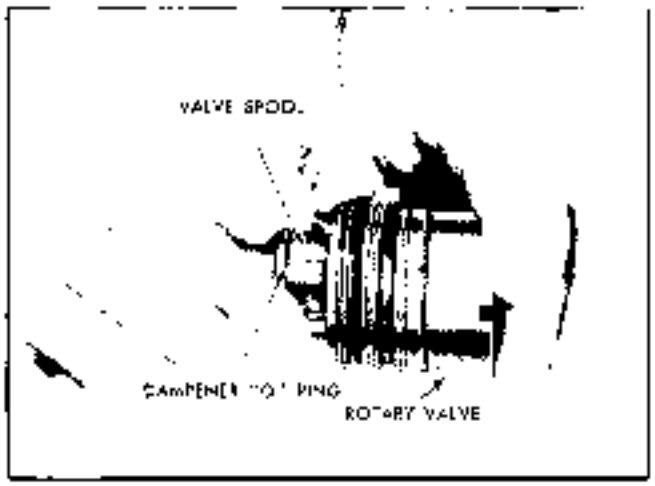


Fig. 9-55 Removing Valve Spool from Rotary Valve

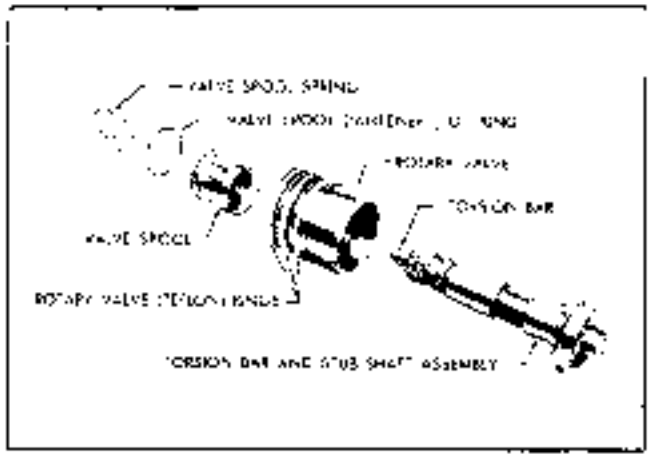


Fig. 9-56 Exploded View of Rotary Valve

4. Remove stub shaft, torsion bar (small diameter bar extending through stub shaft) and valve cap assembly by tapping end of torsion bar lightly with a plastic hammer. This will dislodge the cap from valve body cap pin (Fig. 9-56). Do not disassemble stub shaft assembly. The parts are pinned together and are serviced as an assembly.

5. If valve spool has become cocked as described in step 2, it can now be freed as follows:

a. Inspect parts to determine in which direction the spool is cocked.

b. A few very light taps with a soft plastic or rawhide hammer should align and free the spool in the bore.

c. Remove and discard O-ring dampener seal from valve spool.

6. Carefully remove and discard valve body Teflon rings and ring back-up O-ring seals.

DISASSEMBLE HOUSING

1. Remove pitman shaft outer dust seal back-up washer retaining ring, using Truarc pliers.

2. Remove outer dust seal back-up washer.

3. Remove seal (double lip) by inserting offset screwdriver between seal and back-up washer and prying out of housing.

CAUTION: Do not damage housing bore when removing seal.

4. Remove back-up washer.

5. Remove seal (single lip) by cutting and collapsing seal.

CAUTION: Do not damage housing bore when removing seal.

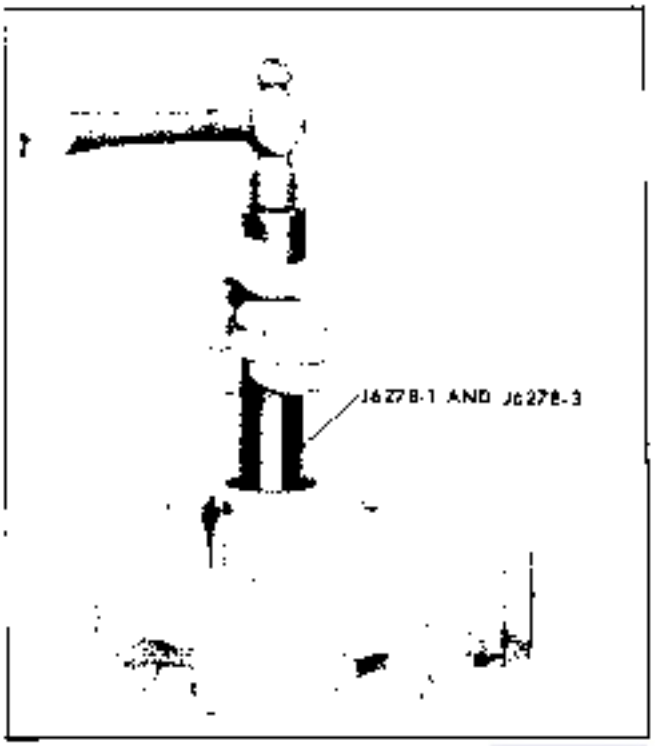


Fig. 9-57 Removing or Installing Pitman Shaft Needle Bearing

6. If pitman shaft needle bearings are to be replaced, remove bearing by driving out of housing, using tool J 6278-1 with adaptor J 6278-3 (Fig. 9-57).

7. If connectors are to be removed, tap threads in holes of connectors, using 5/16-18 NF tap (Fig. 9-58).

8. Remove connectors by using threaded bolt into tapped holes with washer and nut as extractor (Fig. 9-59).

9. If steering gear housing is to be replaced on Pontiac or Firebird models remove the large snap ring placed against the upper end of housing bore. This must be installed in new housing (Fig. 9-60, Item #43).

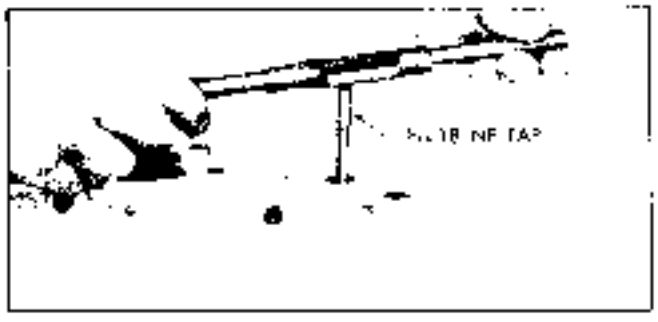


Fig. 9-58 Tapping Connector Hole

ADJUSTER PLUG—DISASSEMBLE

NOTE: Servicing of the adjuster plug need only be done if the stub shaft seal or needle bearing require replacement.

1. Remove thrust bearing retainer with a screwdriver, being careful not to score needle bearing bore. Remove thrust bearing spacer, thrust bearing and thrust bearing races.

2. Remove adjuster plug O-ring and discard.

3. Remove retaining snap ring and dust seal.

4. Using a screwdriver pryout stub shaft seal, be careful not to score bore or adjuster plug.

5. Using tool J 6221 drive needle bearing out of adjuster plug.

6. If needle bearing was removed, install bearing using tool J 6221, position bearing on tool with letter side of bearing against tool. Drive bearing into plug until bearing is centered in bore.

7. Lubricate stub shaft seal and install seal using tool J 5186. Install seal only far enough to allow clearance for the dust seal and retaining snap ring.

8. Install dust seal and retaining snap ring, be sure lip of dust seal is facing outward.

9. Lubricate O-ring seal and install in groove in adjuster plug.

10. Assemble thrust bearing races, thrust bearing, bearing spacer, and bearing retainer on adjuster plug. Using a small brass drift tap retainer onto adjuster plug.

CLEANING AND INSPECTION

Carefully wash all parts in a suitable cleaning solvent.

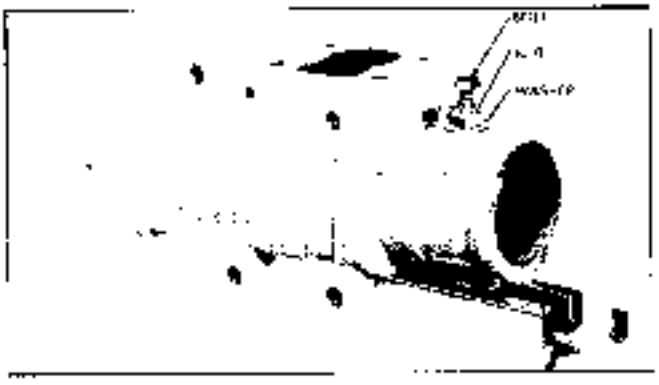
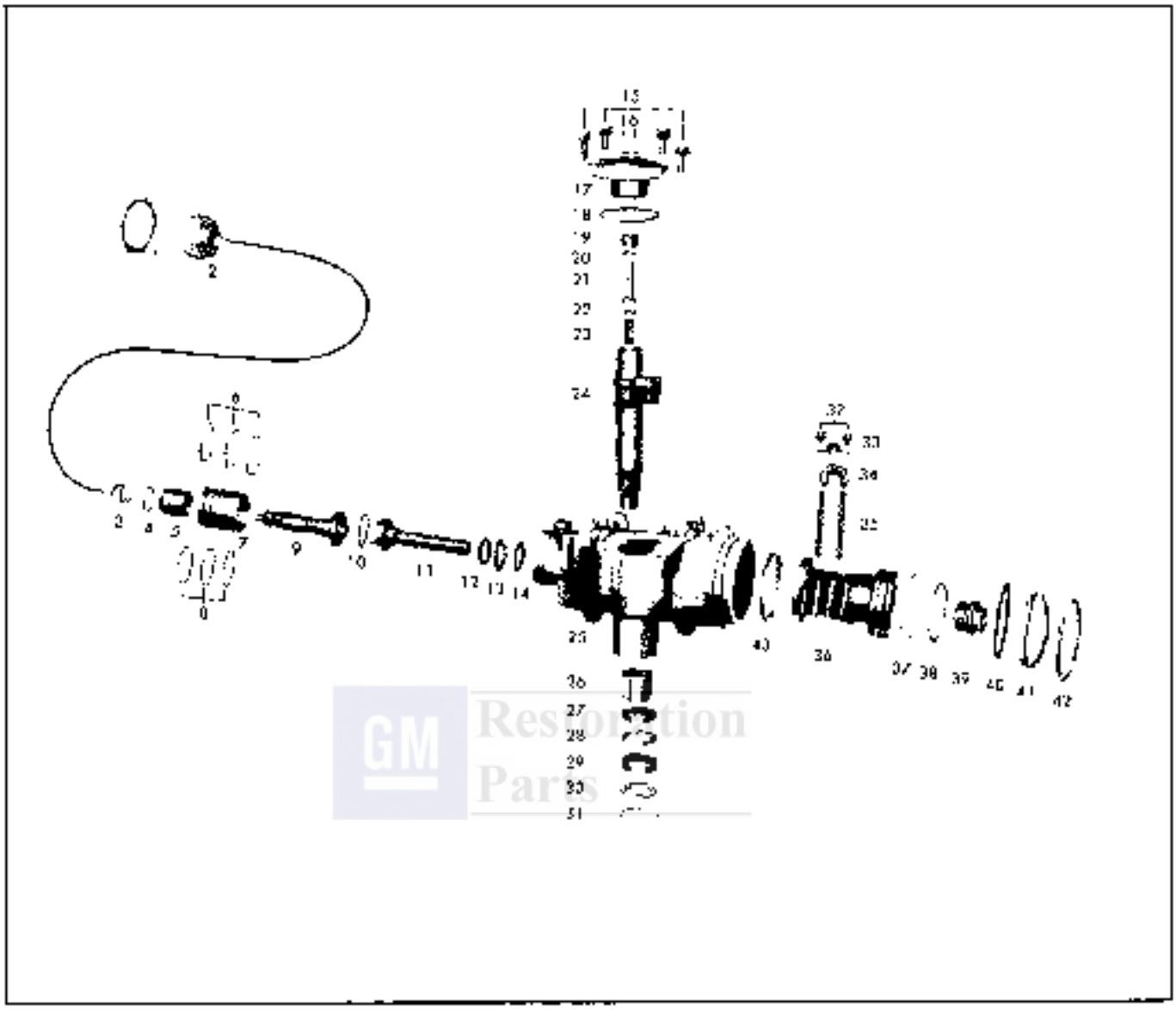


Fig. 9-59 Removing Connector



1. Adjuster Plug Lock Nut
2. Adjuster Plug Assembly
3. Valve Spool Spring
4. Valve Spool Dampener (O-Ring)
5. Valve Spool (O-Ring)
6. Rotary Valve Teflon Seals
7. Rotary Valve
8. Rotary Valve O-Ring Seals
9. Torsion Bar and Stub Shaft Assembly
10. Torsion Bar Cap to Worm O-Ring
11. Worm Shaft
12. Worm Thrust Bearing Inner Race
13. Worm Thrust Bearing
14. Worm Thrust Bearing Outer Race
15. Side Cover Screws
16. Lash Adjuster Lock Nut
17. Side Cover
18. Side Cover O-Ring Seal
19. Lash Adjuster Retainer
20. Lash Adjuster Thrust Washer
21. Lash Adjuster
22. Spring Thrust Washer
23. Lash Adjuster Spring
24. Pitman Shaft
25. Steering Gear Housing
26. Pitman Shaft Needle Bearing
27. Single Lip Oil Seal
28. Inner Back-Up Washer
29. Double Lip Oil Seal
30. Outer Back-Up Washer
31. Retaining Ring
32. Ball Return Guide Retainer Screws
33. Ball Return Guide Retainer
34. Ball Return Guide
35. Rack - Piston Nut Balls
36. Rack - Piston Nut
37. Rack - Piston Nut Ring
38. Rack - Piston Nut Ring Back-Up Seal
39. Rack - Piston Nut End Plug
40. End Plug O-Ring Seal
41. Housing Cover End Plug
42. Housing Lower End Plug Retainer
43. Housing Bore Snap Ring (Pontiac and Firebird Models only)

Fig. 9-60 Exploded View of Power Steering Gear Assembly

CAUTION: Do not use solvent on oil seals and O-rings which are going to be replaced (Fig. 9-69).

INSPECTION OF PITMAN SHAFT GEAR AND SIDE COVER

1. Inspect pitman shaft bearing surface in side cover for excessive wear or scoring. If badly worn or scored, replace side cover and bushing assembly.

2. Check pitman shaft sector teeth, bearing and seal surfaces and replace if badly worn, pitted or scored.

3. Check lash screw for end play.

If end play is noticed in step 3, replace pitman shaft gear assembly.

INSPECTION OF RACK-PISTON NUT AND WORM

1. Inspect worm and rack-piston nut grooves and all of the balls for excessive wear or scoring. If either the worm or rack-piston nut needs replacing, both must be replaced as a matched assembly.

2. Inspect ball return guides, making sure that only where balls enter and leave guides are not damaged.

3. Inspect lower thrust bearing and races for excessive conditions of wear, pitting, scoring or cracking. If any of these conditions are found, replace the thrust bearing and races.

4. Inspect rack-piston nut teeth for pitting, wear, and scoring.

5. Inspect outside surface of rack-piston nut for wear, scoring or burrs.

6. Inspect thrust bearing rollers and races for excessive conditions of wear, pitting, scoring, cracking, or brunelling. If any of these conditions are found, replace the thrust bearing assembly.

INSPECTION OF ROTARY VALVE

1. If there was evidence that the torsion bar to stub shaft O-ring seal has been leaking (oil leak between the stub shaft and torsion bar at the stub shaft coupling flange), the entire rotary valve assembly should be replaced.

2. If any part of parts of the rotary valve assembly (including stub shaft assembly) are badly worn, cracked, pitted or broken, the entire rotary valve assembly should be replaced. A slight polishing of the valving surfaces is normal.

INSPECTION OF GEAR HOUSING

1. Inspect gear housing for any defects in the piston bore or the rotary valve bore. Inspect all retaining ring grooves and seal surfaces for scratches or nicks. If any major defects are found, the housing should be replaced.

NOTE: A slight polishing of the cylinder bore by the piston is not uncommon and does not affect the operation of the gear.

2. Inspect ball plug in the housing, if leaking or raised above the housing surface, drive in flush to 1/16" below surface. The ball plug can be tightened by staking housing. Housing should be replaced only if leaks in this area cannot be properly sealed.

Clean area of leak with solvent and/or a wire brush. Dry thoroughly and apply a liquid sealant which will flow into the area between the ball plug and the housing and then harden. Devcon "B" or equivalent (commercially available products) should seal such leaks.

3. Inspect the connectors. If badly brunelled or scored, replacement will be necessary.

4. Inspect pitman shaft gear needle bearing; if worn or pitted, replace.

ASSEMBLE OF STEERING GEAR

Lubricate all parts as they are assembled.

ASSEMBLE PITMAN SHAFT GEAR AND SIDE COVER

1. Screw lash adjuster through side cover until cover bottoms on pitman shaft gear.

2. Install lash adjuster lock nut while holding lash adjuster with 7/32" allen wrench do not tighten lock nut.

ASSEMBLE ROTARY VALVE

1. Assemble one valve body Teflon ring back-up O-ring seal in each groove on valve body. Do not allow seals to become twisted.

2. Assemble valve Teflon rings in ring groove over O-ring seals by carefully slipping rings over valve body. Rings may appear loose or twisted in grooves, but heat of oil after assembly will cause them to straighten.

3. Install valve spool dampener O-ring seal in valve spool groove, then lubricate seal in Type A hydraulic fluid. Do not allow seal to twist in groove.

4. Assemble stub shaft assembly in valve body aligning groove in valve cap with pin in valve body (Fig. 9-56). Press on cap until cap is against shoulder in valve body with valve body pin in cap groove. Hold these parts together during remainder of assembly.

5. With notch end of spool towards valve body, install spool, aligning spool notch with pin in stub shaft.

CAUTION: Because of small clearance between valve spool and valve body, extreme care must be taken when assembling these parts. Push the spool evenly and slowly with a slight oscillating motion until spool reaches drive pin. Before pushing spool completely in, make sure dampener O-ring seal is evenly distributed in spool groove. Slowly push spool completely in, with extreme care taken not to cut or pinch O-ring seal.

6. Slide spool spring over stub shaft and work spring in position.

7. Lubricate cap to worm O-ring seal and install in valve assembly.

NOTE: If during assembly of valve, stub shaft and cap assembly is allowed to slip out of engagement with the valve body pin, spool will be permitted to enter valve body too far. Dampener O-ring seal may expand into valve body oil grooves preventing removal of spool.

a. Remove valve spool spring and disassemble rotary valve assembly.

b. Press on spool until O-ring seal is cut and spool can be removed.

c. Replace O-ring seal and proceed with assembly as before.

ASSEMBLE HOUSING

1. With stamped end of needle bearing against shoulder of adapter J 6278-3, use remover and replacer J 6278-1 to drive pitman shaft needle bearing into bore from outside of housing until flush-to-1/32" below shoulder. Make sure needle bearings rotate freely (Fig. 9-57).

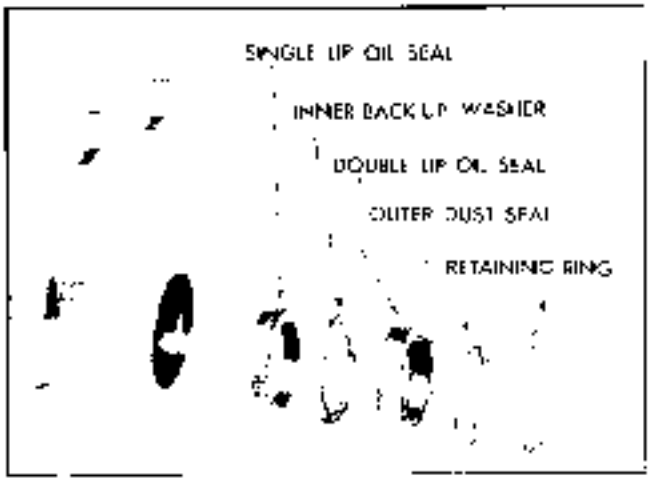


Fig. 9-57 Pitman Shaft Seals and Washers

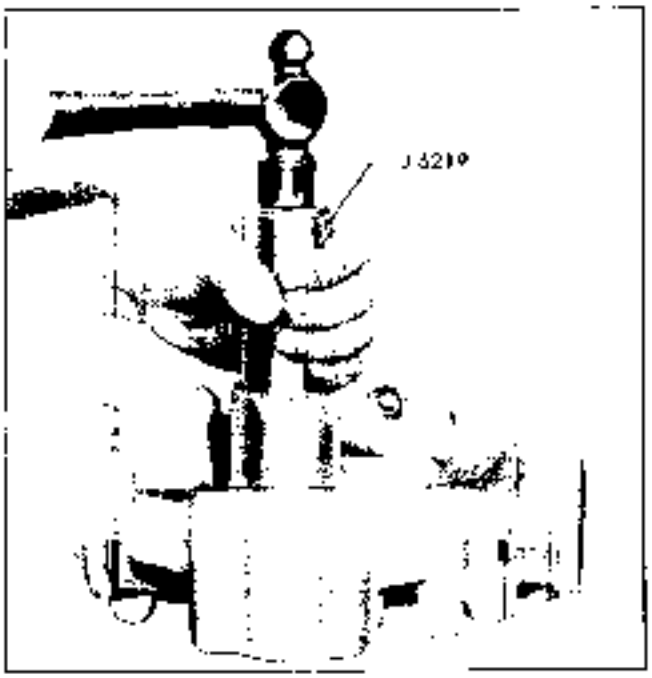


Fig. 9-62 Installing Pitman Shaft Seals Using J 6219

2. Lubricate cavity between lips of pitman shaft (double lip) seal with high melting point, water resistant wheel bearing lubricant.

3. Lubricate and install pitman shaft seals; single lip seal, inner back-up washer, double lip seal, outer dust seal and retaining ring in housing bore (Fig. 9-61). Use tool J 6219 (Fig. 9-62) for seals and Truarc pliers for retaining ring. Make sure seal

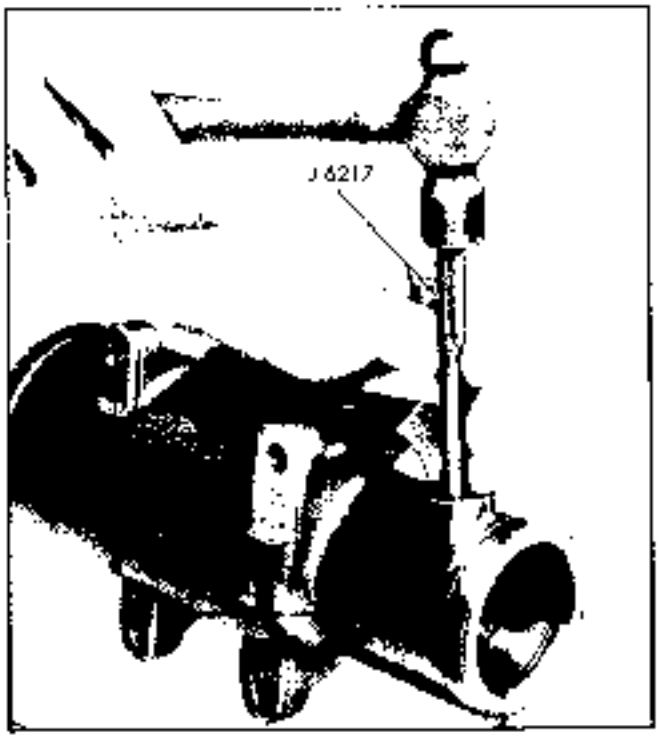


Fig. 9-63 Installing Connector Using J 6217

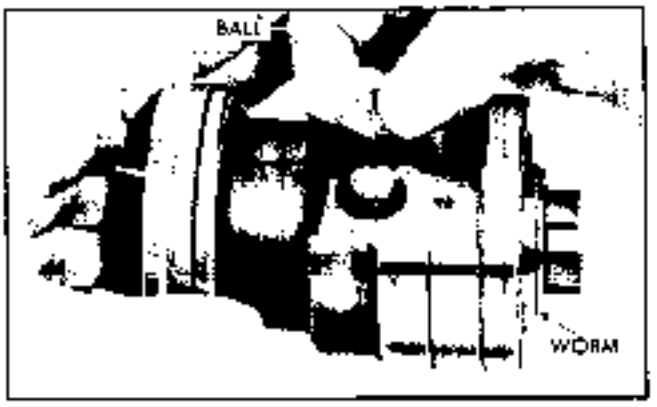


Fig. 9-64 Loading Rack Piston Nut

lips are properly positioned, retaining ring is seated, and that approximately 1/16" clearance is maintained between inner seal (single lip) and bearing.

4. If connectors were removed, install new connectors by driving into place with tool J 6217 (Fig. 9-61).

ASSEMBLE RACK-PISTON NUT AND WORM

1. Lubricate and install new ring back-up seal and Teflon piston ring on rack-piston nut being careful ring and seal do not twist during installation.

2. Insert worm into rack-piston nut to bearing shoulder (Fig. 9-64).

3. Align ball return guide holes with worm groove. Load 15 balls into the guide hole nearest Teflon piston ring. While slowly rotating worm to left, feed balls through the circuit. Alternate black balls with silver balls. If balls are installed properly, worm should turn out of rack-piston nut.

4. Fill one-half of ball return guide with remaining 7 balls. Place other guide over balls and plug each end with heavy grease to prevent balls from falling out when installing guides into rack-piston nut (Fig. 9-65).

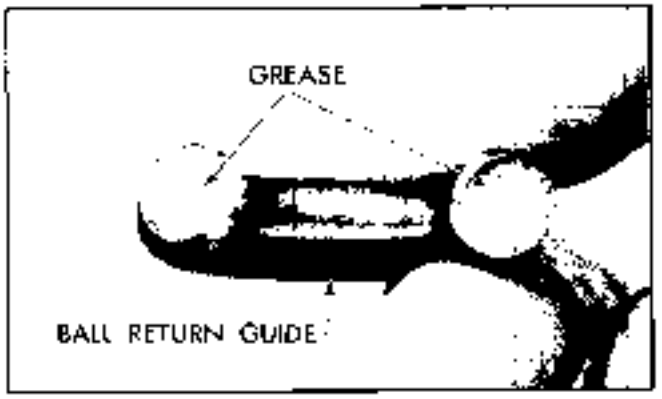


Fig. 9-65 Ball Return Guide

5. Insert guides into guide holes of rack-piston nut. Guides should fit loosely.

6. Place return guide clamp over guides and install two screw and lock washer assemblies and tighten to 10 ft. lb. torque.

CHECK WORM PRELOAD

The worm groove is ground with a high point in the center. When the rack-piston nut passes over this high point, a preload of 6.5-8.0 in. lb. torque should be obtained with gears from Catalina models without air conditioning and all Tempest Firebird models and 1.5-4.5 in. lb. torque on all other Pontiac models.

NOTE: DO NOT refill rack-piston balls unless a complaint of loose steering is received. Upon such a complaint, a thrust adjustment and over center adjustment should correct problem if it lies in steering gear.

1. With worm pointing up, lightly clamp rack-piston nut in a bench vise having brass jaws.

CAUTION: Do not hold rack-piston nut in area of Teflon ring.

2. Place valve assembly on worm, engaging worm drive pin.

3. Rotate worm until it extends 1 1/4" from rack-piston nut to thrust bearing face. This is center position.

4. Attach an inch-pound torque wrench with 3/4" 12-point socket to stub shaft (Fig. 9-66).

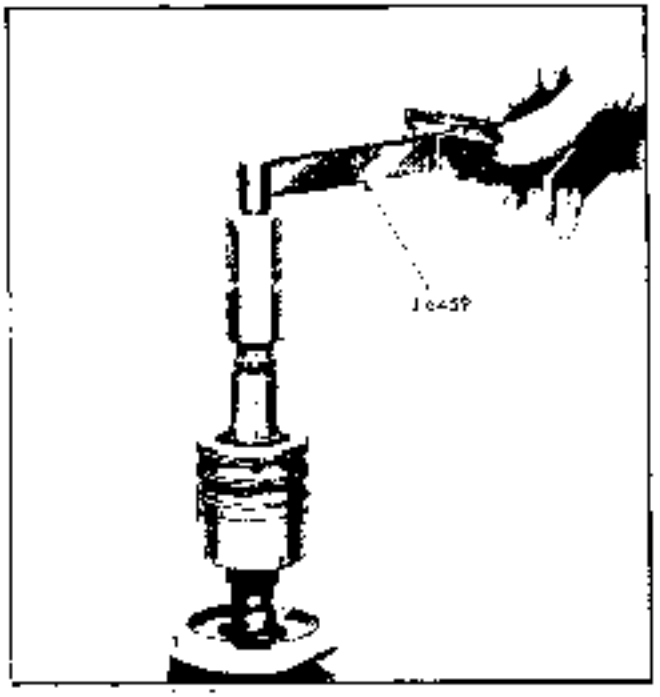


Fig. 9-66 Checking Worm Preload

5. Oscillate wrench through a total arc of approximately 60 degrees in both directions several times and take a reading. Highest reading obtained with worm rotating should be 0.5 to 3.0 in. lb. torque with gears from Tempest, Firebird and Pontiac Catalina models without air conditioning and 1.5-4.5 in. lb. torque on all other Pontiac models. Record torque when in specifications.

NOTE: DO NOT use torque wrench having maximum torque reading of more than 100 in. lb. When taking following torque readings, take a reading, pulling torque wrench to right and a reading, pulling torque wrench to left. Total both readings and take one-half of this total as average torque.

NOTE: DO NOT refit rack-piston balls unless a complaint of loose steering is received. Upon such a complaint, a thrust adjustment and over center adjustment should correct problem if it lies in steering gear. If balls were pitted or rough then select proper ball size for proper adjustment.

6. If reading is too high or low (on new balls only), disassemble and reassemble, using next size smaller (or larger) balls and recheck.

Table of Selective Sizes of Steering Nut Balls

6	.28117"	5695512
7	.28125"	5695513
8	.28133"	5695514
9	.28141"	5695515
10	.28149"	5695516
11	.28157"	5695517

A rack-piston nut with a ball size of 7 does not have a number stamped on flat surface. For ball sizes other than No. 7, ball size is stamped on flat surface of rack-piston nut. In order to obtain proper worm bearing preload install proper new balls.

7. Remove rotary valve assembly from worm head.

8. Position arbor tool J 7639 against worm end. Turn worm out of rack-piston assembly following worm end with arbor. Do not allow arbor to separate from worm until rack-piston nut is fully on arbor. The arbor now keeps the balls from dropping out of ball nut.

ASSEMBLE WORM SHAFT, ROTARY VALVE ASSEMBLY AND ADJUSTER PLUG AS AN ASSEMBLY

1. Assemble lower thrust bearing and races on worm (Fig. 9-67).

2. Be sure O-ring seal is between valve body and worm head and assemble valve assembly to worm by aligning slot in valve body with pin on worm head.

3. Install new O-ring on adjuster plug.

4. Install adjuster plug assembly on stub shaft so bearing rests against upper bearing assembly.

ADJUST THRUST BEARING PRELOAD

1. Install worm valve assembly and adjuster plug in housing as integral unit.

2. Tighten adjuster plug snug in gear housing and back off slightly (1/8 turn maximum).

3. With torque wrench on stub shaft, read torque required to rotate worm, valve assembly, and stub shaft in housing (drag).

4. Turn adjuster plug in until torque reading increases 0.5-2.0 in. lb. above drag reading obtained in (3) above with gears from Tempest, Firebird, and Pontiac Catalina models without air conditioning and 1.0-3.0 in. lb. torque on all other Pontiac models.

NOTE: Do not use torque wrench having maximum torque reading of more than 100 in. lb. When taking following torque readings, take reading, pulling torque wrench to right, and a reading, pulling torque wrench to left. Total both readings and take one-half of this total as average torque.

5. Install adjuster plug lock nut and tighten to 90 in. lb. torque.

6. Recheck thrust bearing preload. Total thrust bearing adjustment plus drag should not exceed 7.0 in. lb. torque with gears from Tempest, Firebird and Pontiac Catalina models without air conditioning and 8.0 in. lb. with all other Pontiac models.

REPLACE RACK-PISTON

1. Slip stub shaft flexible coupling into end of stub shaft.

2. Holding Teflon ring compressor sleeve tool J 6947 or J 7576 tightly against the shoulder of gear housing, insert the rack-piston nut and arbor into housing holding the arbor (tool J 7639) until arbor contacts worm end. See Fig. 9-68. Use tool J 6947

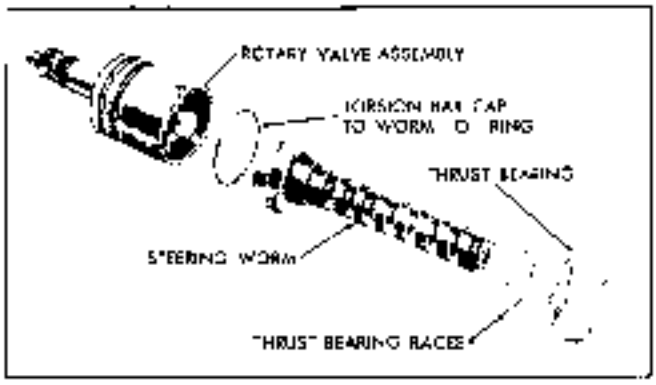


Fig. 9-67 Exploded View of Worm Shaft and Rotary Valve

Fig. 9-68 Installing Rack Piston Nut

on Firebird, Tempest, Pontiac Catalina without air conditioning and tool J 7576 on all other models.

CAUTION: Be certain that no balls drop out.

4. Remove arbor and sleeve.

REPLACE PITMAN SHAFT GEAR AND SIDE COVER

1. Turn worm shaft until center groove of rack-piston is aligned with center of pitman shaft needle bearing.

2. Install new side cover O-ring seal.

3. Install pitman shaft gear so that center tooth of gear meshes with center groove of rack-piston. Make sure that side cover O-ring seal is in place before pushing cover against housing.

4. Install side cover screws and tighten to 30 ft. lb. torque.

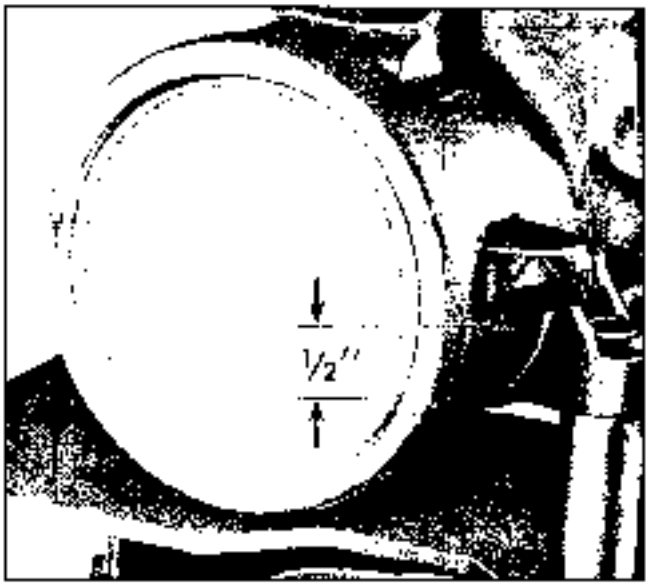


Fig. 9-69 Installing End Plug Retainer Ring

5. Install end plug in rack-piston nut, using 1/2" square drive. Tighten to 75 ft. lb. torque.

REPLACE HOUSING LOWER END PLUG

1. Install new housing end plug O-ring seal.

2. Insert end plug into gear housing and seat against O-ring seal. Slight pressure may be necessary to seat end plug properly.

3. Install end plug retainer ring so end of ring extends over 1/2" beyond ring removal assist hole (Fig. 9-69).

ADJUST PITMAN SHAFT PRELOAD THROUGH CENTER HIGH POINT

NOTE: DO NOT use a torque wrench having maximum torque reading of more than 100 lb. in. When taking following torque readings, take reading pulling torque wrench to right and reading pulling torque wrench to left. Total both readings and take one-half of this total as average torque.

Use a 3/8"-12 point deep socket and inch-pound torque wrench (Fig. 9-70), take a reading through center position to determine total drag, thrust bearing adjustment, and rack and worm preload. Adjust lash adjuster so torque is 4.0 to 6.0 in. lb. in excess of total reading found above.

Total over center preload must not exceed 18 in. lb. torque through center high point when rotating worm shaft through an arc of approximately 20°. Tighten lash adjuster lock nut to 25 ft. lb. torque. Recheck preload after lock nut has been tightened.

REPLACE FLEXIBLE COUPLING

1. Install coupling on stub shaft aligning flat surface on the stub shaft serrations with flat section in flange hole.

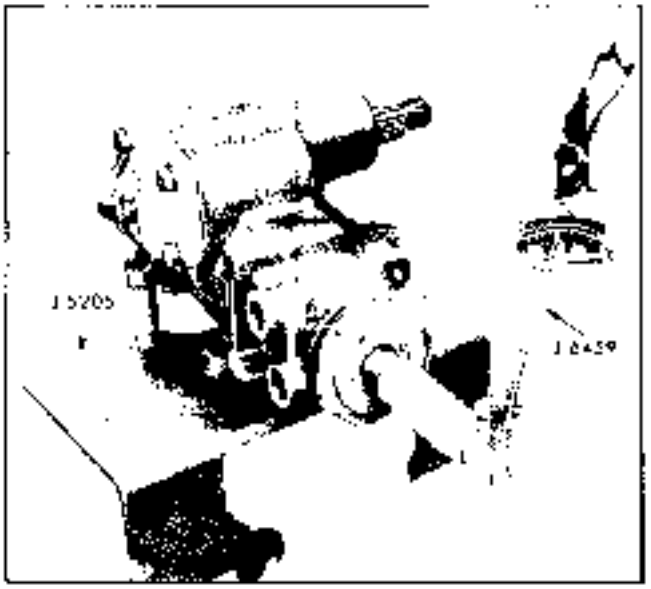
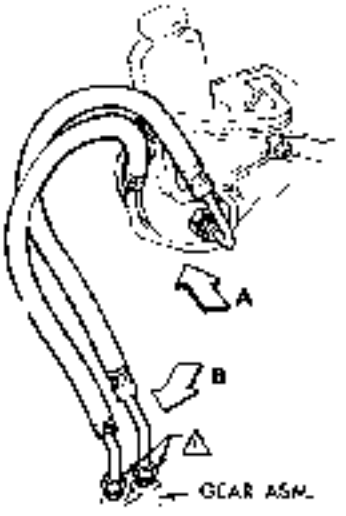
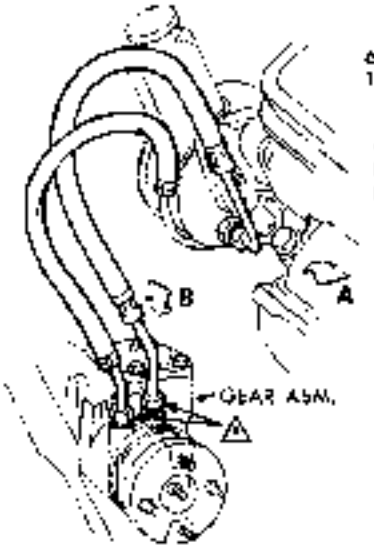


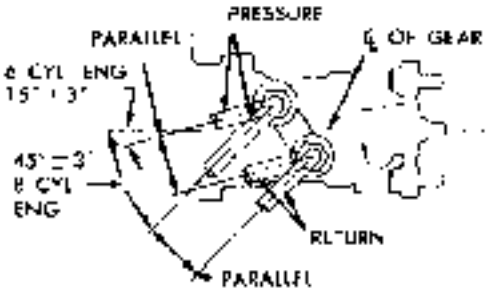
Fig. 9-70 Adjusting Pitman Shaft Preload



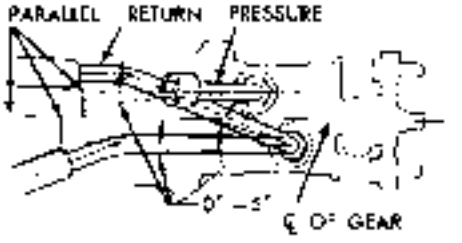
6 CYL. ENGINE (TEMPEST)



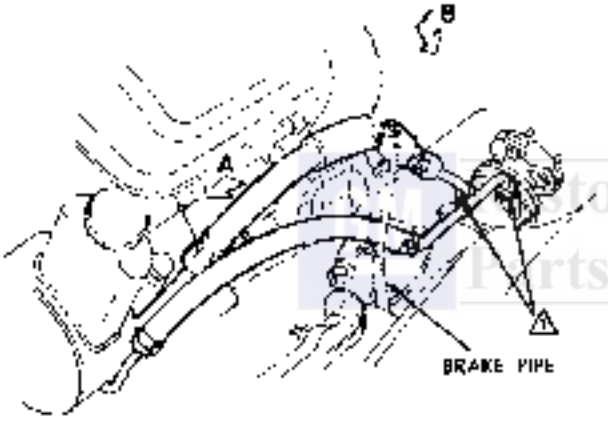
8 CYL. ENGINE (TEMPEST)



VIEW B (TEMPEST)



VIEW B (FIREBIRD)



8 CYL. ENGINE (FIREBIRD)

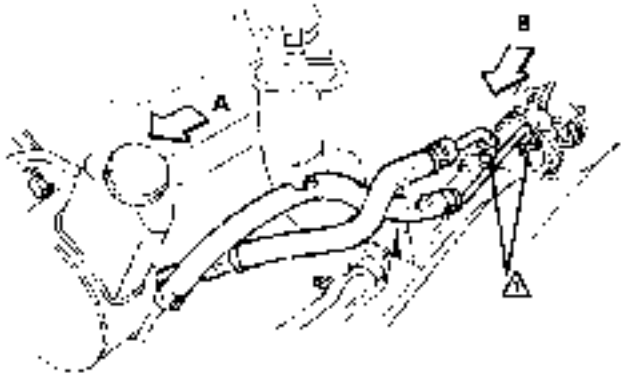
PRESSURE AND RETURN HOSES SHOULD BE POSITIONED SO THEY DO NOT CONTACT.

AFTER INSTALLATION IS COMPLETE AND WITH FRONT WHEELS IN STRAIGHT AHEAD POSITION FILL PUMP RESERVOIR TO FULL MARK WITH 9985010 FLUID.

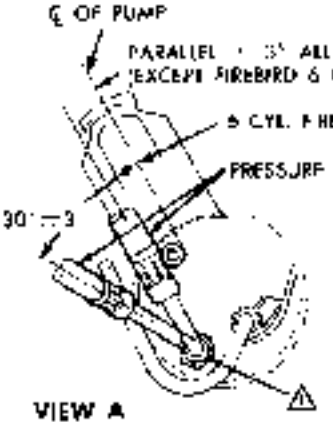
BLEED SYSTEM WITH ENGINE OPERATING BY TURNING FRONT WHEELS FULL LEFT AND RIGHT. REFILL PUMP TO INDICATED LEVEL.

INSPECT SYSTEM FOR LEAKS, ESPECIALLY AT HOSE CONNECTIONS AND FITTINGS.

⚠ 30 FT. LB.



6 CYL ENGINE (FIREBIRD)



VIEW A

Fig. 9-21 Tempest and Firebird Installation of Power Steering Gear Assembly

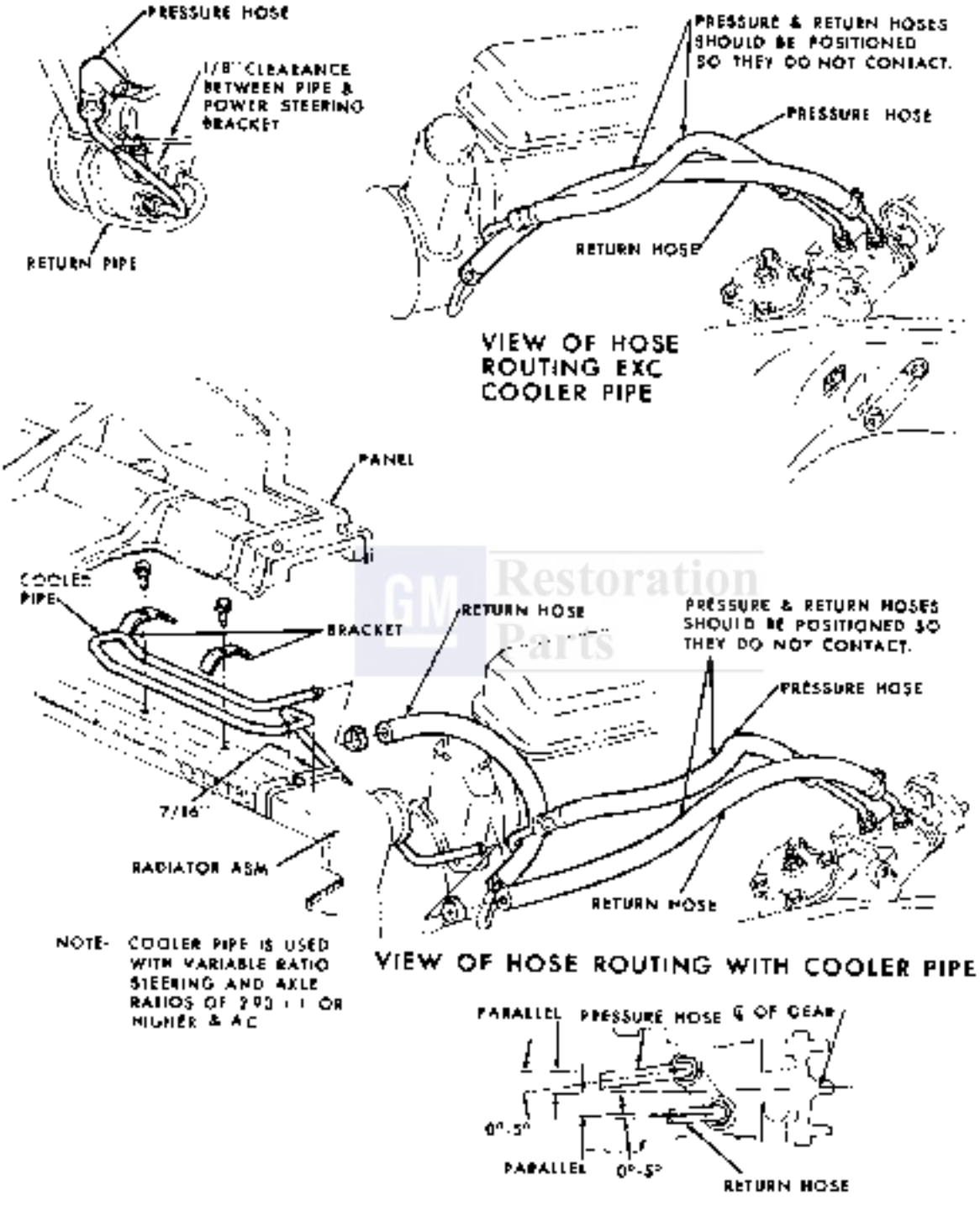


Fig. 9-72 Pontiac Installation of Power Steering Gear Assembly

2. Install coupling clamping bolt and tighten to 30 ft. lb. Be sure to position flange so that it clears end of adjuster plug by approximately 1/16" and rotates without interference with adjuster plug.

INSTALLATION OF STEERING GEAR (Figs. 9-71 and 9-72)

1. Position steering gear assembly in car, aligning large head rivet in widest upper flange opening, Fig. 9-11.

NOTE: Metal-to-metal contact between flanges on stub shaft assembly and steering shaft assembly will transmit and amplify gear noise to the driver.

2. Install steering housing to frame bolts finger tight. Shift gear assembly to obtain best alignment with flange on steering shaft. Tighten housing to frame bolts to 70 ft. lb. torque.

3. Install pitman arm and secure with lock washer and nut. Tighten nut to 140 ft. lb. torque.

4. Connect pressure and return hose assemblies to gear assembly and tighten to 25 ft. lb. torque.

5. Install two flange flexible coupling attaching nuts and lock washers and tighten to 20 ft. lb. torque.

6. Check fluid level in pump reservoir. Fluid should be up to oil level mark in reservoir. Add GM power steering fluid or equivalent as necessary. DO NOT use type "A" automatic transmission fluid, except in an emergency if power steering fluid is not available. With front wheels off floor, start engine and bleed hydraulic system by manually steering through cycle several times until there is no evidence of air bubbles in reservoir. Re-check fluid level and lower car.

POWER STEERING VANE TYPE PUMP

PERIODIC SERVICE RECOMMENDATIONS

No periodic service of the pump is required except checking oil level in reservoir as outlined in GENERAL LUBRICATION Section.

ADJUSTMENTS AND REPAIRS ON CAR

PUMP BELT TENSION ADJUSTMENTS

1. Loosen pump plate (support) to bracket bolts two full turns.

2. Tighten belt with power steering pump to give 72 lbs. as indicated on Burroughs gauge for used belt and 110 lbs. for new belt.

3. Holding adjustment, tighten pump plate to bracket bolts.

PUMP PRESSURE TEST

1. Disconnect pressure hose at union on pump, use a small container to catch any fluid which might leak.

2. Connect a spare pressure hose to pump union.

3. Using pressure gage J 5176-01, adapter fitting J 22326, connect gage to both hoses.

4. Open hand valve on gage.

5. Start engine, allow system to reach operating temperatures and check fluid level adding any fluid if required.

6. Turn steering wheel slowly to left or right until wheel is at full turn position. Holding wheel in this position, read pressure on gage, pressure should be at least 1000 psi, on Tempest, Firebird, and Pontiac Catalina models, 1200 psi, on all other Pontiac models. If pressure does not reach specification there is either internal leakage in steering gear or pump is malfunctioning.

NOTE: Vehicle's front wheel must be on ground and supporting weight of vehicle. Do not hold steering wheel at full turn for over 5 seconds, this will prevent damage to pump.

7. To determine which problem exists, slowly close hand valve on gage, pressure should read 1000 to 1100 psi, on Tempest, Firebird, and Pontiac Catalina without air conditioner, 900 to 1100 Pontiac Catalina with air conditioning, and 1100 to 1200 psi, all other Pontiac models.

NOTE: Do not hold hand valve on gage closed for over 5 seconds during this test to prevent damage to pump.

8. If pressure does not reach specifications in step 7, pump is malfunctioning.

9. If pressure is within specifications in step 7, problem is due to internal leakage in steering gear.

10. Shut off engine, remove testing gage, spare hose, reconnect pressure, check fluid level or make needed repairs.

REPLACEMENT OF FLOW CONTROL VALVE WITHOUT REMOVING PUMP FROM CAR

1. Disconnect pressure hose from pump union and drain oil.

2. Remove union from pump.

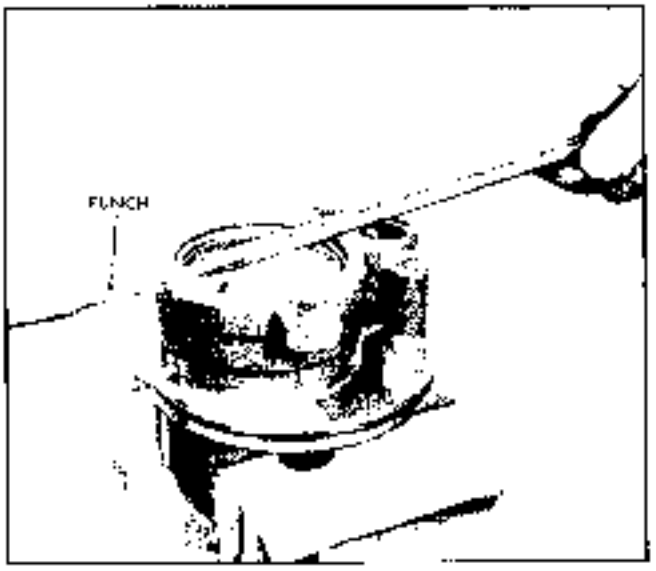


Fig. 9-73 Removing Retaining Ring

3. Using a magnet withdraw flow control valve then spring from pump.

4. Install valve by reversing above steps, be sure that O-ring seal on union is replaced and flow control valve is installed in the proper direction.

PUMP—REMOVAL FROM CAR

1. Disconnect hoses at pump. When hoses are disconnected, secure ends in raised position to prevent drainage of oil.

2. Install two caps at pump fittings to prevent drainage of oil from pump.

3. Remove drive pulley attaching nut.

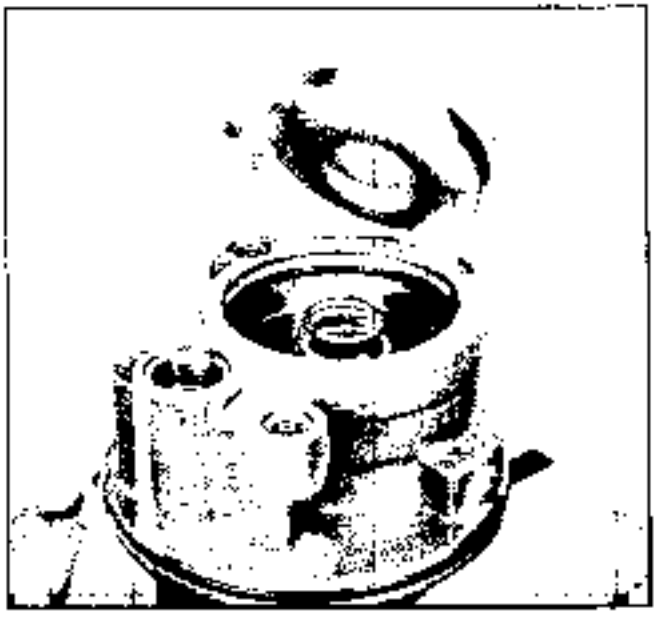


Fig. 9-74 Removing End Plate

4. Loosen bracket to pump mounting bolts.

5. Remove pump belt.

6. Slide pulley from shaft. Do not hammer on rim of pulley as this will damage pulley or pump.

7. Remove bracket to pump bolts.

8. Drain pump of oil.

9. Clean exterior of pump.

DISASSEMBLY AND ASSEMBLY OF PUMP

DISASSEMBLE

CAUTION: In clamping pump in vise, be careful not to exert excessive force on front hub of pump as this may distort bushing.

1. Remove union and seal.

2. Remove pump rear mounting bolts.

3. Lift reservoir from housing by tapping reservoir at flange, rocking back and forth.

4. Remove mounting bolt and union O-ring seals.

5. Remove end plate retaining ring. Push end plate retaining ring out of groove, using a punch through 1/8" diameter hole in pump housing (Fig. 9-73) and remove with screwdriver. End of retaining ring should be next to hole to ease removal.

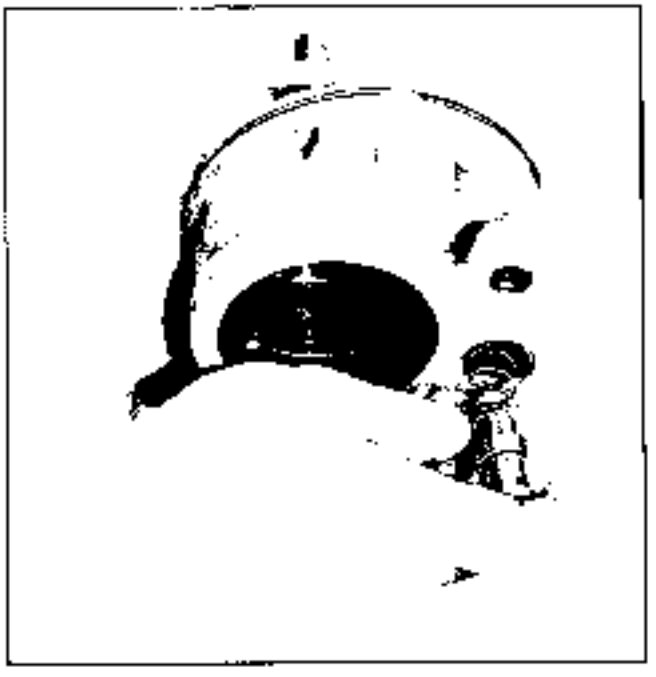


Fig. 9-75 Removing Flow Control Valve

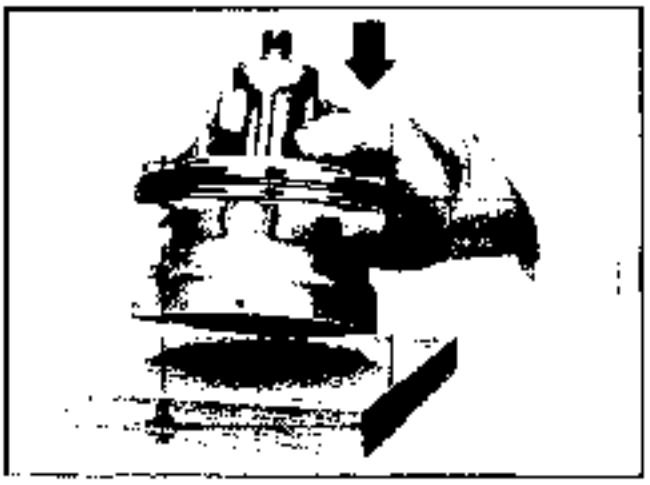


Fig. 9-75 Removing Pressure Plate

6. Remove end plate and spring. End plate is spring-loaded and will generally sit above the housing level. If sticking should occur, a slight tapping action will free the plate (Fig. 9-74).

7. Remove end plate O-ring.

8. With pump housing turned over, remove flow control valve and spring (Fig. 9-75) and tap housing on wood block until pressure plate falls free (Fig. 9-76).

9. Remove pressure plate, pump ring and vanes, being careful not to drop parts (Fig. 9-77).

10. Remount housing in vise. Using a suitable tool, remove shaft retainer ring at end of drive shaft.

11. Remove rotor and thrust plate.

12. Remove shaft through front of housing (Fig. 9-78).

CLEAN PARTS

Carefully clean all parts, except O-ring seals which are to be replaced and should not be immersed in cleaning solvent. Lubricate all O-ring seals and the drive shaft seal with vaseline and install in proper location. Be sure not to immerse drive shaft seal in cleaning solvent as this could damage it. Fig. 9-79 shows an exploded view of the pump.

ASSEMBLY

Be sure all parts are clean during reassembly.

1. Insert shaft at hub end of housing, spline end entering mounting face side (Fig. 9-80).

2. Install thrust plate on dowel pins with ported face to rear of pump housing (Fig. 9-81).

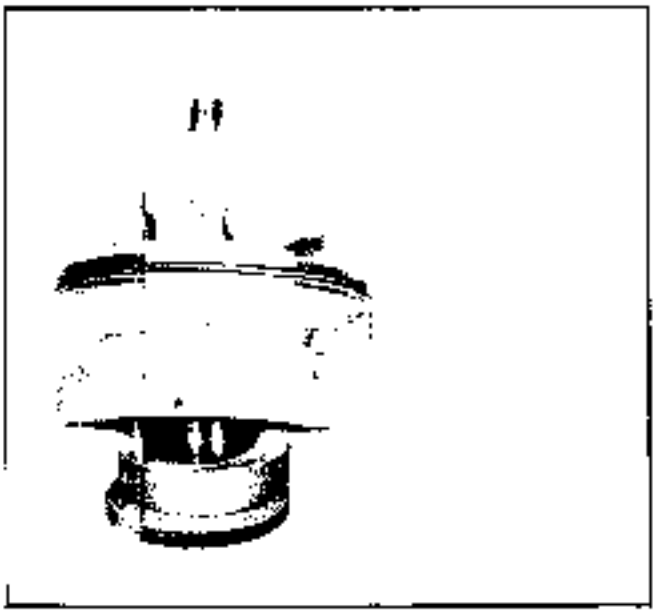


Fig. 9-77 Pressure Plate and Rotor Ring Removed

3. Install rotor (must be free on splines) on pump shaft at splined end.

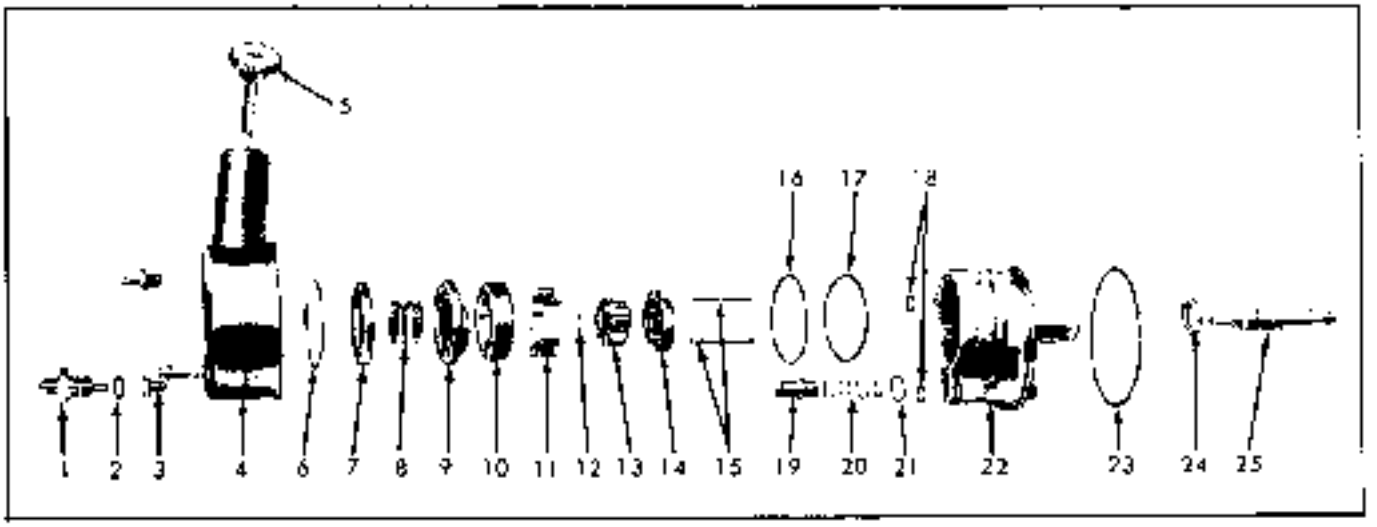
NOTE: Assemble rotor with flat side toward rear of pump (Fig. 9-82).

4. Using suitable tool, install shaft retainer.

5. Install pump ring on dowel pins with rotation arrow facing to rear of pump housing (Fig. 9-83).

6. Install vanes in rotor slots with radius edge towards outside (Figs. 9-84 and 9-85).

Fig. 9-78 Removing Pump Shaft



1. Union
2. Seal
3. Mounting Bolts
4. Reservoir
5. Dip Stick and Cover
6. End Plate Retaining Ring
7. End Plate
8. Spring
9. Pressure Plate
10. Pump Ring
11. Vanes
12. O-Washer
13. Rotor
14. Thrust Plate
15. Dowel Pins
16. End Plate O-Ring
17. Pressure Plate O-Ring
18. Mounting Bolt O-Ring Seals
19. Flow Control Valve
20. Flow Control Valve Spring
21. Flow Control Valve O-Ring Seal
22. Pump Housing
23. Reservoir O-Ring Seal
24. Shaft Seal
25. Drive Shaft

Fig. 9-79 Exploded View of Power Steering Pump

7. Lubricate outside diameter and chamfer of pressure plate with vaseline to insure against damaging O-ring and install on dowel pins with ported face toward pump ring. Applying pressure to outer edge only, seat pressure plate. Never press or hammer on the center of the pressure plate as this will cause permanent distortion with resulting pump failure. (Pressure plate will travel about 1/16" to seat.)

8. Install end plate O-ring.

9. Install pressure plate spring in center groove of pressure plate (Fig. 9-86).

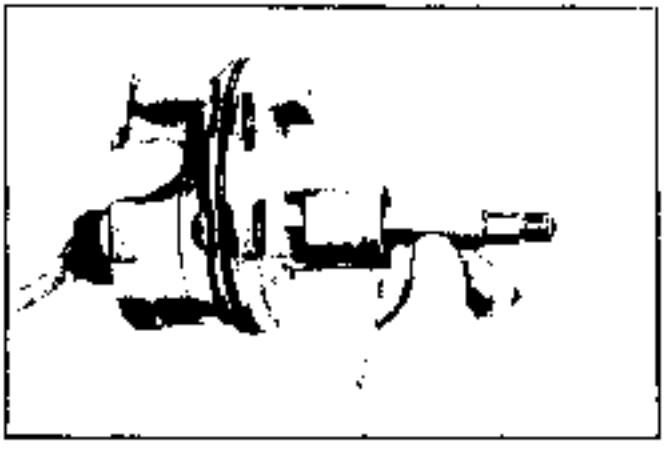


Fig. 9-80 Installing Pump Shaft

10. Lubricate outside diameter of end plate with vaseline to insure against damaging O-ring and install in housing using an arbor press.

11. Install end plate retaining ring while pump is in arbor press. Be sure it is completely seated in the groove of the housing (Fig. 9-87).

12. Install flow control spring and flow control

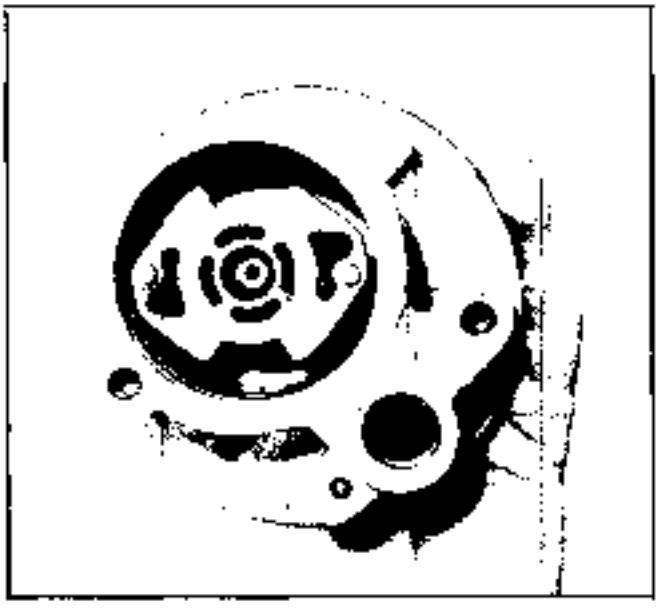


Fig. 9-81 Thrust Plate Installed

Fig. 9-82 Installing Rotor

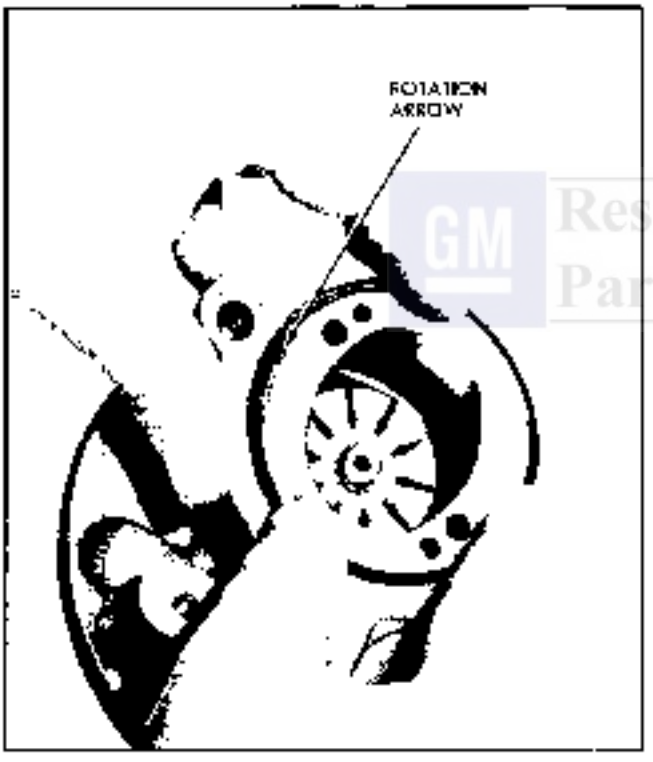


Fig. 9-83 Installing Pump Ring

Fig. 9-84 Installing Pump Vanes

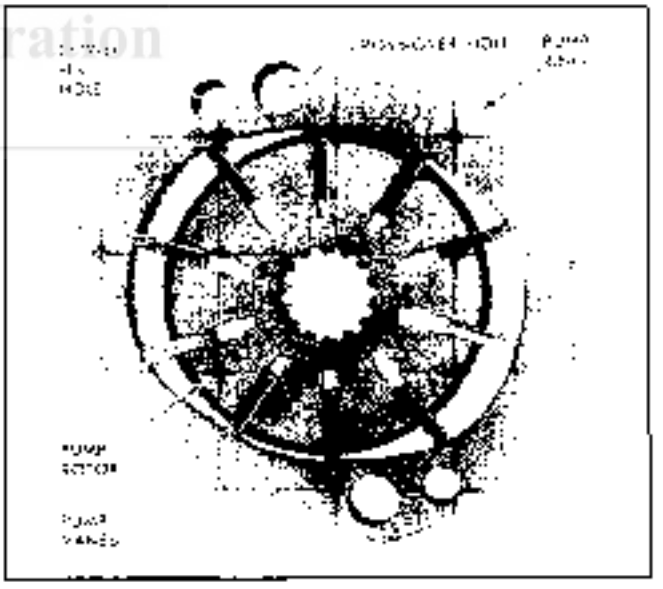


Fig. 9-85 Pump Vanes Installed

plunger. Be sure rod with screen goes into bore first.

13. Install mounting bolt and union O-rings.

14. Drop reservoir into place and press down until reservoir seats on housing.

15. Install studs, torque to 35 ft. lbs., and outlet union, and torque to 35 ft. lb. Install drive shaft key. Support shaft on opposite side of key when installing key.

INSTALLATION OF STEERING PUMP
(Figs. 9-88 and 9-89)

1. Position pump assembly on mounting bracket with holes lined up and install bolts loosely.

2. Slide pulley on shaft. DO NOT hammer on pulley.

3. Install pulley nut finger tight.

4. Connect and tighten hose fitting. Tighten outlet fitting to 25 ft. lb. torque.

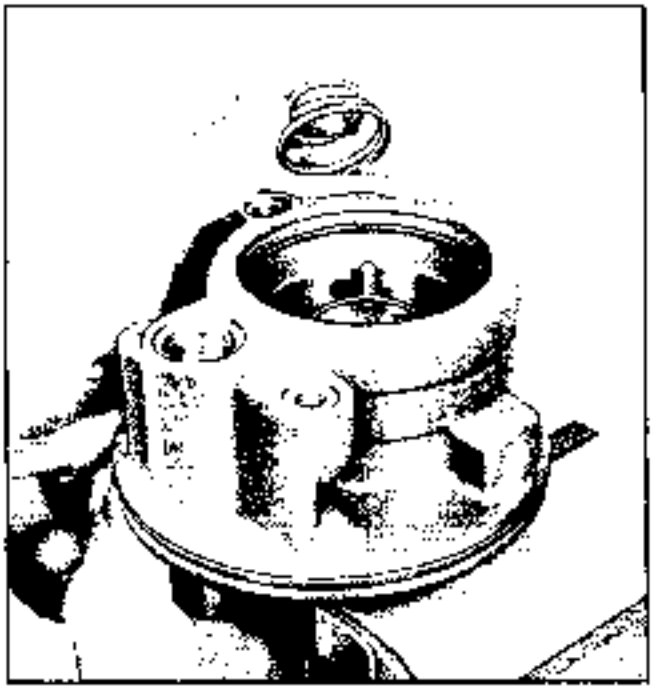


Fig. 9-86 Installing Pressure Plate Spring

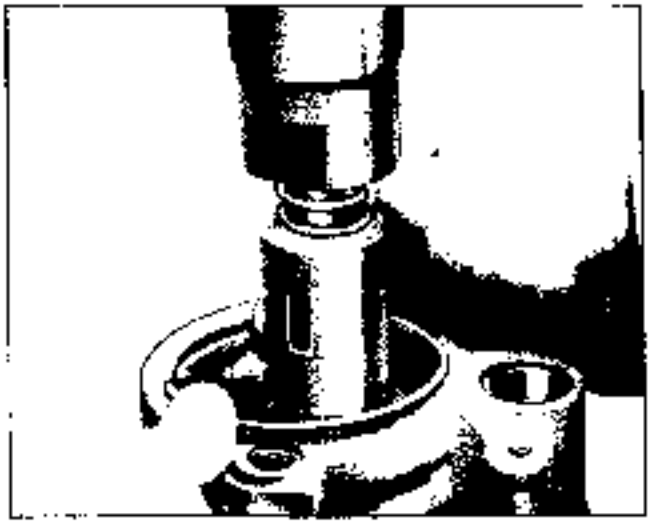


Fig. 9-87 Installing End Plate

5. Install pump bolt over pulley last to avoid damage to belt.

6. Move pump until belt has 112 lb. as indicated on the Burroughs gauge for initial tension of a new belt, tighten used belt to 72 lbs. Tighten mounting bolts 30 ft. lb. torque.

7. Tighten pulley nut to 80 ft. lb. torque.

8. Fill reservoir with GM power steering fluid or equivalent. Bleed pump by turning pulley backward (counter-clockwise as viewed from front) until air bubbles cease to appear.

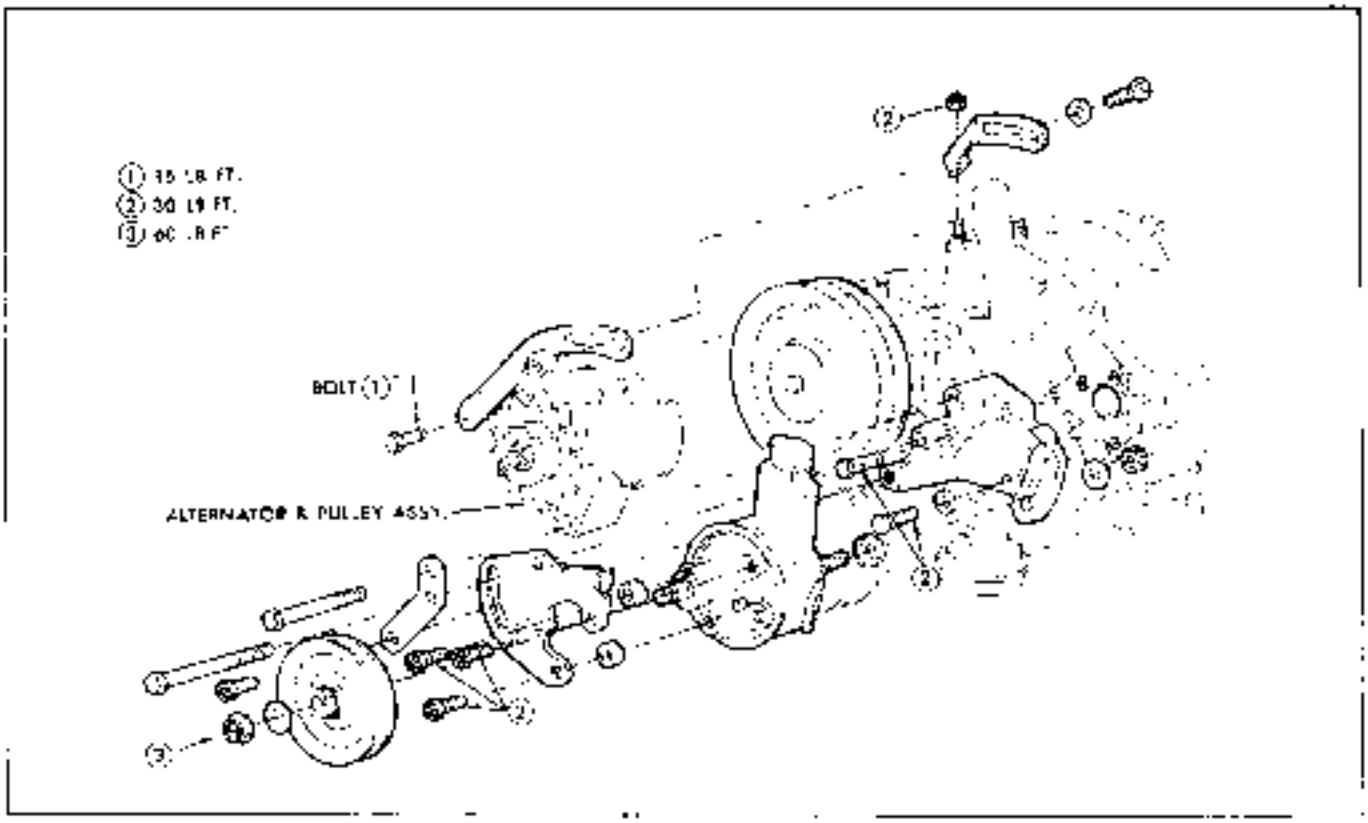


Fig. 9-88 Installation of Power Steering Pump for V8 Engines

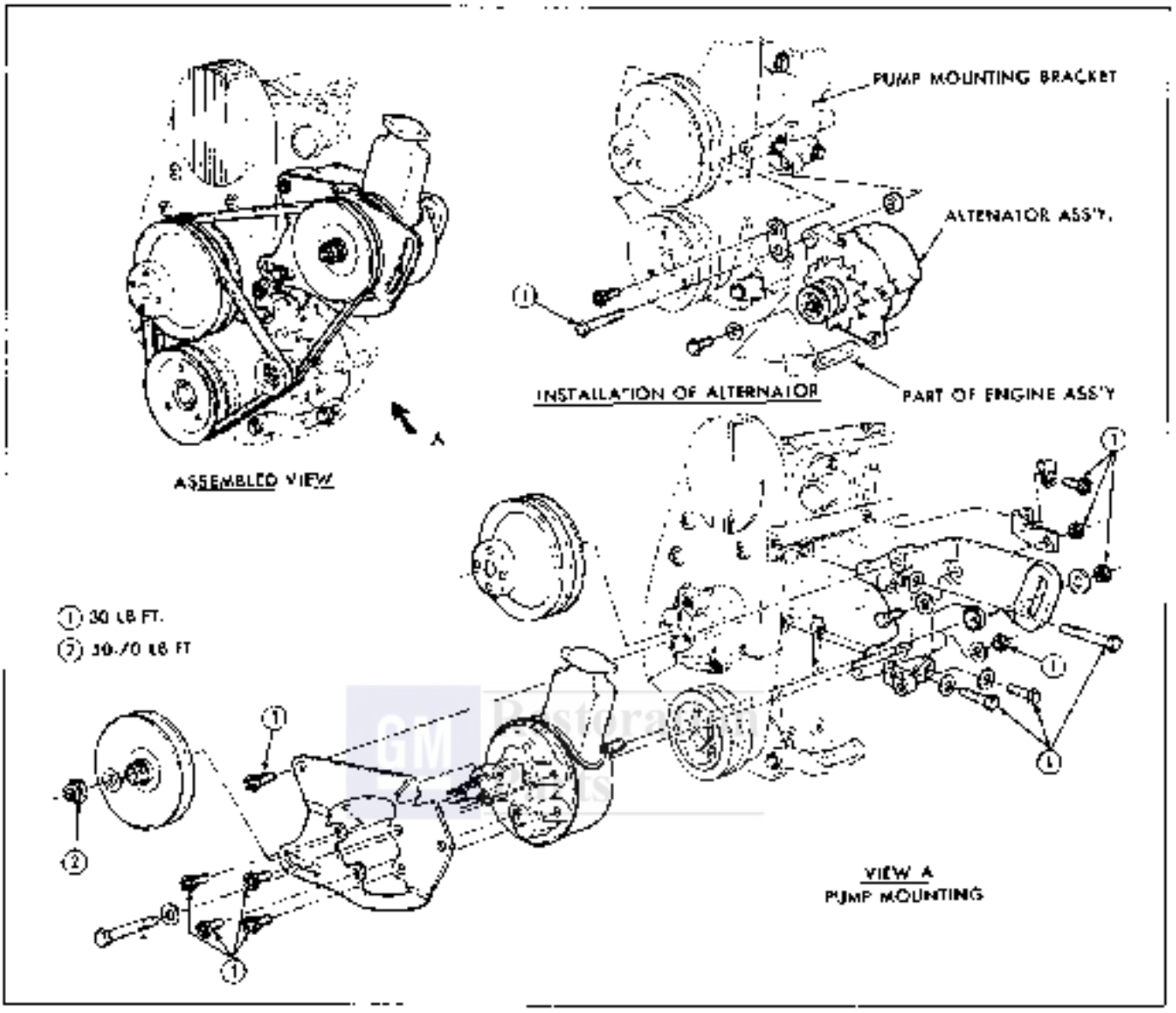


Fig. 9-89 Installation of Power Steering Pump for 6 Cyl. Engines

GENERAL SPECIFICATIONS

STANDARD STEERING

Type: Saginaw Recirculating Ball Nut

Steering Gear Ratio	
Pontiac, Tempest, Firebird	24:1
Firebird (with V8 and Air Conditioning)	28:1
Lubricant Capacity: 11 Fluid Ounces	
Worm Bearing Preload	7 in. lb.
Sector and Ball Nut Backlash	
24:1 Ratio	14 in. lb.
28:1 Ratio	16 in. lb.

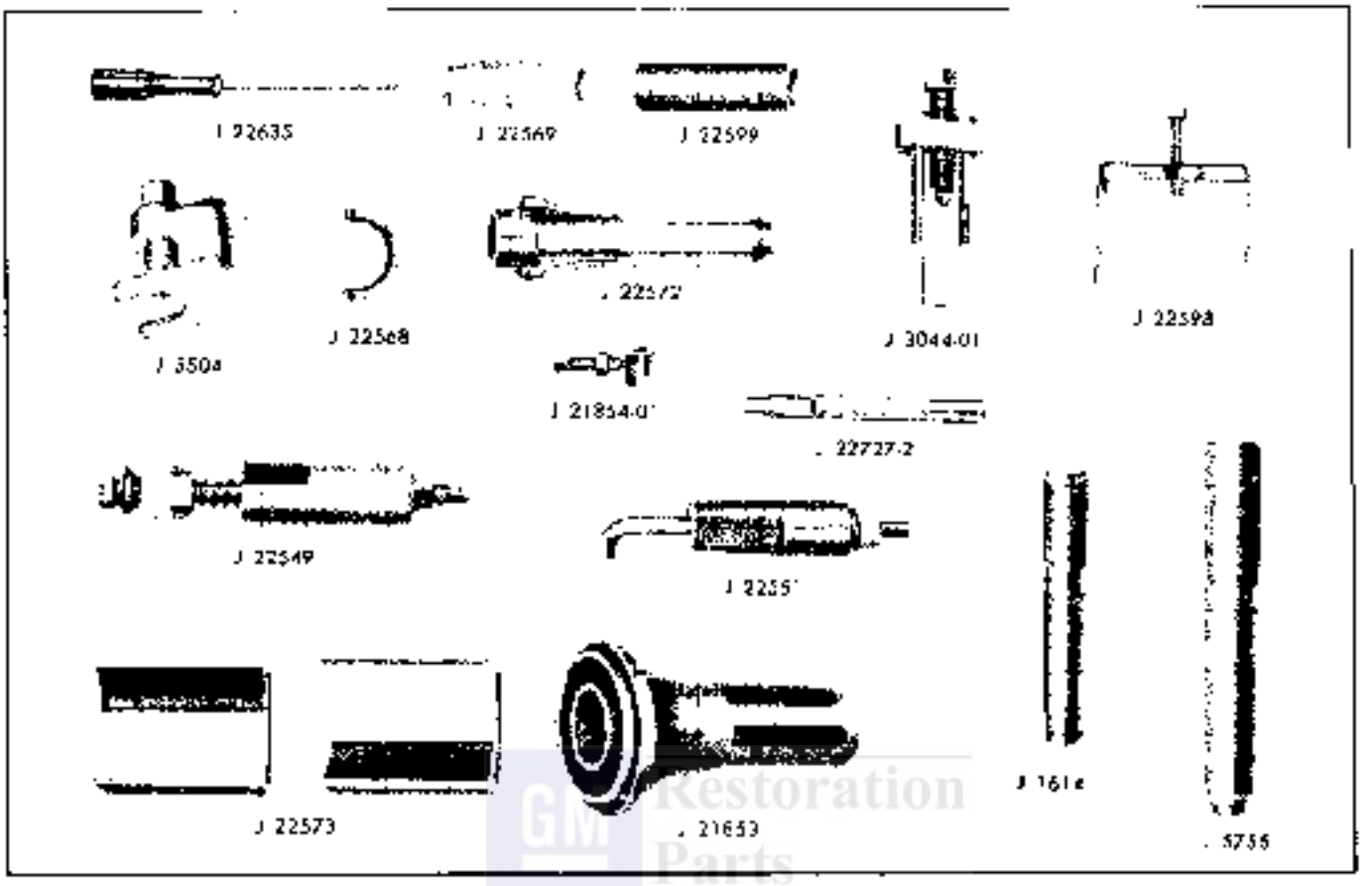


Fig. 9-50 Special Tools for Steering Columns and Standard Steering Gear

POWER STEERING

Type: Saginaw Rotary Valve

Steering Gear Ratio
- Pontiac Catalina, Firebird and Tempest 17.5:1
- Pontiac (Except Catalina) ..... 16:1 to 12.2:1 (Variable Ratio)

Number of Turns of Steering Wheel Stop to Stop (Pitman Arm Disconnected)
- 17.5 Ratio ..... 4.0 (approx.)
- Variable Ratio ..... 3.1 (approx.)

Power Steering Pump Pressures
- Tempest, Firebird, Pontiac Catalina (without air conditioning) ..... 1000 to 1100 psi. max.
- Pontiac Catalina (with air conditioning) ..... 800 to 1000 psi. max.
- All other Pontiac models ..... 1100 to 1200 psi. max.

Fluid Capacity ..... 2.5 pints

Oil Cooler ..... Variable Ratio Steering only on all models with Air Conditioning and axle ratio of 2.93:1 or higher

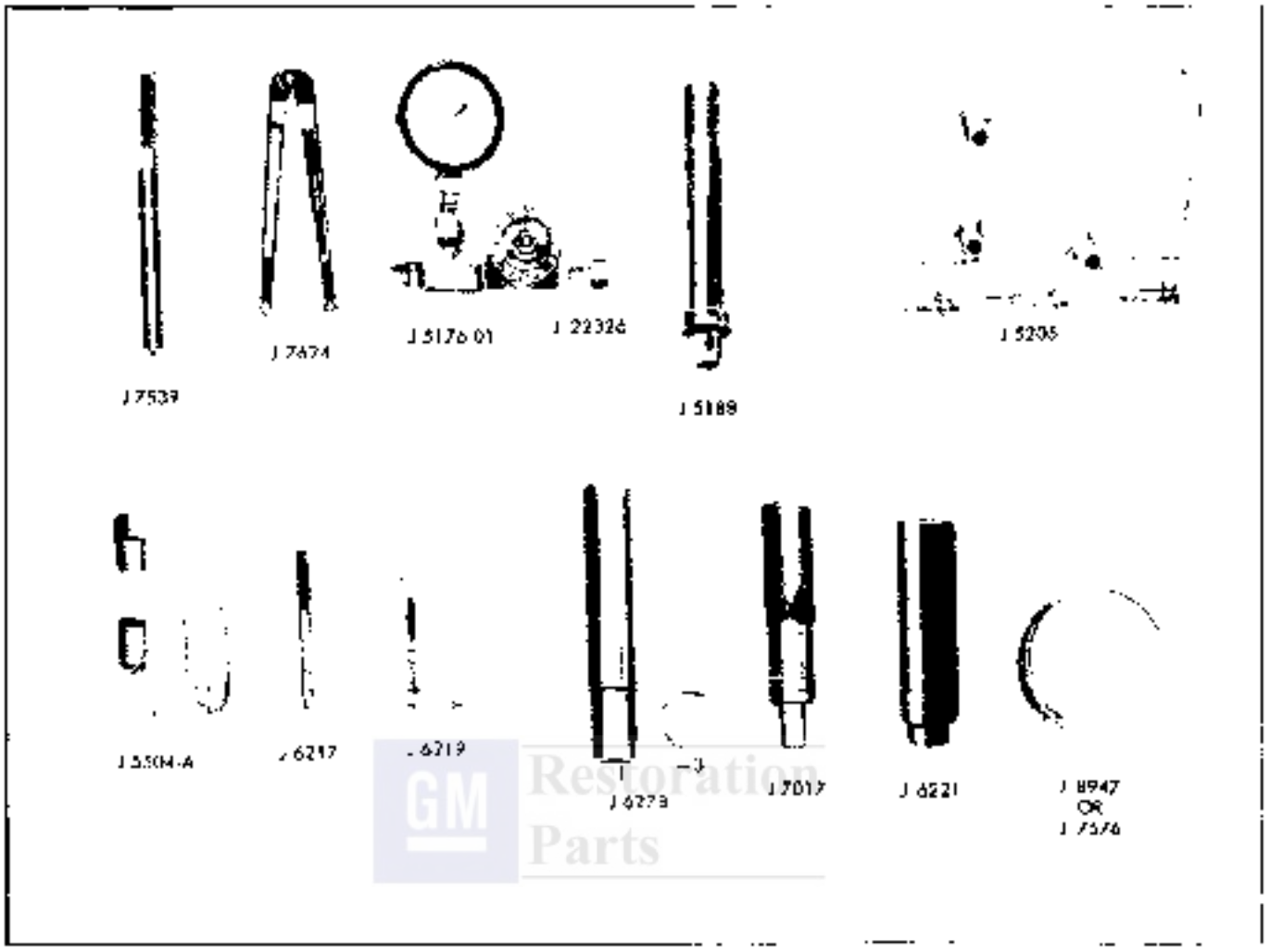


Fig. 9-91 Special Tools for Power Steering

TORQUE SPECIFICATIONS

	FT. LB.
Nut, Steering Knuckle to Tie Rod	
Pontiac	60
Tempest, Firebird	35
Nut, Pitman Shaft to Pitman Arm	140
Nut, Tie Rod Clamp	17
Nut, Idler Arm Support to Frame	40
Nut, Steering Wheel to Steering Shaft	35
Nut, Steering Column to Instrument Panel	20
Bolt, Steering Column to Instrument Panel	20
Bolt, Steering Column to Mounting Bracket	20
Nut, Flexible Coupling to Steering Shaft	20
Bolt, Steering Gear to Frame	70
Screw, Tie Plate to Floor Pan	40 in. lb.
Power Steering Only:	
Connector, Hose to Pump or Gear	25
Union, Pressure Hose Connector to Pump	35
Pump Mounting Stud	35
Bolt, Pump Mounting to Engine	30
Nut, Pump Pulley to Shaft	60
Nut, Adjuster Plug Lock Nut	60
Bolt, Side Cover to Housing	30

WHEELS AND TIRES

CONTENTS OF THIS SECTION

RECOMMENDED TIRE INFLATION PRESSURES

Pounds Per Square Inch (Cold)

Models	Tire Ply	Standard Inflation For All Loads Including Full Rated		Optional Inflation For Reduced Loads	
All except Station Wagons		1 to 8 Passengers + 200 lbs. Luggage (1100 lbs. Load)		1 to 5 Passengers (750 lbs. Load)	
		Front	Rear	Front	Rear
	4 Ply Rating	24 lbs.	28 lbs.	24 lbs.	24 lbs.
	8 Ply Rating	26 lbs.	30 lbs.	24 lbs.	24 lbs.
Station Wagons		1 to 8 Passengers + 300 lbs. Luggage (1200 lbs. Load)		1 to 5 Passengers (750 lbs. Load)	
		Front	Rear	Front	Rear
	4 Ply Rating	24 lbs.	32 lbs.	24 lbs.	28 lbs.
	8 Ply Rating	26 lbs.	30 lbs.	26 lbs.	30 lbs.

1. Tire inflation pressures may increase as much as 6 pounds per square inch (psi) when hot.
2. For continuous high speed operation (over 75 mph) increase tire inflation pressures 4 pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch cold for 4 ply rating tires, or 40 pounds per square inch for 8 ply rating tires. Sustained speed above 75 mph are not recommended when the 4 pounds per square inch adjustment would require pressures greater than maximum stated above.
3. Cold tire inflation pressure: after vehicle has been inoperative for 3 hours or more, or driven less than 1 mile. Hot tire inflation pressure: after vehicle has been driven 10 miles or more at 60-70 miles per hour.
4. Station Wagon loads should be distributed as far forward as possible.
5. Vehicles with luggage racks do not have a vehicle load limit greater than specified.
6. When towing trailers, the allowed passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

MINOR REPAIRS

TEST FOR LEAKS

1. Use soapy water to check valve for leaks. In many cases air loss can be corrected by simply tightening the valve core.

2. If the reason for air loss is not immediately discernible, submerge the complete wheel assembly in a tank of water.

3. Mark the tire and rim at the point where air is escaping.

Tire Mounting and Dismounting Instructions.

The wheel assembly has a flat hump bead seat on the outboard (valve hole) side of the rim. This design provides a tight fit, making it necessary to use a rubber lubricant or a vegetable oil soap solution for tire mounting and dismounting. This design also

makes it mandatory that tire mounting and dismounting be done with the outboard side of the wheel up.

WHEEL STUD
REMOVE AND REPLACE

1. Support the hub and drum assembly with approximately 1" diameter by 5" long pipe or other suitable tool directly under and surrounding the stud to be removed and press out the stud.

CAUTION: If hub and drum are not supported underneath pressure from the press may distort the drum or push the hub assembly away from the drum.

2. Clean out the existing hole by drilling through the hub and drum assembly. Use a 41/64" (.6406) drill on Pontiac and a 9/16" (.5625) drill on Tempest and Firebird.

3. Press in replacement stud.

REMOVE TIRE FROM WHEEL

1. Remove valve cap and valve core. Let out all the air.

2. With valve hole side of tire down, break beads away from rim. Use only conventional bead-breaker type machine.

CAUTION: Do not use hammer or tire irons.

3. Apply a liberal amount of rubber lubricant or thin vegetable oil soap solution to both beads and remove the first bead, using the machine method.

CAUTION: During the entire operation of breaking beads away from rim and removing tire from rim, special care should be taken not to damage the sealing ridges along the tire beads.

PUNCTURE REPAIRS

Puncture repairs may be quickly and permanently performed, using one of several kits available through tire manufacturer's dealer outlets.

WHEEL LEAKS

Examine rim flanges for sharp dents. Any dent visible to the eye should be straightened. Never use heat when straightening a wheel.

CAUTION: Under no circumstances should wheels be brazed, welded or peened. In the event the wheel is severely damaged, it should be replaced.

PREPARATION OF TIRE

Remove excess strings of rubber hanging from tire bead.

PREPARATION OF RIM

1. Clean rim flanges with small piece of No. 3 coarse steel wool or emery cloth to remove all oxidized rubber, soap solution or rust. If rim is badly pitted, use file to remove and paint with primer.

2. Straighten or replace rim if it is bent or damaged.

MOUNTING TIRE ON WHEEL

1. Install valve if valve was removed. Always install valve recommended by tire manufacturer.

2. Apply liberal amounts of vegetable oil soap solution or approved rubber lubricant to rim edges and tire beads.

3. Mount tire on the wheel with valve hole side up, using the machine method.

4. Remove valve core from stem to increase flow of air.

5. With casing on the rim so that the beads are resting uniformly on the bead ledge, quickly apply a large volume of air. This forces the bead on the bead seat and against the flanges where the air seal for the tire is obtained. Inflate tire until beads are completely forced against rim flanges.

CAUTION: Do not stand over tire when inflating. Bead wire may break when bead snaps over safety hump. Do not exceed 40 lb. air pressure when inflating. If 40 lbs. pressure will not seat beads properly, deflate, lubricate, and reinflate.

6. Once beads are seated against rim flanges, air pressure can be reduced.

7. Install valve core and inflate to proper specifications.

8. General precautions in mounting tires:

   a. Use tire mounting and dismounting machine.

   b. Do not use hammer or tire irons.

   c. Work over rim flange so that the section nearest the valve stem will be applied last.

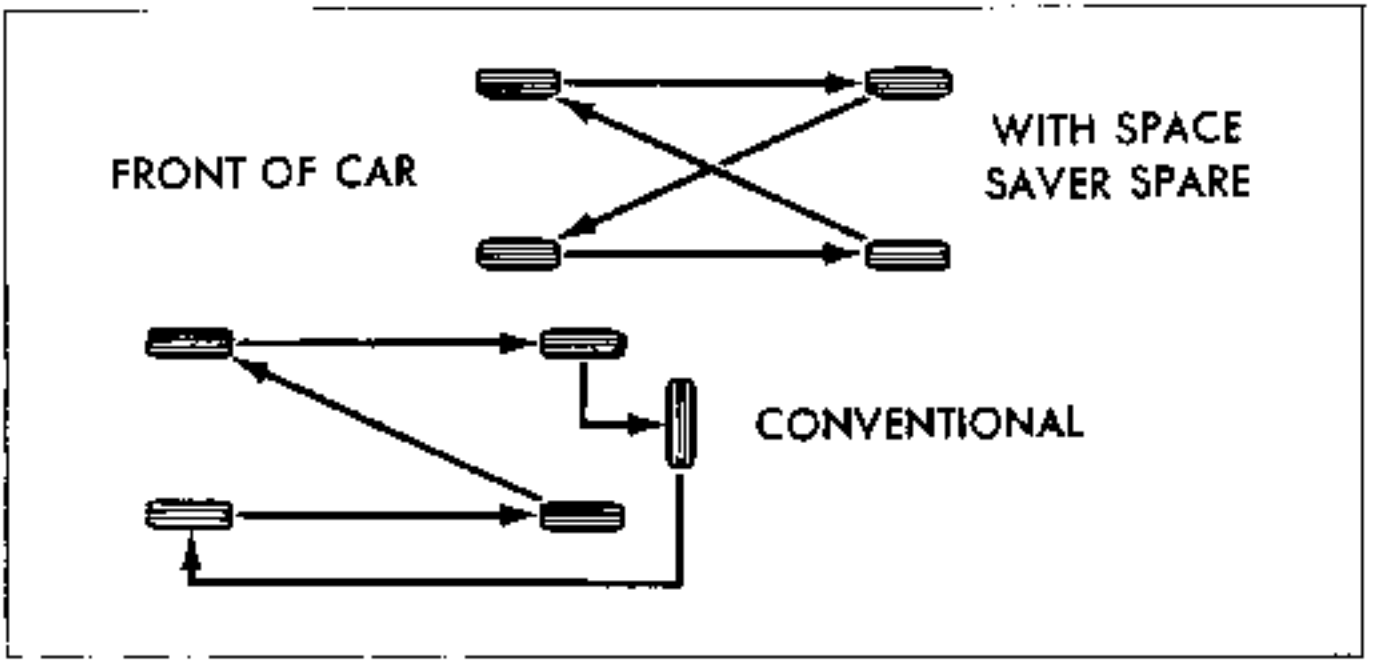


Fig. 10-1 Tire Rotation Diagram

INSPECTION BEFORE BALANCING WHEELS AND TIRES

1. Check and if necessary adjust front wheel bearings as outlined in section 3.

2. Set tire pressure to cold specifications and drive car until tires are hot to eliminate flat (cold set) spots.

3. Attach a dial indicator to the car body or stationary support. With indicator against tire (Fig. 10-2), slowly rotate wheel and check for total radial run-out of wheel and tire. Maximum allowable total radial run out is .092". If total radial run-out exceeds .092" then re index tire to wheel as noted below and recheck run-out of assembly. If still over .092" check radial run-out of wheel only.

4. Attach a dial indicator to a stationary stand similar to step 3 above. Slowly rotate wheel and check for total lateral run-out of wheel and tire. See Fig. 10-3. Maximum allowable total lateral run-out is 1/8". If total lateral run out exceeds 1/8" then attach a dial indicator to the stationary object and check for lateral run-out of wheel. Lateral run-out of wheel should not exceed .045".

Excessive total lateral or radial run-out of wheel and tire assemblies can sometimes be reduced within specifications by rotating the tire on the wheel until the high spot on the tire indexes with the low spot on the wheel. If this procedure fails to bring the total radial or lateral run-out within specifications, check for damaged or improperly mounted tire, bent or distorted wheel, and variations in tread surface due to wear and correct as necessary. The following procedure may be followed to determine if excessive total lateral or radial run-out is caused by wheel or tire:

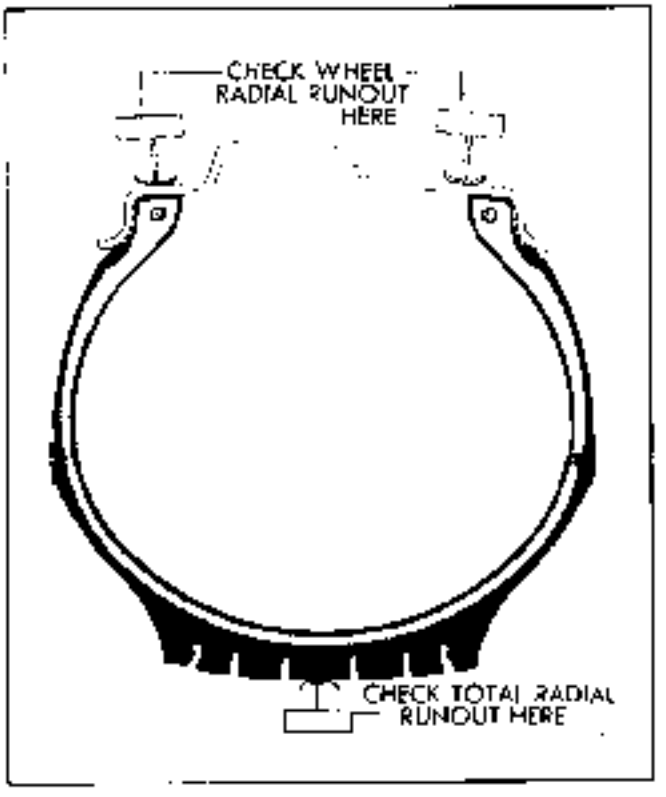


Fig. 10-2 Radial Runout Inspection

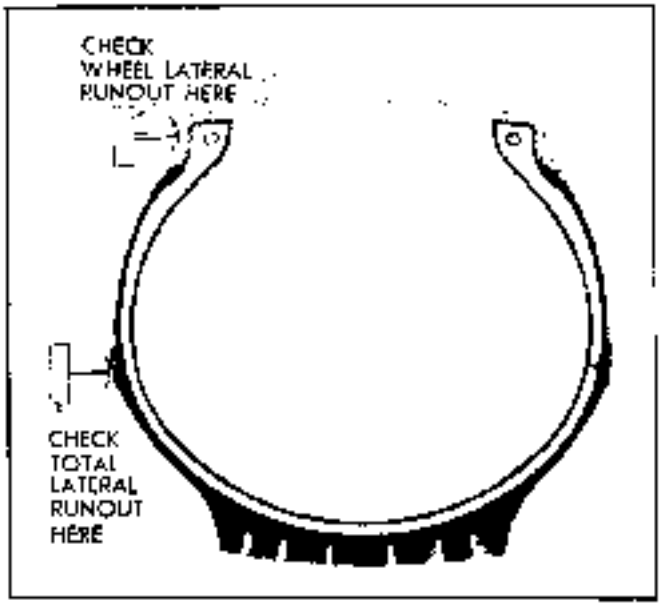


Fig. 10-3 Lateral Runout Inspection

1. Rotate tire on wheel.

2. Make total wheel and tire run-out check.

3. Make wheel run-out check if total lateral wheel and tire run-out exceeds 1/8" after tire rotation or total radial run-out exceeds .092".

4. If total wheel and tire assembly run out minus wheel run-out is .057" or greater for radial run-out, or .060" or greater for lateral run-out, excessive run-out is in the tire. If either occurs, the tire should be replaced. (Maximum wheel radial run-out is .035", maximum wheel lateral run-out is .045".)

BALANCE PROCEDURE

The preferred method of balancing wheels and tires is with on-the-car type equipment. But whether on or off car-type equipment is used, always follow the manufacturer's instructions for the equipment being used. In addition, pay particular attention to the following points.

1. Be sure tires are free of stones or other foreign objects that may become wedged in the tread. Be sure wheels are free of mud and brake drums do not drag on brake shoes.

2. Tires are at normal operating temperatures (hot).

3. Never use more than 6 ounces of balance weights. Always split weight evenly between inside and outside of wheel to avoid changing dynamic balance. If more than 6 ounces is required, reindex wheel to drum. Continued out of balance would require reindexing of tire to wheel. If more than 6 ounces is still required for balance, replace the tire.

4. Wheels and tires must be balanced statically before being balanced dynamically. Recheck static balance after dynamic balance.

5. When balancing rear wheels on the car, always check to see if car is equipped with Safe-T-Track differential. Never balance Safe-T-Track-equipped car with one wheel on ground as car may move when engine is started and transmission is in drive gear.

If car is equipped with Safe-T-Track rear axle, the balancing of the rear wheels should be performed as follows:

a. Raise and block the rear of the vehicle with both wheels off the floor.

b. Remove one wheel.

c. Reinstall two (2) lug nuts and tighten securely to retain the brake drum.

d. Proceed with balancing operation on the remaining wheel using engine power to spin the wheel.

e. When proper balance has been achieved on first wheel, reinstall the second wheel and balance in the same manner.

6. When balancing rear wheels on the car, remember that: With one wheel on the ground, speedometer speed is one-half (1/2) rear wheel speed. With both wheels off the ground, speedometer speed is the same as rear wheel speed.

Wheels are identified as follows:

PONTIAC

Standard	H
Station Wagon	K
Disc Brake and certain heavy duty options	L
Rally II	JA

TEMPEST

Standard	H
GTO	HG
Disc Brake (Standard)	HC
Disc Brake (GTO)	HF
Rally I	KB
Rally II (Drum only)	JC
Rally II (Disc only)	JA

FIREBIRD

Standard	HG
Rally II	JC
Disc Brake	HK

SPECIFICATIONS

WHEELS

Material	Steel
Type	Drop Center with flat safety hump
Diameter	Standard (All) 14"
	Optional (Pontiac) 15"
Width	Pontiac, GTO and Firebird 6"
	Tempest 5"
	Firebird Space Saver Spare 5"
	Pontiac and Tempest Space Saver Spare 9"

TORQUE SPECIFICATIONS

Pontiac Wheel to Drum Nut—	
Front and Rear	75 Lb. Ft.
Tempest and Firebird Wheel to Drum Nut - Front and Rear	70 Lb. Ft.

TIRE USAGE CHART

PONTIAC TIRES

Models	Equipment	Standard*	Optional*
Catalina 2 and 4 door sedans	All except: Air Conditioning, Police Option, Disc Brakes, Trailer Provision	8.25 x 14	8.55 x 14 8.55 x 14 (4 ply rating—4 ply) 8.25 x 14 8.65 x 14 (8 ply rating—4 ply) 8.45 x 15 8.45 x 15 (4 ply rating—4 ply) 8.45 x 15 (8 ply rating—4 ply) H70 x 15 215R x 15 (radial ply)
All other except 3 seat station wagon	All except: Police Option, Disc Brakes, Trailer Provision	8.55 x 14	8.55 x 14 (4 ply rating—4 ply) 8.65 x 14 8.65 x 14 (8 ply rating—4 ply) 8.45 x 15 8.45 x 15 (4 ply rating—4 ply) 8.45 x 15 (8 ply rating—4 ply) H70 x 15 215R x 15 (N.A. station wagon)
3 seat station wagon	All except: Police Option, Disc Brakes, Trailer Provision	8.85 x 14	8.55 x 14 (4 ply rating—4 ply) 8.85 x 14 (8 ply rating—4 ply) 8.45 x 15 (8 ply rating—4 ply)

TEMPEST TIRES

All except GTO	All except: Trailer Provision	6-cyl. - 7.75 x 14	8.25 x 14 (6-cyl. only) G70 x 14
	All	8-cyl. - 8.25 x 14	
GTO	All	G77 x 14 Red Stripe	G70 x 14

FIREBIRD TIRES

All 6-cyl. 1-Bbl.	All	E70 x 14	F70 x 14 185R x 14
All other	All except 400 Option**	F70 x 14	F70 x 14 Red stripe or white 185R x 14 (radial ply)

*All Standard and Optional tires are 4 ply rated—2 ply unless otherwise specified.
**Red stripe tires are standard with 400 option - disc brakes require 15" wheels (Pontiac only).

CHASSIS SHEET METAL

CONTENTS OF THIS SECTION

HOOD

The hood (Figs. 11-1-11-3), of rigid sheet metal construction, is composed of a single sheet metal outer panel and a rugged inner panel reinforcement. Further rigidity is obtained by the insertion of reinforcement braces and brackets strategically located so as not to interfere with adjustment or service repair conditions.

A. ADJUSTMENT

Slotted holes are provided at all hood hinge attaching points for proper adjustment; both vertically and fore and aft.

To lower the rear corners for proper alignment to the cowl and fenders, and to ensure contact with the hood side wedges, proceed as follows:

1. Loosen front end of hinge mounting bracket to fenders.

2. Hold hood open as high as possible and force front of hinge upward.

3. Tighten fender connection.

NOTE: If this does not correct condition, loosen entire hinge by loosening attachment bolts at cowl and pushing downward.

The portion of hood hinge that attaches to cowl has elongated holes at top and bottom to take care of any body variations.

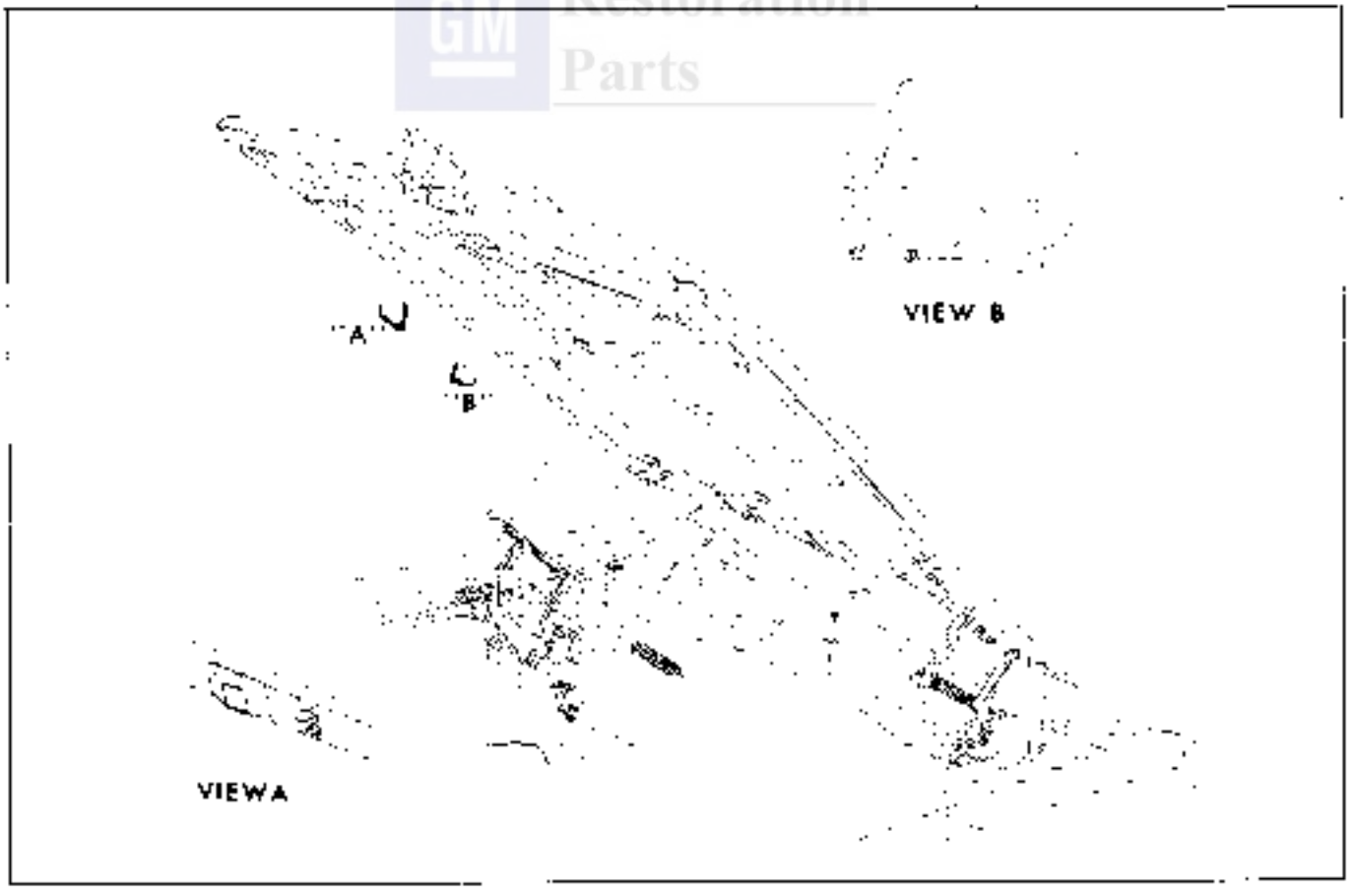


Fig. 11-1 Pontiac Hood

B. REMOVAL

1. Open hood.

2. Loosen hood hinge to hood attaching bolts.

3. With aid of a helper, hold hood securely and remove attaching bolts.

4. Lift hood assembly from sheet metal.

C. REPLACEMENT

To replace, simply reverse above procedure checking hood alignment, one hinge at a time as outlined in steps 4 and 5 under HOOD HINGE -- REPLACEMENT.

HOOD LATCH

A positive locking hood latch, which incorporates a safety catch with the pilot assembly is used on all models. The hood latch being fastened to the support and baffle assembly locks securely with the latch plate mounted to the hood.

Latch adjustment is not necessary. After proper positioning of the hood bumpers, hood height is automatically controlled by the vertically self adjusting hood latch. No lateral adjustment of the latch is possible. However, proper hood alignment is essential for ease of latch operation.

To open the hood, pull the release handle under the center portion of the front bumper grille downward. A "pop-up" spring on the support and baffle provides initial opening of the hood upon release. To fully open the hood, pull the release handle past the detent position and lift hood.

HOOD HINGE

The hood opens on gear-type hinges (Figs. 11-1--11-3), mounted to the cowl and fender panel. Double assist overcenter springs are used (one at each hinge), both ends of which are fastened to the arms of hinge. This construction provides hold open power. Fore and aft adjustment of hood is provided by slotted holes in the hinge bracket.

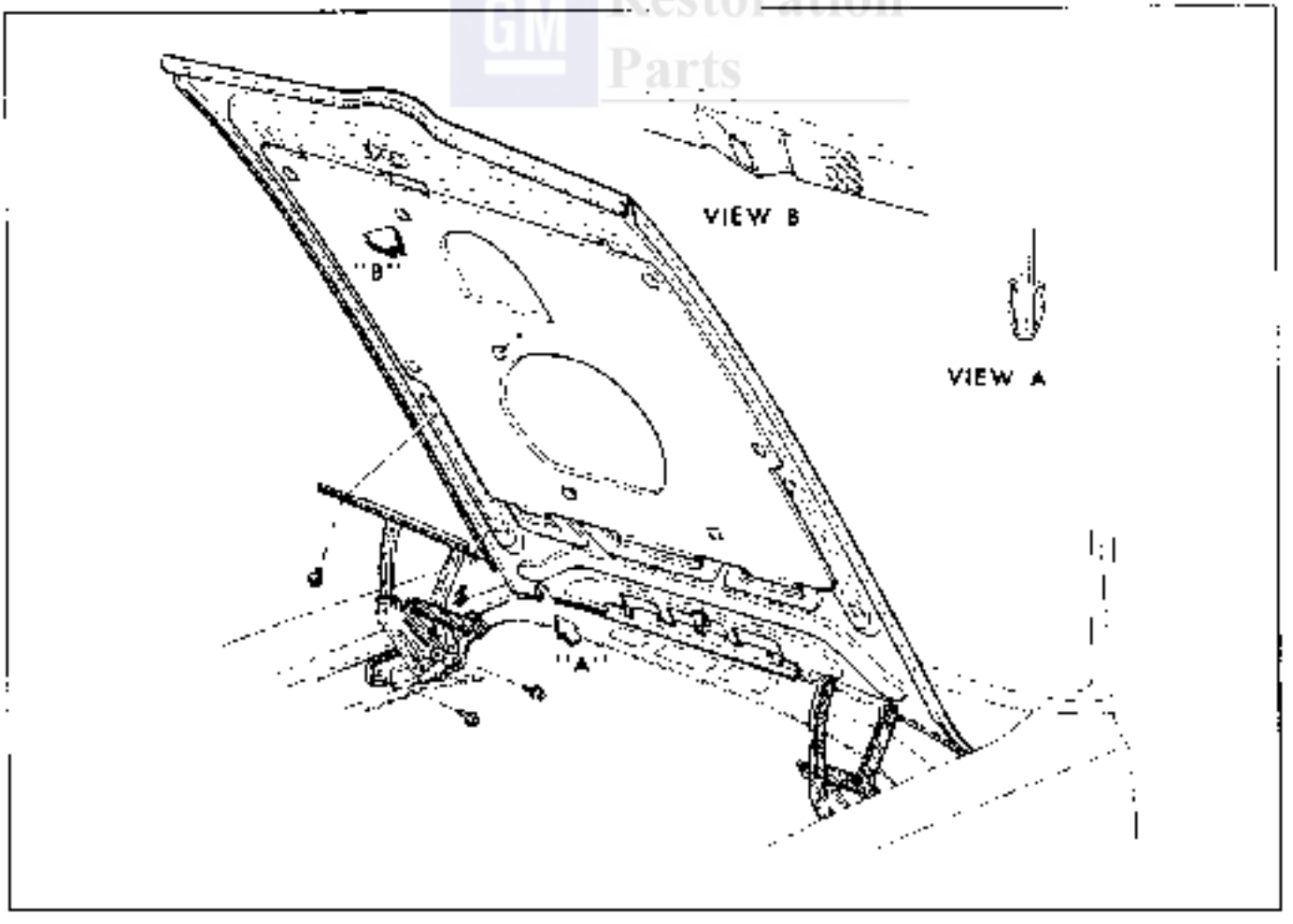


Fig. 11-2 Tempest Hood

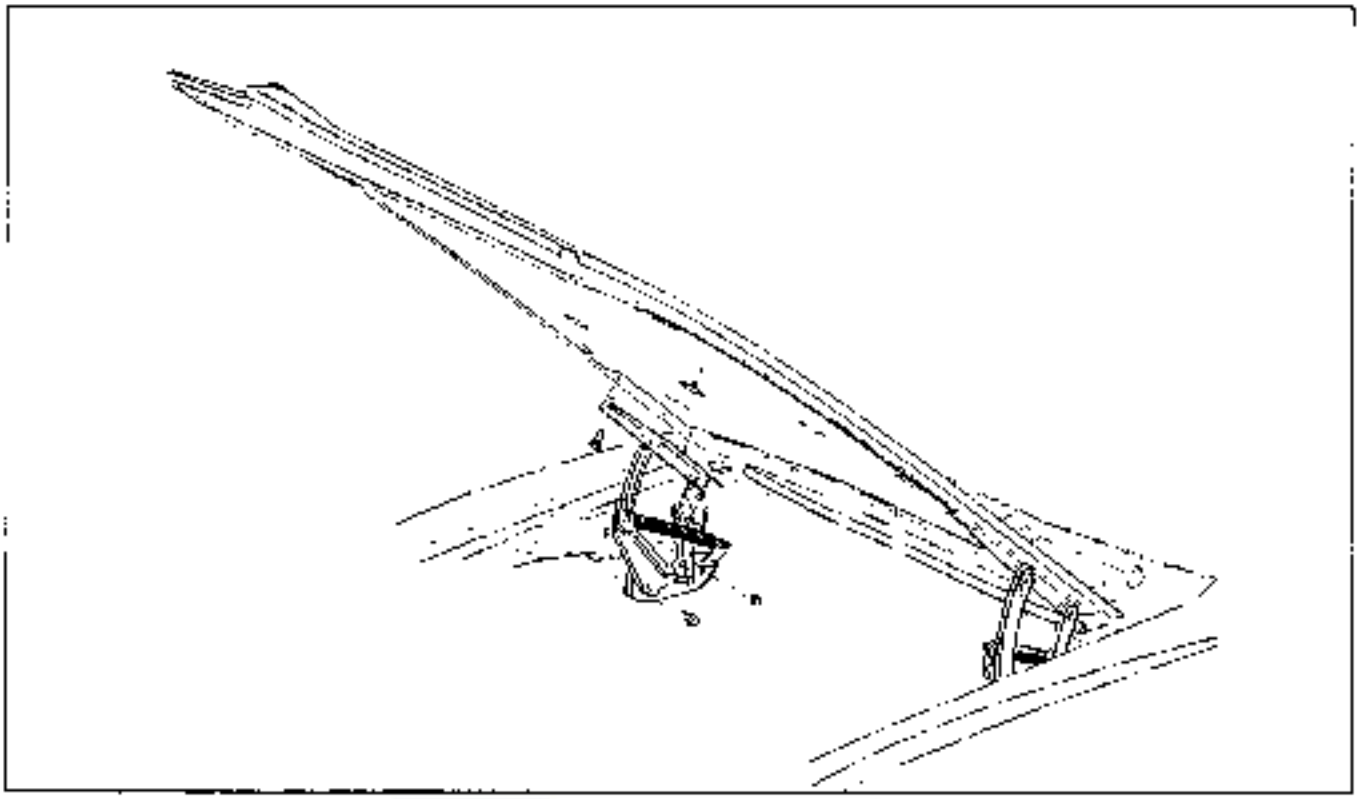


Fig. 11-3 Hinged Hood

REMOVAL

1. Open hood.

2. Block hood on side where hinge is to be removed.

3. Prop hood open and pull front of spring off hinge.

4. Remove hinge-to-hood attaching screws and hinge-to-fender attaching screws.

5. Carefully remove hinge.

REPLACEMENT

1. Mount new hinge to fender and tighten attaching screws.

2. Position hinge to hood, install attaching screws and tighten snug.

3. Replace spring.

NOTE: When replacing spring, hook rear end of spring on pin first, then stretch and hook at front.

4. Carefully close hood and check for proper alignment.

5. If hood is misaligned, measure amount of misalignment.

a. Open hood, mark position of hinge relative to hood.

b. Loosen hinge at hood and reposition to correct misalignment.

c. Tighten securely and recheck (torque 25 lb. ft.).

FENDERS

ALIGNMENT

Vertical, fore, aft and lateral adjustment is provided at the rear of fender by enlarged holes in the reinforcement at attaching points, and the use of shims at these points (Figs. 11-4 – 11-5).

1. Check the space between the front door to fender rear edge and adjust as necessary to obtain a parallel opening, also adjusting for proper fender to windshield molding and cowl vent grille clearance.

2. Check to insure that all fender attaching bolts are secure.

3. The height of entire sheet metal assembly is controlled in front by the amount of shims used between the frame horn and secondary mounting

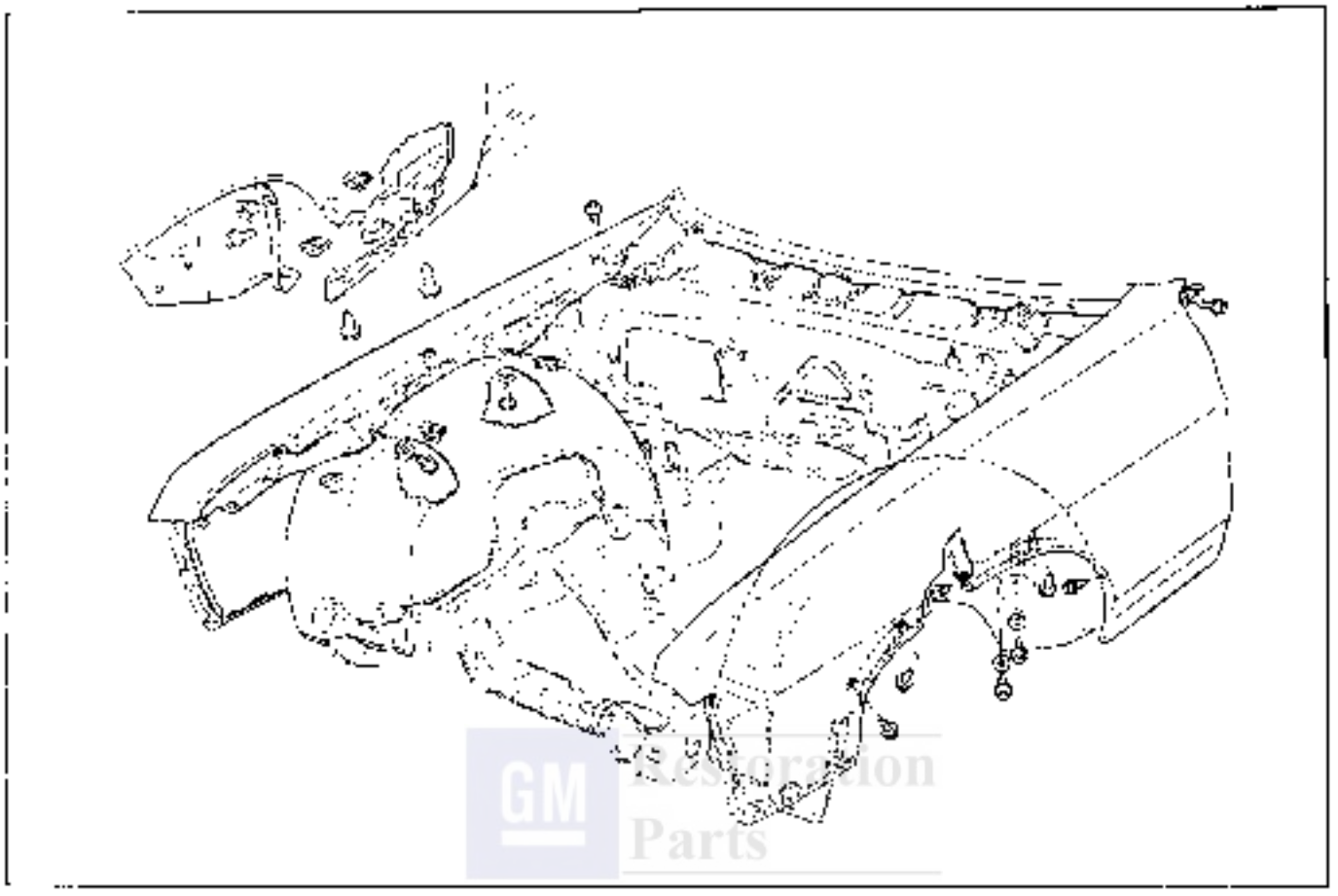


Fig. 11-4 Pontiac Front Fenders

insulator (Figs. 11-7, 9, 10). Special attention is required to ensure that the sheet metal is resting on these mounts and not being supported by the fender to shroud attachments. For this reason, the fender to shroud attachments must be loosened and readjusted whenever the front mounting is disturbed.

FRONT FENDER— REMOVAL AND REPLACEMENT

A. REMOVAL

NOTE: If the same fender is to be replaced, note position, location and number of alignment shims used.

1. Remove valance panel and front bumper assembly.

2. Remove fender to support and baffle assembly attaching screws.

3. Remove hood hinge to fender attaching screws.

4. Remove fender to inner skirt attaching screws at wheelhouse.

5. Disconnect fender from cowl at door opening and from rocker panel area.

6. Remove fender.

B. REPLACEMENT

1. To install, reverse above procedure.

2. Align fender with other sheet metal and body parts.

3. Torque all fender to cowl and rocker panel attaching screws 30 lb. ft., all fender to fender inner skirt and fender to fender extension attaching screws 12 lb. ft. and all fender extension and upper grille panel attaching screws 12 lb. ft.

FRONT INNER FENDER REMOVAL

(PONTIAC AND TEMPEST)

A. REMOVAL

1. Lift front end on frame allowing front suspension to hang free.

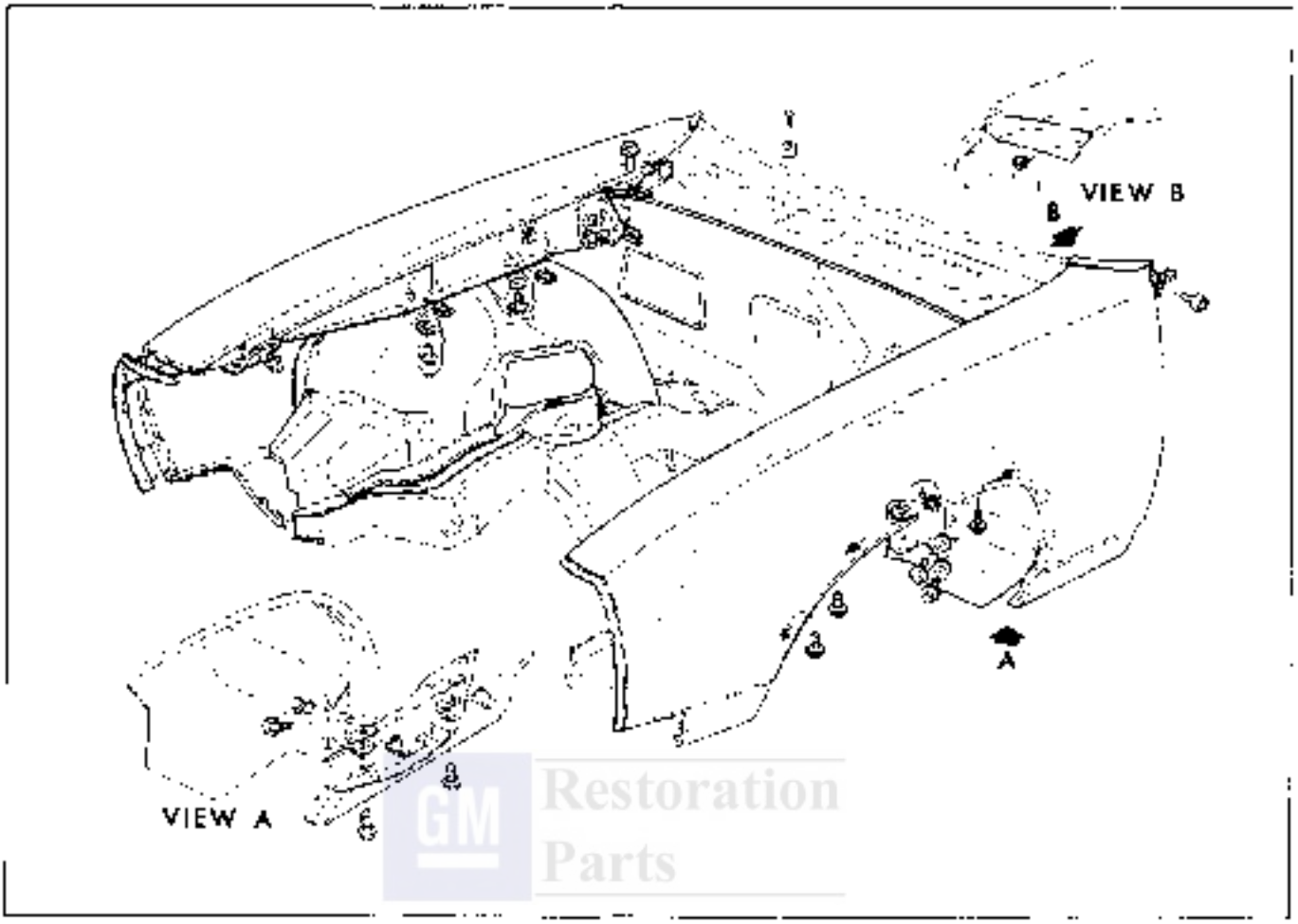


Fig. 11-5 Tempest front fender

2. Remove wheel.

3. Remove front fender wheel opening molding.

4. Remove inner fender skirt retaining screws.

5. Disconnect ground strap from right inner fender skirt.

6. Remove lower fender attaching bolts and rocker panel molding.

7. Pry out and block fender away from frame.

CAUTION: Exercise care in pulling fender away from frame to avoid bending fender.

8. Disengage inner fender skirt lip from outer fender panel by pulling out and down on inner edge of skirt.

9. Move inner fender skirt toward rear of car in twisting downward motion.

B INSTALLATION

1. To replace, reverse above procedure checking fender alignment with other sheet metal and body parts.

2. Torque all fender inner skirt to fender attaching screws 12 lb. ft., and lower fender attaching screws 30 lb. ft.

(FIREBIRD)

REMOVAL

1. Remove front fender.

NOTE: On convertibles, remove vibration damper to skirt mounting bolts.

2. Remove battery and battery tray to skirt attaching screw (right side only).

3. Remove firewall to skirt brace.

4. Disconnect any components attached to skirt such as cruise control, hoses, electrical harnesses, etc.

5. Remove skirt.

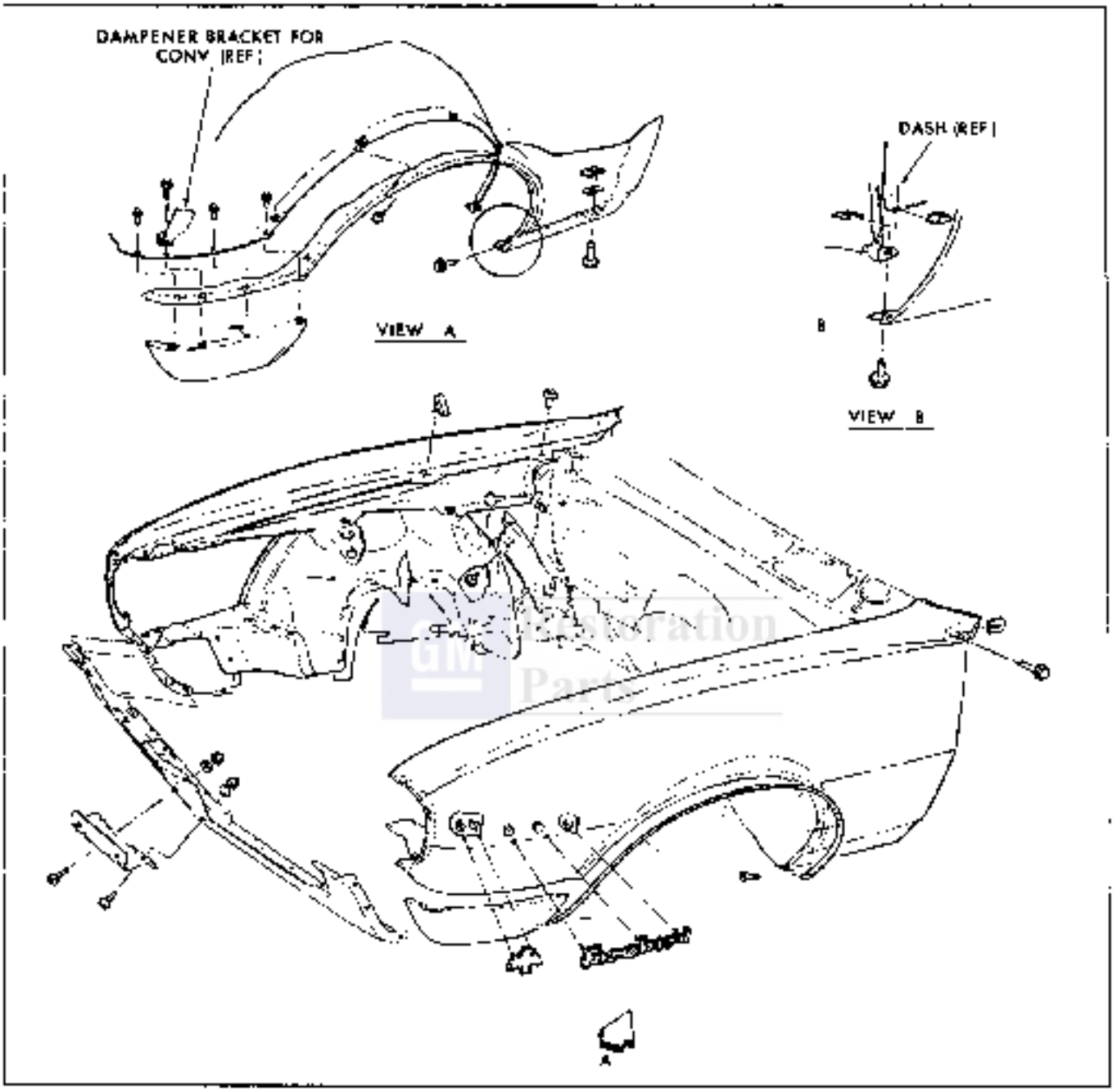


Fig. 11-6 Firebird Front Fenders

REPLACEMENT

1. To replace, reverse above procedure checking fender alignment with other sheet metal and body parts.

2. Torque all fender inner skirt to fender attaching screws 12 lb. ft., and lower fender attaching screws 30 lb. ft.

GRILLE

Distinct grilles are used on Pontiac, Grand Prix, GTO, Tempest and Firebird. All are integral with the front bumpers, the split grille shells being retained and entirely surrounded by the front face bar.

The Grand Prix and GTO have their own distinct grille design incorporating headlight doors, which conceal the horizontally mounted lights when not in use. The two doors swing down to reveal the headlights. All operating mechanism is held by the bumper and must be removed to replace the grille shells.

To remove and replace grille on all models, proceed with disassembly as described in Front Bumpers, section 14.

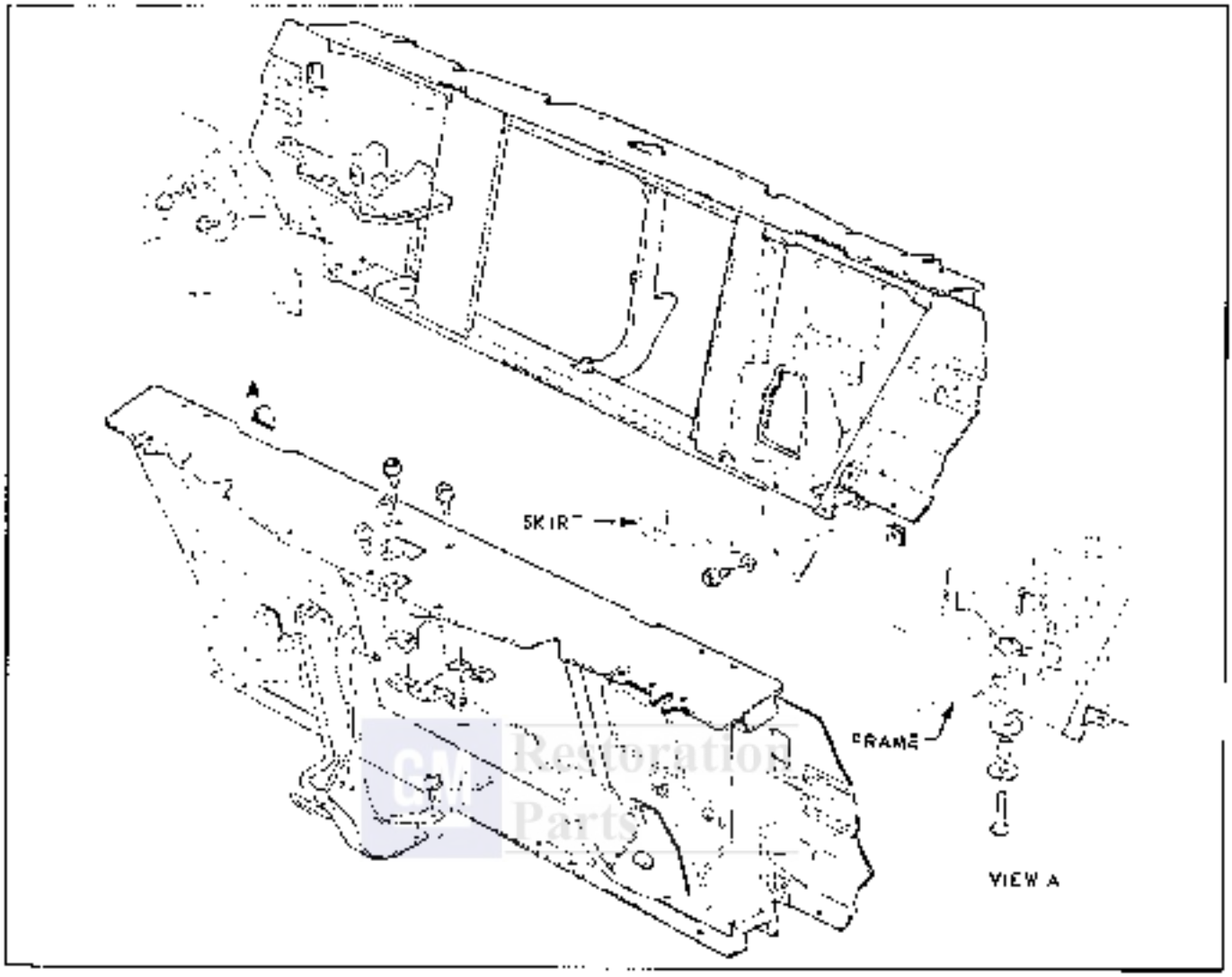


Fig. 11-7 Pontiac Support and Baffle

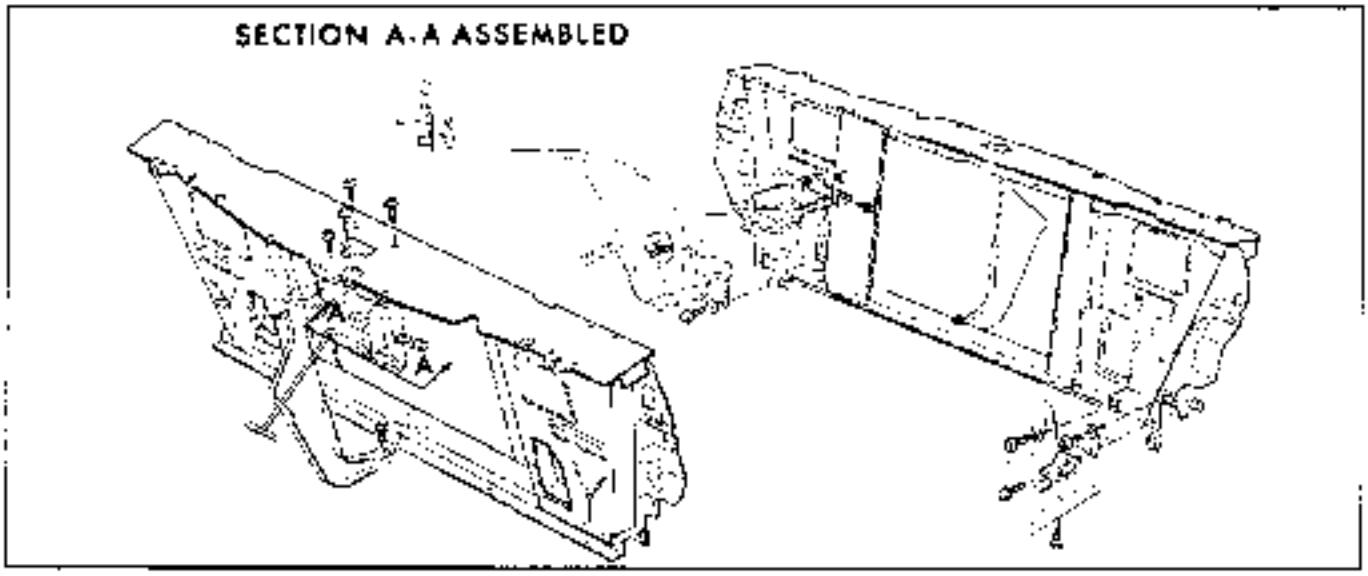


Fig. 11-8 Pontiac Rear Fender Skirt

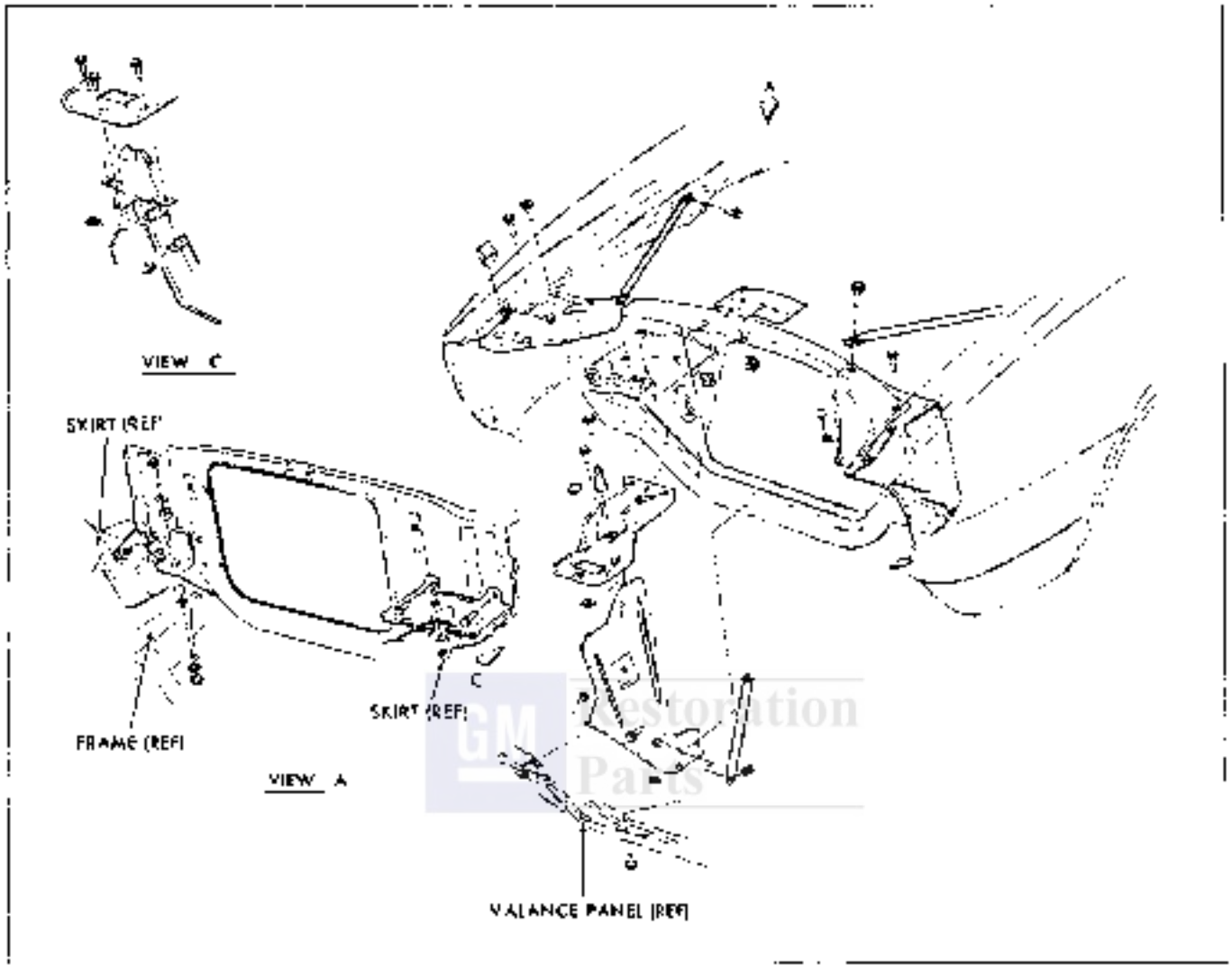


Fig. 11-9 Tempest Support and Baffle

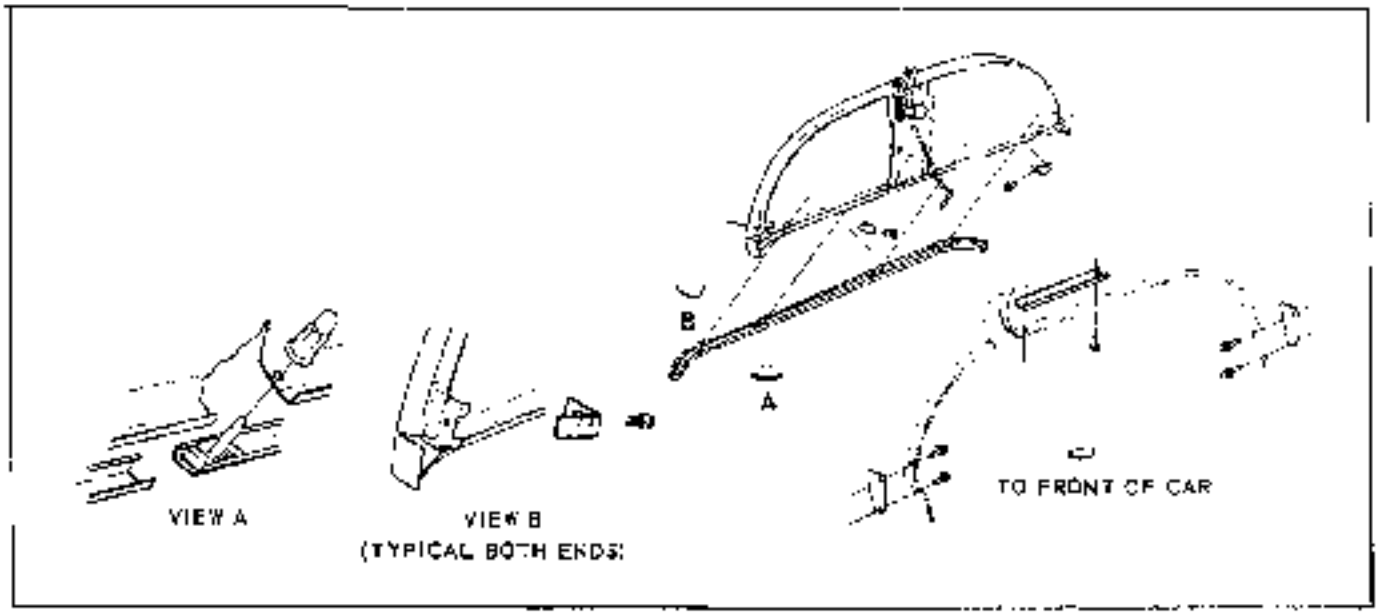


Fig. 11-10 Firewall Support and Baffle

CHASSIS ELECTRICAL SERVICE

CONTENTS OF THIS SECTION

REMOVAL AND REPLACEMENT PROCEDURES

Procedures apply to all models unless otherwise specified.

BATTERY

1. Remove positive and negative battery cables.

2. Remove battery clamp.

3. Remove battery keeping in an upright position.

4. If desired, remove battery tray.

5. To replace, reverse removal procedures.

NOTE: On Tempest models it is important to route cable as shown in Fig. 12-10

BATTERY CABLE

Battery Cable routing is shown in Figs. 12-11 for Pontiac and 12-12 for Firebird.

FUSIBLE LINK

1. Disconnect battery.

2. Locate burned out link.

NOTE: Link may be recognized on Pontiac or Tempest V-8 models as a loop of wire (approximately 3" in length) protruding from engine wiring harness along left rocker arm cover where harness breaks out for alternator. On Pontiac or Tempest 6-cylinder models loop will be located at breakout for voltage regulator from engine wiring harness. On Firebird models two links are used, one from voltage regulator and one from + battery to junction block.

3. Strip away all melted harness insulation.

4. Cut burned link ends from circuit wire.

5. Strip (approximately 1/2") back circuit wire that new link is to be soldered to.

6. Using fusible link 4 gauges smaller than protected circuit (approximately 10" long), solder new link into circuit.

CAUTION: Use only resin base solder. Under no circumstances should an acid base solder be used nor should link be connected in any other manner except by soldering.

7. Tape soldered ends securely using suitable electrical tape.

8. After taping wire, tape harness leaving an exposed loop of wire of approximately 5" in length.

9. Connect battery.

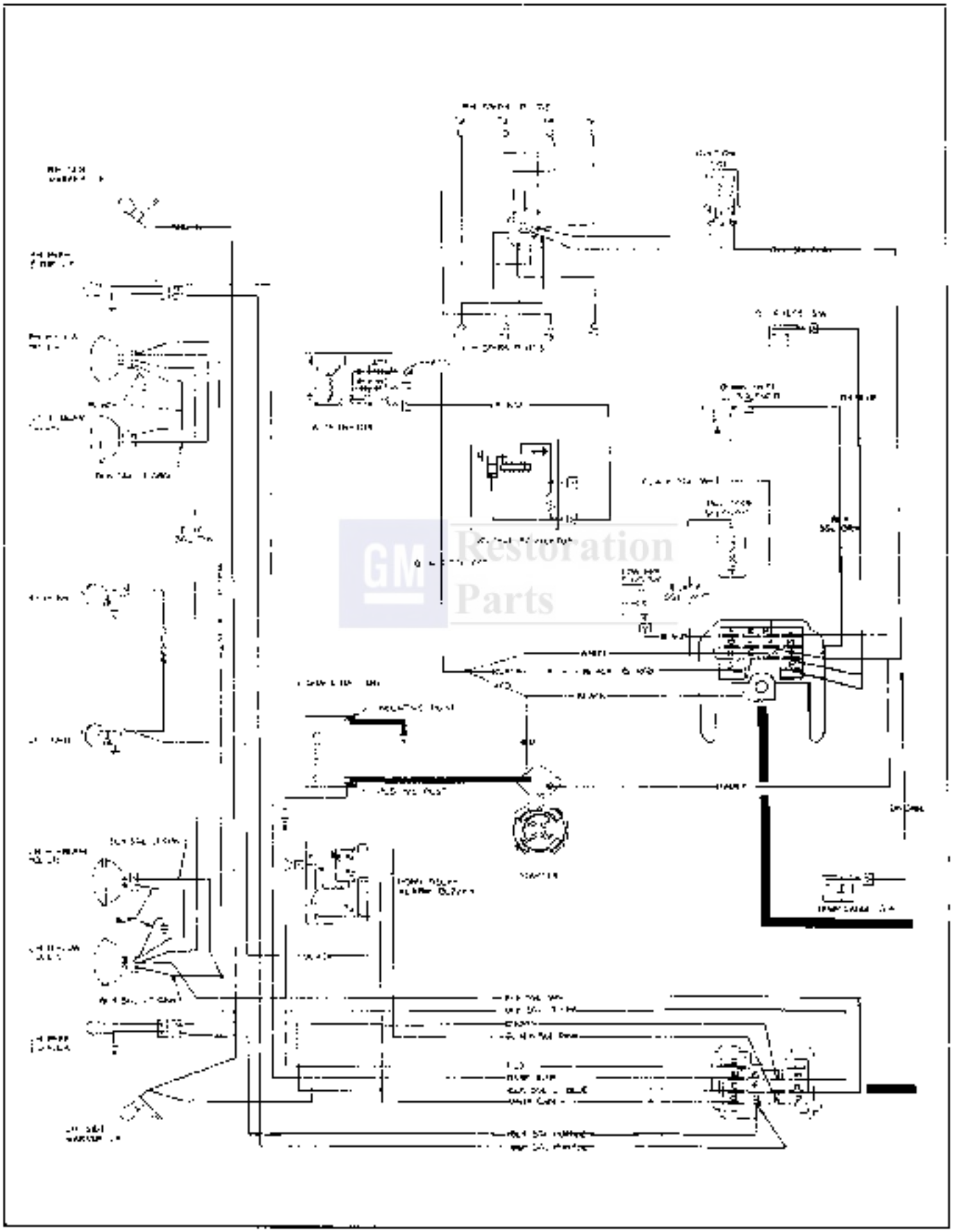


Fig. 12-1 Pontiac - Engine Compartment Wiring

FUSE BLOCK

1. Remove bolt holding front end and engine harness to fuse block. Separate harnesses.

2. Inside car, remove two screws retaining fuse block to dash.

3. Remove remaining in-car wire connectors.

4. Remove fuse block and harness.

5. To replace, reverse removal procedure.

WIRING HARNESS

Procedures for removing the wiring harnesses can be obtained from harness installation drawing shown in Figs. 12-13 through 20.

SEAL BEAM (Includes Adjustment)

1. Remove plastic filler between lamps.

2. Remove seal beam rim retaining screws.

3. Remove wire connector and remove seal beam.

4. To replace, reverse removal procedure.

5. Adjust headlights as shown in Fig. 12-21. If commercial aiming devices are used, follow manufacturer's instructions as well as local variations.

FRONT PARK AND SIGNAL LAMPS

1. To replace bulb remove lens.

2. To replace lamp assembly remove retaining screws.

3. Disconnect electrical feed wire.

4. Remove lamp.

5. To replace, reverse removal procedure.

HORNS

1. Remove lower valance panel.

2. Remove horn wire.

3. Remove horn retaining screw.

4. Remove horn or horns.

HORN RELAY AND BUZZER ALARM

1. Remove wire connectors.

2. Remove relay retaining screw.

3. Remove relay.

4. To replace, reverse removal procedure.

BRAKE WARNING LIGHT SWITCH

It is necessary to remove brake line distributor to replace brake warning light switch. Instructions for removal of the switch can be found in Section 5.

CORNERING LAMPS

For installation of cornering lamps see Fig. 12-22.

SIDE MARKER LAMPS

Front side marker lamps are integral with park and directional signal lamp. The marker lamp is of single filament type and has a single wire leading to it from the front end harness. The rear marker lamp, located in the quarter panel is also fed by a single wire contained in the rear harness.

INSTRUMENT CLUSTER AND INSTRUMENT FACE PAD

Removal of these units can be accomplished by using the following installation diagrams: Fig. 12-14, 12-23, 12-24.

PONTIAC

1. Disconnect battery (Fig. 12-14).

2. Remove the instrument panel pad.

NOTE: If car is equipped with front speaker, disconnect speaker wire.

3. Remove two bolts on each end of instrument panel trim plate.

4. On air conditioned cars it will be necessary to remove lower duct assembly.

5. Remove bolts connecting instrument panel trim plate and lower instrument panel.

6. If car is equipped with automatic transmission, remove column cover and remove transmission indicator.

7. On Grand Prix models it may be necessary to disconnect vacuum lines from headlight switch.

8. On models with upper level ventilation system, remove pipes connecting to nozzle.

9. If car is equipped with radio, remove bolt from radio to radio support brace.

10. If car is equipped with safeguard speedometer, buzzer must be detached.

11. Disconnect feeder of fiber optic system from cigar lighter.

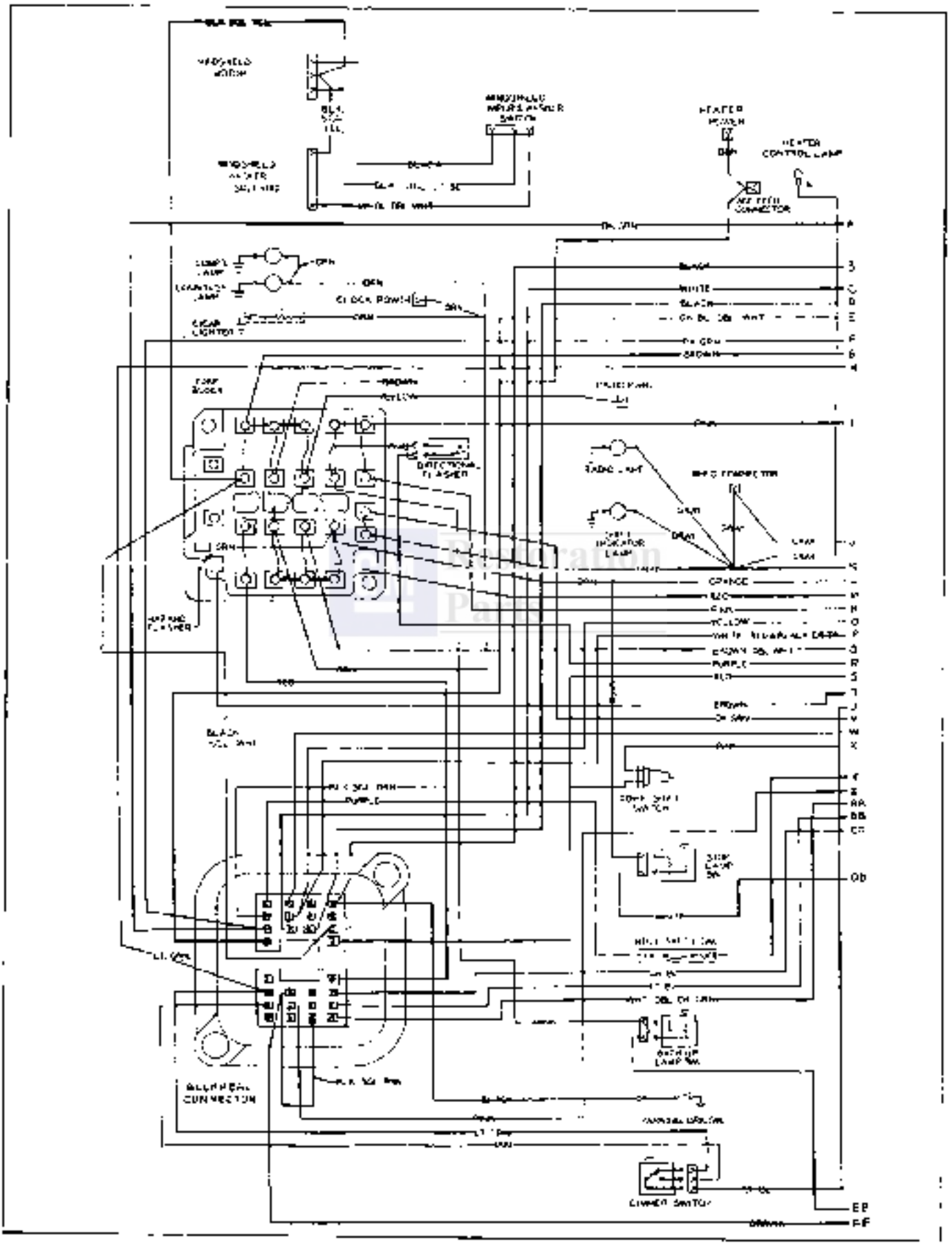


Fig. 12-2 Pontiac—Passenger Compartment Wiring

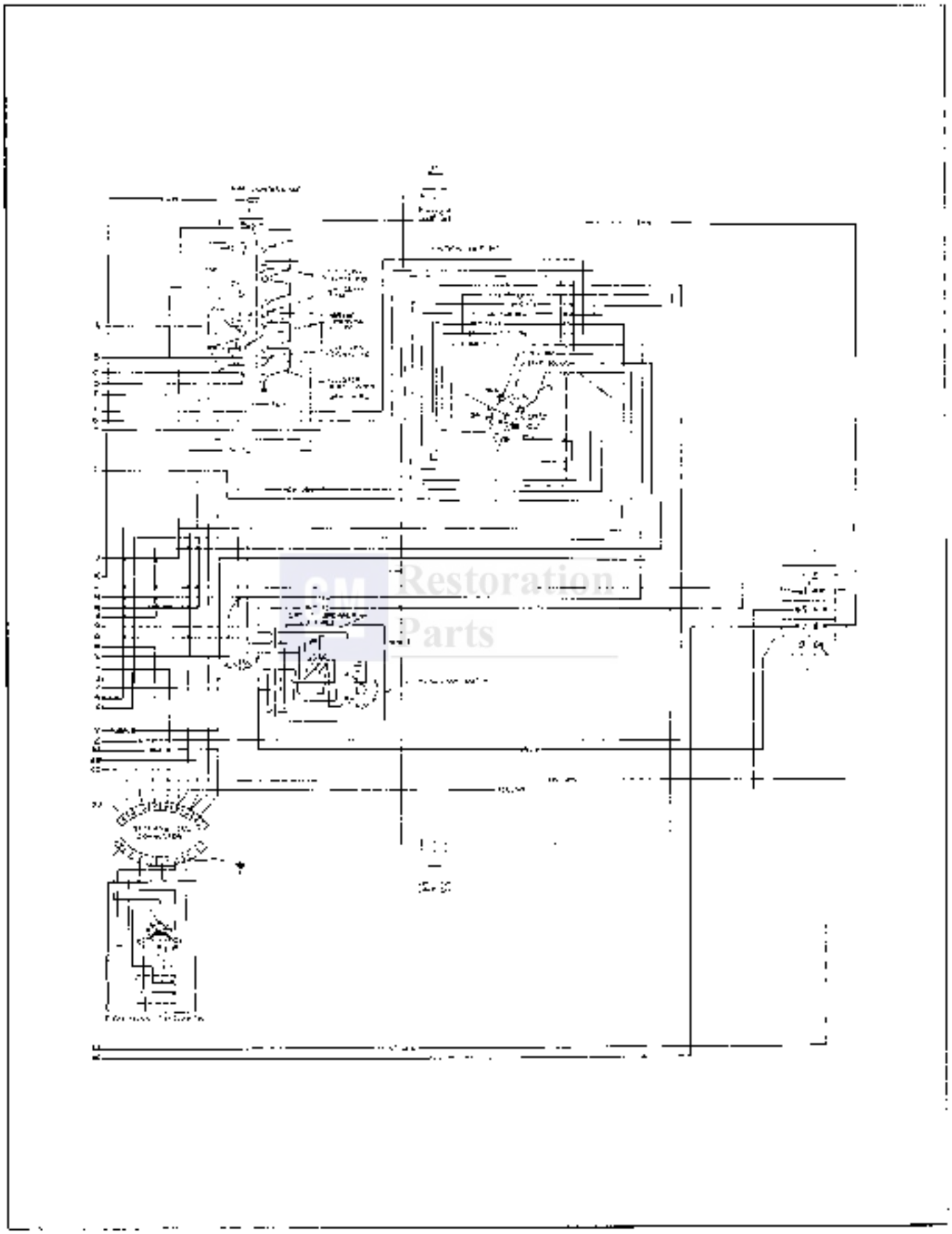


Fig. 12-2A Position—Passenger Compartment Wiring

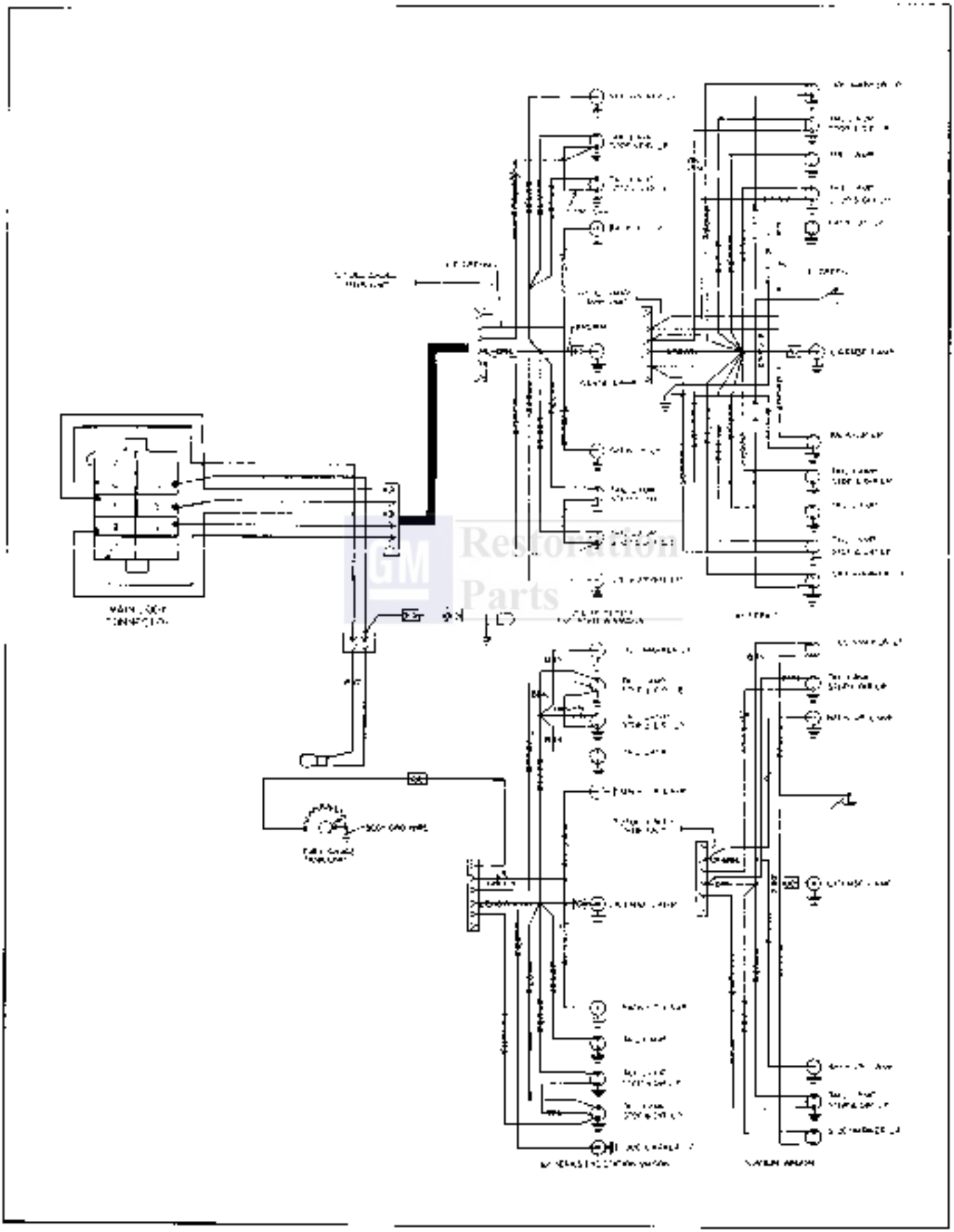


Fig. 12-3 Pontiac—Rear End Wiring

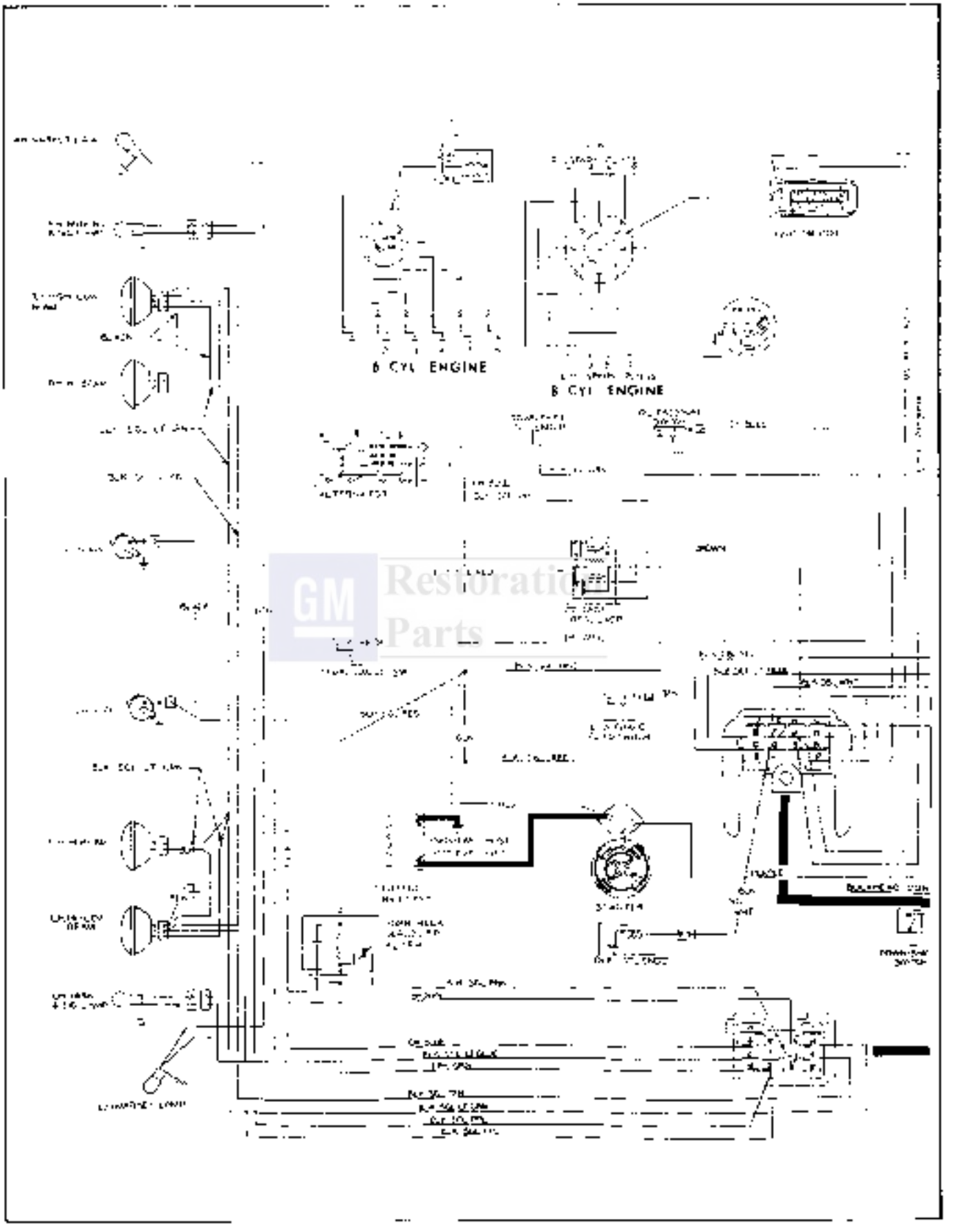


Fig. 12-4 Tempest—Engine Compartment Wiring

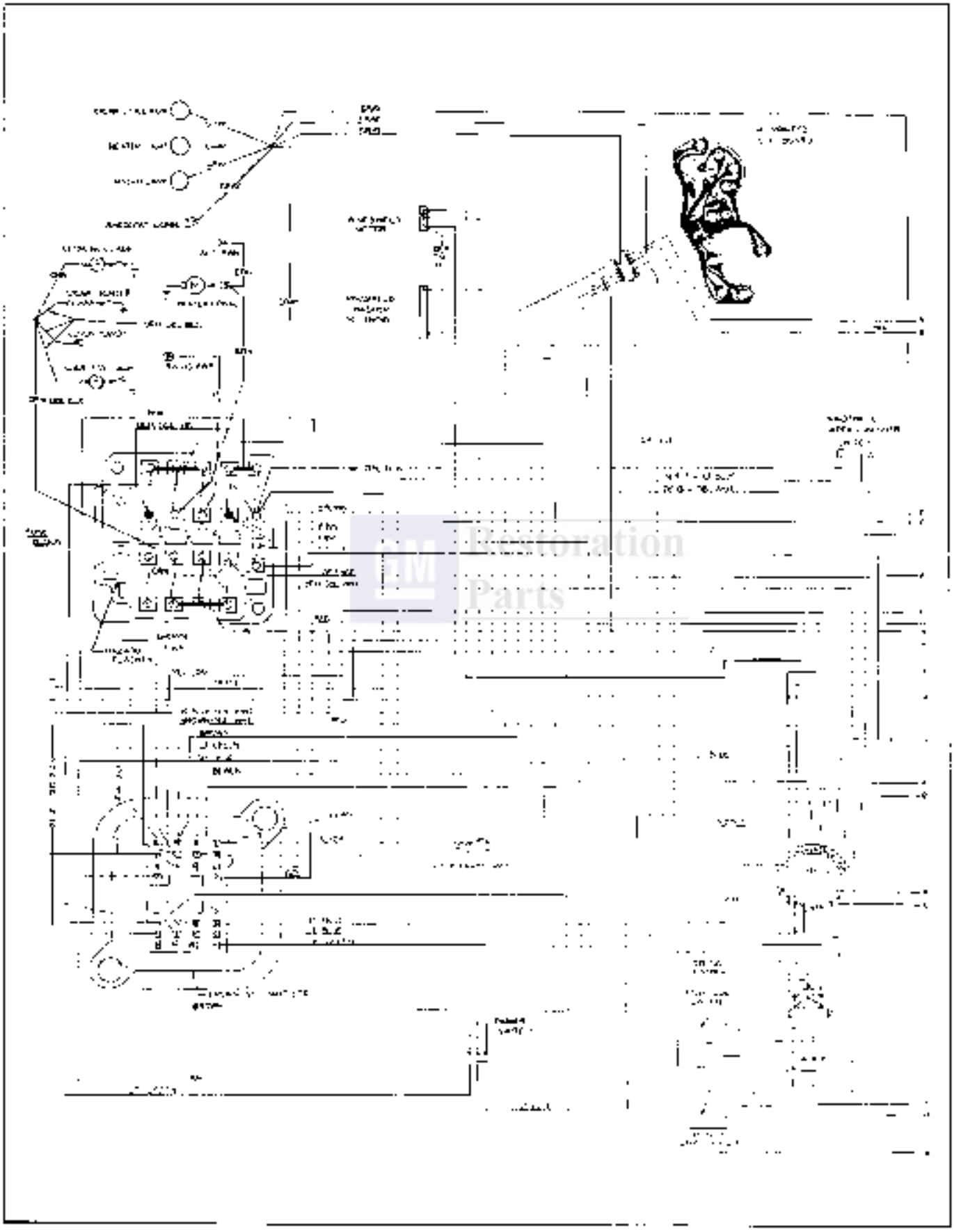


Fig. 12-3 Tempest—Passenger Compartment Wiring

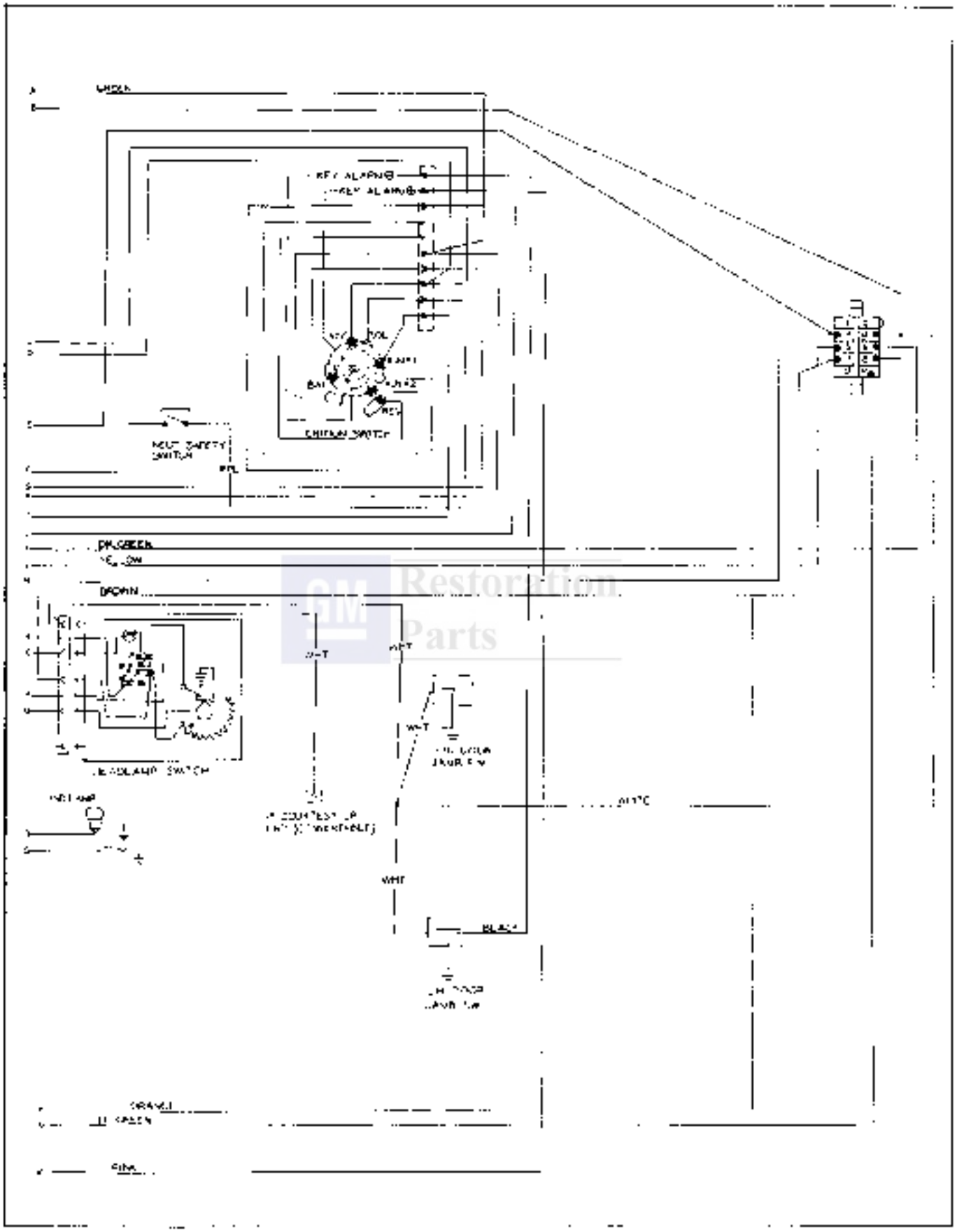


Fig. 12-5A Tempest-Passenger Compartment Wiring

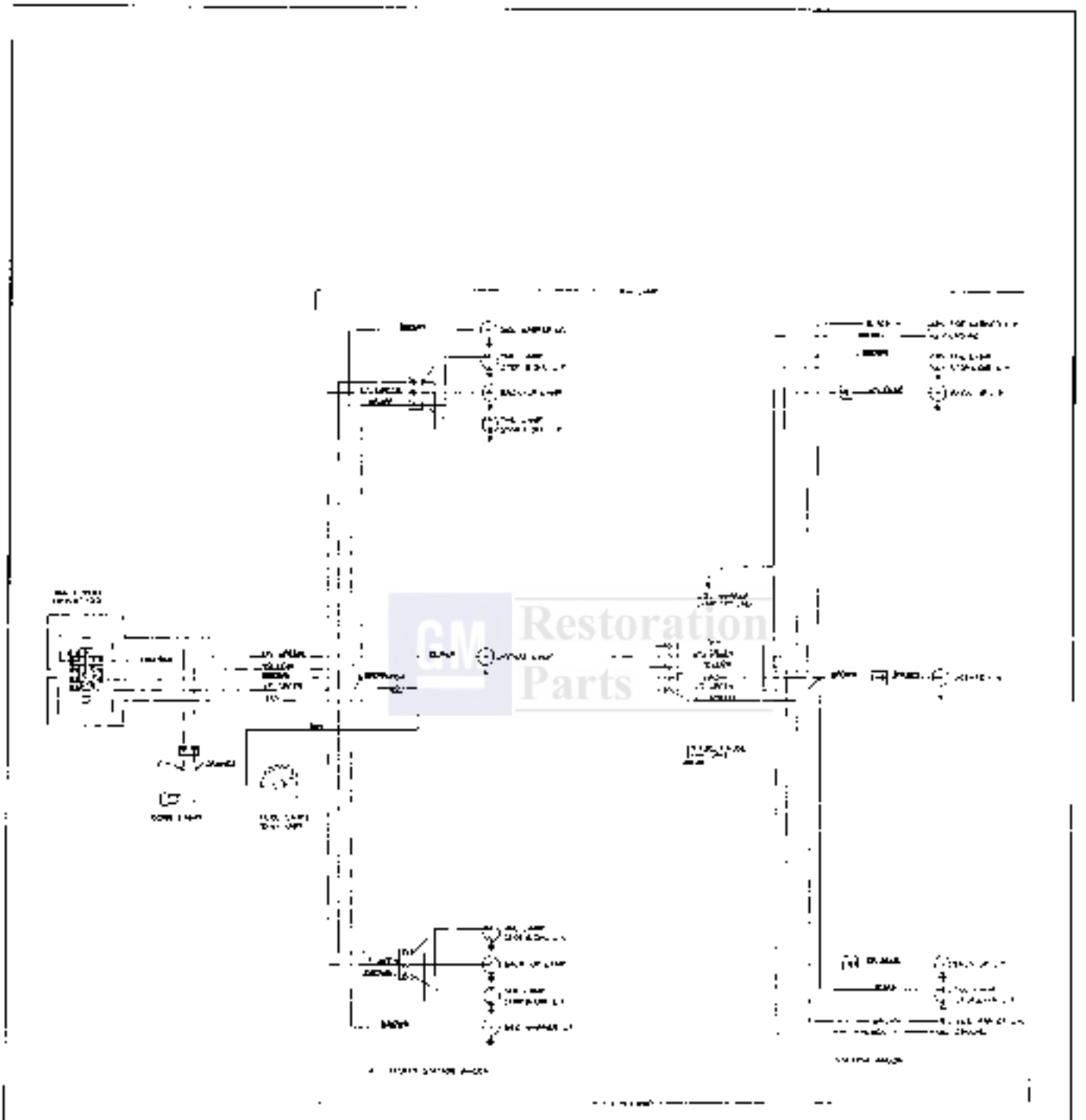


Fig. 12-6 Tempest-Rear End Wiring

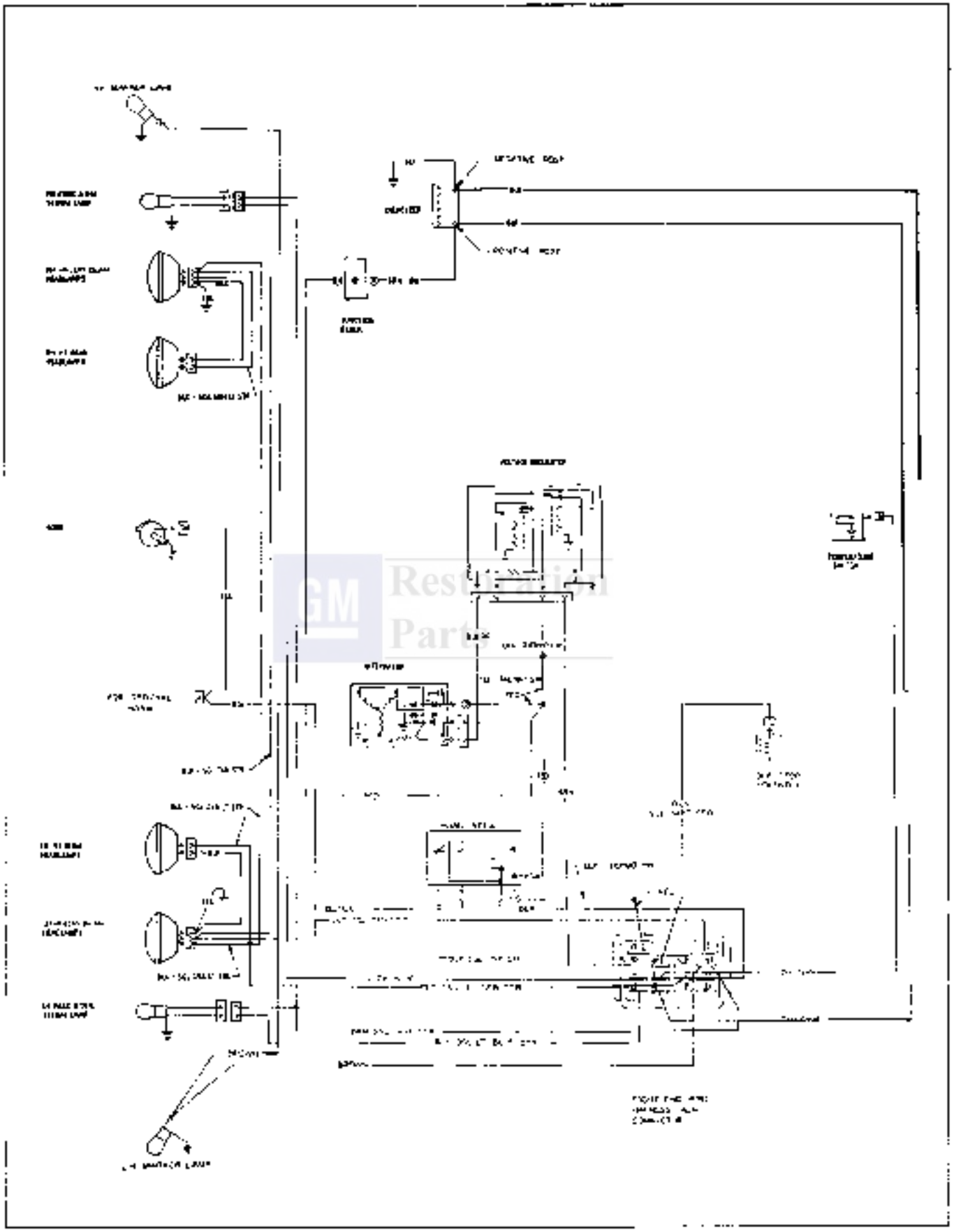


Fig. 12-7 Firebird-Engine Compartment Wiring

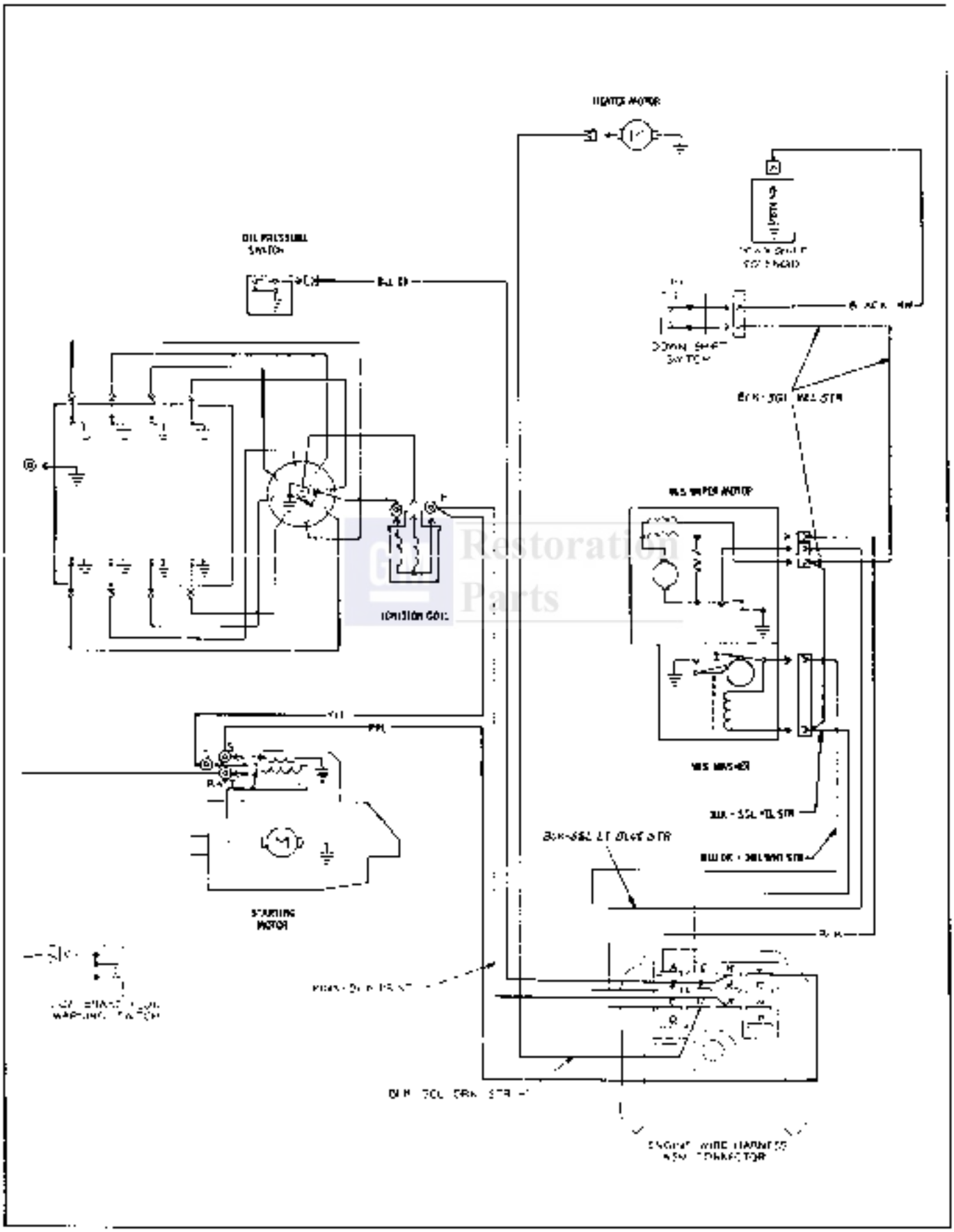


Fig. 12-2A Firebird Engine Compartment Wiring

12. If car is equipped with multiplex disconnect multiplex unit.

13. Disconnect speedometer.

14. Pull instrument panel plate forward.

CAUTION: Make sure all wires and routing clips are loose enough to allow panel to come forward

15. Disconnect wires attaching to instrument cluster.

16. Remove four nuts that retain instrument cluster to instrument panel trim plate.

17. Remove cluster.

18. Replace by reversing above procedure.

TEMPEST

1. Disconnect battery (Fig. 12-23).

2. Remove instrument panel fore pad.

3. Disconnect speedometer cable, main wire and switch connectors

4. Remove instrument panel trim panel retaining screws and disconnect heater control.

5. Remove mast jacket upper retaining screws, lower column and remove trim panel.

6. Remove cluster retaining screws, then cluster.

7. To replace, reverse removal procedure.

FIREBIRD

1. Disconnect battery ground cable (Fig. 12-24).

2. Remove mast jacket lower support screws at toe pan.

3. Remove mast jacket upper support bolts and allow steering wheel to rest on seat cushion.

CAUTION: Both supports must be detached to prevent distortion of mast jacket.

4. Remove attaching screws from face of panel and partially remove cluster from console opening.

5. Reach behind cluster and disconnect speedometer cable, speed warning device (if so equipped – Fig. 12-28) and chassis harness connector at rear of panel.

6. Remove cluster from console opening.

7. To install, reverse removal procedure.

SPEEDOMETER CABLE

1. Disconnect speedometer cable casing from speedometer head.

2. Slide old cable out from upper end of casing, or if broken from both ends of casing.

3. Take short piece of speedometer cable with a tip to fit speedometer and insert it in speedometer socket. Spin short cable between fingers in direction that higher speed is indicated on speedometer dial and note if there is any tendency to bind. If binding is noted, there is trouble inside head and speedometer should be repaired.

4. Inspect cable casing, especially at transmission end, for sharp bends and breaks. If breaks are noted, replace casing.

5. To insure quiet cable operation, apply suitable speedometer cable lubricant on lower two-thirds of cable and assemble to casing in following manner:

a. Wipe cable clean, using lint free cloth. Flush bore of casing with clean spirits or suitable solvent solution and blow dry with air under pressure.

b. Place some suitable speedometer cable lubricant in palm of hand.

c. Feed cable through lubricant in hand and into casing until lubricant has been applied to lower two-thirds of cable. Do not over-lubricate and do not apply lubricant to upper third of cable, since operation of cable assures adequate lubrication of upper third and at same time prevents lubricant from seeping into speedometer head.

6. Seat upper cable tip in speedometer and tighten casing connector to speedometer case as tightly as possible with fingers.

NOTE: Insufficient tightening of connector will result in connector loosening, causing speedometer indicator to waver.

PRINTED CIRCUIT—TEMPEST OR FIREBIRD

1. Remove instrument cluster.

2. Remove all cluster illuminating and indicator lamps from housing (Fig. 12-23 and 24).

3. Remove fuel gauge terminal nuts securing printed circuit to housing.

4. Remove hex head screws retaining printed circuit to the cluster housing and remove circuit from housing.

5. To install, reverse removal procedure.

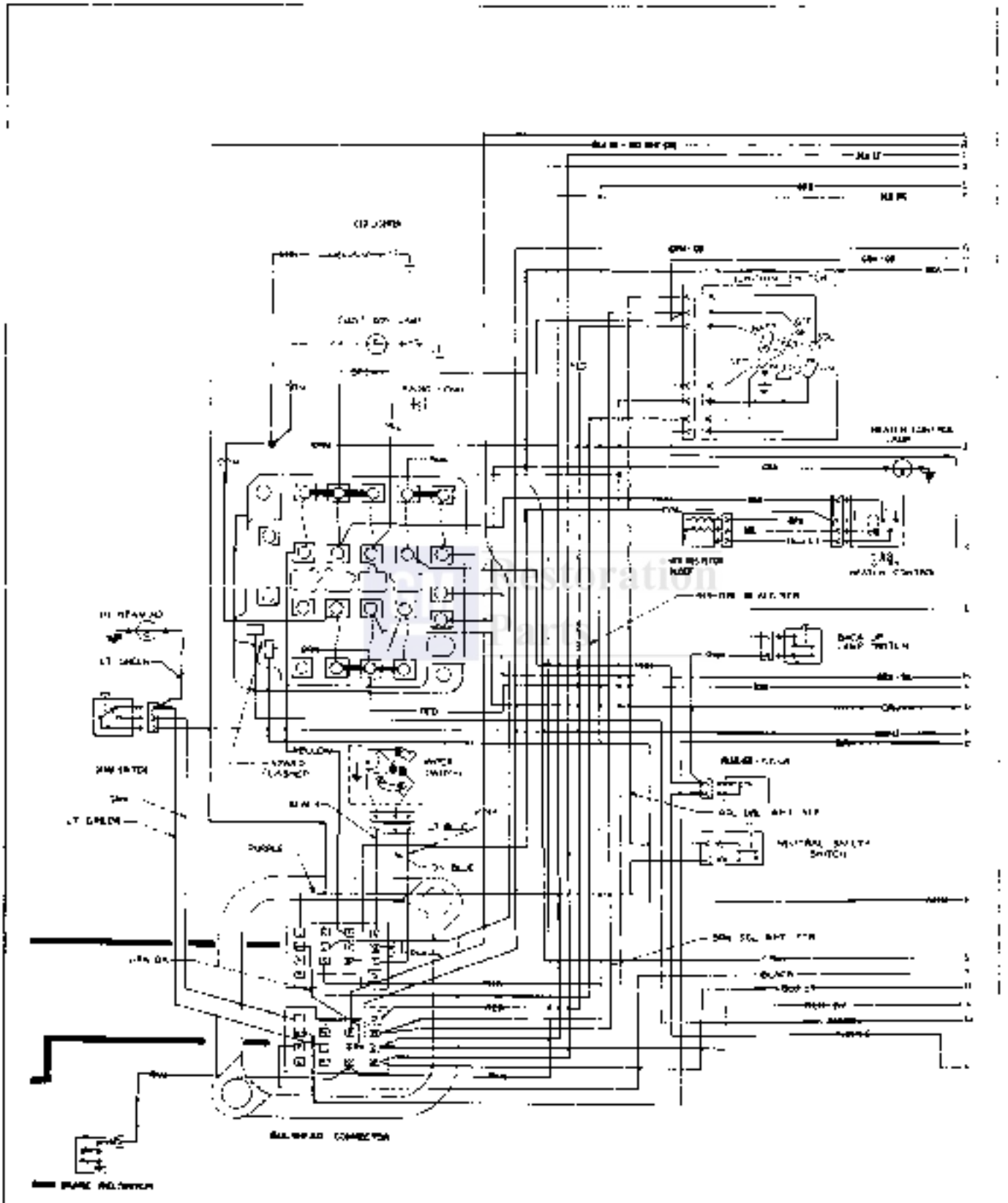


Fig. 12-8 Firebird—Passenger Compartment Wiring

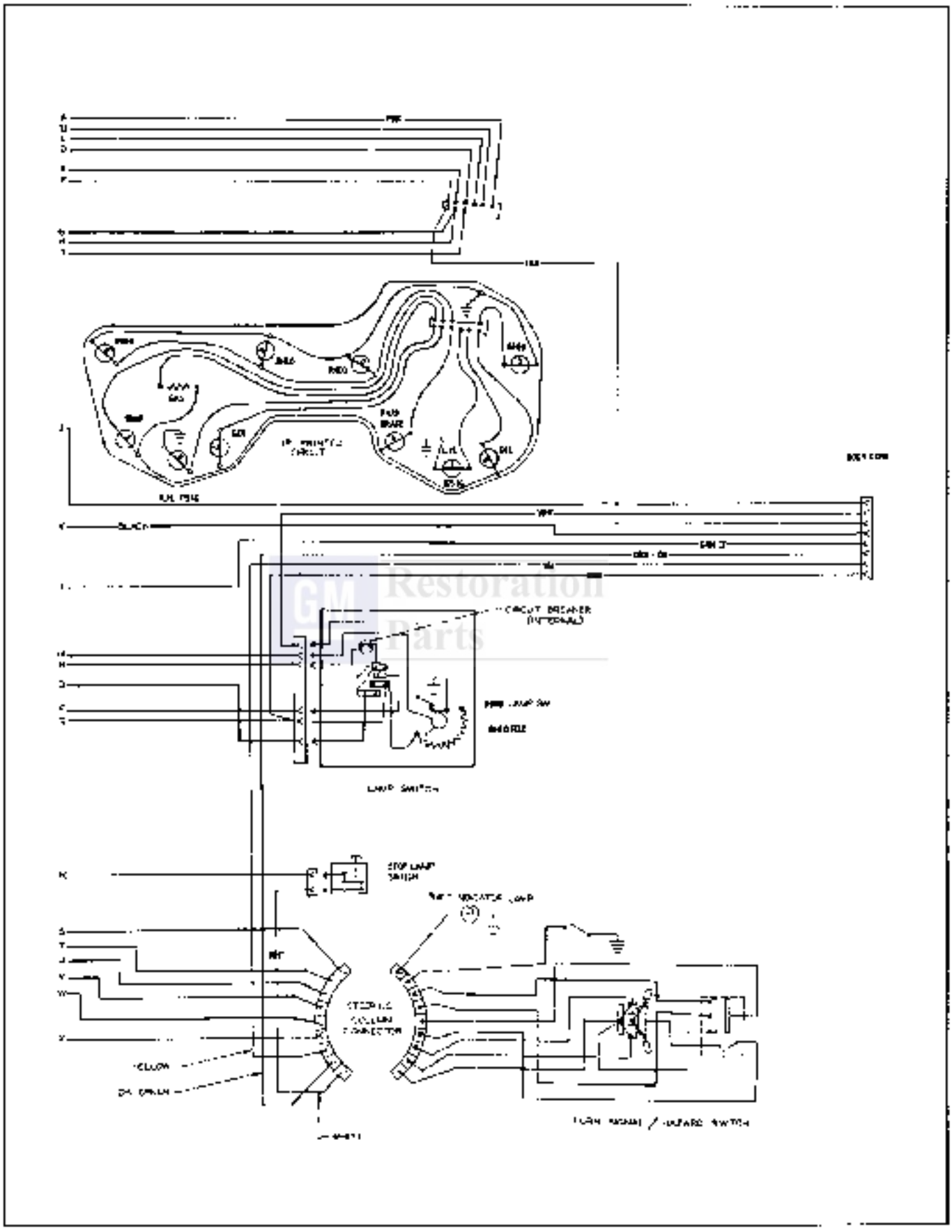


Fig. 12-6A Firebird—Passenger Compartment Wiring

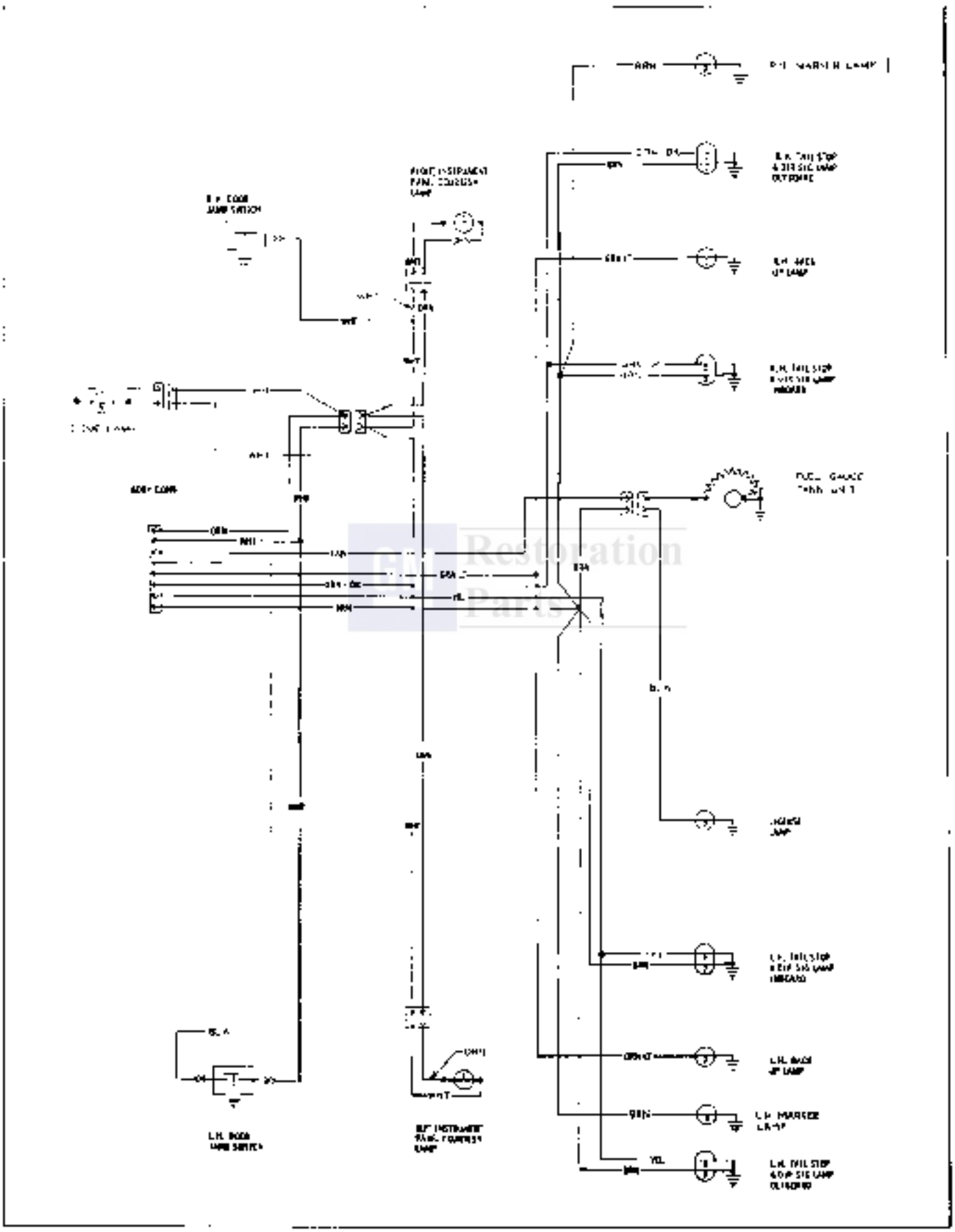


Fig. 12-9 Firebird—Rear End Wiring

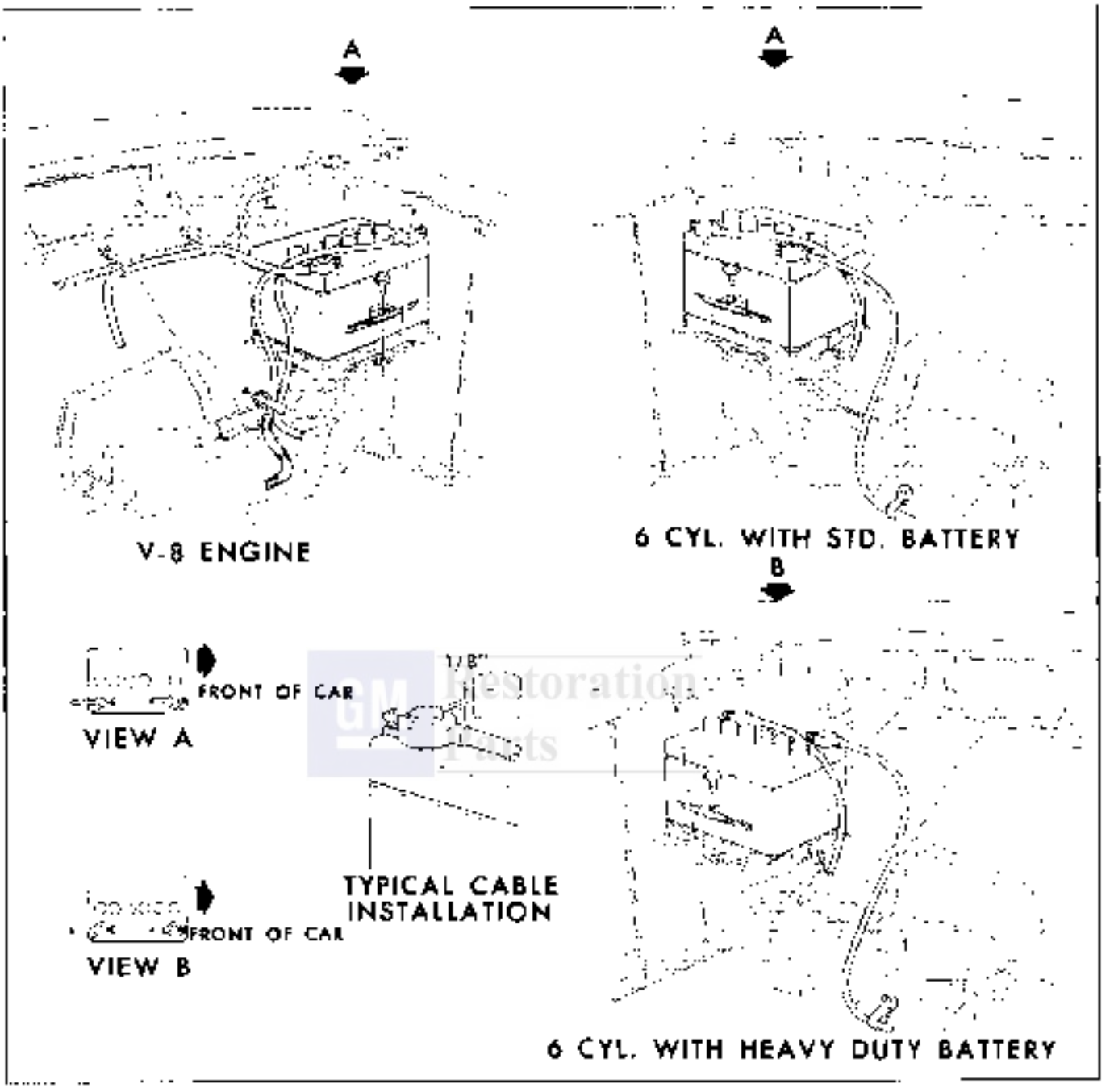


Fig. 12-12 Tempest—Battery Cable Routing

CAUTION: The retaining screws are part of the grounding circuit and must be installed to provide proper connections for the printed circuit.

FUEL GAUGE—PONTIAC

1. Remove two screws that retain gauge to cluster.

2. Remove screws that retain circuit board to cluster.

3. Remove gauge.

4. To replace, reverse above procedure.

FUEL GAUGE—TEMPEST OR FIREBIRD

1. Remove instrument cluster.

2. Remove cluster lamps from gauge cover plate, ground screw and terminal nuts attaching printed circuit to fuel gauge.

3. Remove three screws retaining gauge to cluster housing.

4. Carefully move printed circuit away from gauge and remove gauge from cluster housing.

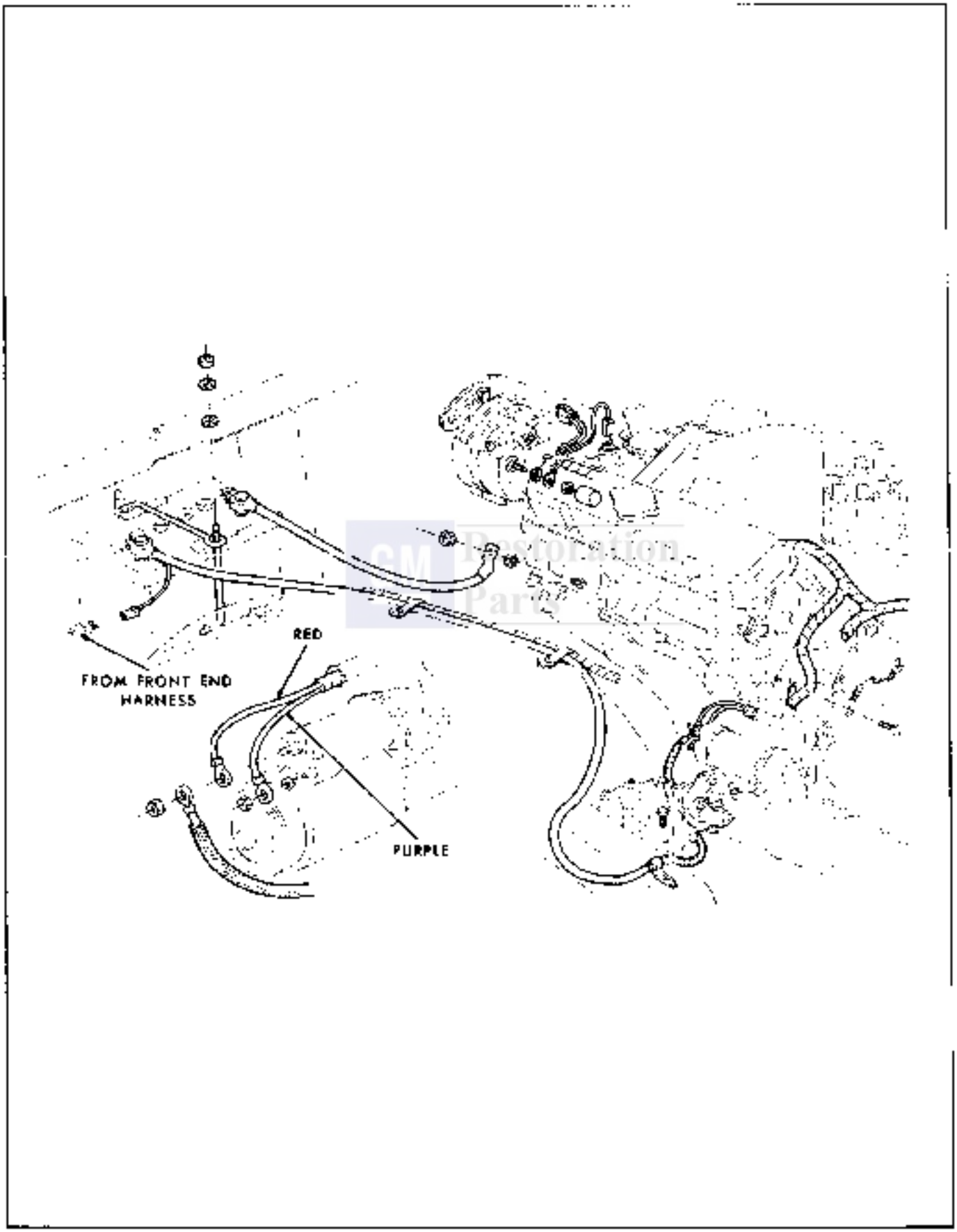


Fig. 12-11 Pontiac—Battery Cable Routing

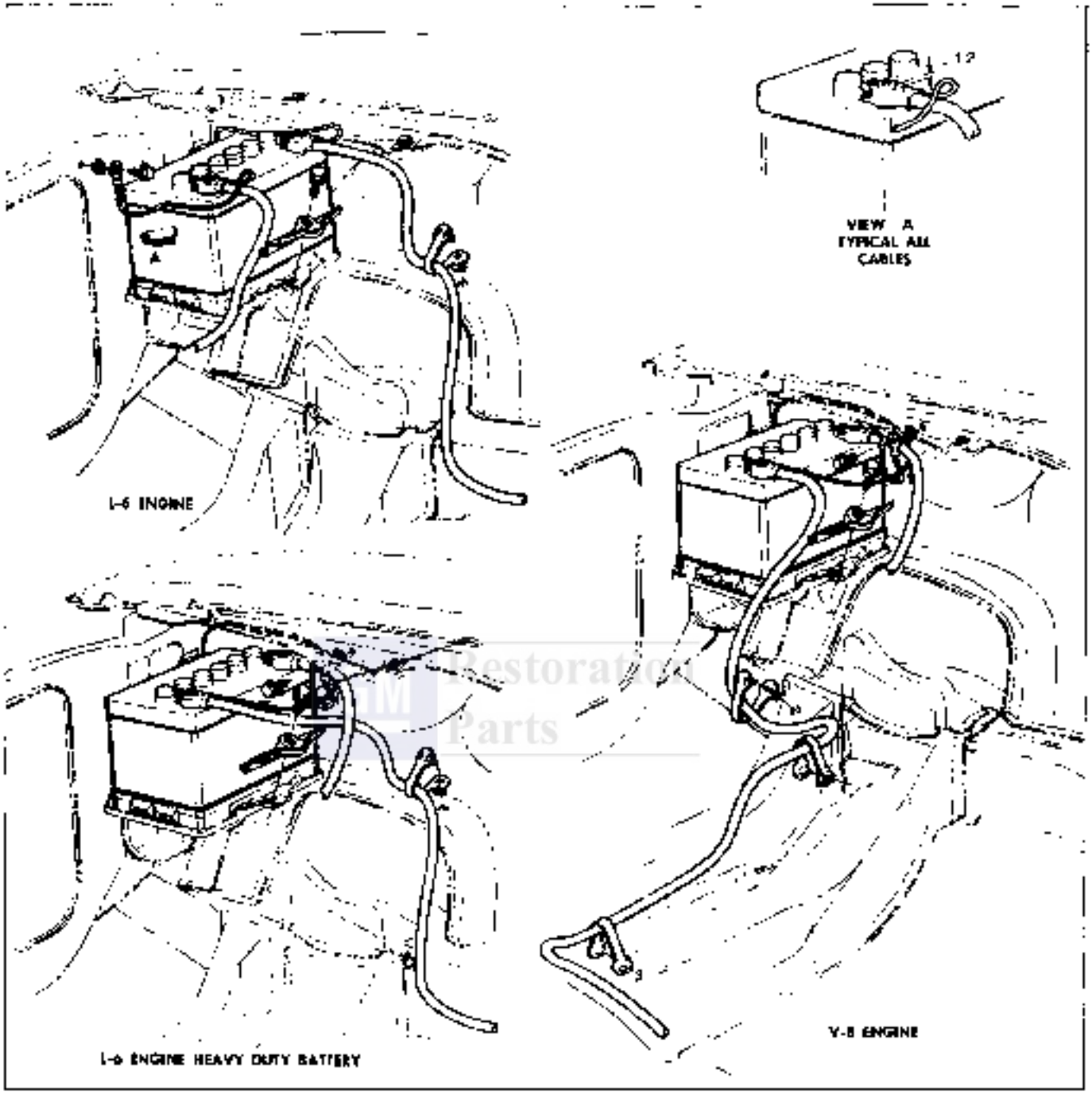


Fig. 12-12 Firebird—Battery Cable Routing

5. Remove terminal nuts securing gauge to cover plate and detach gauge unit.

6. To install, reverse removal procedure.

WINDSHIELD WIPER SWITCH

1. Remove knob.

2. Remove retaining nut securing shaft and bezel.

3. Remove switch and disconnect terminals.

4. To install, reverse above procedure.

HEADLIGHT SWITCH

1. Depress button on switch and remove knob and shaft (Fig. 12-26).

2. Remove retaining nut.

3. Remove wire connector from switch and remove switch.

4. On vacuum operated headlight models, remove vacuum connector.

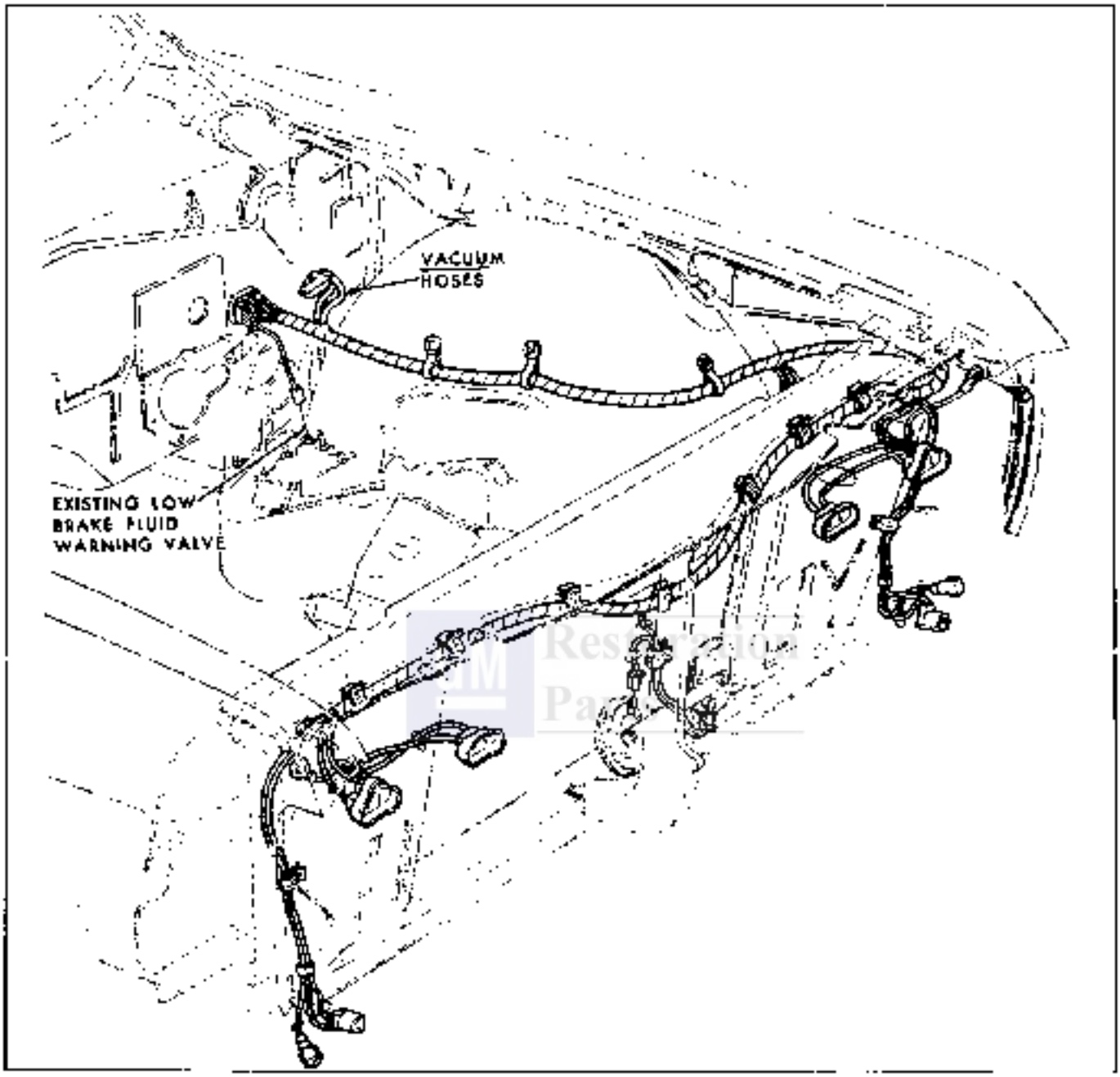


Fig. 12-13 Front End Harness Installation—Pontiac

5. To replace, reverse removal procedure.

CIGAR LIGHTER

1. Remove lighter.
2. Remove bezel retainer.

NOTE: Use care not to destroy fibre optic light

3. Remove wire connector.
4. To replace, reverse removal procedure.

IGNITION SWITCH

1. Remove ignition lock.
2. Remove bezel retaining switch to dash.

NOTE: Use care not to destroy Fibre optic light.

3. Remove wire connector from ignition switch.
4. Remove switch.
5. To replace, reverse removal procedure.

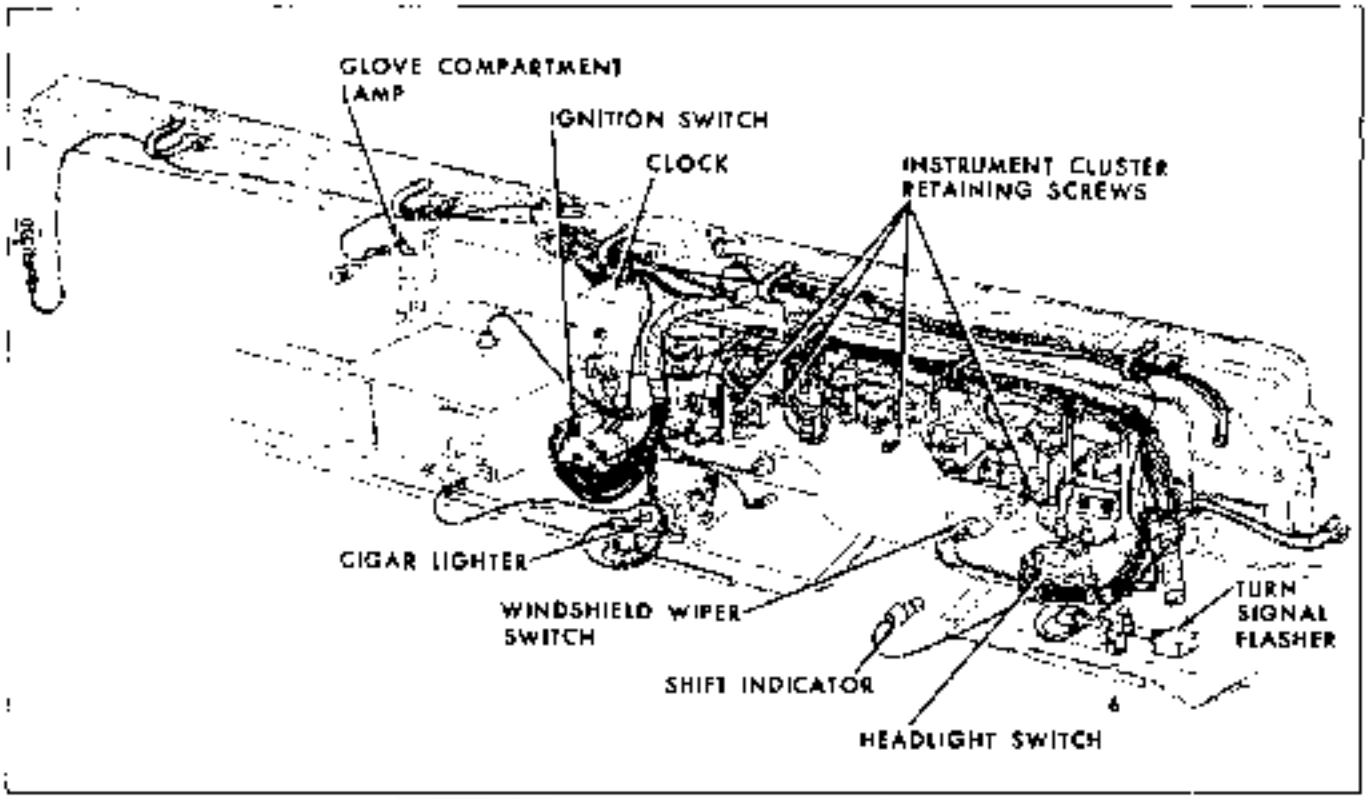


Fig. 12-14 Instrument Panel Wiring

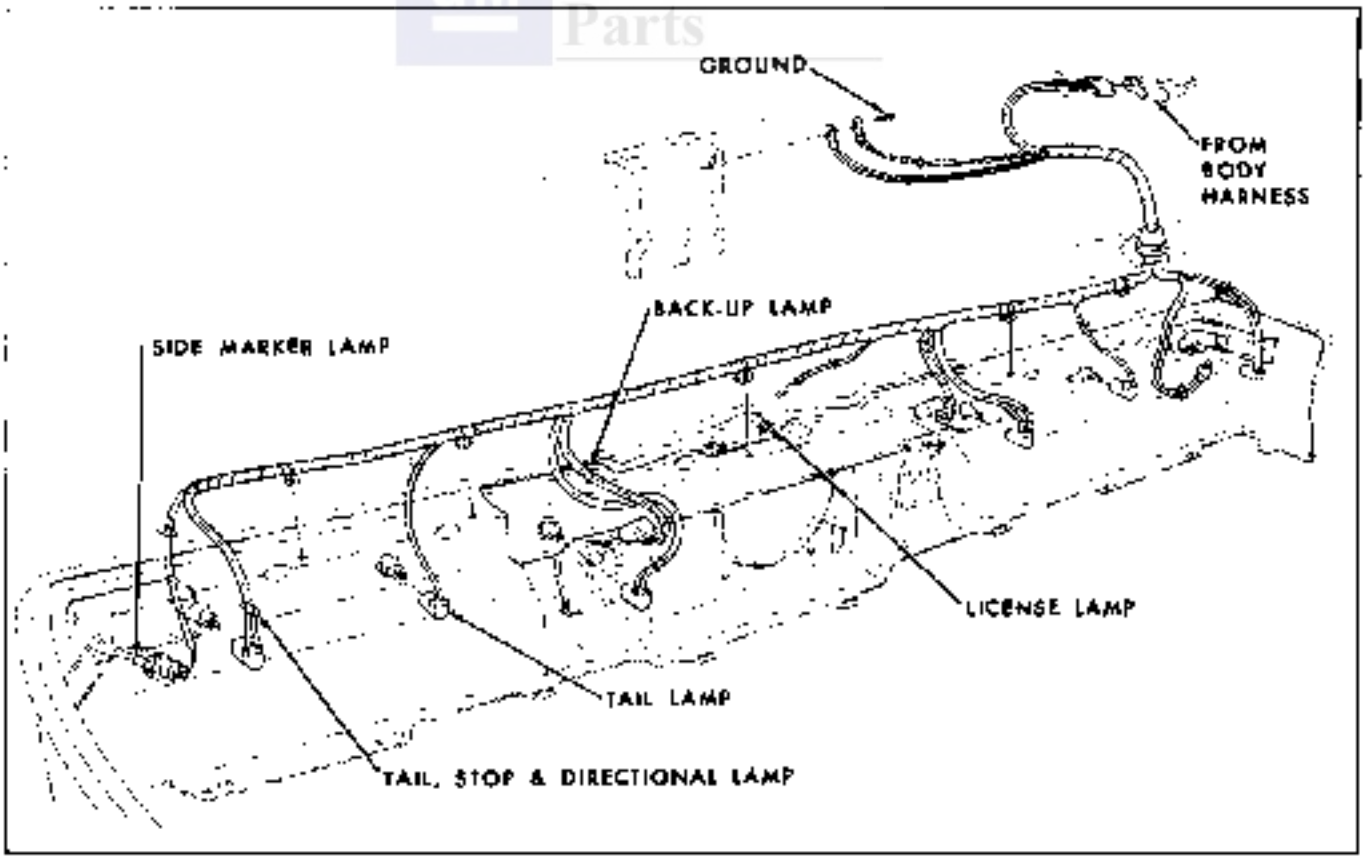


Fig. 12-15 Rear Lamp Harness—Grand Prix

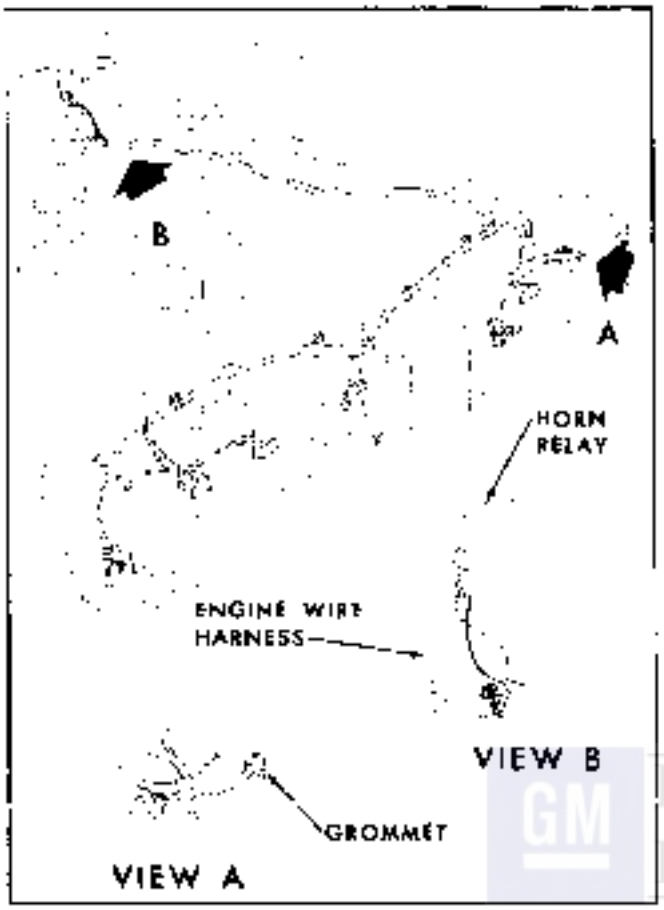


Fig. 12-16 Floor End Harness Installation—Tempest

DIMMER SWITCH

1. Fold back carpet in area of switch.

2. Remove wire connector.

3. Remove screws retaining switch to bar pan.

BACK UP LAMP SWITCH

For removal procedures of back up lamp switch (Fig. 12-27). To adjust back up lamp switch use the following procedure and Fig. 12-27. For automatic transmission see neutralizer switch adjustment.

ALL MANUAL TRANSMISSION WITH COLUMN SHIFT

1. Insert .090 gauge pin thru hole in switch body, and into hole in Drive Tang.

2. Set transmission gearshift lever in reverse position.

3. Insert switch drive tang in shifter tube slot with tang touching R.H. edge of slot and assemble switch.

4. Remove gauge pin.

ALL MANUAL TRANSMISSION WITH FLOOR SHIFT

1. Place lever in reverse position.

2. Position switch so that plunger is fully depressed against lever.

WINDSHIELD WIPER

SERVICE OPERATIONS

ARM BLADE ASSEMBLY REPLACEMENT

With wiper switch off and motor in parked position, place drag link of arm and blade assembly on pin. Slide retainer onto pin before placing head of arm on transmission shaft.

CAUTION: Always install right-hand blade and arm assembly parallel and touching windshield moulding. Left hand must be above right-hand assembly and touching upper side.

BLADE REPLACEMENT

To remove blade from arm insert small screw driver in opening at center of blade with handle of screw driver pointed toward outer end of blade. Raise handle only enough to force spring in blade down to allow blade to slip off on the pin.

WIPER TRANSMISSION AND LINKAGE REPLACEMENT (Figs. 12-29, 30 and 31)

REMOVAL OF COMPONENTS

1. Remove arm and blade assemblies.

2. Remove fresh air intake grille or screen.

3. Remove wiper transmission retaining screws.

4. Pontiac models - Remove center support retaining screws.

5. Pontiac and Tempest Optional System models - Remove retainer securing linkage which attaches to wiper motor crank.

NOTE: On Pontiac Model this can be done by removing plastic plug from left side of upper shroud, directly above wiper motor.

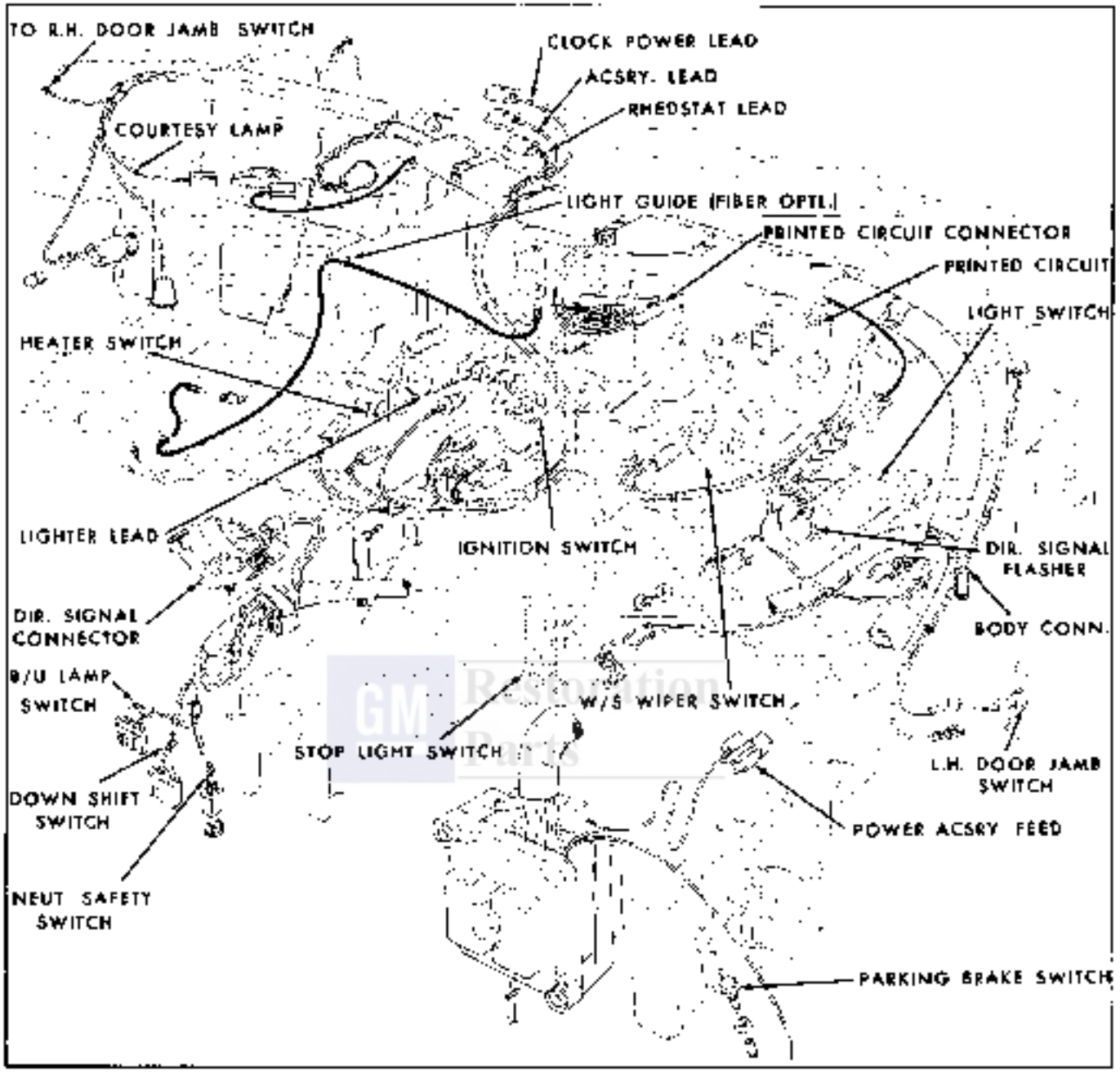


Fig. 12-17 Instrument Panel Wiring—Tempest

6. Tempest models - Remove retainer securing right wiper transmission to linkage which attaches to wiper motor crank.

7. Remove wiper transmission and linkage.

NOTE: Windshield wiper linkage components are to be serviced. Check master parts catalog for correct service packages. Service packages will include installation instructions

8. To install, reverse above procedure. Make sure wiper blades are in park position after they are installed.

ARM AND BLADE ADJUSTMENT

Pontiac Models (Fig. 12-29)

1. With motor in park position, and wiper switch off, place drag link of left arm and blade assembly on pin. With arm and in position as shown in view C, push head of arm on transmission shaft.

2. Place drag link of right arm and blade assembly on pin. Lock retainer on pin with blade pivot head in position shown in view B and push head of arm on transmission shaft.

3. Locate blade ends on stop in position shown in

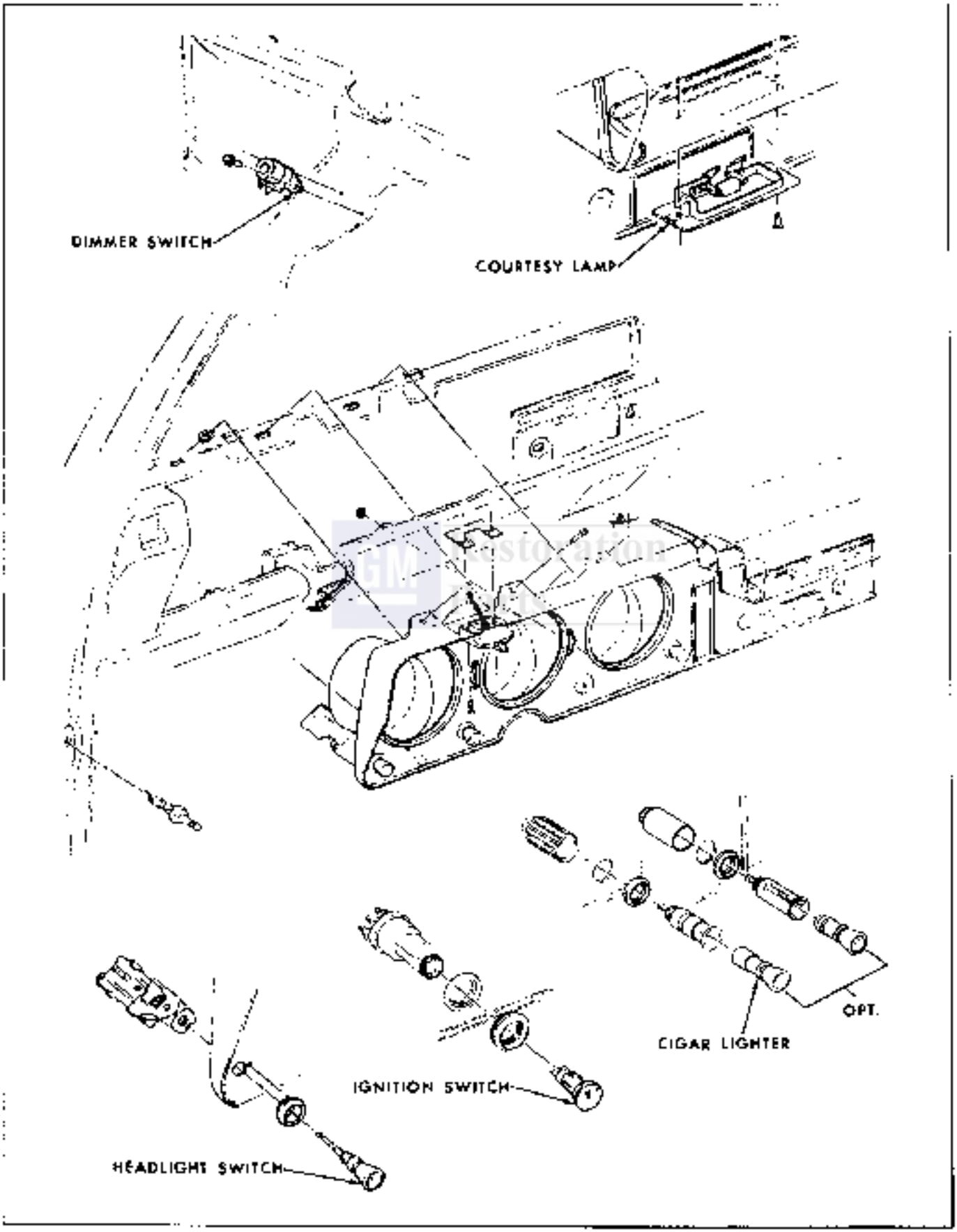


Fig. 12-16 Instrument Panel Switches—Tempest

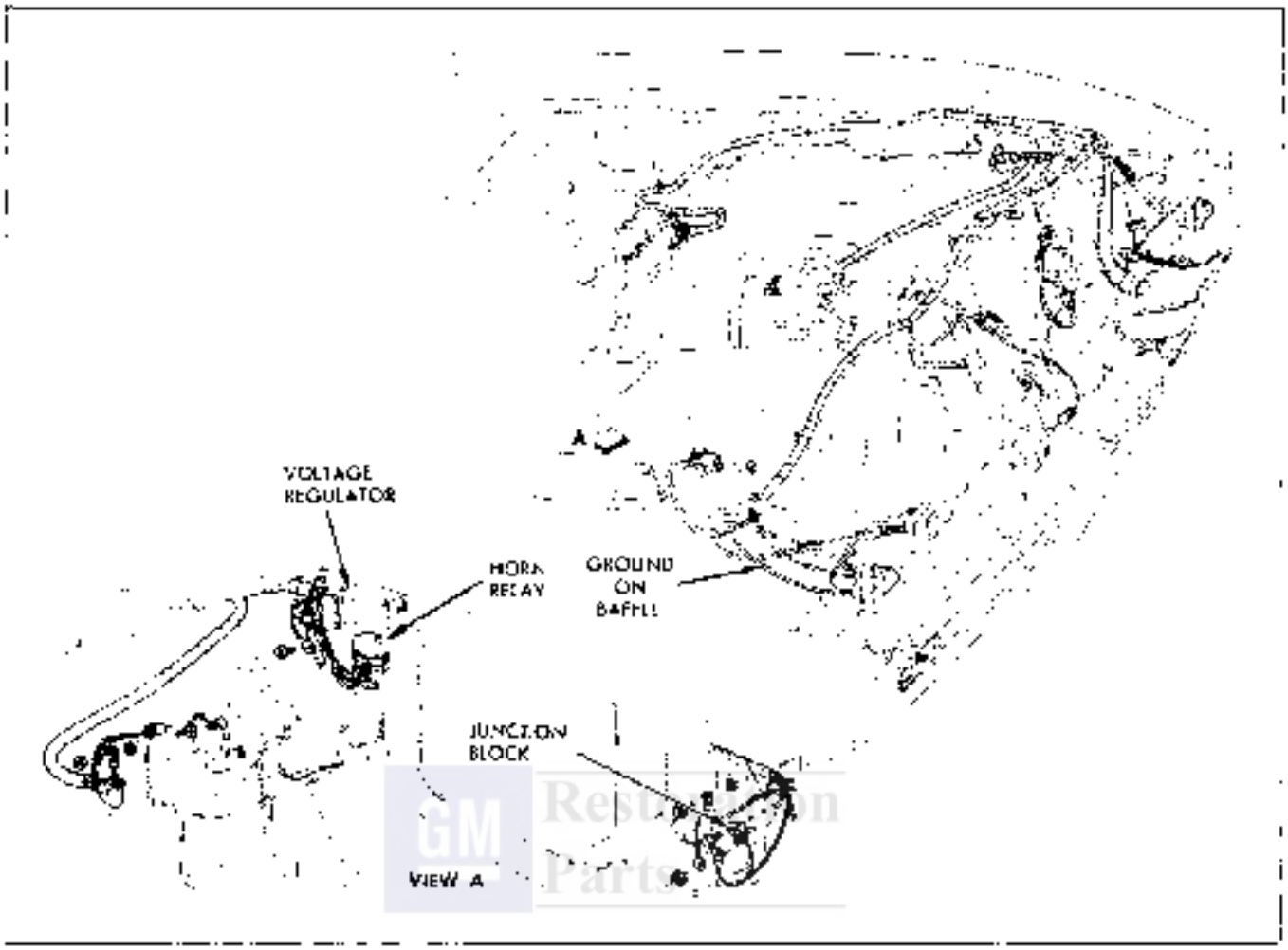


Fig. 12-17 Generator and Fireware Loop Harness Installation-Firebird

view E. This positions the ends to the rear of the stop on the lower edge of the moulding. The left blade must be on top of the right blade.

NOTE: When checking for correct wiper position, always make tests with a wet windshield.

Tempest Optional System Models

NOTE: Motor must be in park position.

1. Remove screen from cowl.

2. Remove right arm and blade assembly.

3. Loosen adjustable retainer at motor crank arm.

4. Position left blade and arm assembly against stop on moulding.

5. Tighten adjustable retainer.

6. Install right arm and blade assembly against stop on moulding.

7. Install screen.

Tempest Standard System and Firebird

1. Allow motor to stop in park position.

2. Install both right and left arm and blade assemblies so that end of blade is 1" above bottom of windshield.

NOTE: With standard Tempest system do not attempt to place arm and blade assemblies against stops on moulding.

REMOVE WIPER MOTOR

1. Remove hoses and wire terminals connected to wiper unit.

2. Pontiac models - Remove retainer securing wiper crank to wiper transmission linkage.

NOTE: This can be done by removing plastic plug from left side of upper shroud, directly above wiper motor.

3. Tempest Optional System Models - Remove

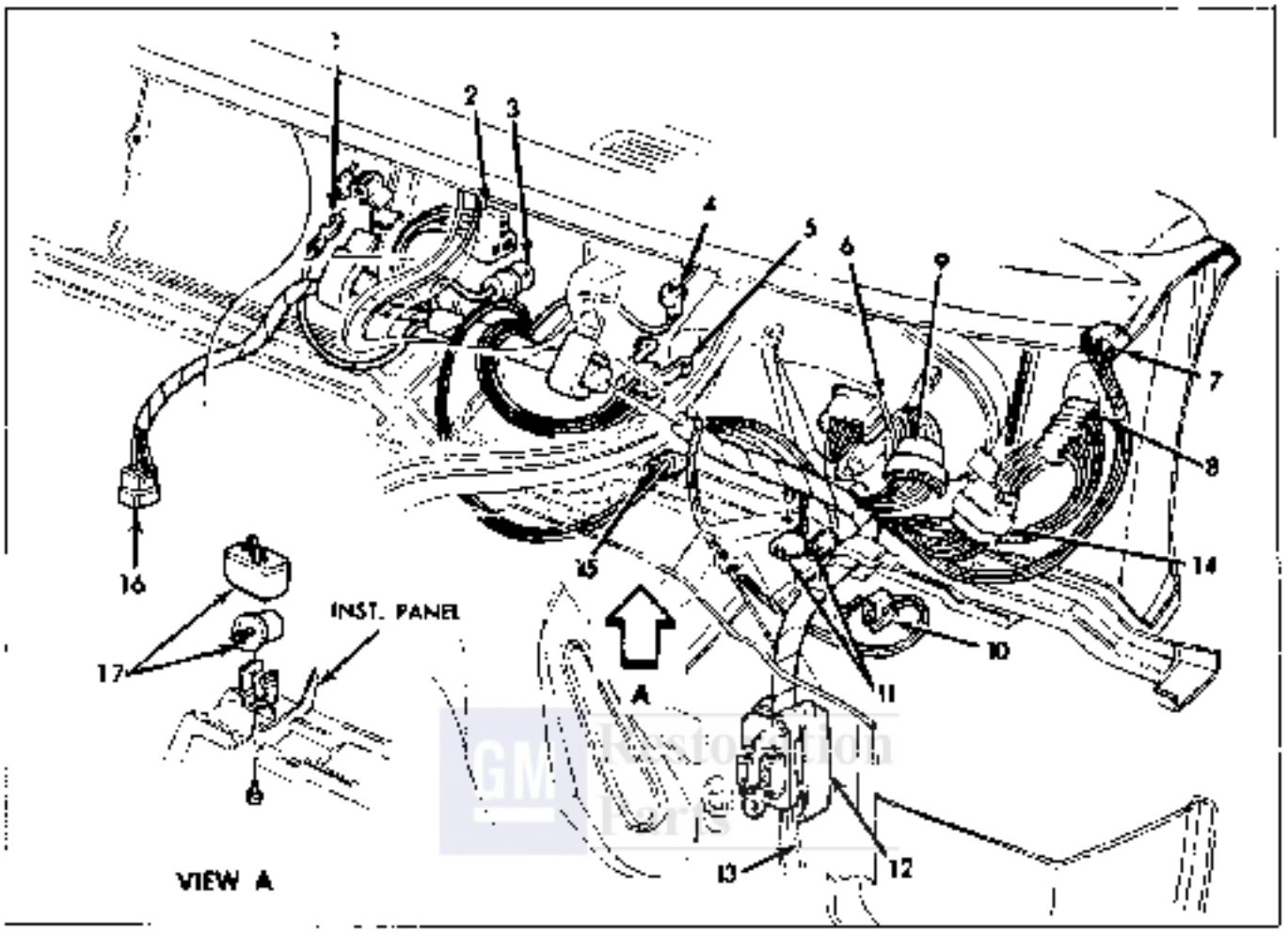


Fig. 12-20 Instrument Panel Harness—Firebird

1. To Glove Box Light
2. To Heater Control
3. Heater Control Lamp
4. To Cigarette Lighter
5. To Ignition Switch
6. To Instrument Cluster
7. To Wiper Switch
8. To Light Switch
9. To Directional Signal Switch
10. To Stop Lamp Switch
11. To Backing Lamp Switch
12. Fuse Panel
13. To Dimmer Switch
14. To Fisher Body Connector
15. To Directional Signal Flasher
16. To Heater Resistor
17. Directional Signal Flasher

screen and remove retainer securing wiper crank to wiper transmission linkage.

4. Remove screws securing wiper assembly to fire wall.

5. Tempest and Firebird models - Carefully pull wiper assembly away from firewall until retainer securing wiper crank to wiper transmission arm can be removed.

6. Tempest models - Remove arm.

7. Remove wiper motor from firewall.

INSTALL WIPER MOTOR

1. Make sure gasket is on motor.

2. Tempest models - Connect wiper crank to wiper transmission arm.

3. Install wiper assembly on fire wall and secure.

4. Connect wire terminals and hoses.

5. Pontiac and Tempest Optional System models - Connect crank to wiper transmission arm.

6. Tempest Optional System models - Adjust arms as outlined under Arm and Blade Assembly - Adjust and replace screen.

WIPER SWITCH—REPLACE

1. Loosen Allen screw and remove knob.

2. Remove retaining nut securing shaft and bezel.

3. Remove switch and disconnect terminals.

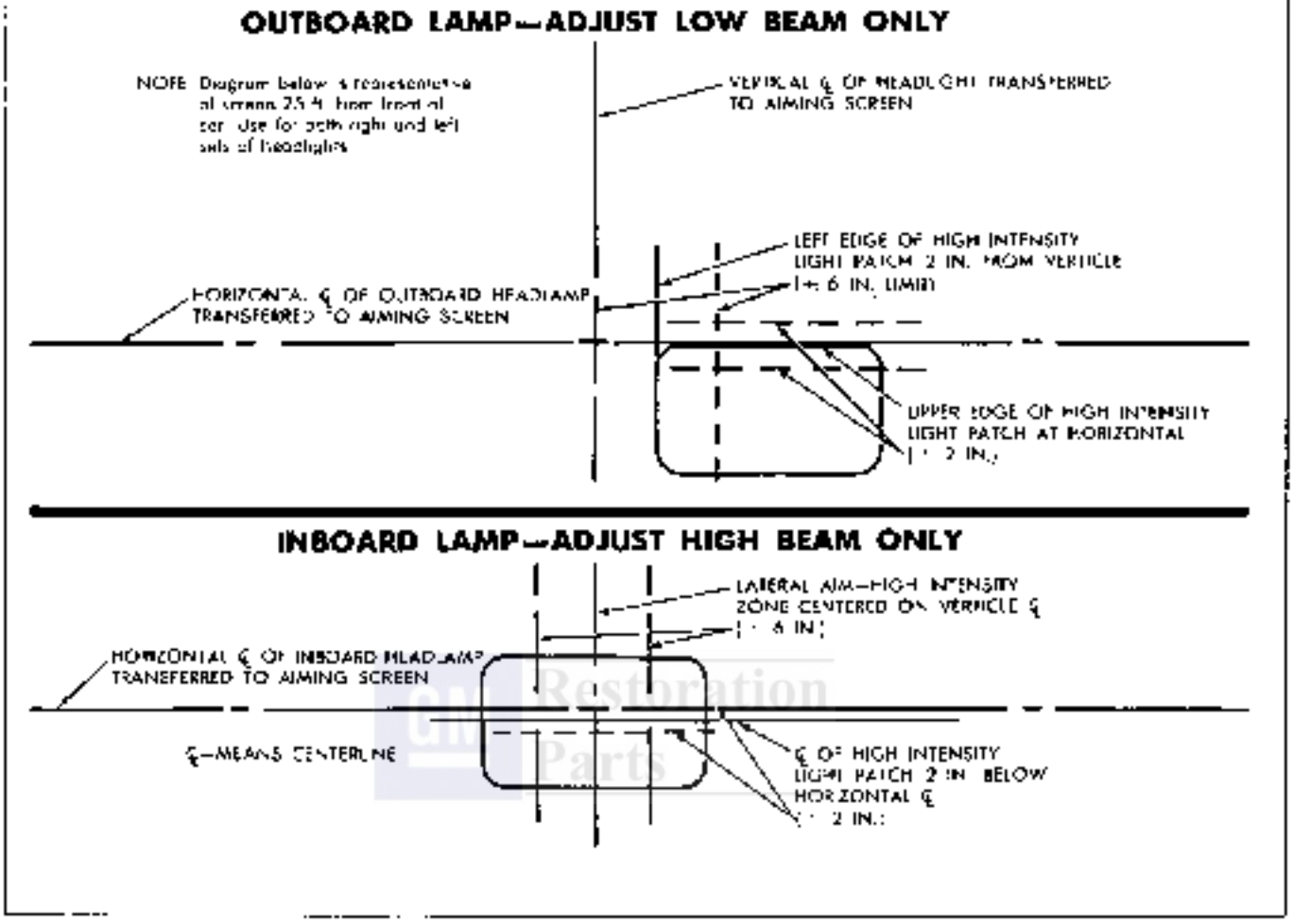


Fig. 12-29 Headlight Aiming Chart

4. Models equipped with vacuum headlight doors - Disconnect vacuum lines.

5. To install, reverse above procedure.

DISASSEMBLY AND ASSEMBLY PROCEDURES

The disassembly-assembly procedures for the wiper are broken down into two major areas: The motor section and gear box section. Each section may be serviced independently of the other.

WIPER MOTOR—PONTIAC

BRUSH PLATE AND CIRCUIT BREAKER REMOVAL

1. Scribe reference line along side of rear housing and end cap to ensure proper re-assembly.

2. Remove two bolts thru motor.

3. Strike steel case lightly with mallet to partially loosen it from die cast housing and motor field.

4. Feed exposed excess length of motor leads through casting grommet and carefully separate end case and field assembly, plus armature, from gear housing.

5. Unsolder black ground lead from circuit breaker terminal, (Fig. 12-33).

6. Straighten out legs that retain brush plate to field extensions.

NOTE: Be extremely careful not to break mounting tabs.

7. Install U shaped brush retainer clip J 7890 over brush holder that has brush lead attached to circuit breaker (Fig. 12-33).

8. Holding opposite brush from that retained in step 7, carefully lift brush holder off mounting legs

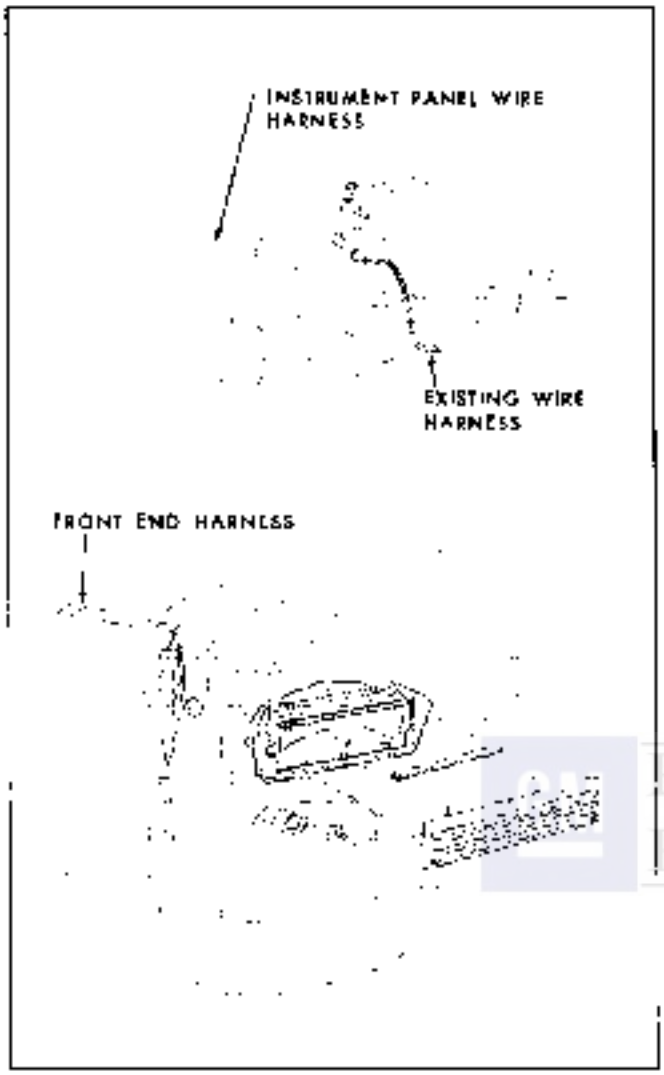


Fig. 12-22 Connecting Lamp Installation—Typical

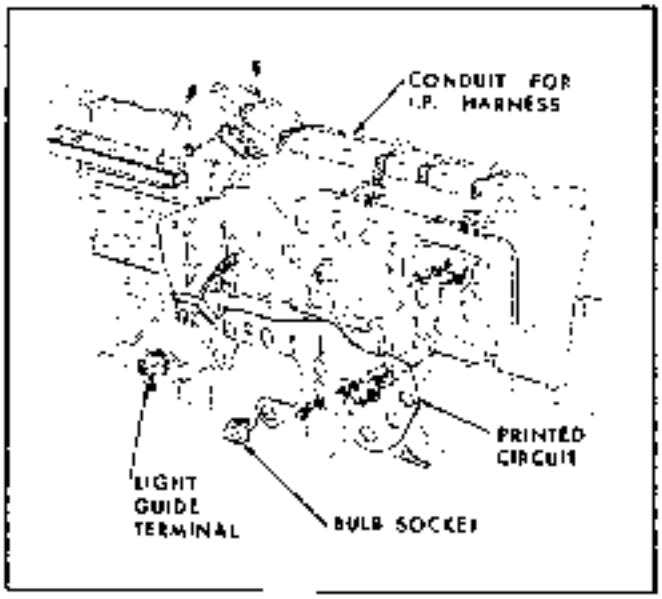


Fig. 12-23 Tempest Instrument Cluster

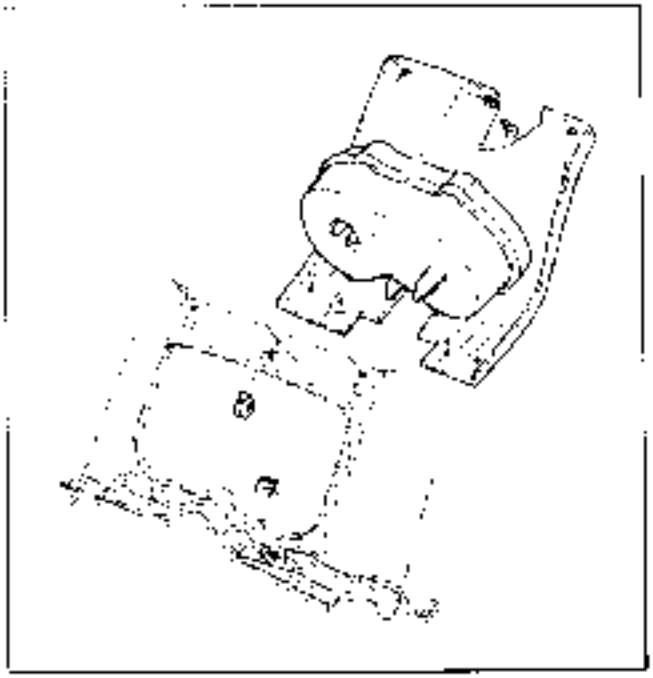


Fig. 12-24 Firebird Instrument Cluster

fit enough to clear armature commutator.

9. Allow brush, held in step 8, to move out of its holder. Remove brush spring and lift brush holder off armature shaft.

10. Lift the brush plate circuit breaker assembly from the field coil receptacles and off armature shaft.

ARMATURE REMOVAL

1. Follow steps 1 through 8 under brush plate removal.

2. Lift armature out of case and field assembly.

3. Remove thrust ball from end of armature shaft as required and save for reassembly.

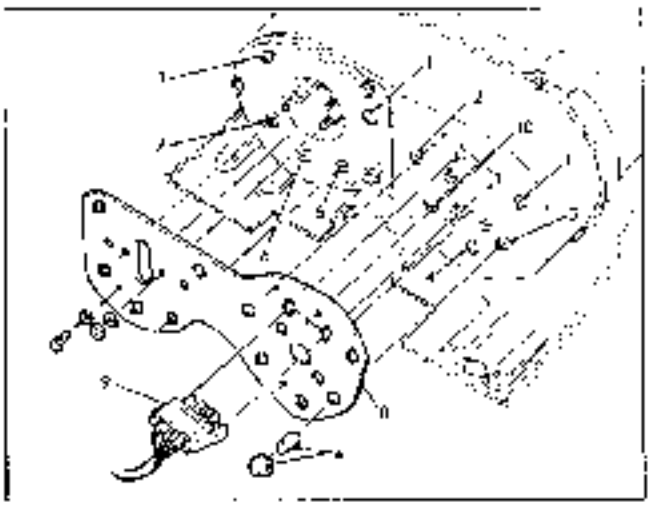


Fig. 12-25 Firebird Printed Circuit

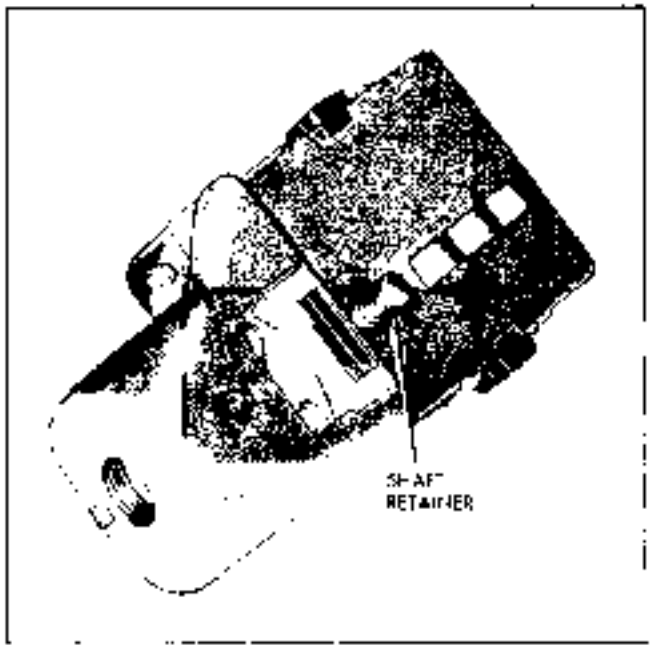


Fig. 12-26 Shaft Retainer

NOTE: Thrust bolt may be easily removed with a magnet.

CASE AND FIELD ASSEMBLY REMOVAL

1. Remove brush plate and armature.

2. The red case and field assembly is serviced as a unit. To free field and case assembly, cut solid black and black with pink stripe leads in a location convenient for splicing - preferably near field.

3. Remove steel thrust disc and rubber disc from end cap bearing as required.

To re-assemble motor, reverse the procedures as required.

PONTIAC AND TEMPEST OPTIONAL GEAR BOX SYSTEM

RELAY SWITCH-LATCH ASSEMBLY— TERMINAL BOARD REMOVAL

1. Remove washer pump.

2. If wiper gear drive pawl is in full park position remove gear. If wiper gear mechanism is not in park position (drive pawl away from latch arm (Fig. 12-34, proceed to step 3).

3. If only relay-switch requires replacement, proceed as follows:

a. Remove relay-switch attaching screw (Fig. 12-34 and carefully lift relay-switch out of gear box.

b. Cut red lead about 3 inches from relay.

c. Unsolder two leads from relay switch terminals.

4. If only terminal board requires replacement, proceed as follows:

a. Slide terminal board out of gear box housing.

b. Unsolder three leads at terminal board.

5. If both relay-switch and terminal board require replacement, proceed as follows:

a. Remove relay-switch attaching screw (Fig. 12-34) and carefully lift relay-switch out of gear box.

b. Unsolder two motor leads at relay.

c. Slide terminal board out of gear box housing.

d. Unsolder two leads (black and black with yellow stripe) at terminal board.

REASSEMBLE PONTIAC RELAY-SWITCH LATCH AND TERMINAL BOARD

1. If only relay-switch was replaced, solder red lead (shortened by approximately 2 inches) of new relay assembly to red lead from terminal board, and tape this splice.

2. If only terminal board was replaced, resolder three leads to new terminal board - solder red lead to terminal No. 1, solder tan with yellow-stripe lead to terminal No. 2, and solder black lead to terminal No. 3. Terminal identification shown in Fig. 12-72.

3. If both terminal board and relay assemblies were replaced, resolder two motor leads to new relay and resolder three leads to new terminal board.

4. Slide terminal board into wiper housing, being careful to position terminal board resistor lead as shown in (Fig. 12-35).

NOTE: With relay-switch replaced in housing and washer pump reinstalled, the relay-switch plastic housing applies pressure against resistor lead to form a positive ground connection to wiper housing. Without this resistor ground, the wiper probably would have excessive speed on high while having a normal low speed.

5. Position relay-switch in housing.

CAUTION: Be very careful to route leads in such a manner as to avoid having them pinched between relay and wiper housing.

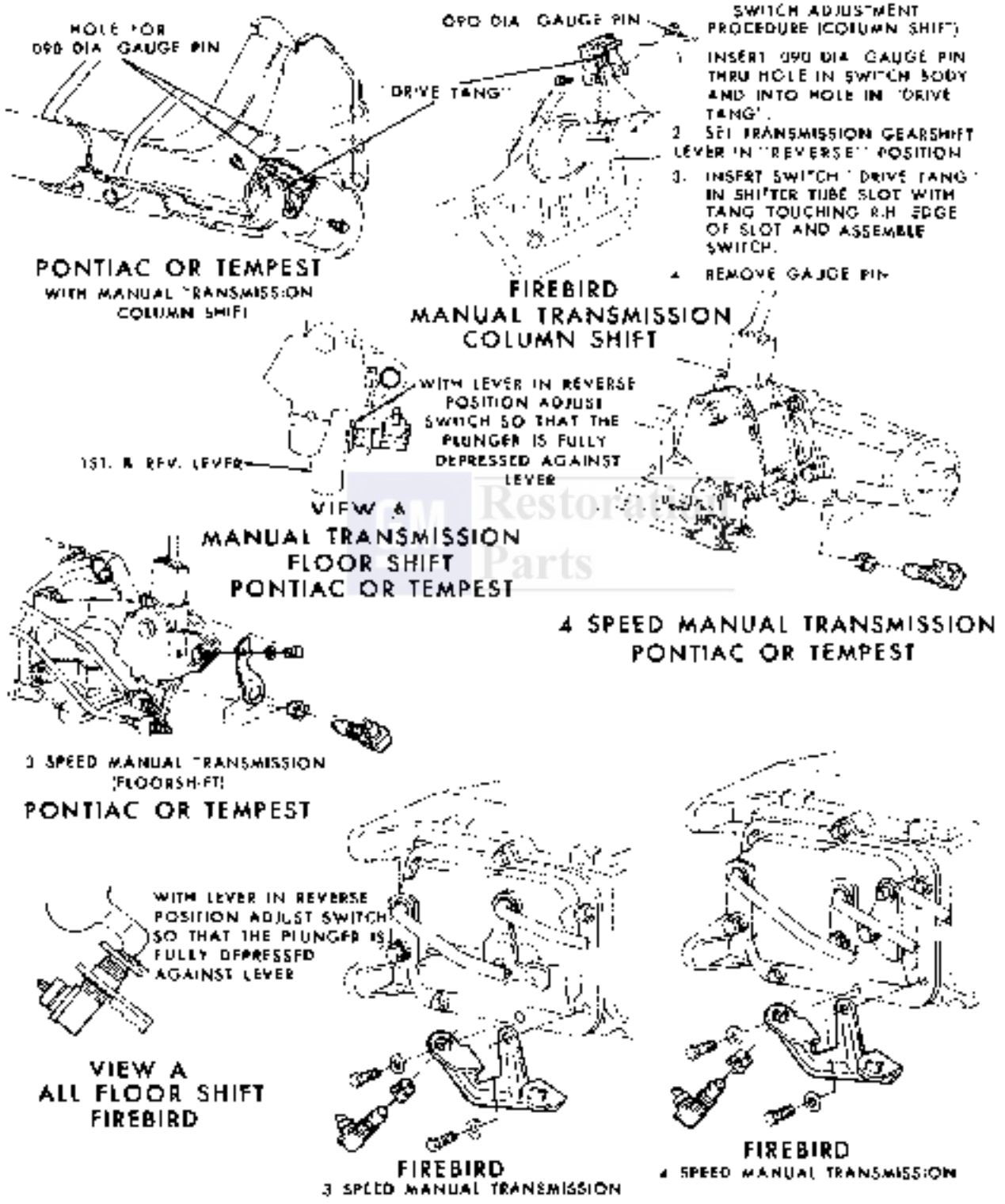


Fig. 12-27 Back-up Lamp Installation

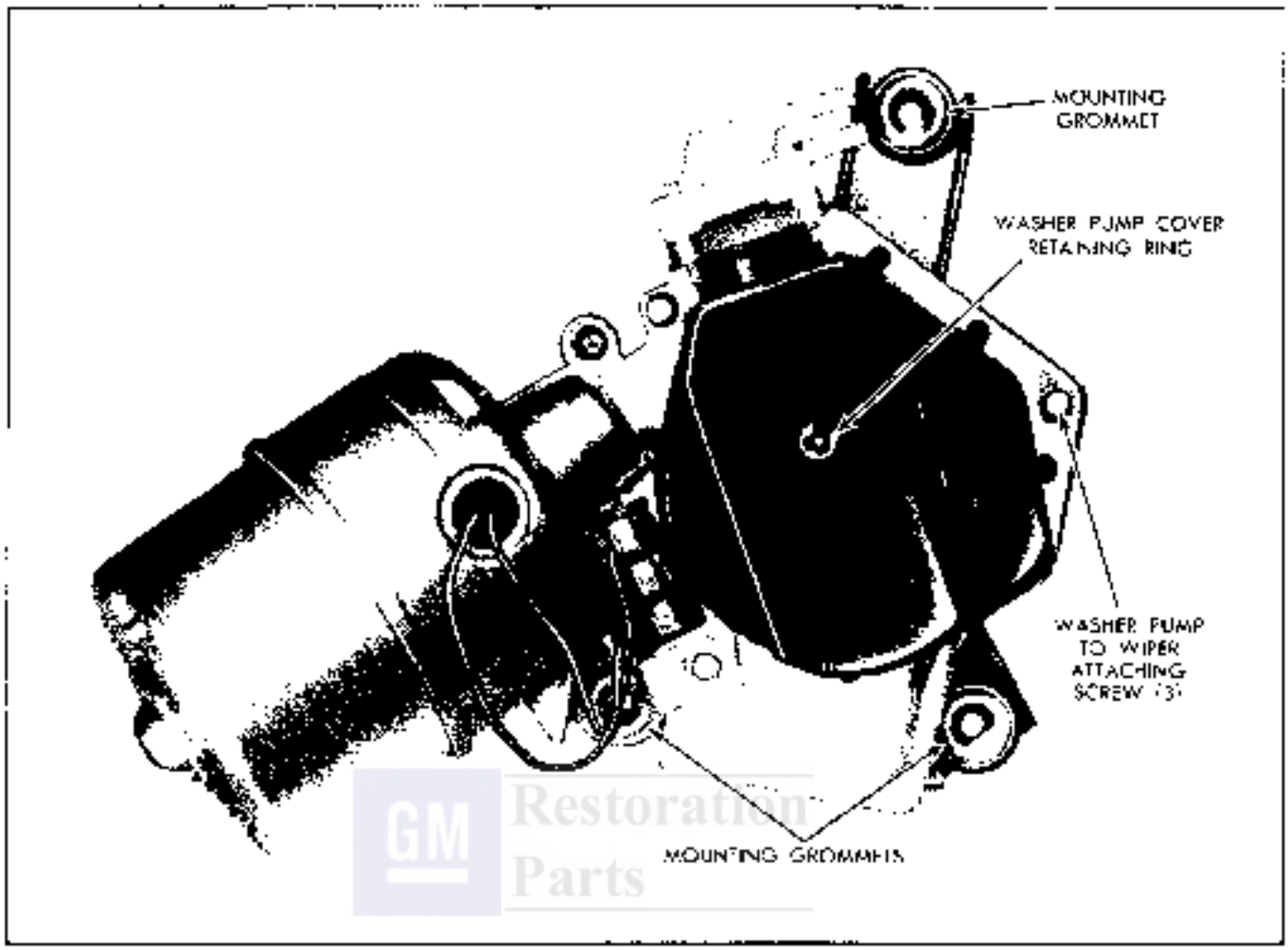


Fig. 12-28 Wiper Motor Assembly—Pontiac—Optional Tempest

6. Install relay-switch mounting screw (Fig. 12-34).

7. Assemble washer pump to wiper, being careful that ground strap is properly connected.

PONTIAC AND TEMPEST OPTIONAL SYSTEM—DRIVE GEAR DISASSEMBLY

1. Remove crank arm retaining nut, crank arm, rubber seal cap, retaining ring, shim washers, shield and spacer washer in order indicated.

2. Slide gear out of housing (Fig. 12-36).

3. Slide drive shaft and plate assembly out of gear and remove drive pawl, lock pawl and coil spring as required (Fig. 12-37).

PONTIAC AND TEMPEST OPTIONAL SYSTEM—DRIVE GEAR RE-ASSEMBLY

1. Position drive pawl on drive shaft as shown in Fig. 12-38.

2. Assemble lock pawl over drive pawl as shown in Fig. 12-39.

3. Slide gear and tube over the drive shaft (Fig. 12-40). Make drive and lock pawls as required to allow their respective pins to fit in gear guide channel).

4. Holding gear, manually rotate drive plate in counterclockwise direction until drive and lock pawl guide pins move into their respective pockets in gear.

5. Reinstall coil spring between lock and drive pawls.

IMPORTANT: Be very careful to maintain lock and drive pawl guide pins in their respective pockets during step 6.

6. Assemble inner spacer washer over gear shaft and assemble gear mechanism in housing so that the pawls are approximately 180° away from the latch assembly (Fig. 12-36).

7. Reassemble outer spacer washer, shield, (shim washers are required to obtain .005" max. end-play)

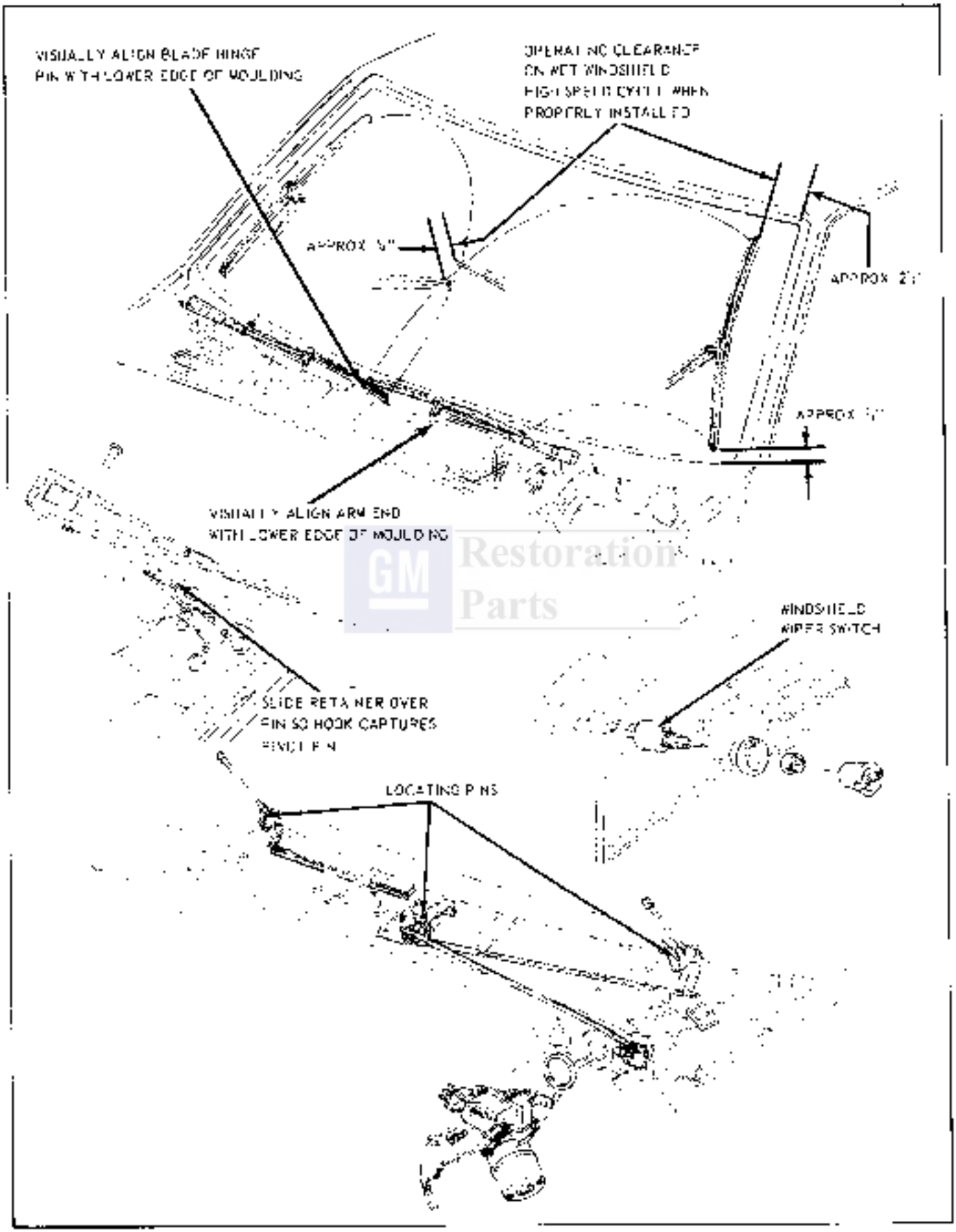


Fig. 12-29 Wiper Transmission Replace—Pontiac

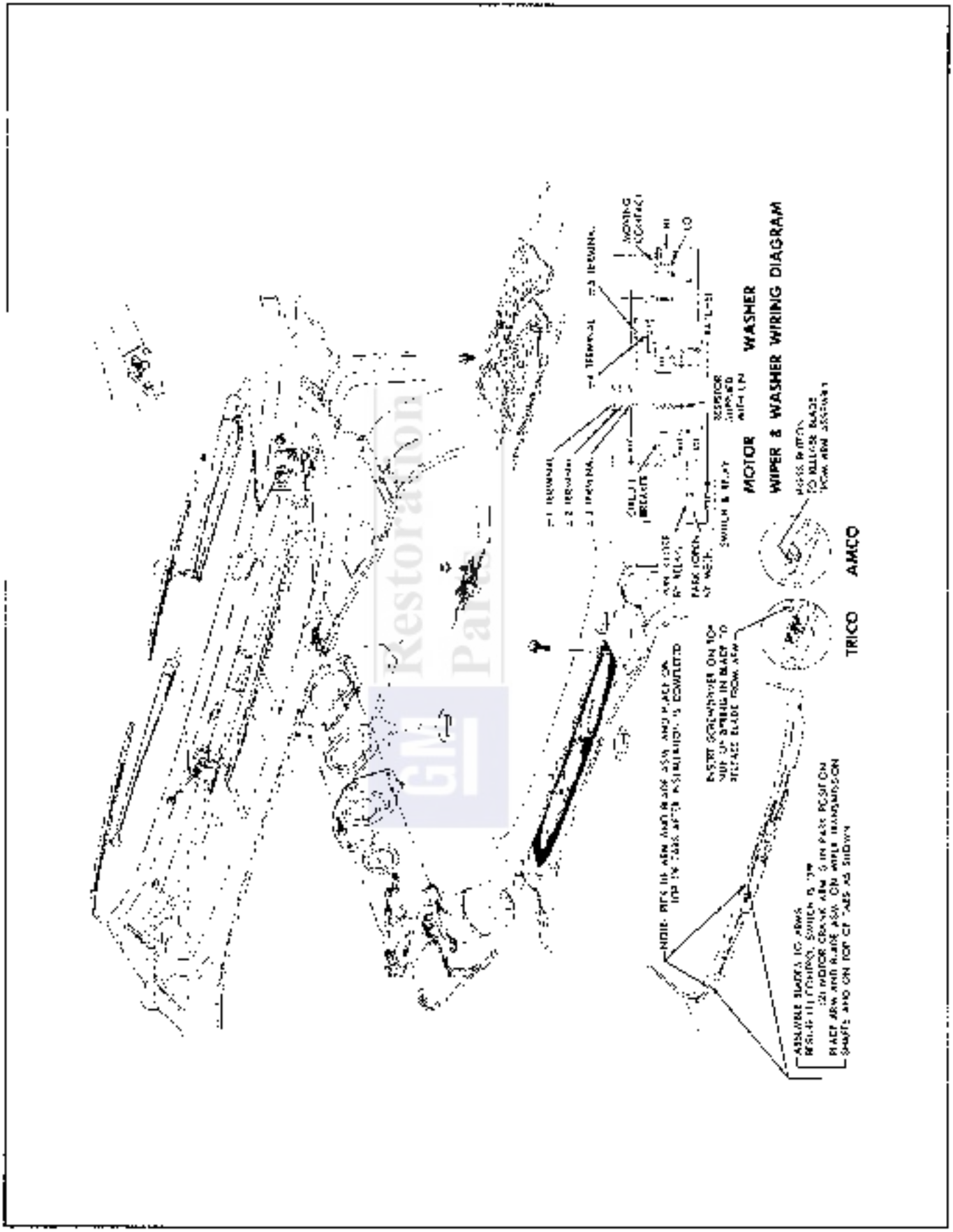


Fig. 12-30 Wiper Transmission Replace—Optional Tempest

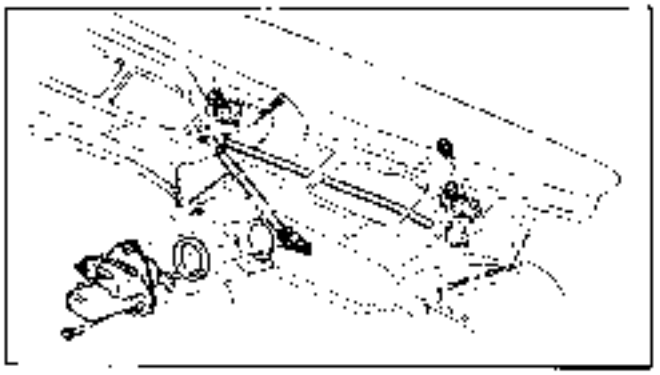


Fig. 12-31 Wiper Transmission Replace—Tempest and Firebird

snap ring and rubber seal cap in order indicated.

8. Operate wiper to PARK or OFF position and install crank arm in approximate position.

9. Reassemble washer pump to wiper (Fig. 12-41) using alignment pin.

PONTIAC WIPER ADJUSTMENTS

a. Armature end-play

(1) Loosen adjusting screw lock nut and

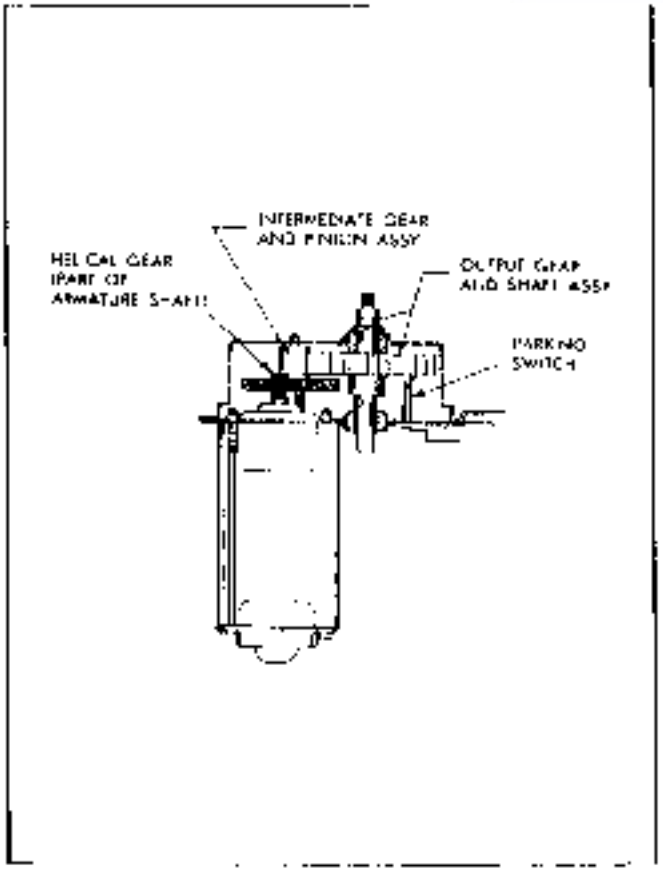


Fig. 12-32 Wiper Gear Train—Tempest

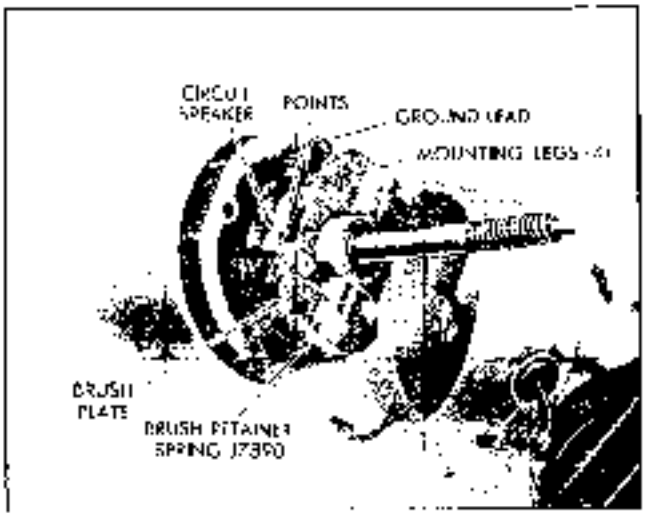


Fig. 12-33 Retains Holding Brush in Place—Pontiac

tighten or loosen adjusting screw as required until end of screw barely touches end of armature.

(2) Back off set screw 1/4 turn and tighten lock nut.

b. Gear end-play.

(1) Add or remove end-play washers as required to obtain .006" minimum end-play.

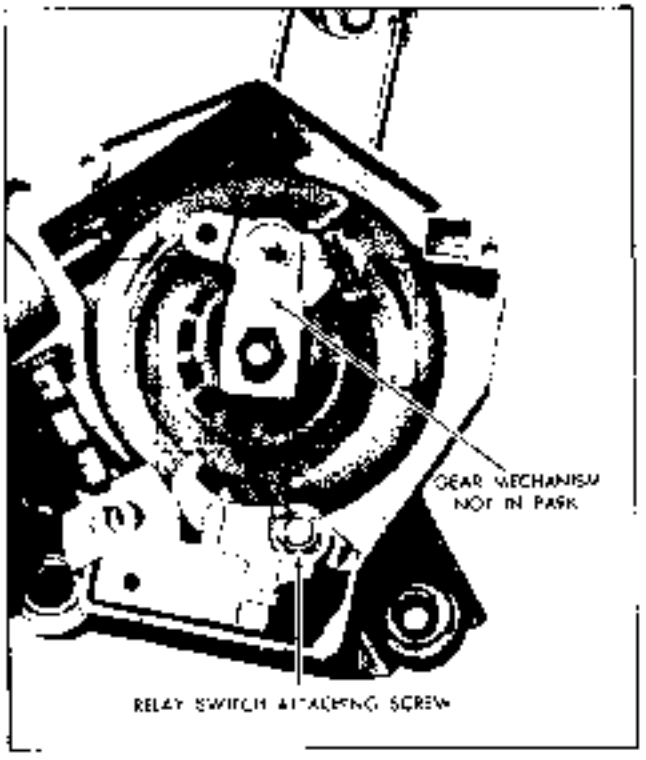


Fig. 12-34 Checking Latch Arm Switch—Pontiac

Fig. 12-35 Position of Resistor Lead—Pontiac

TEMPEST AND FIREBIRD GEAR BOX

DISASSEMBLE

1. Clamp crank arm in a vise and remove crank arm retaining nut, arm, seal cup, retainer clip, and end play washers.

2. Drill out gear box cover retaining rivets (6) and remove cover from gear box.

CAUTION: Mark ground strap location for reassembly purposes.

Fig. 12-36 Removing Drive Gear—Pontiac

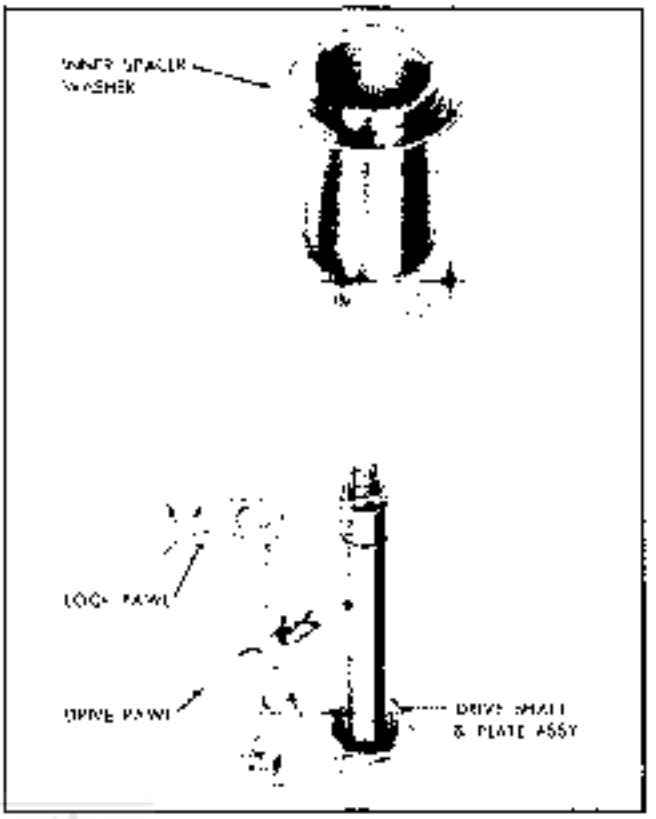


Fig. 12-37 Drive Shaft and Gear Assembly—Pontiac

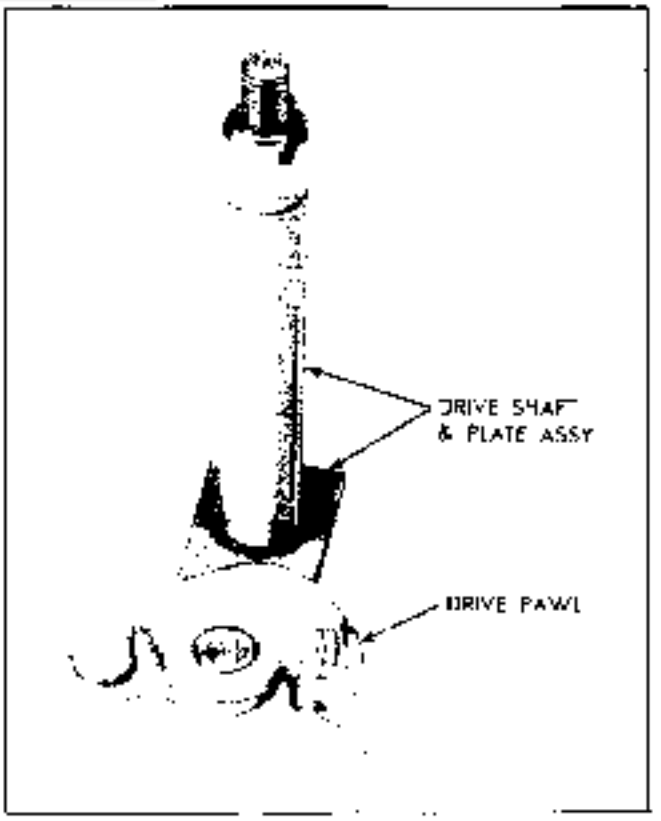


Fig. 12-38 Assembly of Drive Pawl to Drive Shaft—Pontiac

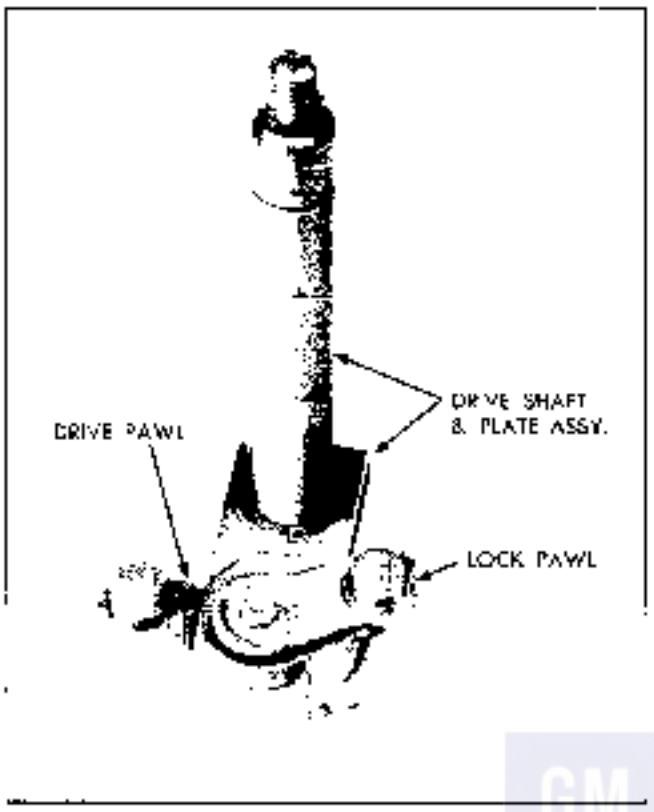


Fig. 12-39 Installing Lock Pawl—Pontiac

NOTE: Screws, nods and lockwashers for reassembling cover to wiper are contained in a service repair package.

3. Remove output gear and shaft assembly, then slide intermediate gear and pinion and pinion spring washer off shaft.

4. Remove terminal board and park switch assembly as follows:

a. Unsolder motor leads from terminals.

b. Drill out rivets that secure terminal board and park switch ground strap to cover.

NOTE: Screws and nuts for attaching a replacement terminal board-park switch are included with replacement assembly.

ASSEMBLY

Reverse steps 1 through 4 above except as noted:

1. Reassembly of gear cover - be sure cover is located properly over locating dowel pins and be sure to reinstall ground strap and gasket.

2. Reassembly of crank arm - operate wiper to park position and install crank arm on output shaft so that identification marks line up with those in cover (Fig. 12-43). Clamp crank in vise before securing retaining nut.

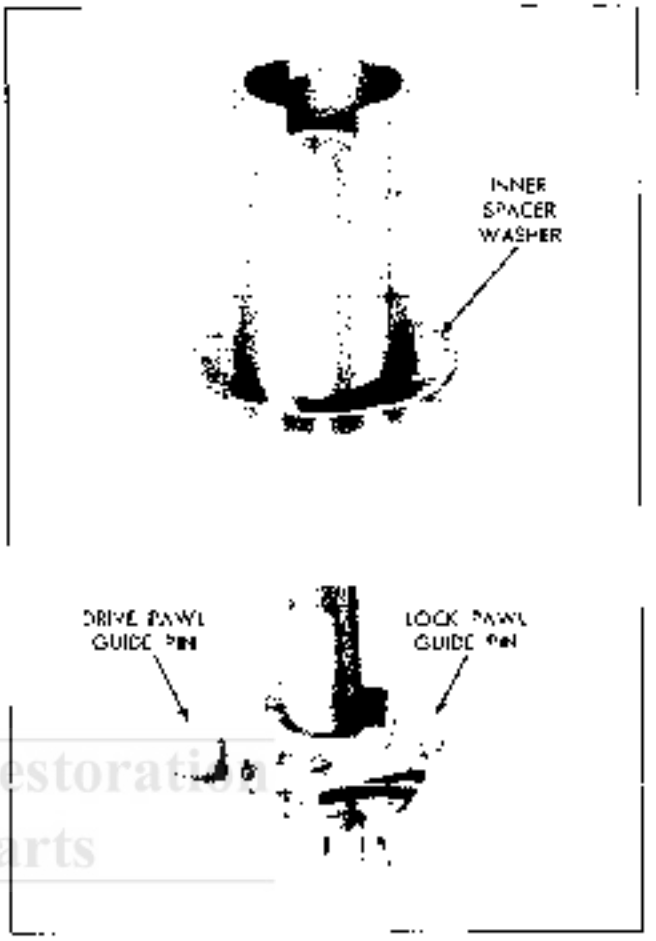


Fig. 12-40 Installing Gear and Drive Shaft—Pontiac

TEMPEST MOTOR SECTION

DISASSEMBLE AND ASSEMBLE

Refer to Fig. 12-42.

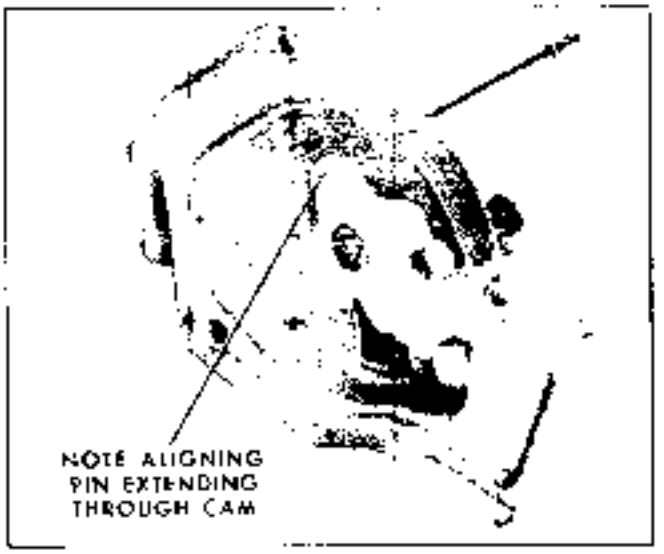


Fig. 12-41 Assembling Washer Pump to Wiper—Pontiac

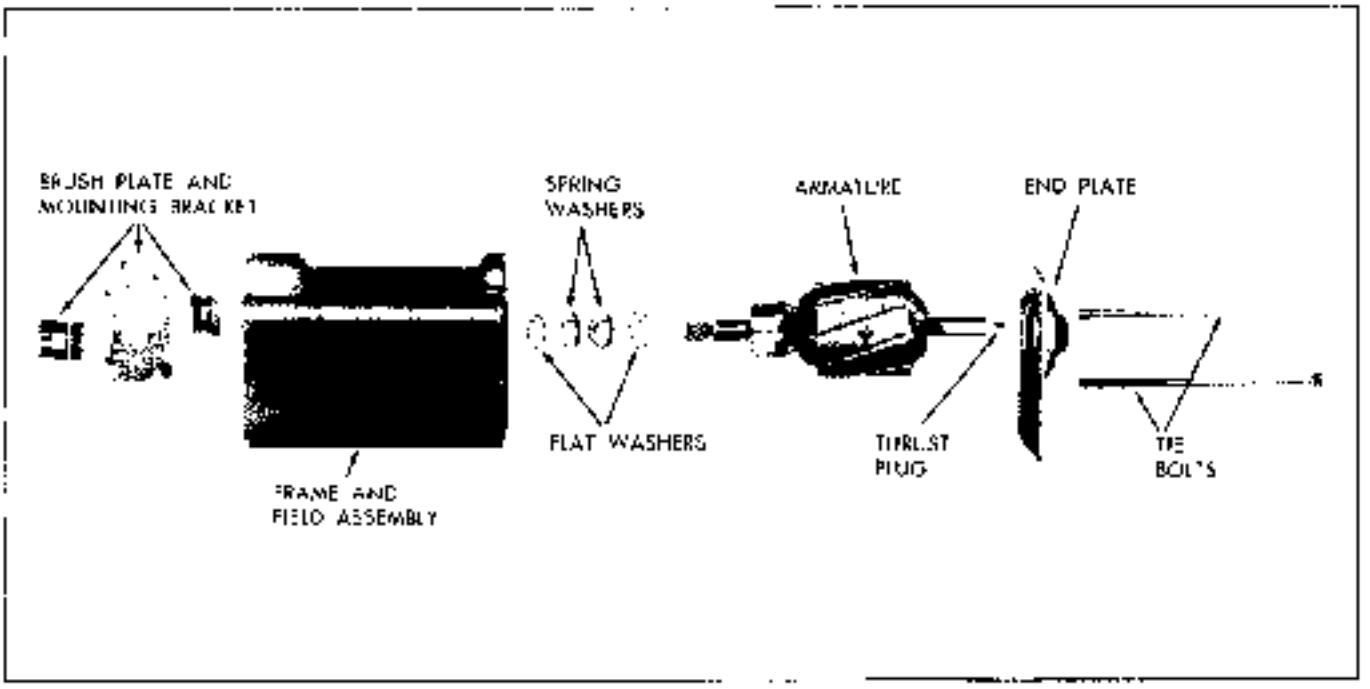


Fig. 12-42 Motor Exposed View—Tempest

1. Follow steps 1 thru 4(a) under gear box disassembly.

2. Remove bolts, then remove gear box cover from frame and field assembly.

3. Release brush spring pressure against brushes as shown in Fig. 12-44.

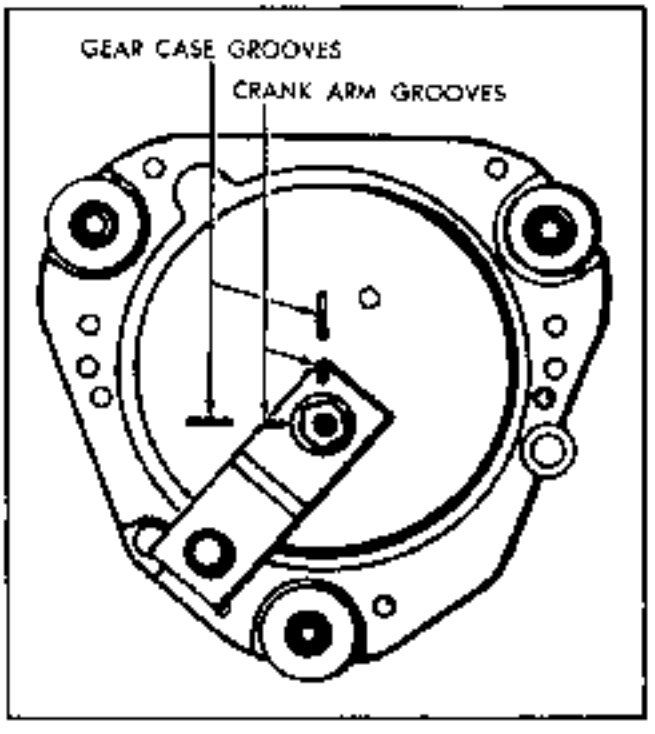


Fig. 12-43 Crank Arm in Park Position—Tempest and Firebird

4. Move brushes away from armature and slide armature out of frame and field assembly. Pull end plate assembly off armature.

CAUTION: Use care to insure that small thrust play at end of armature shaft does not get lost.

5. Remove end play adjusting washers.

To reassemble motor, reverse steps 1 thru 4 as required.

TEMPEST AND FIREBIRD LUBRICATION

Armature shafts and bearings: Light grade machine oil.

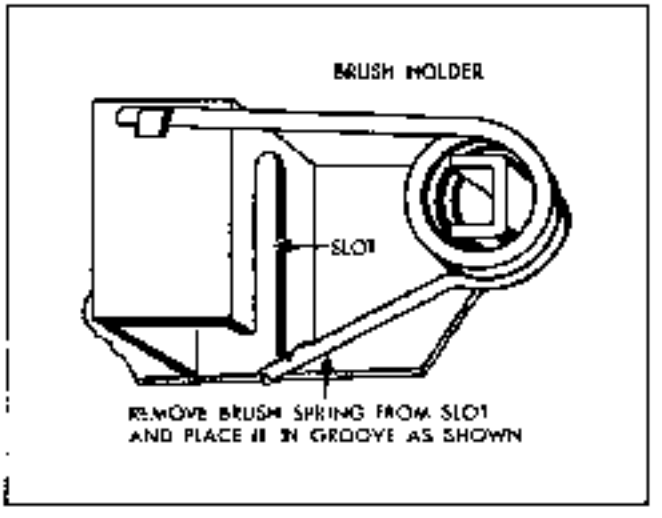


Fig. 12-44 Brush Spring Tempest and Firebird

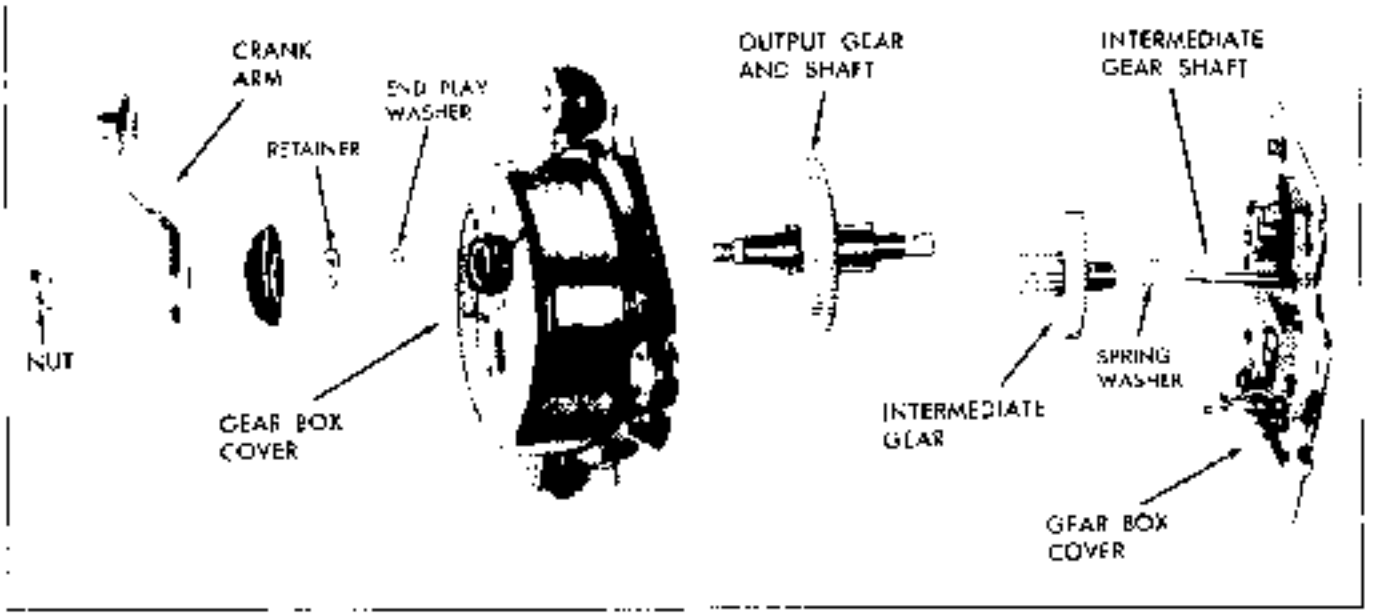


Fig. 12-45 Gear Box—Exploded View—Tempest

Gear Teeth (All): Delco cam and ball bearing lubricant or equivalent.

PONTIAC AND TEMPEST OPTIONAL SYSTEM LUBRICATION

Use Delco Remy cranking motor and distributor lubricant 1948792 or equivalent.

Lubrication:

Gear Teeth and Gear Clutch Mechanism

Gear Shaft

Seal Cap (inside)

Armature Worm

TORQUE SPECIFICATIONS

All specifications are in Lb. In. unless otherwise specified.

Washer pump mounting screws	18
Armature adjusting screw jam nut (Tempest and Firebird)	50
Motor tie bolts	30
Relay attaching screw (internal) Pontiac and Tempest Optional System	30
Crank arm nut	60
Wiper to firewall attaching bolts	25

WINDSHIELD WASHER PUMP

PONTIAC AND TEMPEST OPTIONAL SYSTEM DISASSEMBLY PROCEDURES (Figs. 12-46)

FOUR-LOBE CAM

1. Remove E-ring and slide cam off shaft.

RATCHET WHEEL

1. Remove E-ring, hold relay armature against relay coil and slide ratchet wheel off shaft.

CAUTION: When reassembling ratchet wheel be careful not to damage ratchet dog.

RATCHET PAWL AND PAWL SPRING

1. Disengage pawl spring from pawl and slide off cam-follower pin.

NOTE: Early production models are equipped with an "E" retaining ring. Later models have slots at both top and bottom of pin. When servicing, replace "E" ring if one is used.

RATCHET DOG:

1. Remove attaching screw and lift ratchet dog off mounting plate.

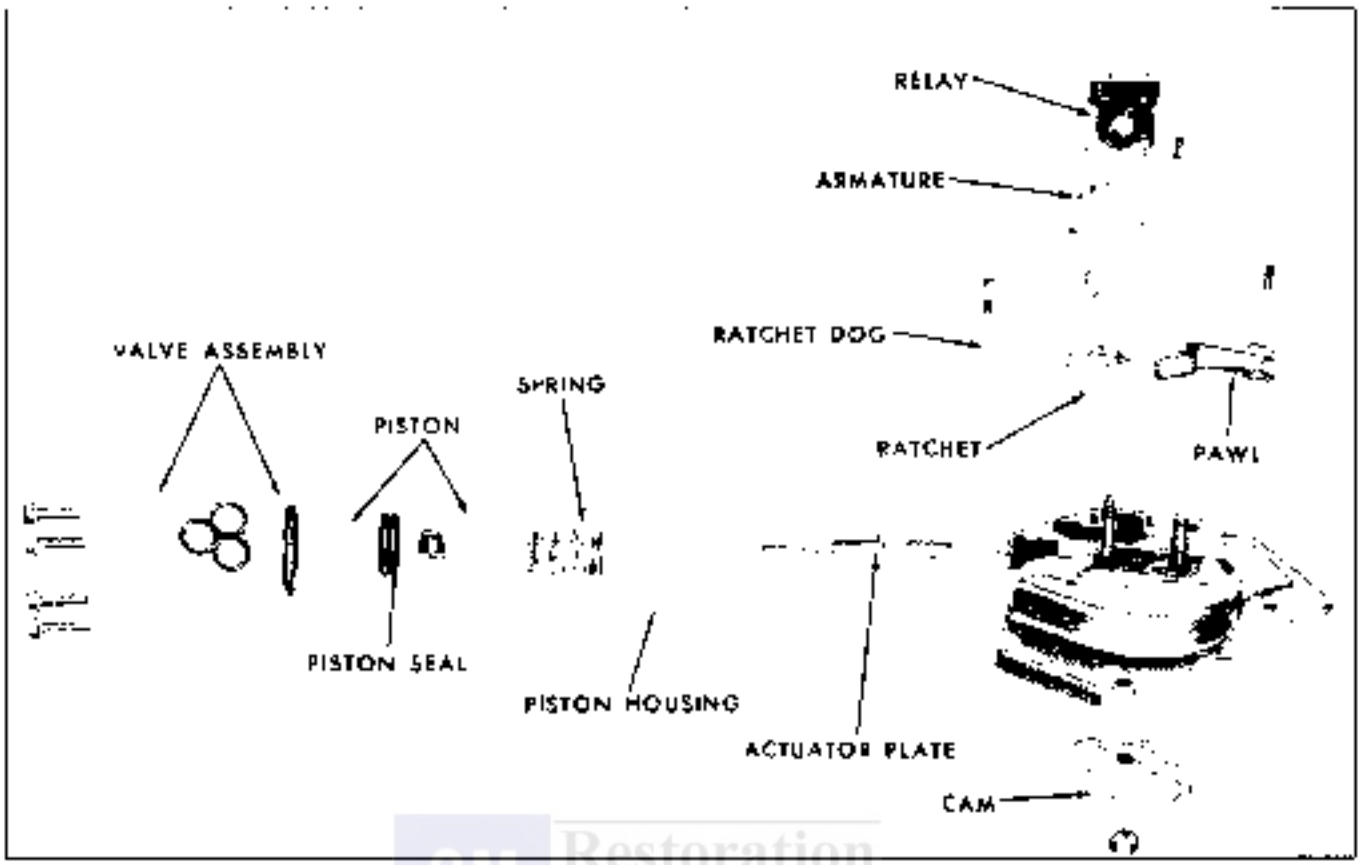


Fig. 12-46 Exploded View Pump Assembly—Ventura and Optional Tempest

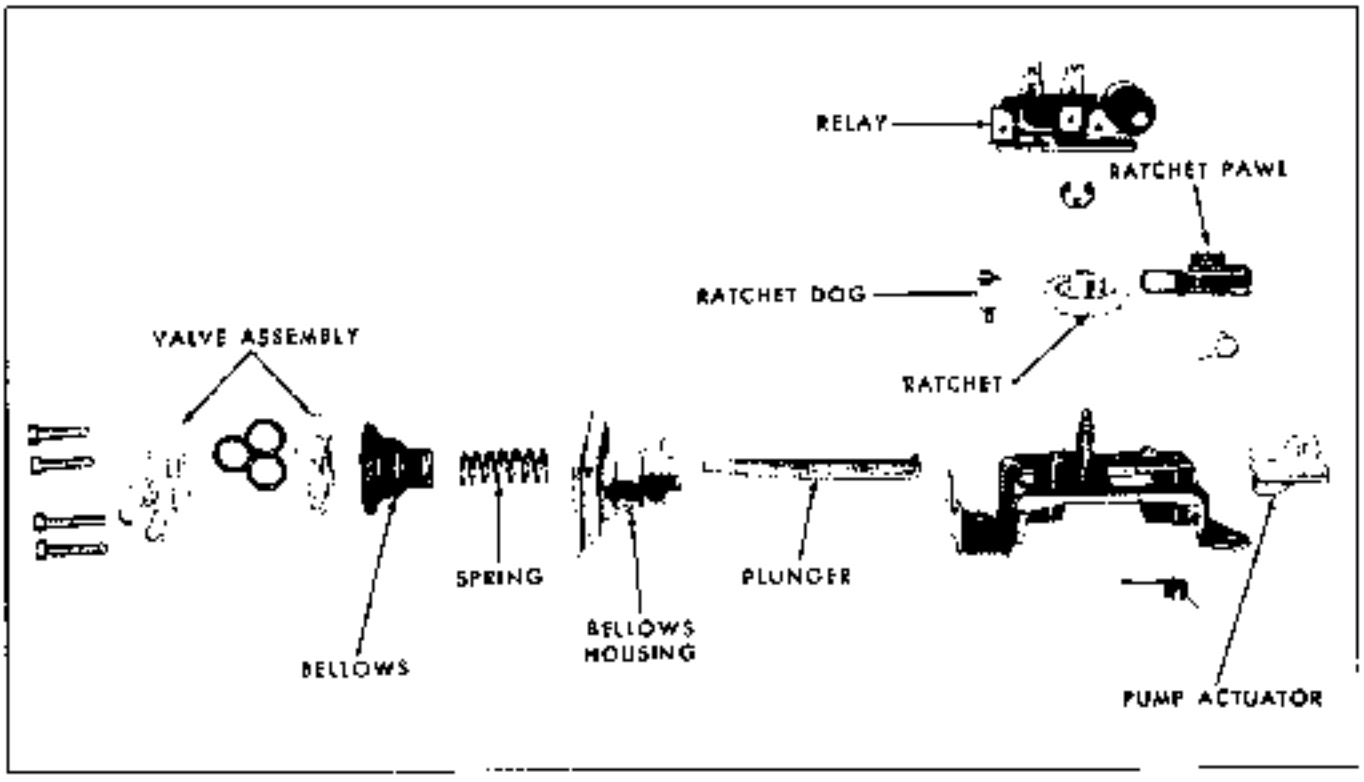


Fig. 12-47 Exploded View Pump Assembly—Tempest and Firebird

RELAY-TERMINAL BOARD

1. Remove 4-lobe cam.

2. Remove ratchet pawl and pawl spring.

3. Remove relay armature and spring.

4. Chisel off the four bent-over tabs that secure the coil mounting bracket to the base. Remove and discard relay coil and terminal board assembly. To mount a replacement relay, hold it securely against the base mounting surface and bend locking tabs over.

CAUTION: *Be careful not to damage coil winding or terminals.*

5. To check the pump programming mechanism, manually rotate the 4-lobe cam through complete 12-tooth cycle (360°) and observe if pump is operating as explained in the PRINCIPLE OF OPERATION section of Diagnosis Manual.

VALVE

1. Note position of valve relative to the pump housing for reassembly then remove four screws that secure valve to housing.

2. Remove housing-to-valve-body gasket and save for reassembly.

PUMP

1. Remove ratchet wheel, ratchet wheel dog, ratchet pawl and spring.

2. To release the plastic pump housing from the sheet-metal base, pull it in the direction toward the valve end until the housing grooves clear the sheet-metal base. Next, detach the assembly from the cam-follower pin. (Fig. 12-47).

PISTON

1. Remove valve.

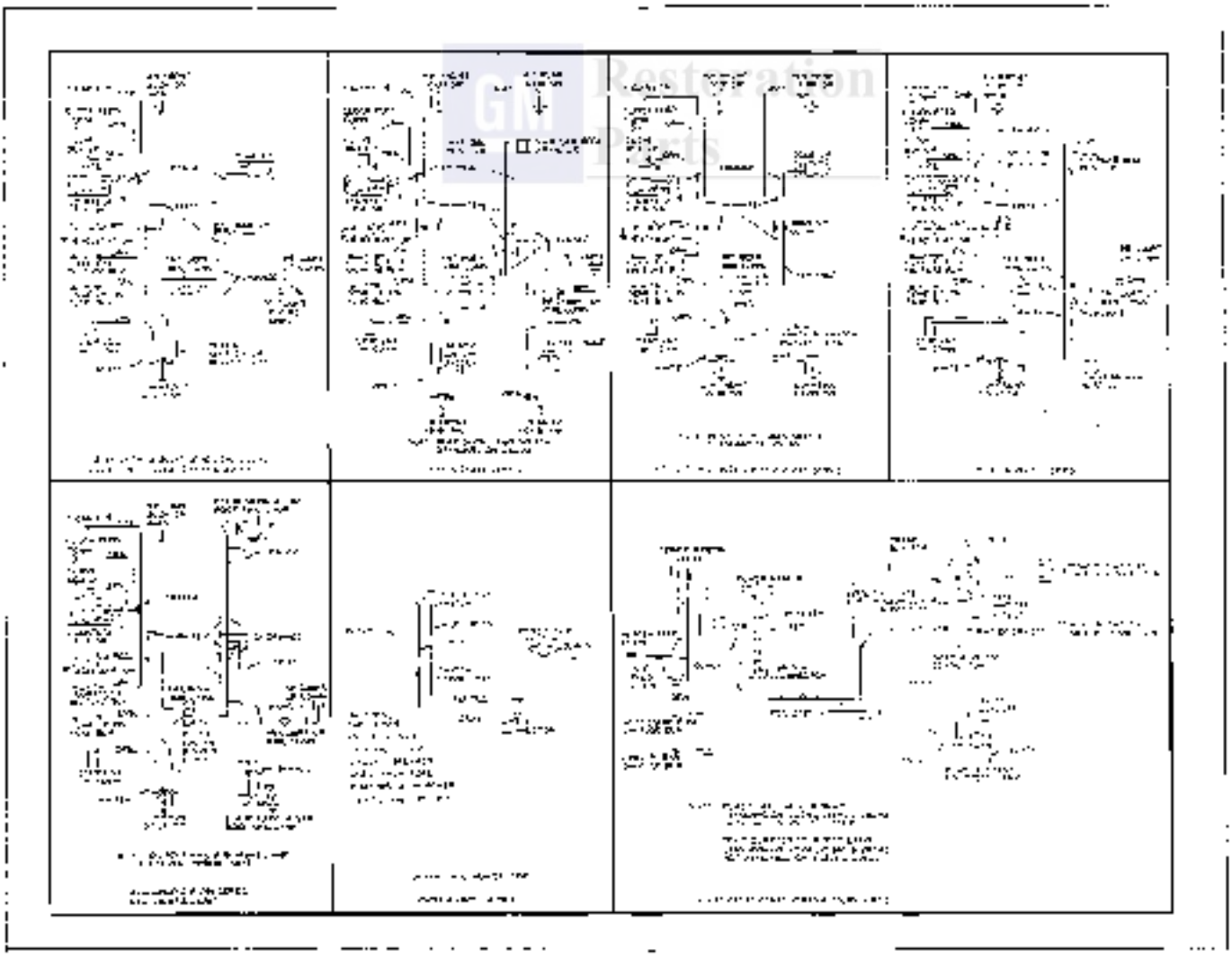


Fig. 12-48 Pontiac Accessory Circuits

2. Remove front of piston containing seal from housing.

3. Remove rear of piston and spring by turning 90° to separate from actuator plate.

PONTIAC AND TEMPEST OPTIONAL SYSTEM ASSEMBLY PROCEDURES—REVERSE ASSEMBLY PROCEDURES

TEMPEST AND FIREBIRD DISASSEMBLY PROCEDURES

RATCHET PAWL

1. Remove washer pump cover.

2. Disengage spring from ratchet pawl.

CAUTION: Be sure spring is properly assembled before replacing washer pump cover.

3. Squeeze the slotted nylon ratchet pawl post together and slide ratchet pawl off the post.

RELAY COIL

1. Remove washer pump cover.

2. Unsolder coil leads from terminals.

NOTE: No coil polarity is necessary when resoldering coil leads

3. Pry off coil retainer clip and slip coil out of mounting bracket.

NOTE: A new clip is supplied with replacement coils

4. Resolder coil leads to terminals.

VALVE ASSEMBLY

1. Remove four screws that secure valve to housing.

BELLOWS AND BELLOWS SPRING

1. Remove valve.

2. Manually rotate ratchet wheel as required to release pump from lock-out position.

3. Hold end of plunger arm from moving. At this same time, push in against bottom of bellows with thumb and turn bellows 90°. This should release bellows.

4. Slide bellows spring and spring retainer off plunger arm.

PONTIAC AND FIREBIRD ASSEMBLY PROCEDURES

In each of above cases, enlarge assembly procedure is given, reverse procedure to assemble.

WIPER SPECIFICATIONS

Operating Voltage Pontiac and Optional Tempest System	12–14 VDC
Operating Volts Tempest and Firebird	12 VDC
Crank Arm Rotation (looking at Crank Arm)	Counterclockwise
Crank Arm Speed (rpms) (No Load).	
LO	40 Min.
HI	70 Min.
Current Draw – Pontiac and Optional Tempest System	
Bench Check (No Load)	3.1–4.8 Amps.
Installed in Car	3.5–5.0 Amps.
Current Draw – Amps.: Tempest and Firebird	
No Load (LO Speed)	4.5 Max.
Installed in Car – (Dry Glass)	5.0 Max.
Stall	12 Max.

ACCESSORY CIRCUITS

Accessory circuits for Pontiac, Tempest and Firebird are shown in Figs. 12-48, 12-49 and 12-50 respectively.

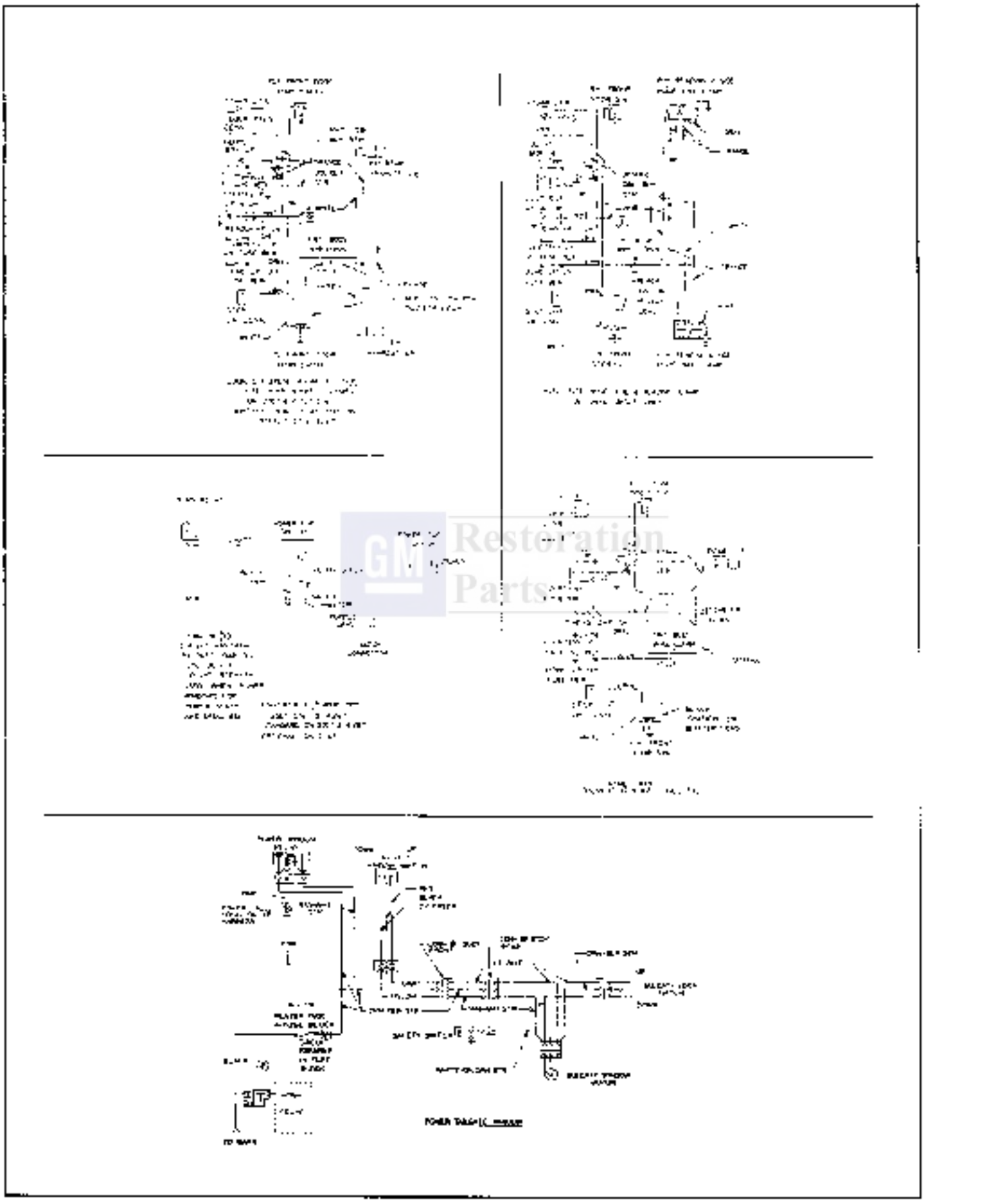


Fig. 12-42 Tempest Accessory Circuits

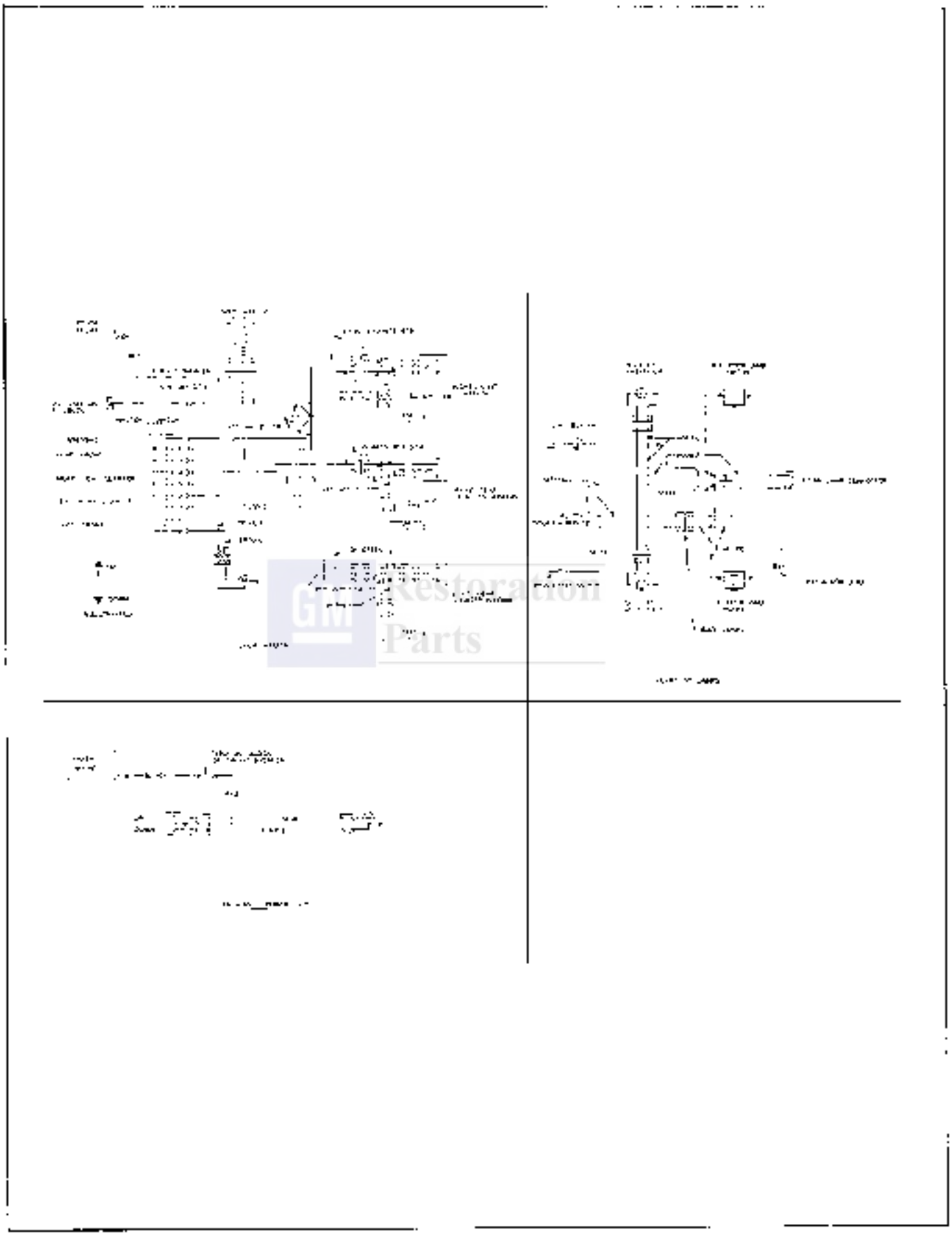


Fig. 12-50 Headland Accessory Circuits

RADIATOR SUPPORT AND MOUNTING PARTS

GENERATOR DESCRIPTION

All models are equipped with cross-flow radiators, which provide horizontal coolant flow for improved cooling characteristics. For specifications and usage, refer to the radiator charts in section 6A.

Pontiac and Tempest radiators are supported by insulated cradle type brackets (Fig. 13-1), which retain both the lower and upper radiator tanks. The two upper cradles are attached to the bottomside of the upper panel mounting assembly (Figs. 13-2 and 3) which, in turn, is fastened to the front end support and baffle assembly.

The Firebird radiator is attached by cap screws to the radiator support. The fan shroud on all V-8 models is mounted in two bottom slots and secured at the top by one center bolt.

RADIATOR—REMOVAL AND REPLACEMENT PONTIAC AND TEMPEST

REMOVAL

1. Disconnect positive battery cable.

2. Open drain cock at bottom of radiator and drain radiator and cylinder block. Remove filler cap so coolant will flow freely.

NOTE: To save coolant, remove radiator overflow hose and connect to drain cock.

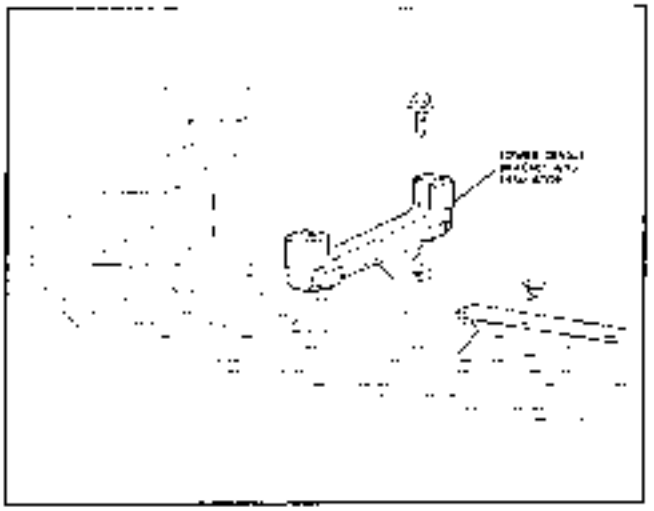


Fig. 13-1 Lower Cradle Bracket and Insulator

3. Loosen hose clamps and disconnect upper and lower radiator hoses at radiator inlet and outlet pipes.

4. On cars equipped with V-8 engines and automatic transmissions, disconnect and plug the transmission cooler lines.

5. Remove upper panel mounting assembly by removing attaching screws.

NOTE: The upper portion of radiator is held in place by cradle type brackets attached to bottom side of upper panel mounting assembly (Figs. 13-2 and 3).

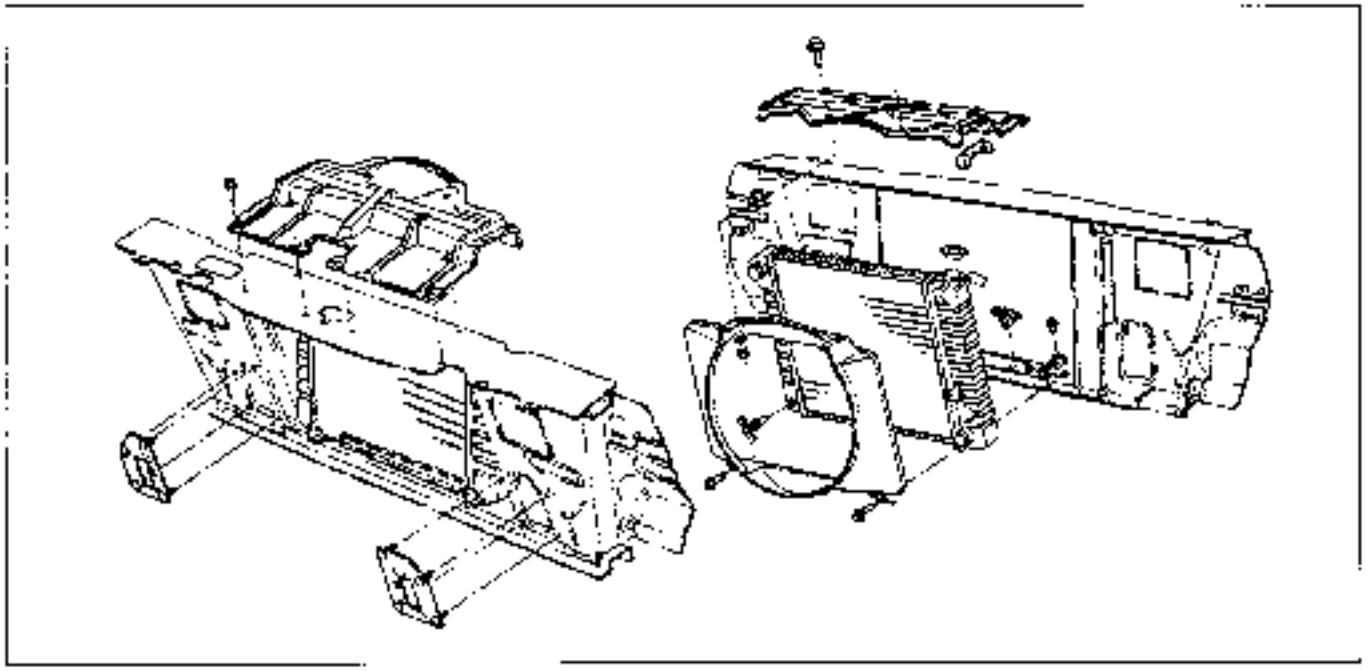


Fig. 13-2 Pontiac Support and Baffle Assembly

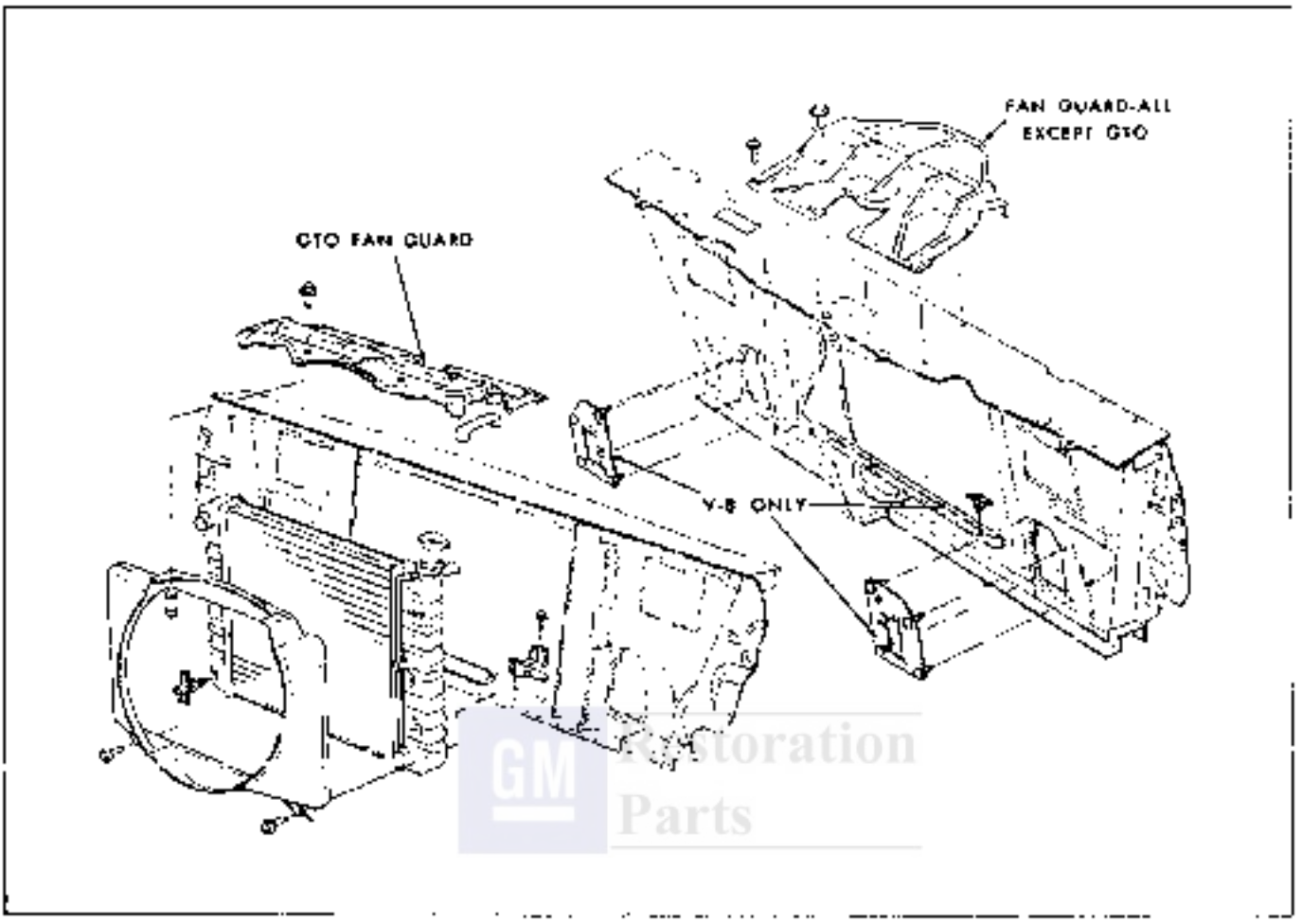


Fig. 13-3 Tempest Support and Baffle Assembly

6. On cars equipped with air conditioning, it will be necessary to remove the fan shroud from the rear of the radiator assembly.

NOTE: Exercise care so as not to damage the rubber seals around radiator.

7. Remove radiator by lifting straight up.

NOTE: Radiator is held at bottom by two cradle type brackets and insulators secured to support and baffle assembly (Fig. 13-1).

REPLACEMENT

1. Replace radiator assembly by reversing the above procedure, making sure the lower "cradle" brackets and insulators are properly located in the radiator bottom tank recesses.

2. On air conditioned cars be sure rubber seals around radiator are carefully replaced to prevent possible flapping or loss of coolant due to overheating. Purpose of seals is to ensure that all incoming air goes through condenser and radiator.

3. Torque all upper panel mounting studs to 12 lb. ft., all fan shroud to upper panel mounting studs to 7 lb. ft., and all cradle type bracket attaching studs to 12 lb. ft.

4. Refill radiator with enough coolant to insure all weather corrosion protection.

FIREBIRD (Fig. 13-4)

REMOVE

1. Disconnect positive battery cable

2. Open drain cock at bottom of radiator and drain radiator and cylinder block. Remove filler cap so coolant will flow freely

NOTE: To save coolant, remove radiator overflow hose and connect to drain cock.

3. Loosen hose clamps and disconnect upper and lower radiator hoses at radiator inlet and outlet pipes.

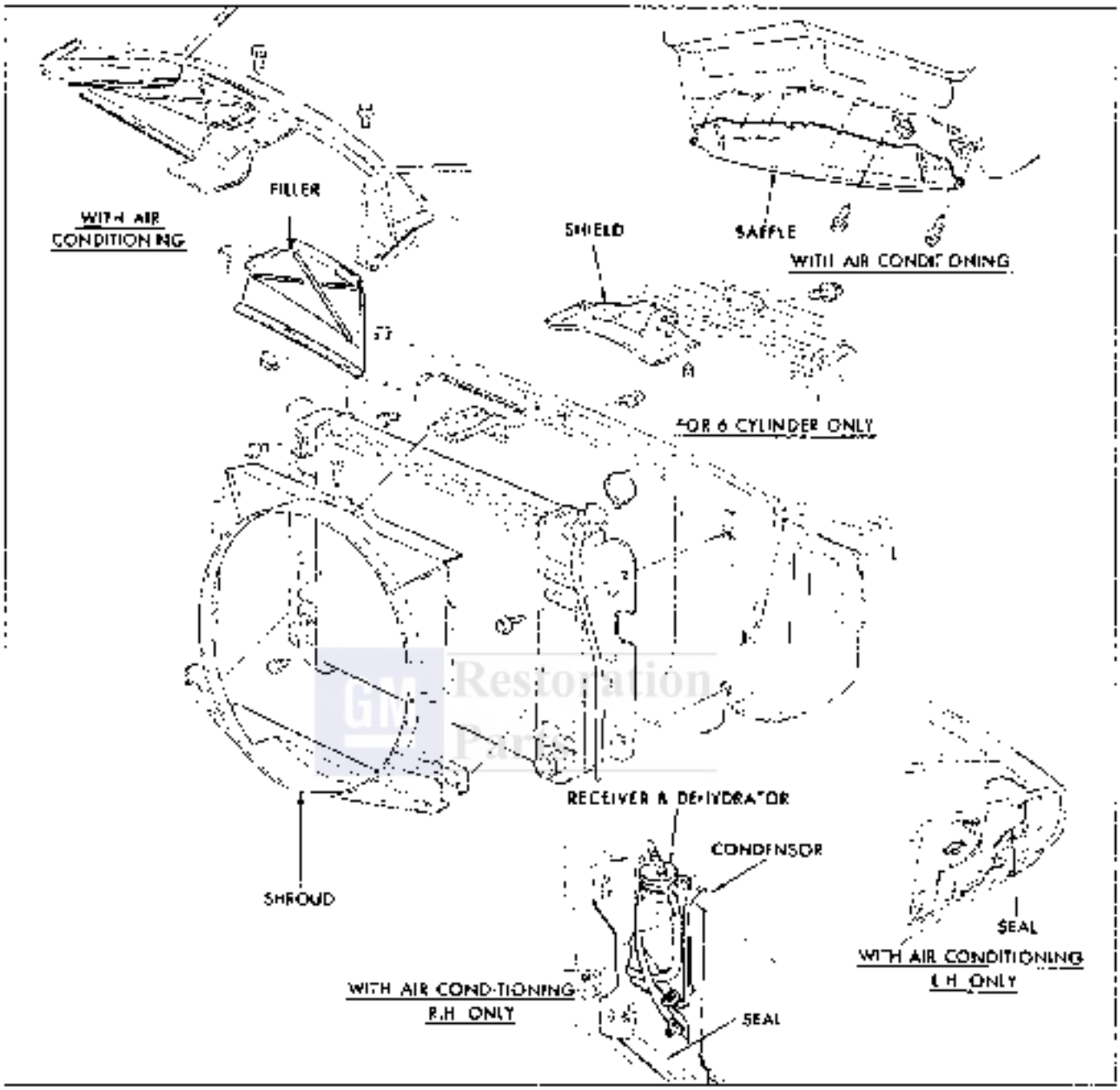


Fig. 13-4 Firebird Support and Baffle Assembly

4. On cars equipped with V-8 engines and automatic transmissions, disconnect and plug the transmission cooler lines.

5. Remove upper fan shield (six cylinder) or upper shroud bracket (V-8).

6. Remove radiator attaching screws and lift radiator and shroud out of vehicle.

REPLACE

1. Replace radiator by reversing the above procedure.

2. Torque all mounting screws to 12 lb. ft.

3. Refill radiator with enough coolant to ensure all weather corrosion protection.

FRONT AND REAR BUMPERS

CONTENTS OF THIS SECTION

GENERAL DESCRIPTION

Front and rear bumpers are of one piece construction except Pontiac's front vertical extension which is a separate piece. The reinforcements, attachment bars and braces provide maximum support and proper clearances between bumper and sheet metal. All front bumpers are peripheral in design incorporating the grille shells within the structure.

BUMPER ADJUSTMENT

Attachment of bumpers is such that slotted holes in the frame and bumper to frame attachment bars provide fore and aft lateral as well as vertical adjustment.

FRONT BUMPERS

REMOVE PONTIAC BUMPER (Fig. 14-1)

1. Disconnect parking lights, headlights and vacuum hoses (Grand Prix only).

2. Remove valance panel.

3. Support bumper. Remove frame attaching bolts and loosen bumper at radiator baffle. With aid of helper, remove bumper from car.

4. Remove all reinforcement bar to frame attaching bars and braces.

5. Remove headlight assemblies.

NOTE: To disassemble Grand Prix headlight mechanism, see Fig. 14-2.

6. Remove front vertical extension.

7. Remove grille shells (Fig. 14-3 and 4).

8. Remove face bar reinforcement.

REMOVE TEMPEST BUMPER (Fig. 14-5)

1. Disconnect parking lights, headlights and vacuum hoses (GTO only).

2. Remove valance panel.

3. Support bumper and remove frame attaching bolts. With aid of helper, remove bumper assembly from car.

4. Remove all reinforcement bar to frame attaching bars and braces.

5. Remove headlight assemblies.

NOTE: To disassemble GTO headlight mechanism, see Fig. 14-6.

6. Remove grille shells (Figs. 14-7 and 8).

7. Remove face bar reinforcement.

REMOVE FIREBIRD BUMPER

1. Remove radiator support to fender gussets using J 22413 (Fig. 14-9).

NOTE: Pozidrive screws are used to secure the front fender to radiator support gussets and the rear license plate bracket. These screws may require a No. 4 Pozidrive bit, a #3911, to be removed.

2. Disconnect headlamps.

3. Remove frame bar to frame bolts and remove bumper and grille assembly from vehicle.

4. Disassemble bumper and grille assembly to replace face bar (Fig. 14-10).

REPLACE BUMPERS—ALL

1. To install, reverse above procedures making sure the front bumper is properly aligned with the front end sheet metal. Use shims if necessary.

2. Torque all face bar to attachment bar bolts 25 lb. ft. and all attachment bar to frame bolts 70 lb. ft.

NOTE: Always check headlight aim whenever any front bumper is removed or readjusted.

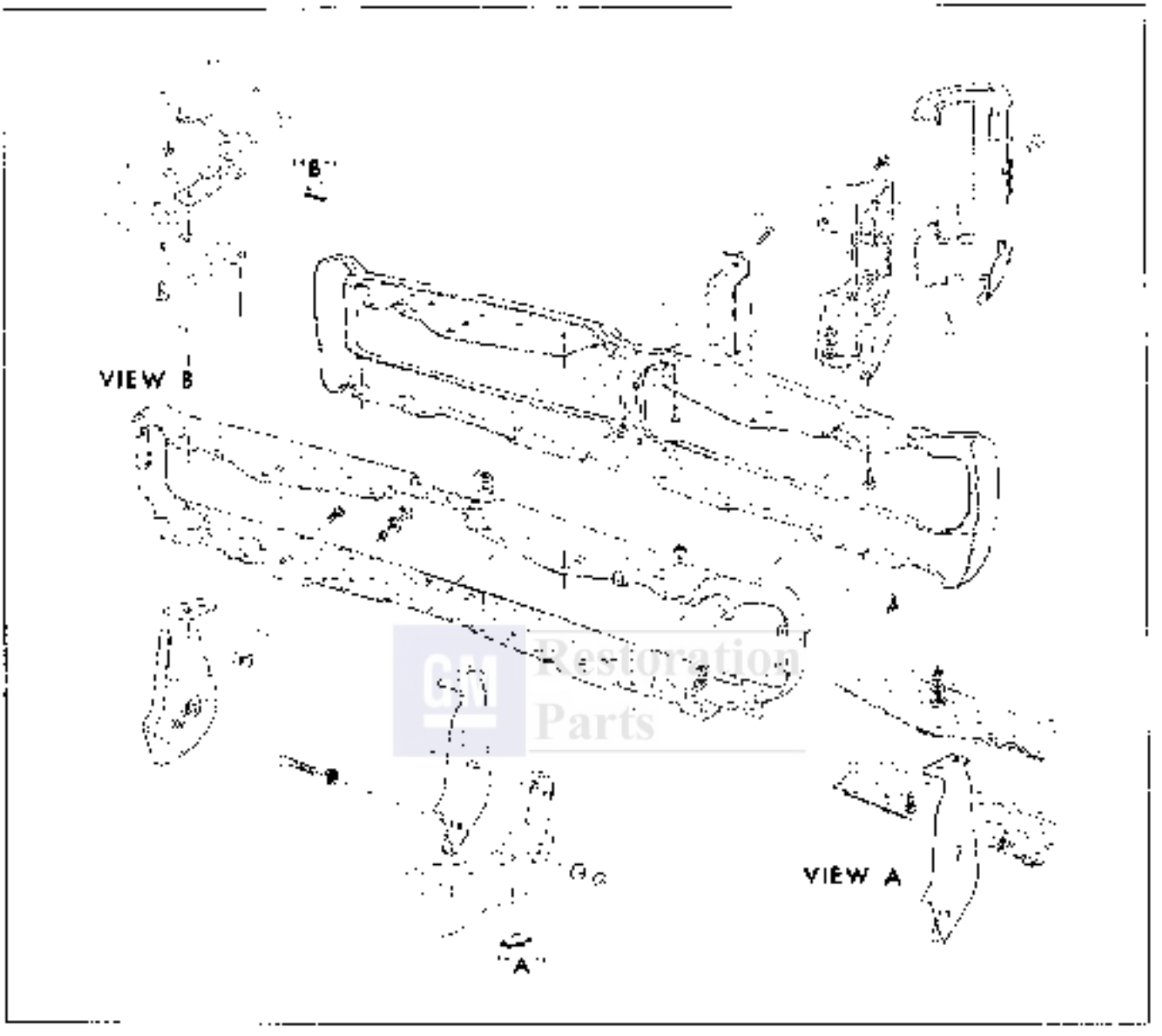


Fig. 14-1 Pontiac Front Bumper

REAR BUMPERS

All rear bumpers except on station wagon and Firebird contain a center opening for access to the gasoline filler. All Tempest models (except station wagons) and Grand Prix have taillight assemblies mounted in the bumper.

Shims may be required at the center hanger bar bracket where the face bar is mounted to prevent possible rattles.

REMOVE PONTIAC OR TEMPEST BUMPER (Figs. 14-11 thru 14-15)

1. Disconnect all lights contained in or attached to the bumper.

2. Support bumper; on Pontiac, loosen two forward frame attaching bolts and remove two rear bolts. On Tempest, remove all four bolts.

3. Remove face bar attaching bolts in license plate area.

4. Remove all face bar to frame attaching bars and braces, filler panel and lower valance panel (Pontiac only) and fuel filler door.

5. Remove taillight or back-up light assemblies.

REMOVE FIREBIRD BUMPER

1. Raise and support rear of vehicle (Fig. 14-16).

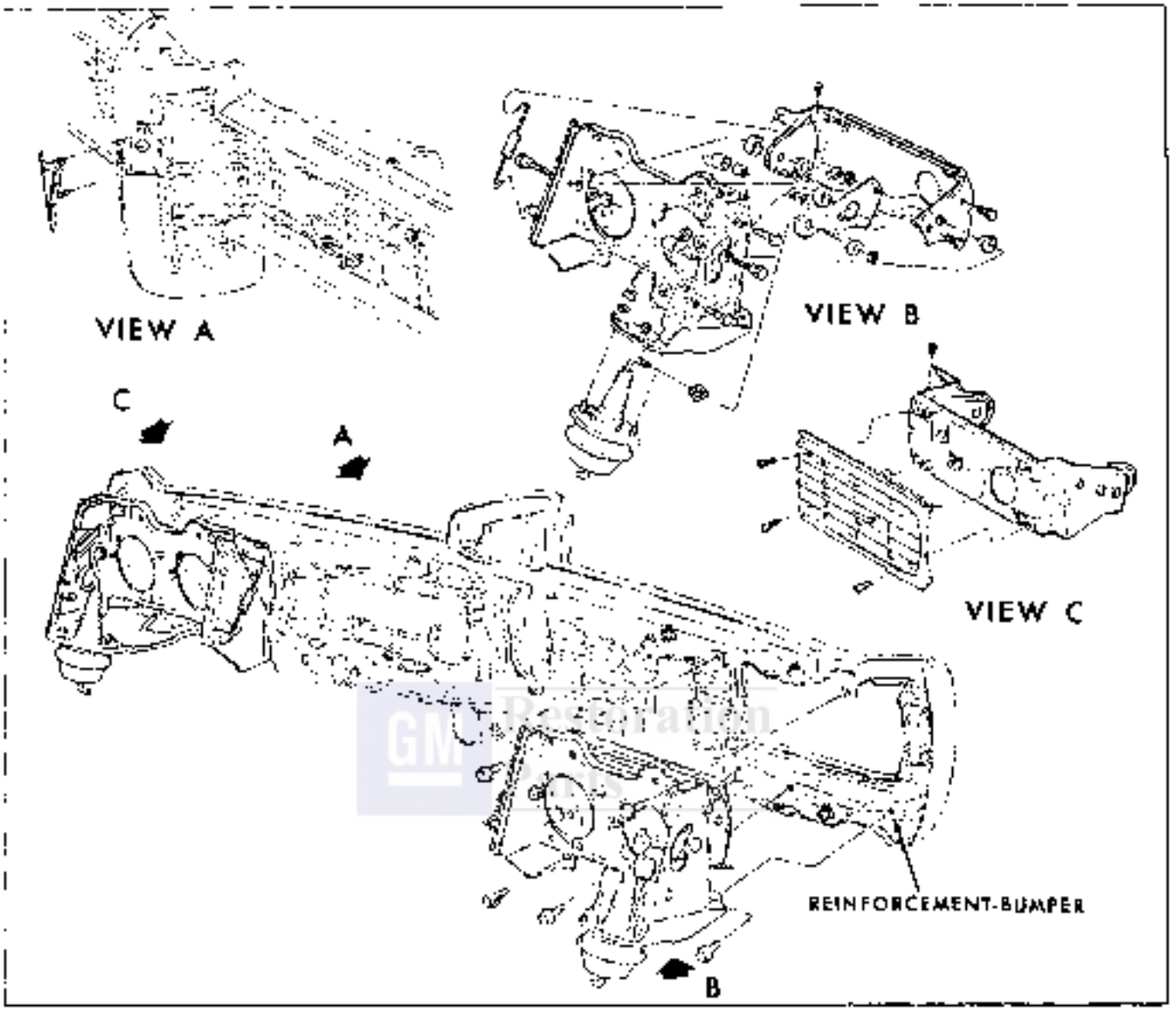


Fig. 14-2 Grand Prix Headlight Mechanism

2. Remove bolts securing rear attachment bars to frame and rear end sheet metal. Also remove bolts holding sheet metal attachment bars to rear quarters at each side.

NOTE: Remove dampers on convertible styles.

3. Remove screws securing license plate bracket to body and remove bumper from vehicle.

4. Remove license plate bracket from face bar using J 22413.

REPLACE BUMPERS—ALL

1. To install, reverse the above procedures making sure rear bumper assembly is properly aligned.

2. Torque all face bar to attachment bar bolts 17 lb. ft. and all attachment bar to frame bolts 25 lb. ft.

NOTE: If splash shields were removed at any time during the above operations, they must be replaced before installing bumper.

Apply a medium bodied sealer to all Firebird rear bumper bolts to prevent leaks at the body attaching points.

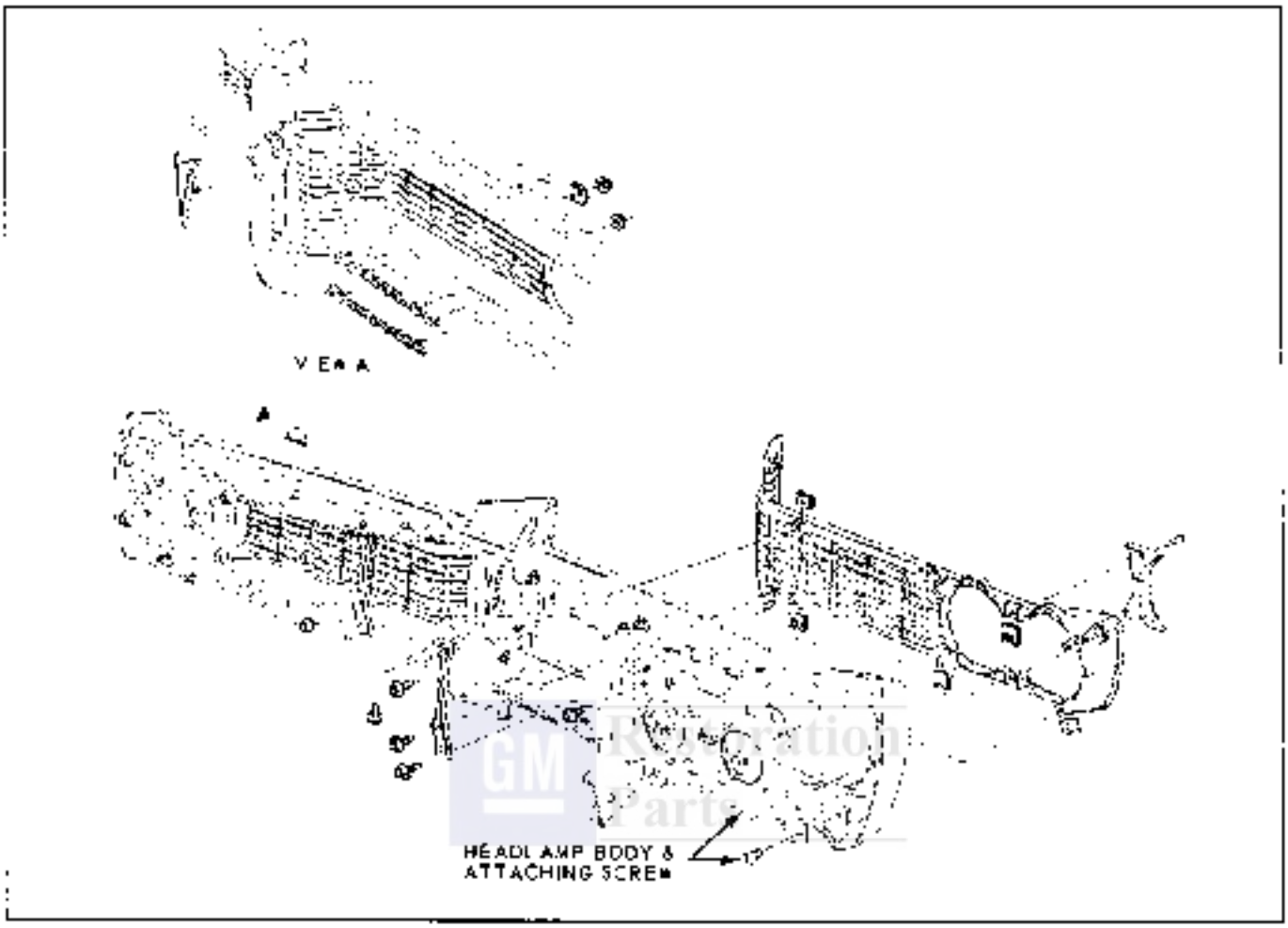


Fig. 14-3 Pontiac Grills

GTO ENDURA FRONT BUMPER REPAIR

DESCRIPTION

The new GTO Endura front bumper represents an extensive effort by stylists to design a bumper that appears as an extension of the car itself, rather than an add-on assembly.

In order to create this appearance, the bumper is painted to match body color. It is constructed of a resilient urethane closed-cell foam, bonded to a steel base. The foam is primed and painted with an elastomer-base material of equal resilience as the foam base.

Selection of the base material and paint finish was influenced by the need for a bumper that would absorb a reasonable amount of isolated impact and recover its original shape. Such impact is characterized by the type that causes unsightly dimples and dents in steel bumpers.

The new bumper material will withstand minor impacts and the resultant damage such as occur in parking lots by recovering its original shape. The paint film responds to impact in a similar manner without cracking or splitting. In addition, the paint finish may be polished for removal of surface marks as with an acrylic paint film. If, however, an area of damage in the bumper does not recover its shape, or the surface is gouged, a repair system has been developed to restore the original shape and appearance of the foam base material.

The repair sequence amounts to a filling operation with a flexible epoxy resin. After curing, the patch is dressed to conform to the surrounding contour. The refinish operation includes application of a glazing compound which, after drying, is sanded smooth, followed by the color coats and clear top coats. The application and refinishing methods employed with this material conform to generally known

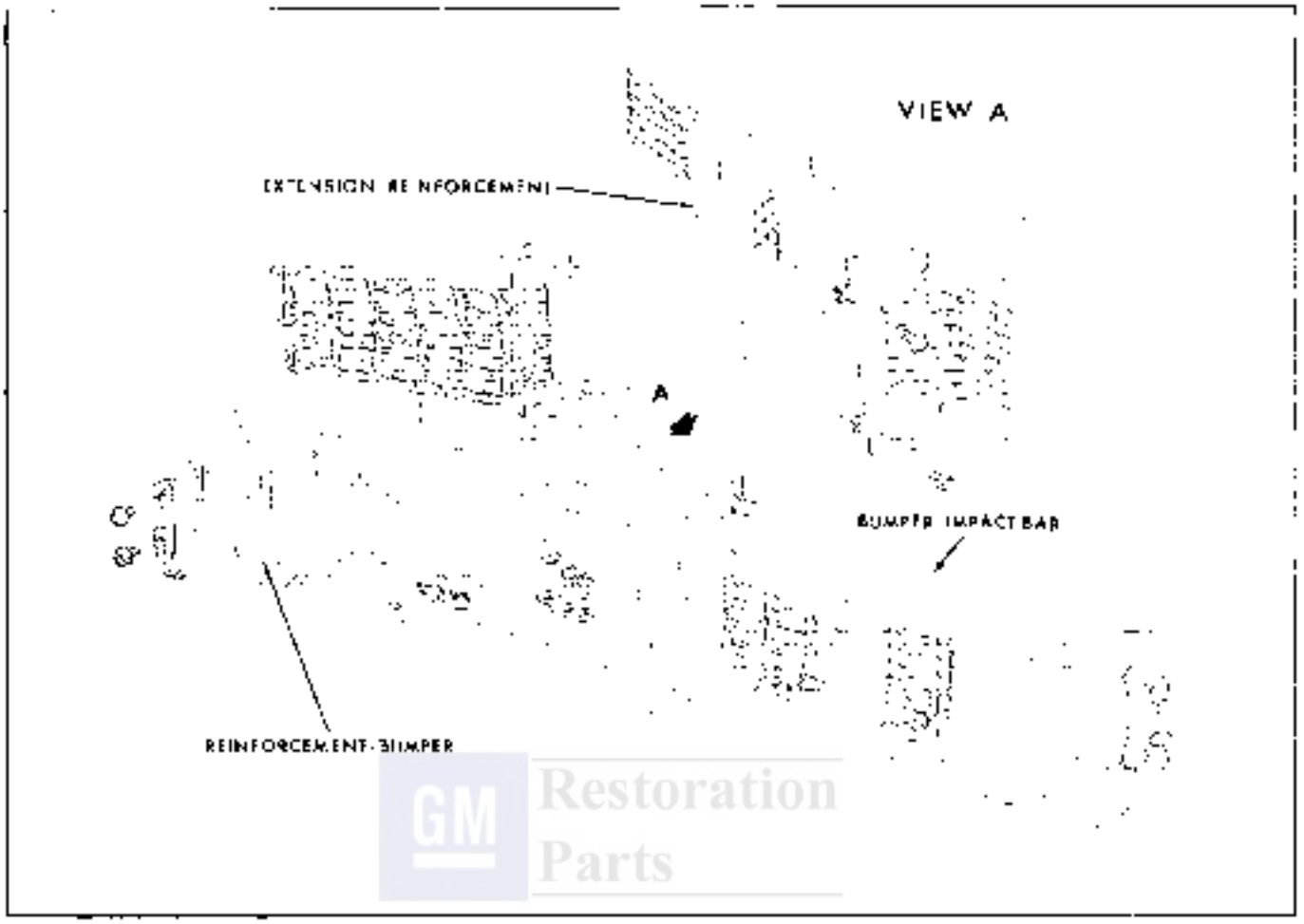


Fig 14-5 Cloth Fix Grille

and accepted existing methods -- only the material is different.

REPAIR PROCEDURE

a. FILLING

Material:
Part A - Flexible Resin
Part B - Resin Hardener

Equipment:
Putty Knife
Squeegee
Heat Lamp(s)
#220 & #400 Sandpaper
DA Sander w/#80 Discs
Body File w/Holder

1. Clean the repair area with a wax, grease, and silicone removing solvent. With a DA sander adjusted to a feathering action and fitted with a #80 grit disc, remove the paint film in and surrounding the area to be filled. This is necessary because the patching compound will adhere only to the foam base material.

2. If the surface to be repaired is cut or gouged, use the DA sander and a clean disc to enlarge the cut or gouged area(s). This must be done to ensure removal of grease, oil, or dirt from the area to be contacted by the repair material. This action should also taper the edges of the cut to minimize the possibility of highlighting the repair.

3. Mix the patching compound and hardening agent at the prescribed proportion (10 to 1). The patching compound and hardening agent should be mixed until a uniform color is achieved.

4. Fill the repair area with the mixed compound to a height slightly above the surrounding contour. Work out air bubbles, if present.

NOTE: Thinly spread the remaining mixture on a clean, hard surface to lengthen pot life. This may be used later on the cured patch for repair of pin holes.

5. Place a heat lamp approximately 15 inches from the patched surface for 15 to 30 minutes, or until the repair material will not transfer to the touch.

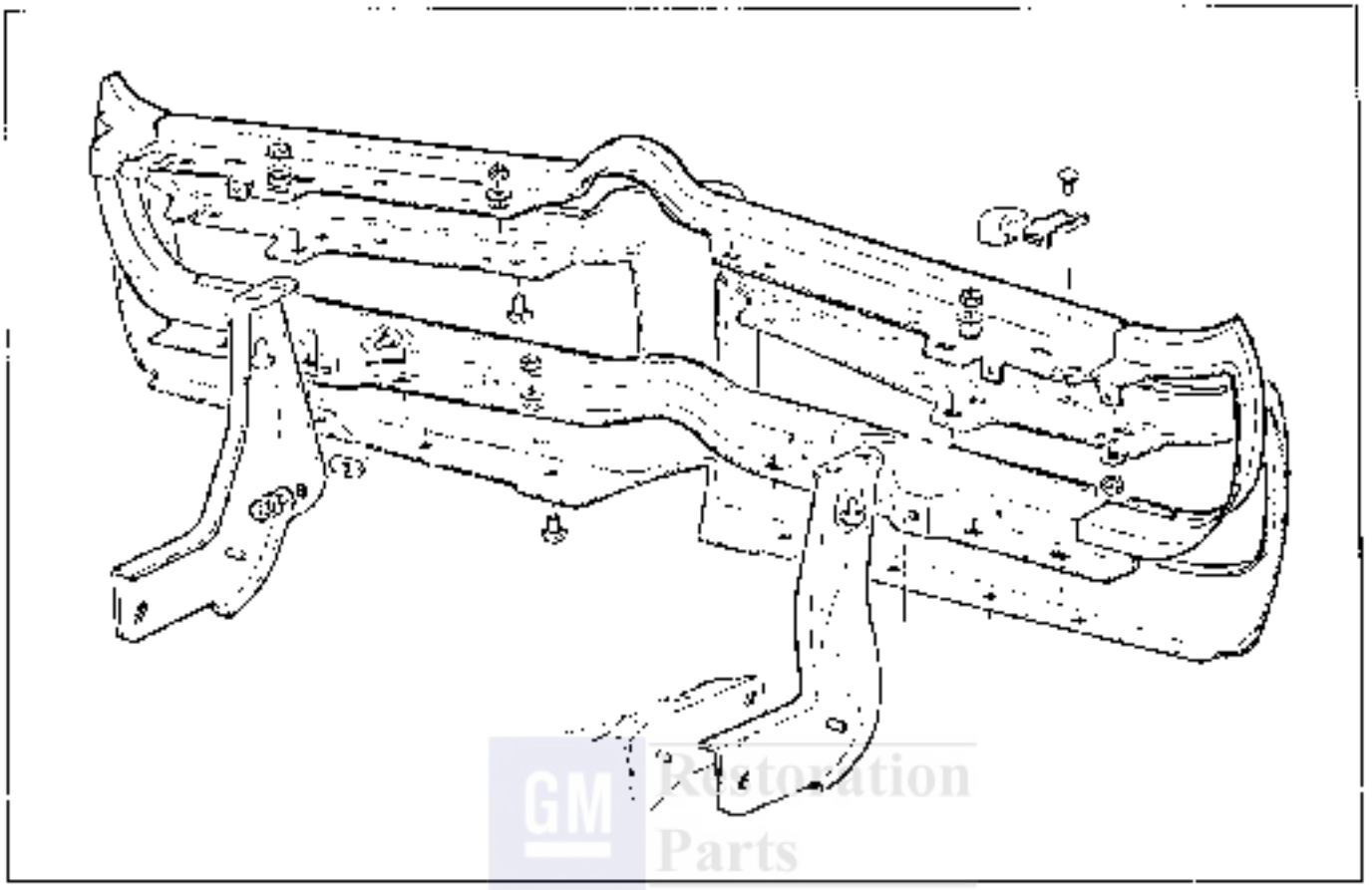


Fig. 14-2 Tempest Front Bumper

6. Remove the heat lamp and allow the patch to return to room temperature. The repair mix will harden with cooling.

7. Dress the patch to contour with a curved-tooth body file, followed by sanding with #220 sandpaper and block.

CAUTION: The cured repair material is slightly harder than the original foam and may easily be undercut.

8. If the patch is uneven or porous, repeat steps 4 thru 7.

b. REFINISHING

Refinishing the patched area amounts to no more than a standard paint procedure. Under no circumstances, however, should regular paint materials be used in refinishing this bumper. As mentioned earlier, the glaze coat, color coats, and clear top coats that are to be used are specially formulated with an elastomer vehicle so that the cured film may bend under impact without cracking or splitting.

Material:
- Glazing Compound
- Color
- Top Coat Clear
- Thinner
- #220 and #400 Sandpaper

Equipment:
- Suction Spray Gun with same nozzle and air cap combination used for acrylic application

1. Featheredge the repair area by dry-sanding with #220 sandpaper followed by #400 grit sandpaper.

2. Thoroughly mix the glazing compound and spray-apply the material in the same manner as PX primer-surfacer. Apply two or three coats, allowing flash-time between coats.

3. Allow 15 to 30 minutes drying time at room temperature. When dry, water-sand the glazed area with #400 sandpaper. Block-sand for maximum leveling.

NOTE: Dry-sanding clogs the sandpaper due to the elastomer-type vehicle used in the compound.

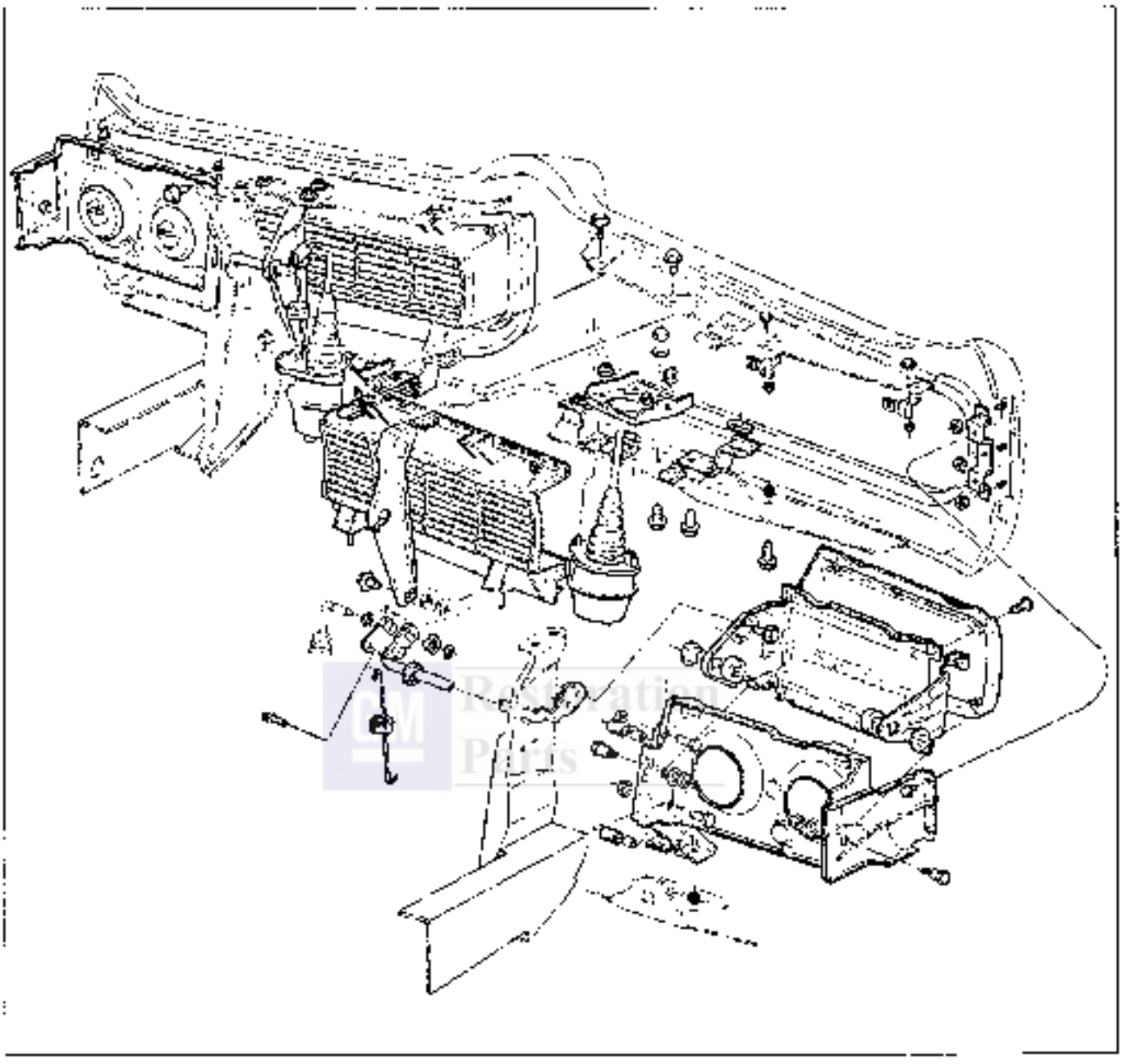


Fig. 14-6 GTO Headlight Mechanism

4. Re-clean the repair area with a final solvent wash.

5. Thoroughly stir the color and apply in sufficient quantity to achieve hiding only--one dry coat followed by a wet coat.

NOTE: If mottling occurs, the metallic color control method of color application corrects this problem.

6. Blend the perimeter of the patch with the special thinner provided with the material. Use standard blending techniques after each color coat.

7. Allow the color to dry 5 to 10 minutes at room temperature.

8. Thoroughly mix and apply the top coat clear, using two coats as done previously with the color.

CAUTION: Wet application of clear coats causes considerable darkening of the color.

Wetness of clear coats is dependent upon the amount of color-darkening required to achieve a match. If application of clear coats over a spot repair creates an objectionable mis-match, the entire bar may be coated with clear material.

9. Air-dry of the clear coats require 8 hours at room temperature. Force-dry is recommended for 1/2 hour at 150° - 170°F.

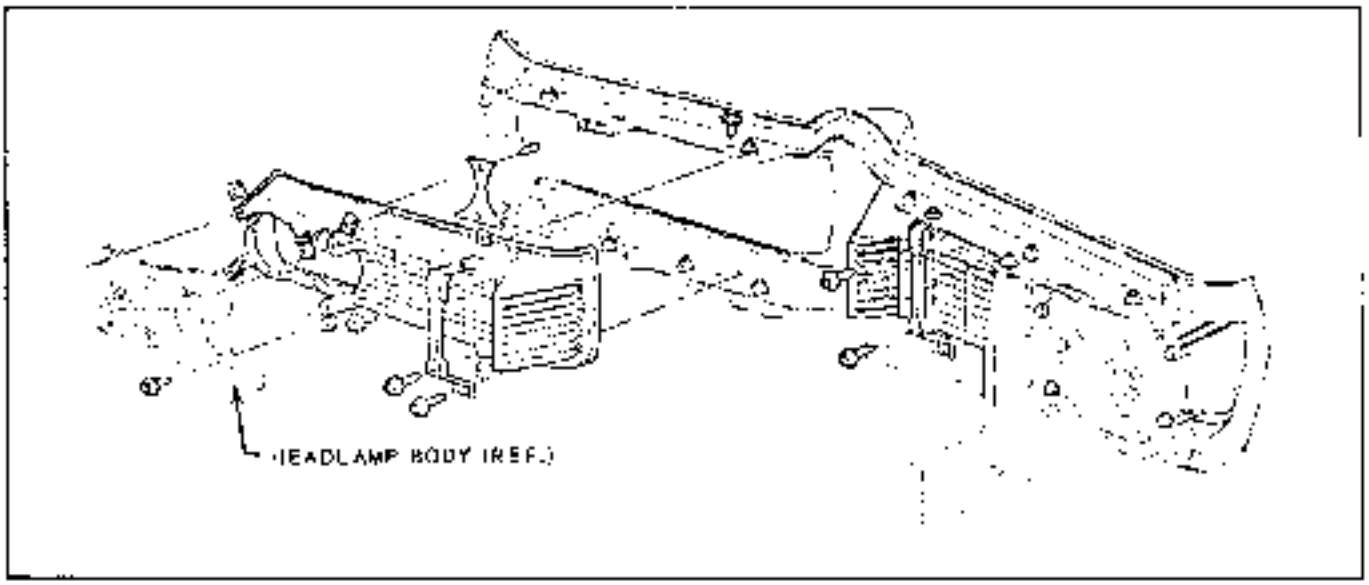


Fig. 14-7 Tempest Grille

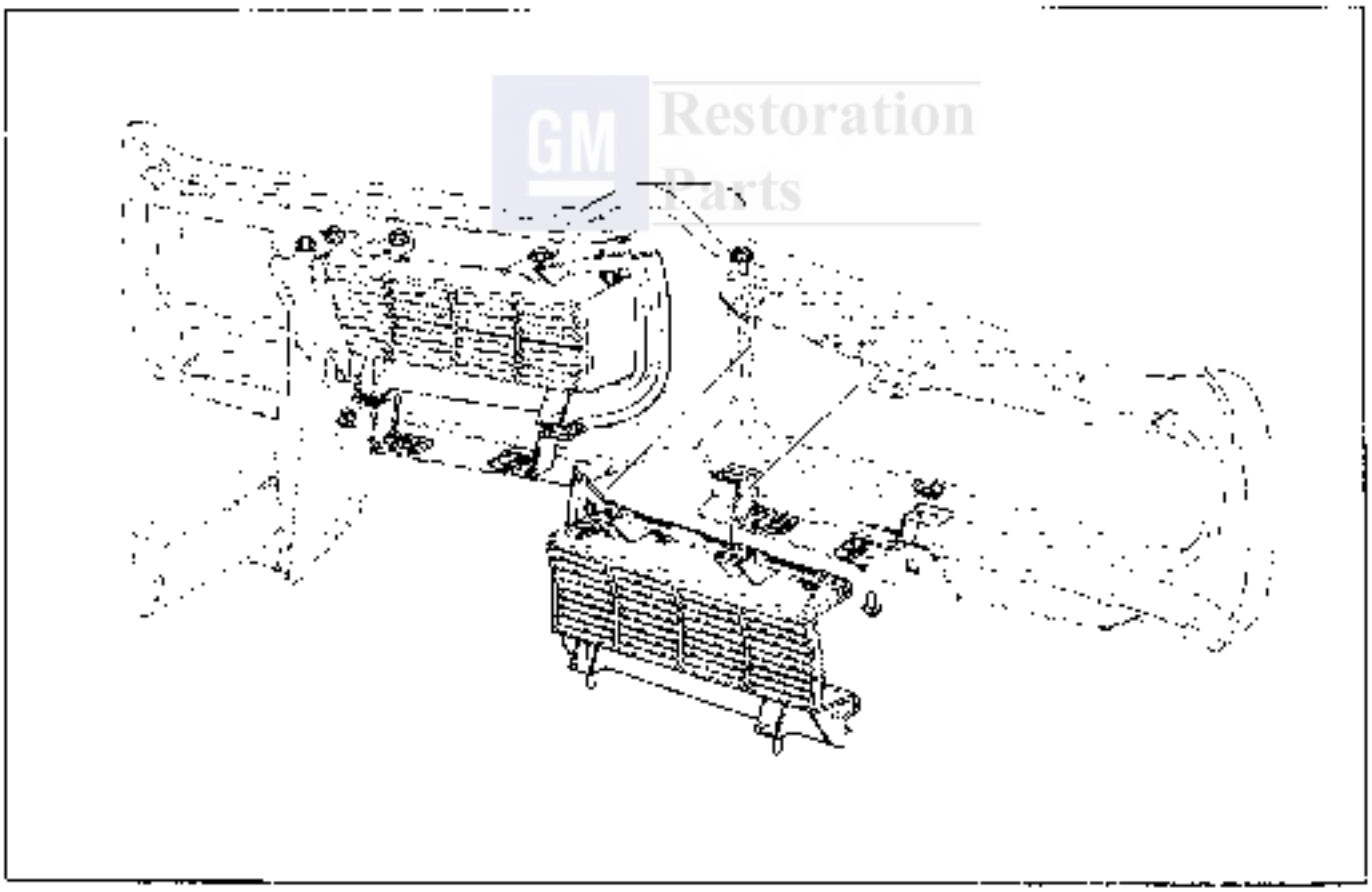


Fig. 14-8 GTO Grille

10. Compounding reduces the gloss, for this reason, rubbing compound should be used only if a reduction of gloss is desired

NOTE. In using this material, the following cautions should be noted:

. . . All the bumper refinishing materials are packaged at spraying viscosity. Only if "misting" occurs during application will additional reduction be necessary.

. . . Reduce these refinish materials with the special thinner only -- never use acrylic thinner.

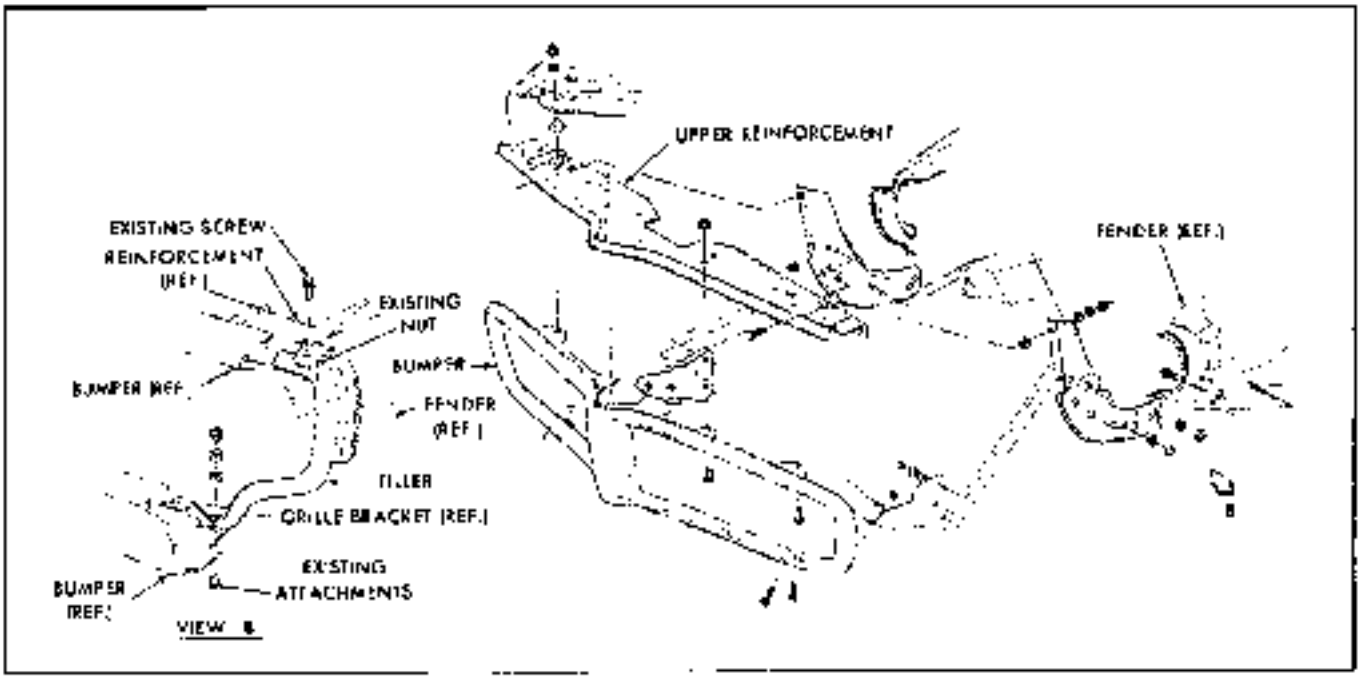


Fig. 14-9 Firebird Front Bumper

. . . The top coat clear material has a tendency to yellow if subjected to prolonged, elevated temperatures (300°F).

. . . The clear coat tends to soften the color over which it is applied. For this reason, premature feathering (within 24 hours) of an enamel film, as an overlap of a previously repaired area, will tend to pull the color off the surface.

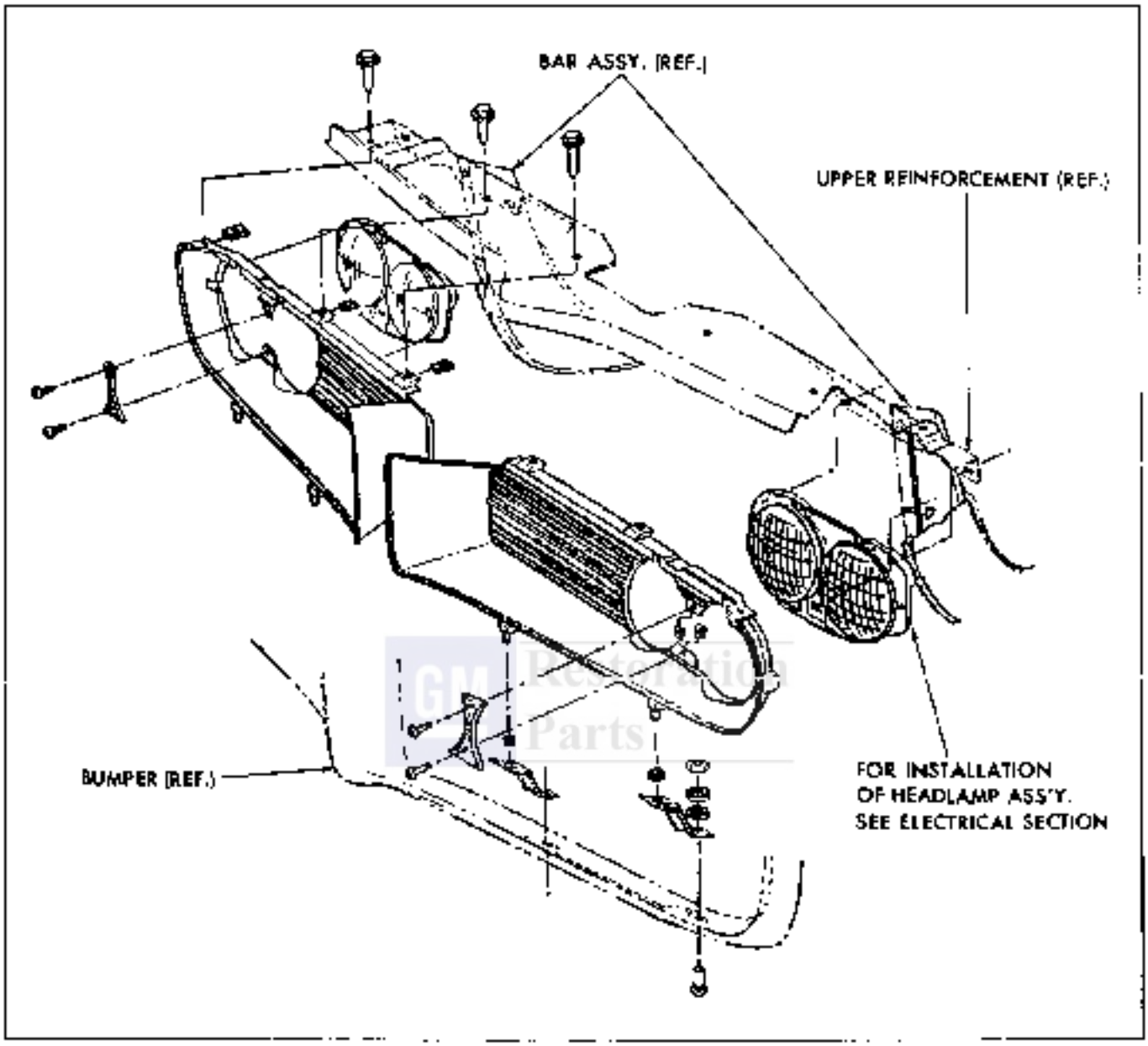


Fig. 14-10 Firebird Grille

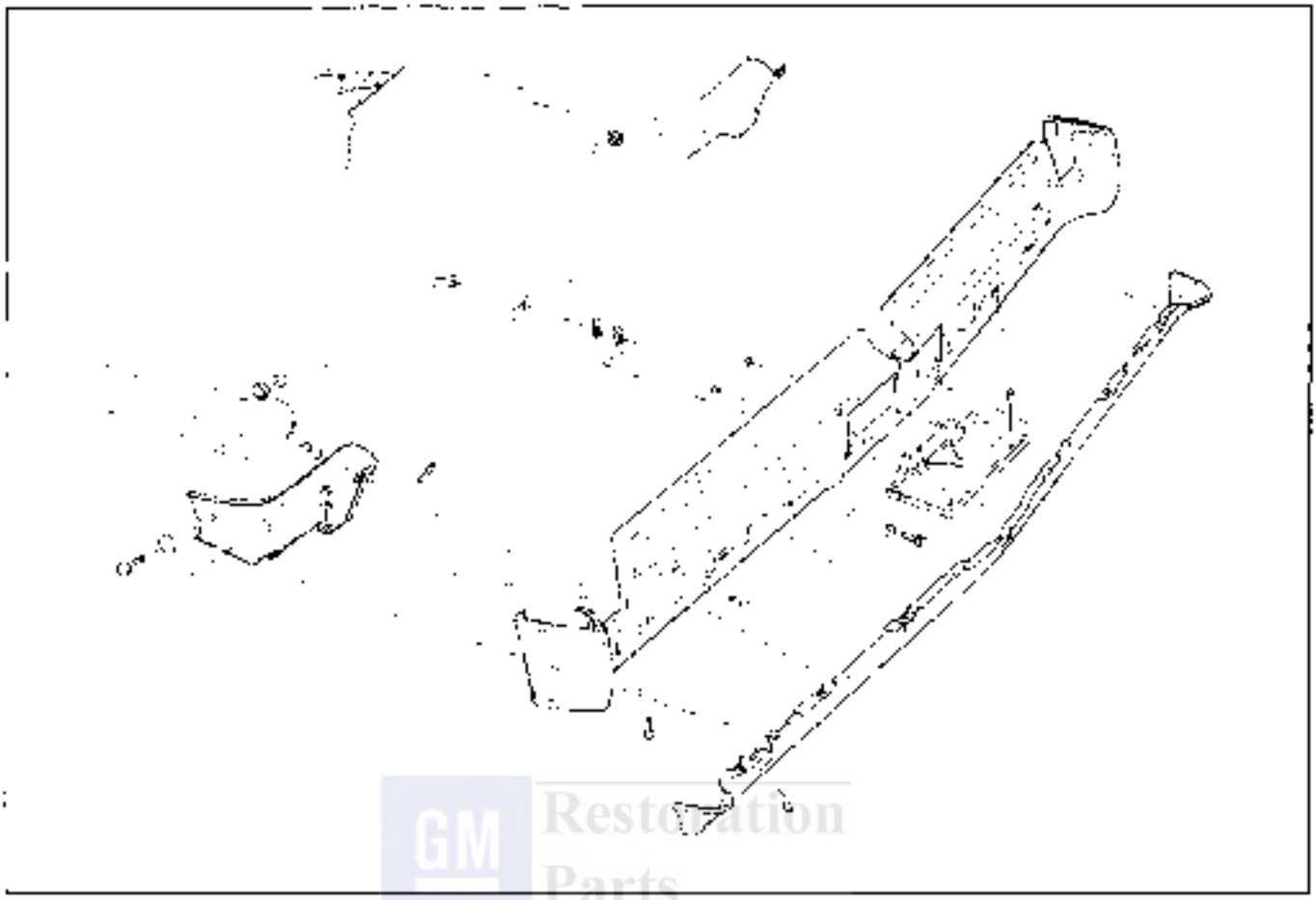


Fig. 14-11 Removing Rear Bumper (Exc. Sta. Wag.)

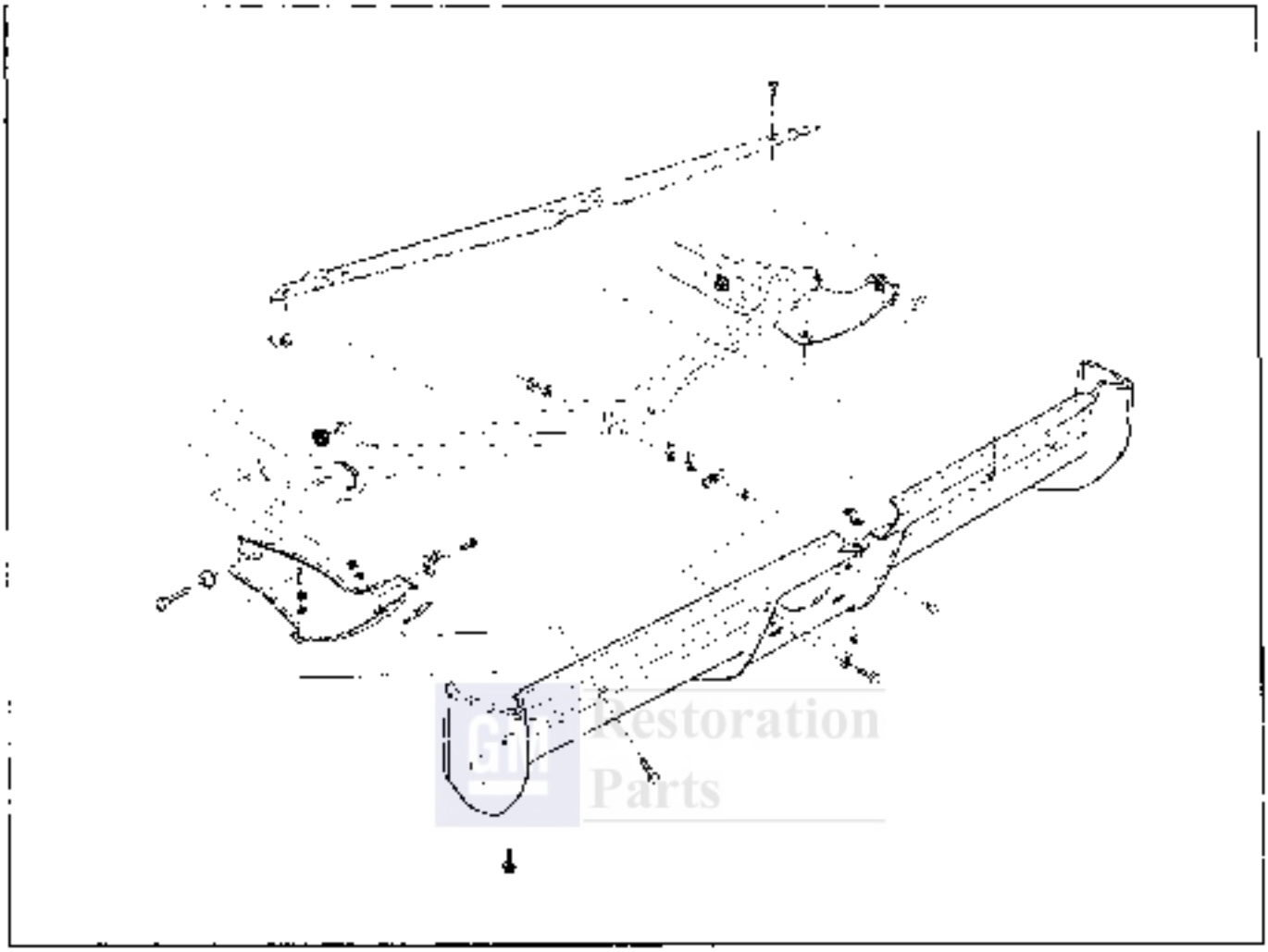


Fig. 14-12 Pontiac Sta. Wag. Rear Bumper

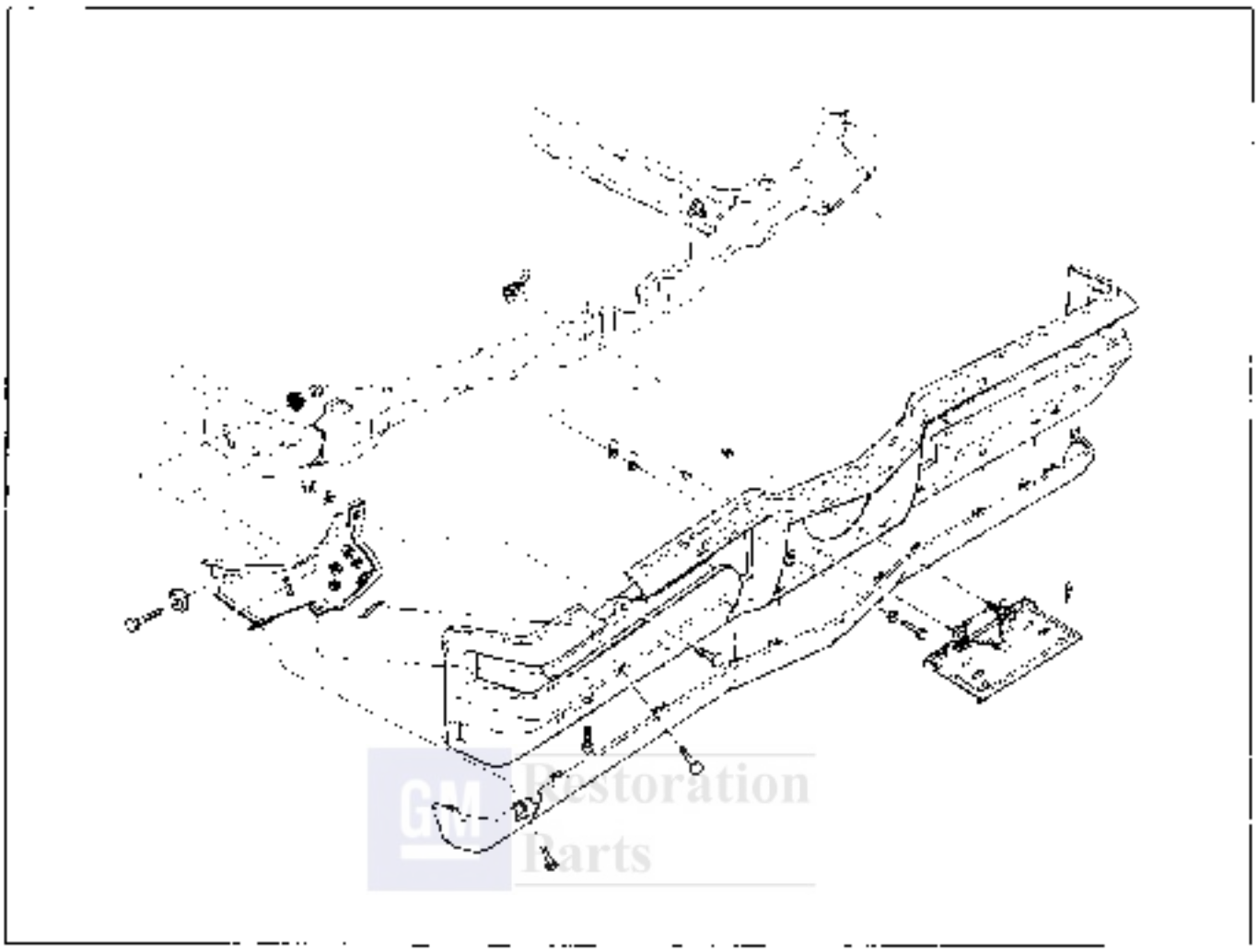


Fig. 14-13 G.P. Rear Bumper

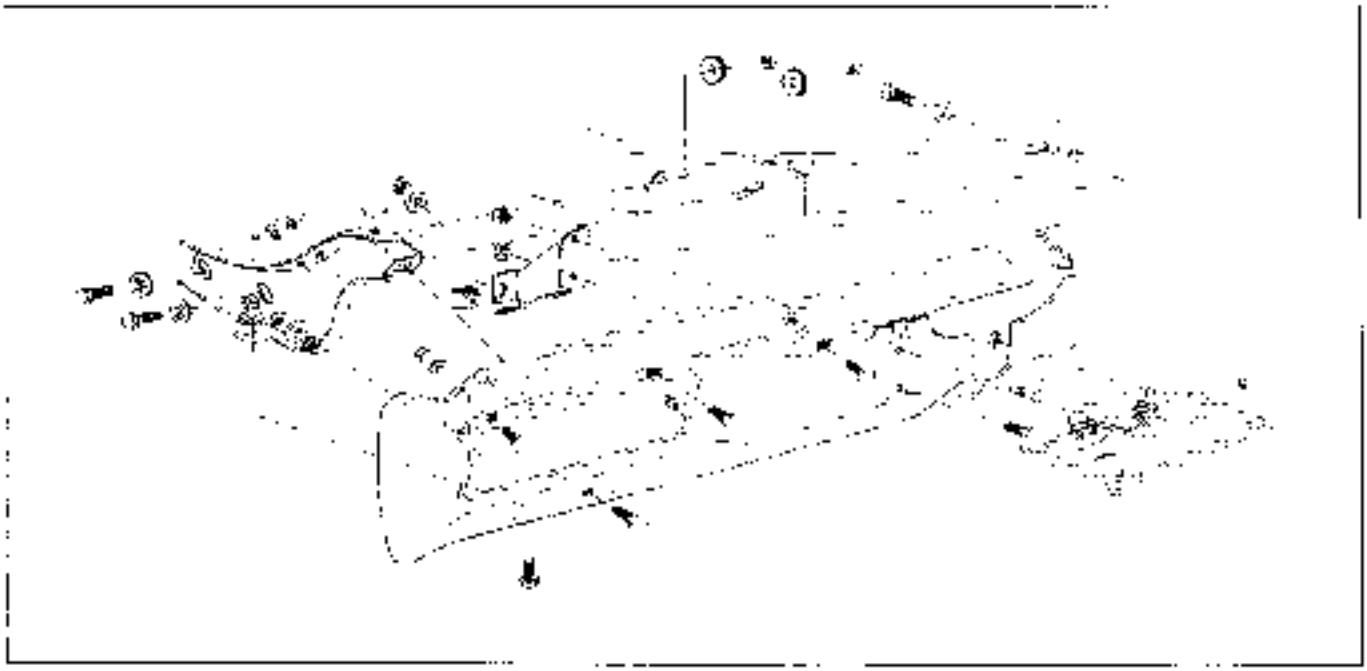


Fig. 14-14 Tempest Rear Bumper (Exc. Sta. Wag.)

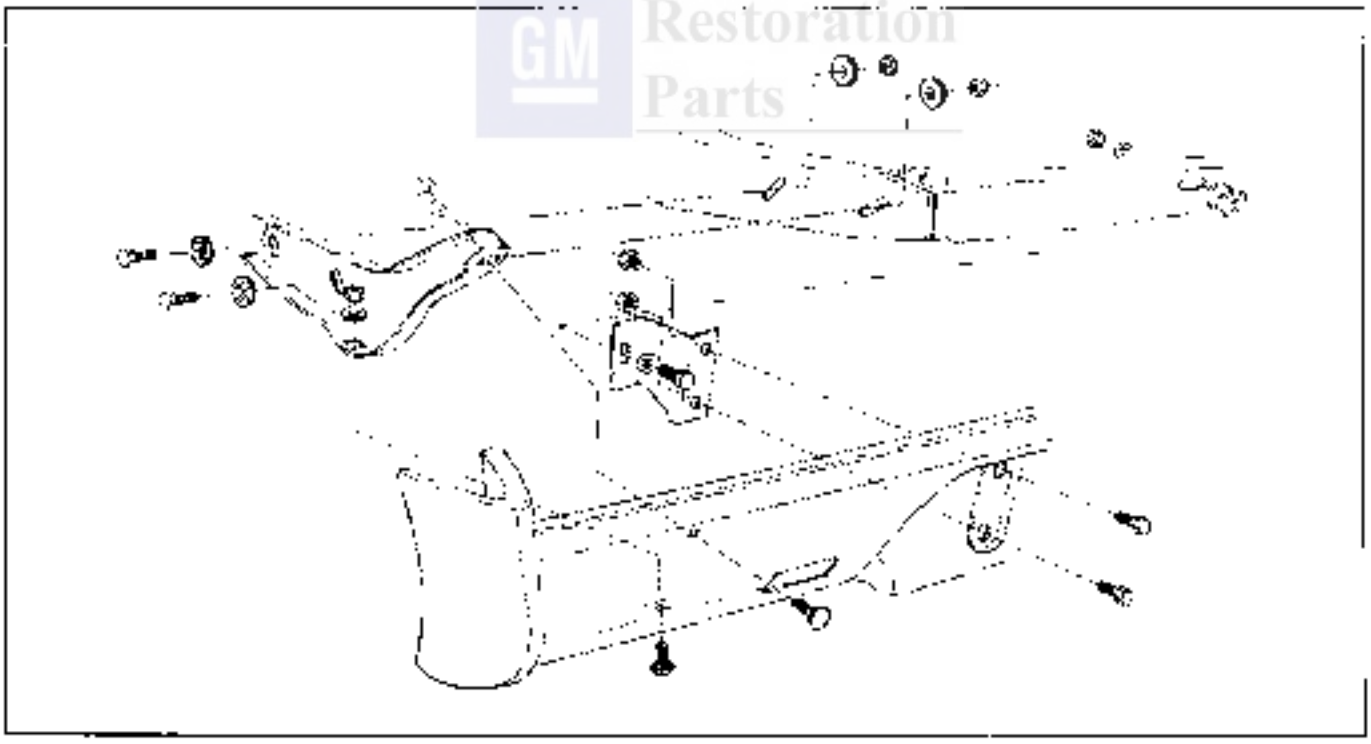


Fig. 14-15 Tempest Sta. Wag. Rear Bumper

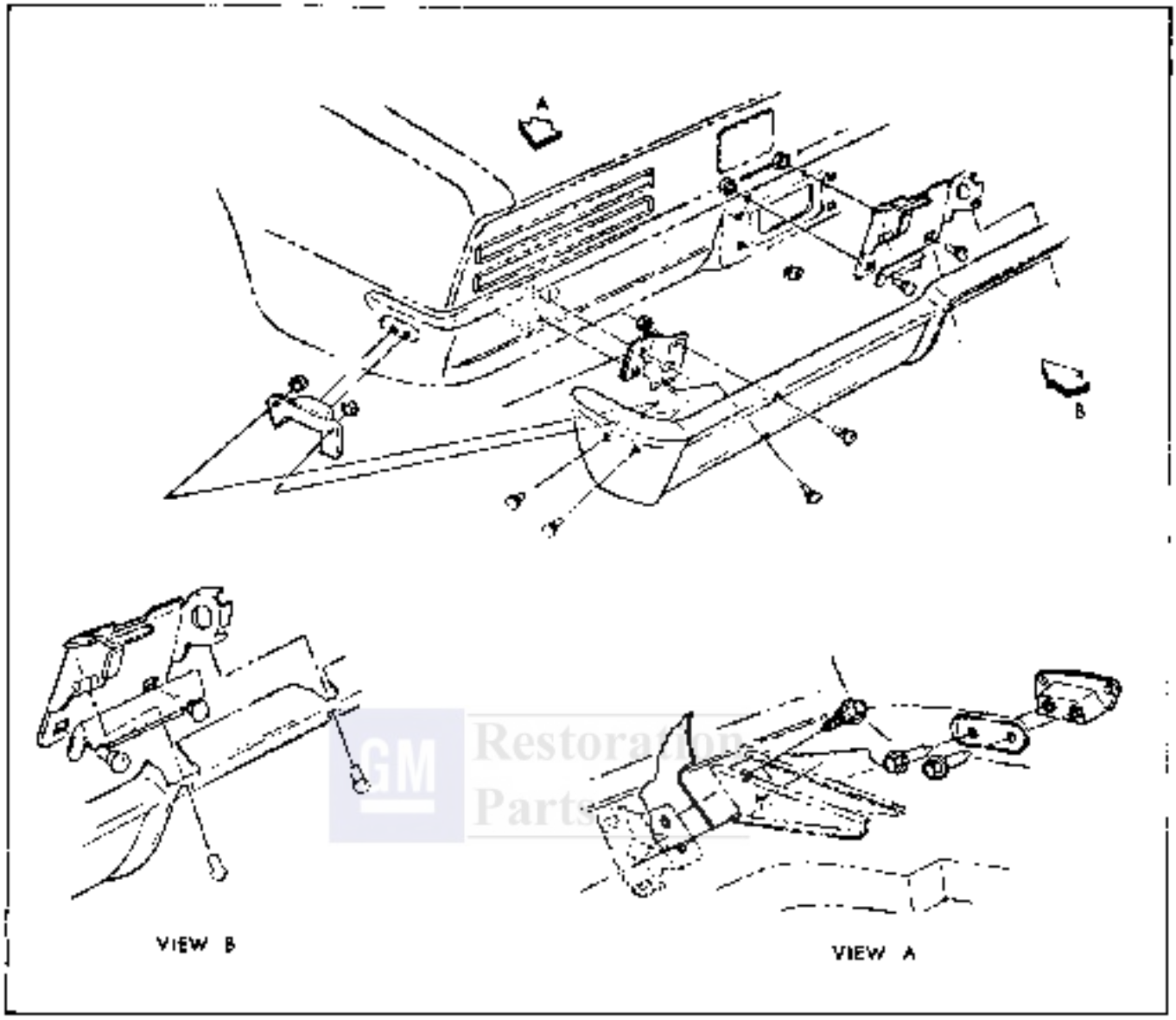


Fig. 14-16 Firebird Rear Bumper

ACCESSORIES

CONTENTS OF THIS SECTION

CRUISE CONTROL

CHAIN LINKAGE ADJUSTMENT

1. Start engine and set carburetor to hot idle position.

2. Thread bead chain thru hole in carburetor lever extension (Fig. 15-1).

3. Adjust bead chain (at extension) to provide minimum chain slack and assemble clip to extension by straddling extension.

4. A minimum of two beads must extend outside of clip after adjustment of chain and installation of clip. Cut off excess chain.

BRAKE RELEASE SWITCH ADJUSTMENT (Fig. 15-2)

PONTIAC AND TEMPEST

Apply brake pedal and push both switches forward as far as possible. Pull pedal forcibly rearward to adjust switches.

FIREBIRD

While holding brake pedal rearward, adjust switches so that plungers are fully depressed against arm.

CENTERING SPRING ADJUSTMENT (Fig. 15-3)

1. If Cruise Control holds speed three or more mph higher than selected speed, turn centering spring adjusting screw (C) clockwise 1/8" turn or less.

2. If Cruise Control holds speed three or more mph below selected speed, turn centering spring adjusting screw (C) counterclockwise 1/8" turn or less.

CAUTION: Do not loosen adjustment screw (B). See below under Disassembly.

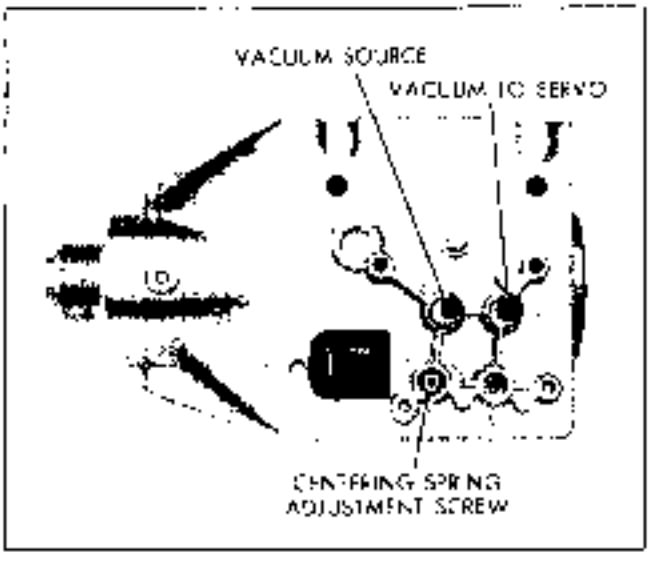


Fig. 15-3 Adjustment Screw Identification

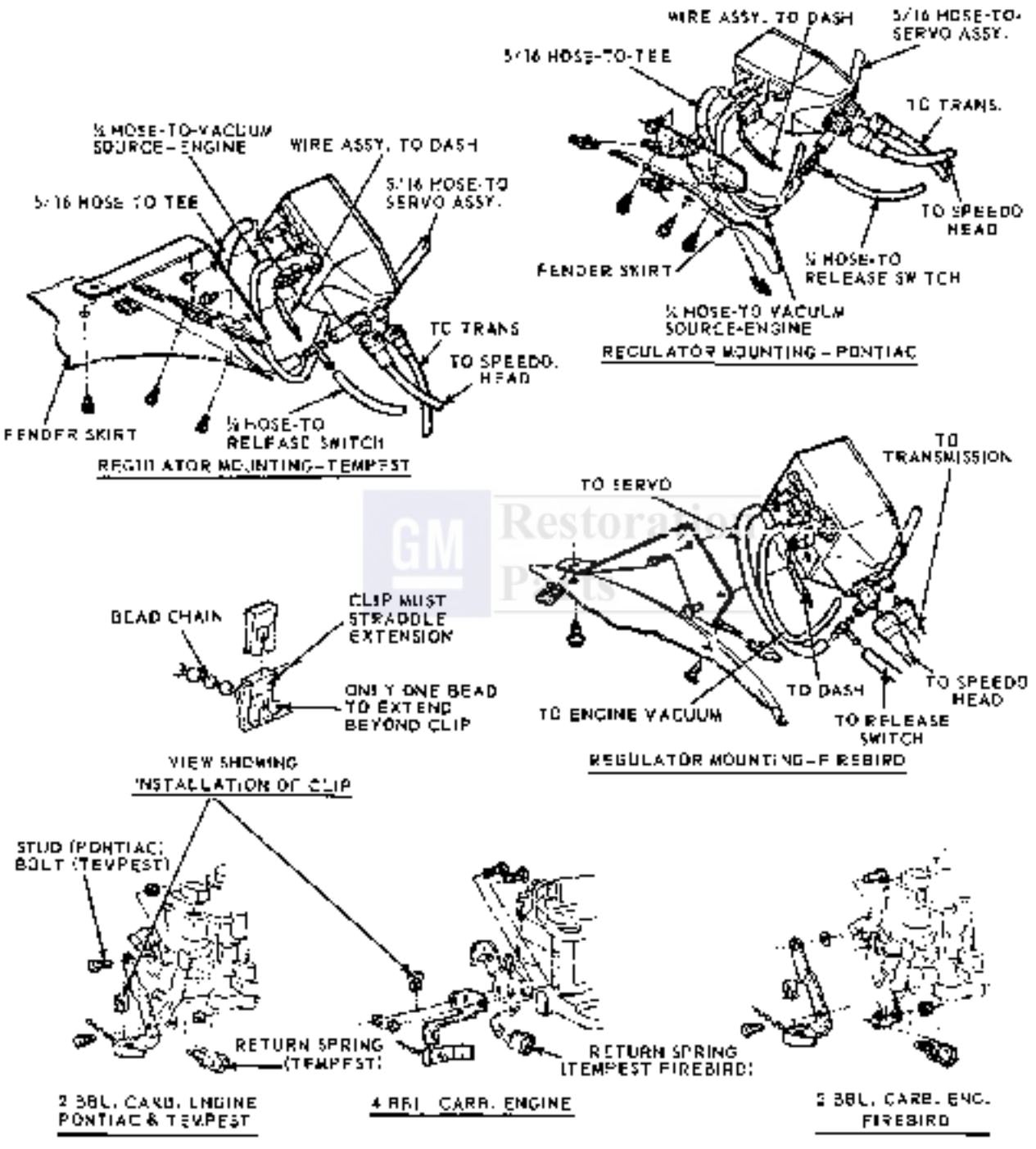


Fig. 15-1A Cruise Control Installation

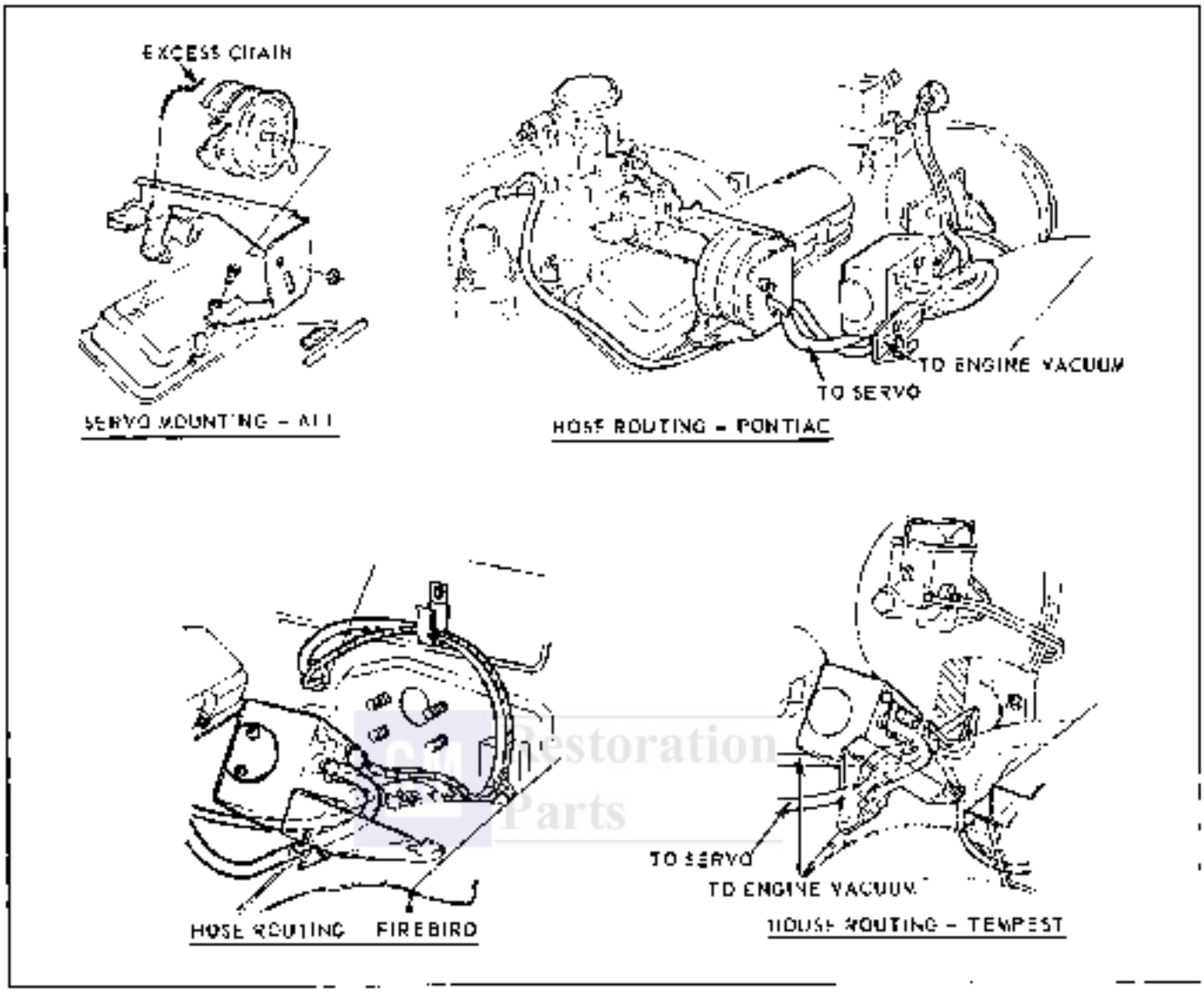


Fig. 15-18 Cruise Control Installation

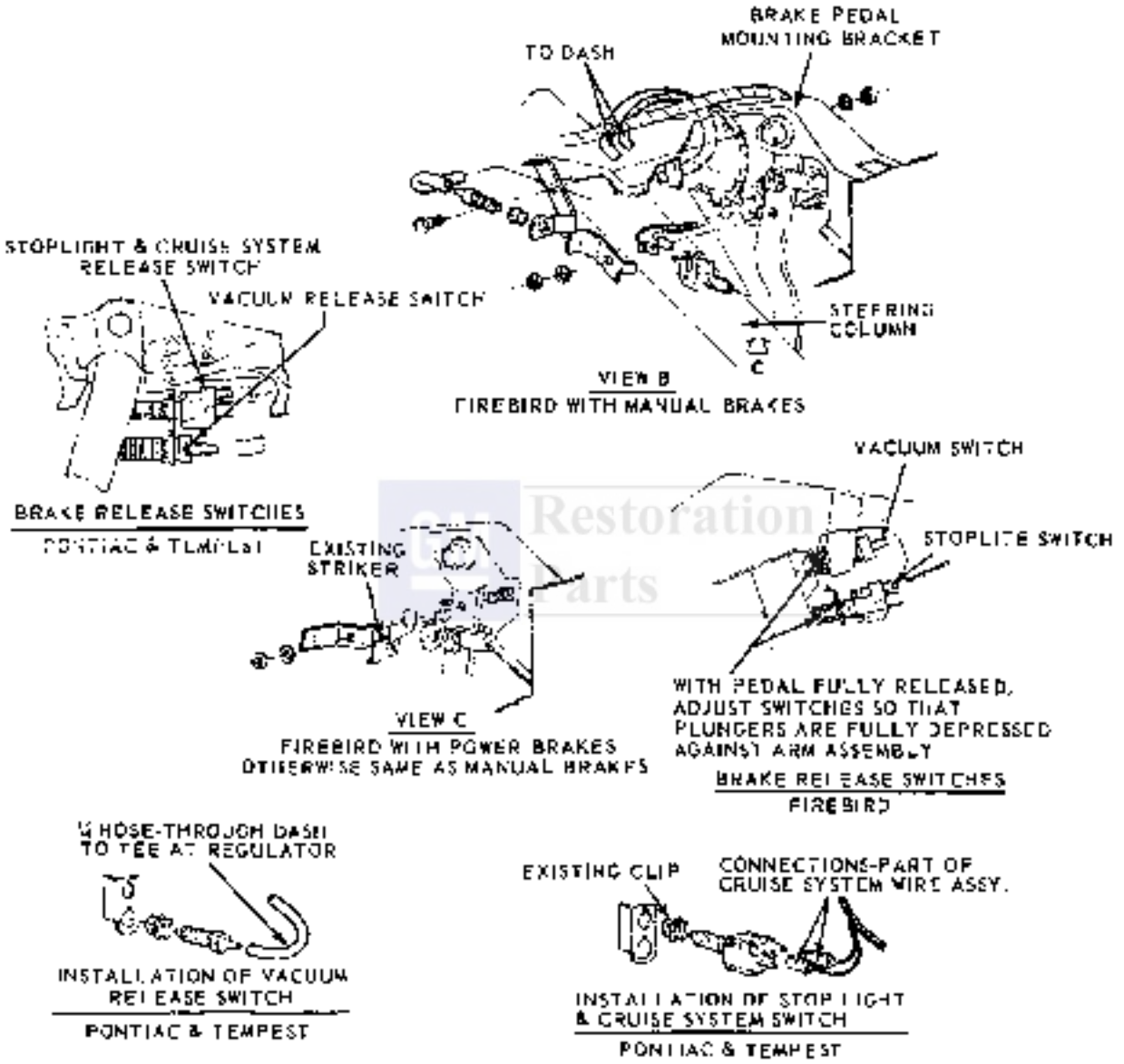


Fig. 15-2A Electrical Wiring and Vacuum Switch

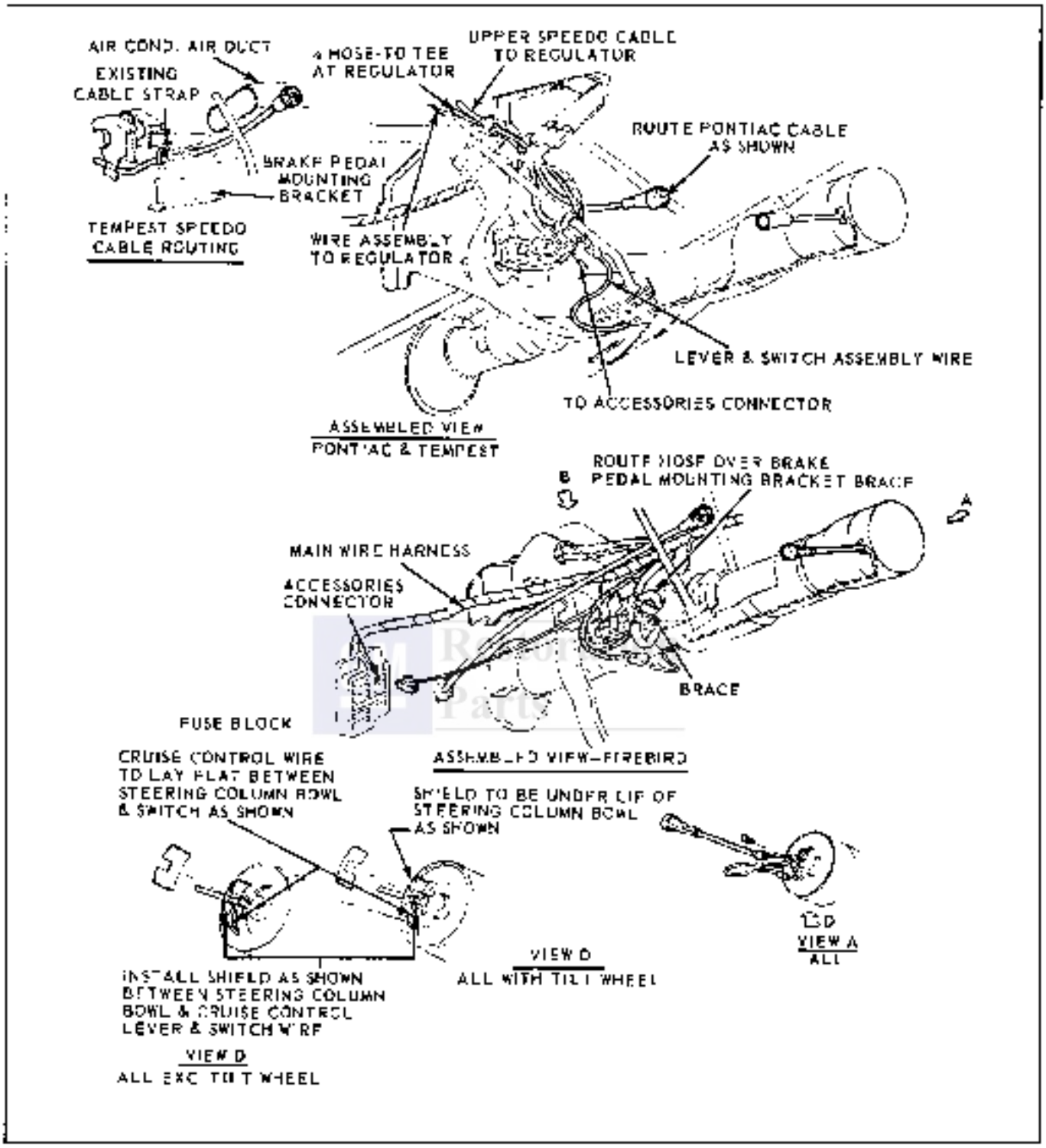


Fig. 10-23 Electrical Wiring and Vacuum Switch

CHECKING FOR DAMAGED CABLES AND GEARS

1. Raise rear of car and place on jack stands.

2. Start engine and move transmission shift lever to "Drive" range.

3. Remove input cable at regulator to determine if cable from transmission or regulator is turning. If cable is not turning, check for broken cable or stripped transmission speedometer gear.

4. If input cable is turning and speedometer was inoperative, cable to speedometer or regulator driven gear is broken.

REGULATOR

REMOVE AND REPLACE (Fig. 15-1)

1. Disconnect vacuum hoses and electrical connector.

2. Disconnect both speedometer cables.

3. Remove screws holding regulator to fender skirt and remove regulator.

4. To replace, reverse above steps. Note proper hookup of vacuum hoses shown in Fig. 15-4.

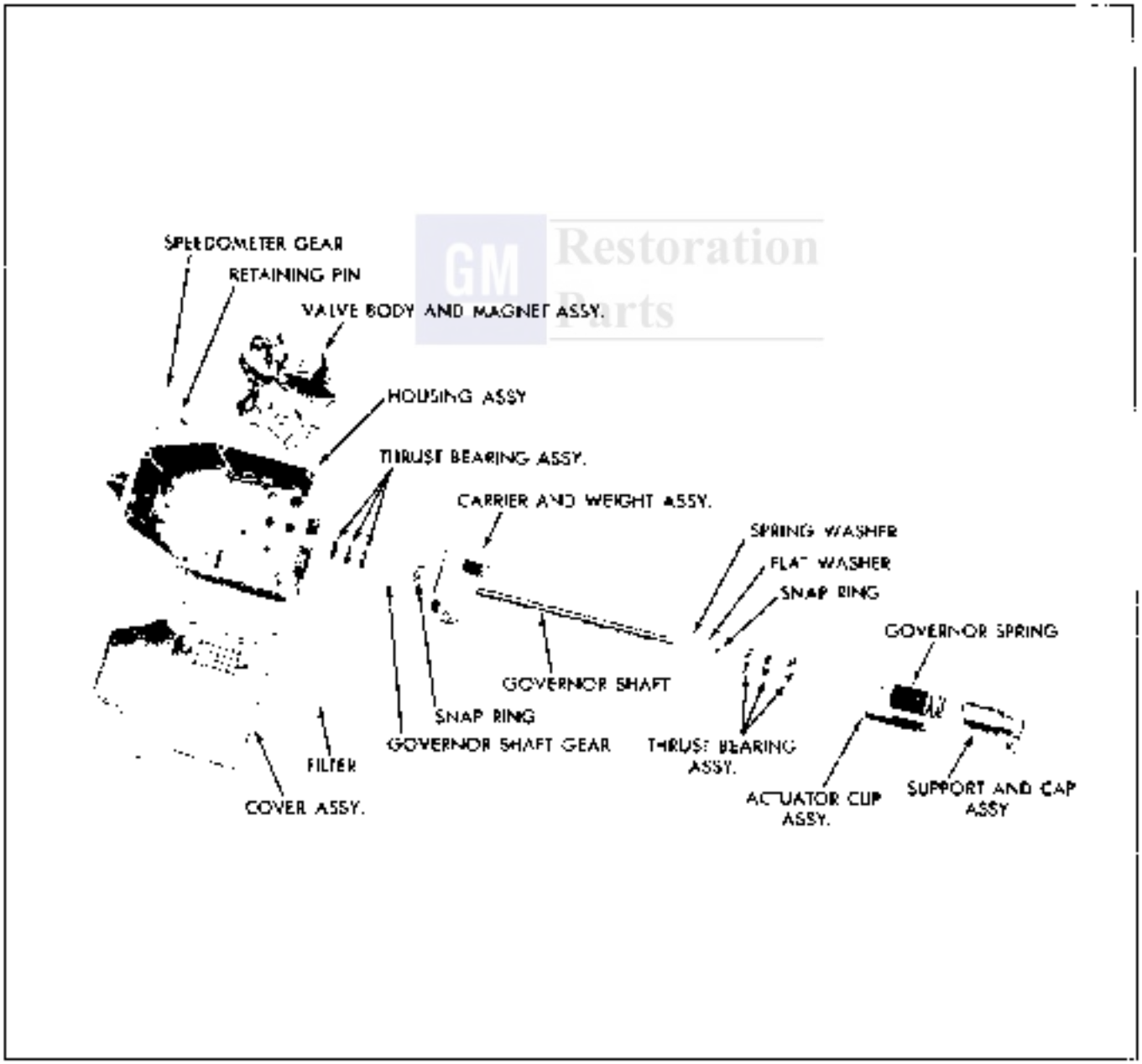


Fig. 15-4 Exploded View of Regulator

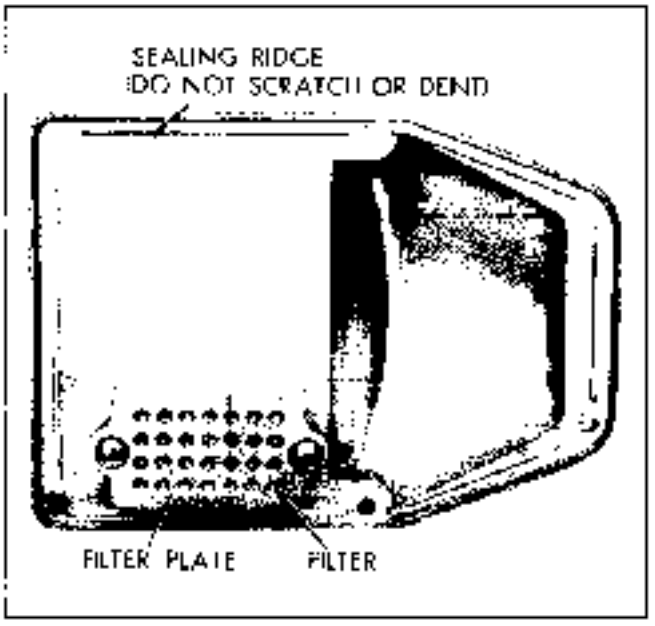


Fig. 15-5 Cover and Intake Filter Assembly

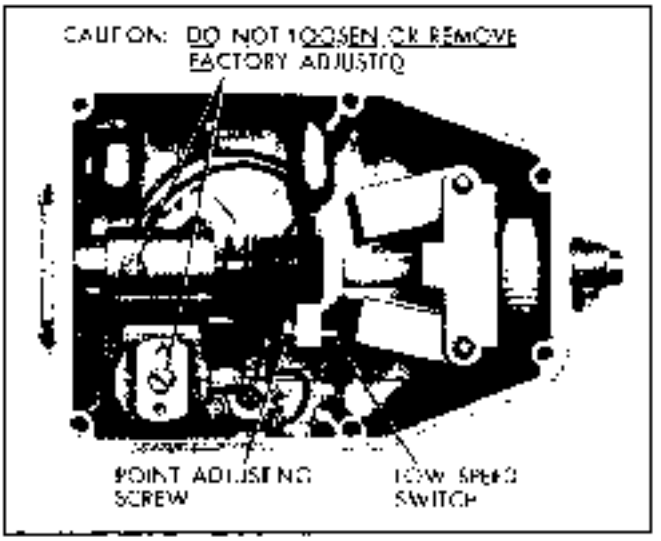


Fig. 15-6 Adjusting Low Speed Switch

DISASSEMBLY (Fig. 15-6)

NOTE: Do not tamper with the following screws (Fig. 15-6).

1. Vacuum restriction screw in the regulator housing.
2. The screw in the bearing support assembly.
3. The screw on top of the solenoid coil.

These screws are preadjusted at the factory.

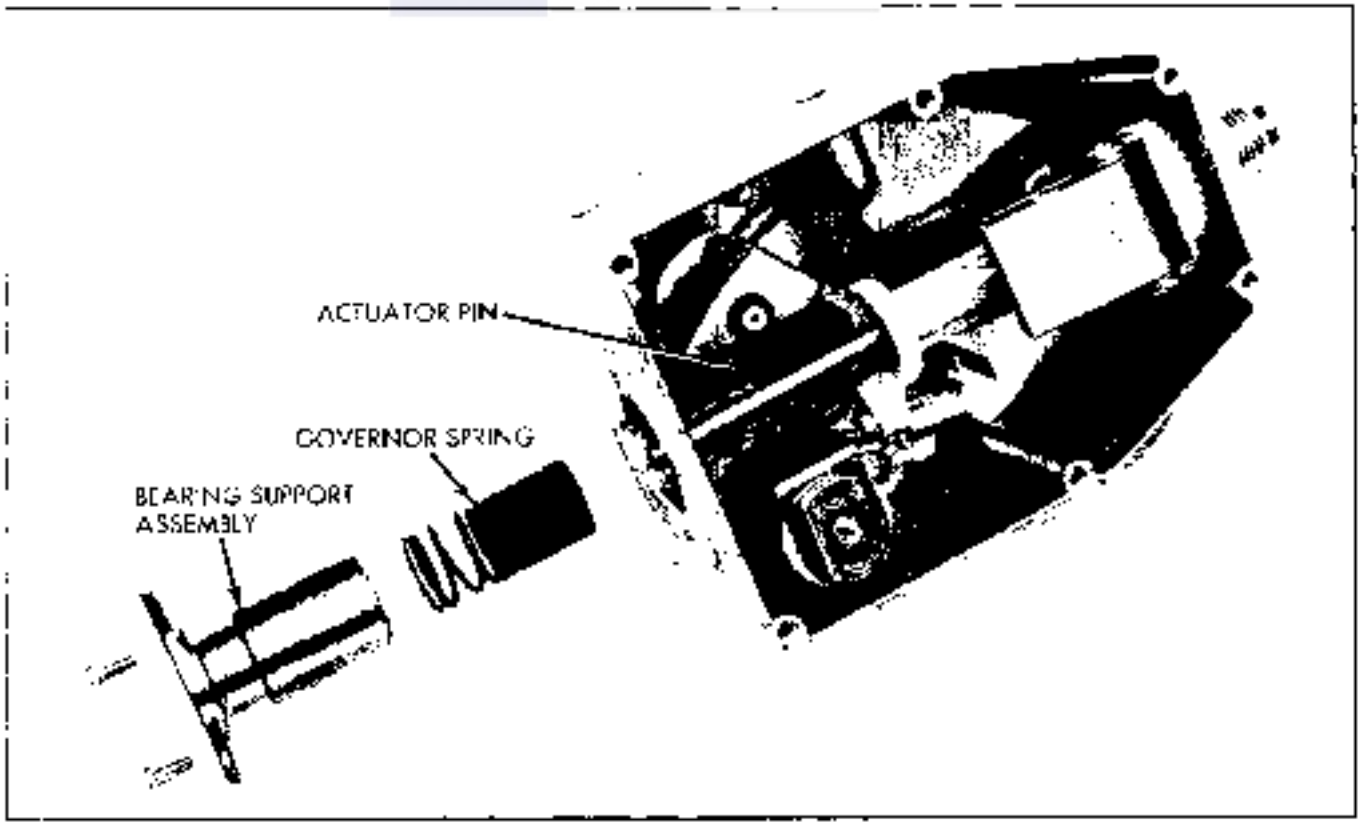


Fig. 15-7 Bearing Support—Removal

1. Remove screws and cover. To replace air filter in cover, push filter out from under filter plate (Fig. 15-5).

2. Remove two screws securing bearing support, rotate support 180° and slide out (Fig. 15-7).

NOTE: Do not tamper with screw in bearing support. This screw positions the governor spring and is pre-set at the factory.

3. Remove governor spring.

4. Spread governor weights in an up and down position and pry up on actuator coupling with a screwdriver until pin is disengaged from magnet assembly and can be rotated clockwise (Fig. 15-7). Rotate actuator cup 180° and hook the actuator coupling over the top of regulator housing (Fig. 15-8).

5. Slide the governor assembly away from the speedometer drive adapter and until the shaft is free of bearing. This will allow the governor assembly to be removed from the regulator. For further disassembly of governor see Fig. 15-4.

6. Remove four screws (2 internal, 2 external) holding the valve body and magnet assembly. Remove valve body and magnet assembly from the regulator housing. (Fig. 15-9).

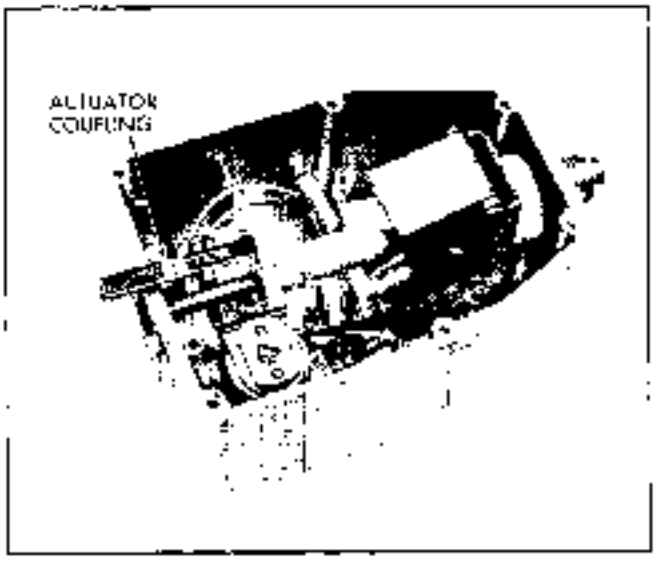


Fig. 15-8 Governor Assembly—Removal

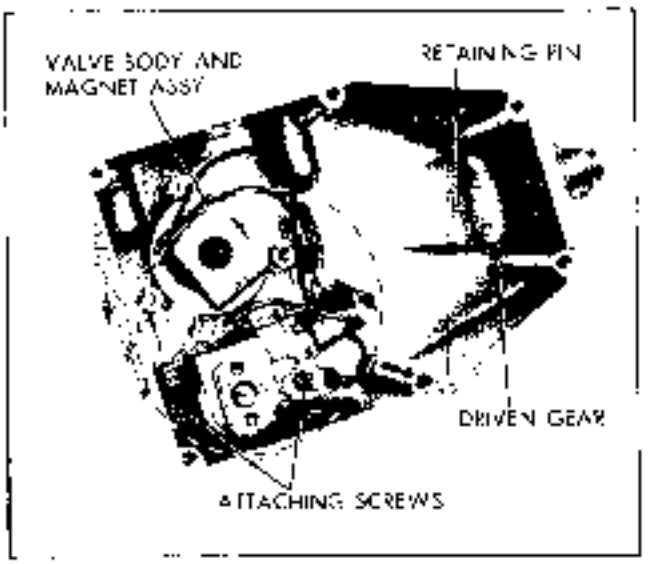


Fig. 15-9 Valve Body and Magnet Assy —Removal

7. Remove driven gear from regulator by pressing retaining pin out of regulator body.

ASSEMBLY

1. Install driven gear and retaining pin in housing.

2. Insert valve body and magnet assembly into the regulator housing and install four screws.

NOTE: Make sure the rubber gasket on the bottom of the valve body and magnet assembly lies flat against the regulator housing. Under no circumstances should this gasket be glued to the valve body and magnet assembly.

3. With weights in an up and down position, insert the long end of the governor shaft through the bearing support mounting hole keeping the actuator coupling hooked over the regulator housing. Insert the shaft far enough to allow the short end of the governor to be inserted into its bearing. Slide the governor assembly into the bearing until it bottoms.

4. Move the actuator cup down the shaft until it bottoms and rotate 180°. Using a screwdriver, pry the actuator coupling up and rotate the magnet counterclockwise until the pin engages the actuator coupling hole.

5. Install governor spring over governor shaft with closed end of spring toward the actuator cup.

6. Install bearing support in regulator. Rotate 180° and secure with two (2) screws.

7. Secure cover with six (6) screws.

NOTE: When the relief body and magnet assembly or the governor assembly is replaced, the low speed switch must be adjusted. With the governor cup held in the lowest speed position (governor weights all open) adjusting screw until the gap between the switch points is .020" (Fig. 15-6)

CLOCK

REMOVE AND REPLACE – PONTIAC (Fig. 15-10)

1. Remove radio as outlined in Radio - Remove and Replace.

2. Remove center air duct if equipped with A/C.

3. Disconnect clock lead wire.

4. Remove two 3/8" nuts at bottom and one 5/16" screw at top of clock and remove clock.

5. To replace, reverse the above.

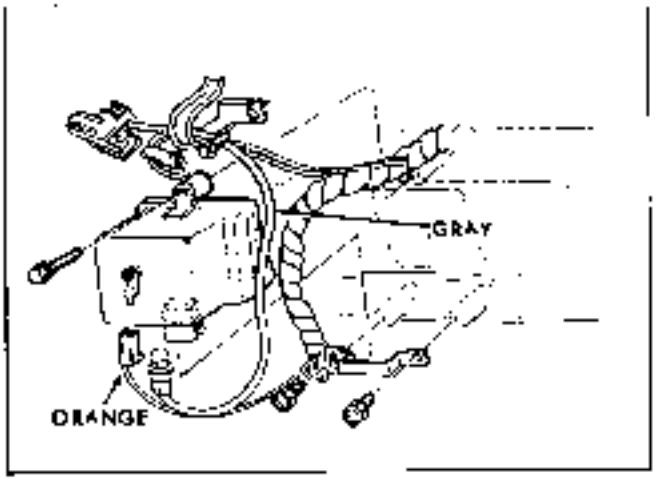


Fig. 15-10 Clock Installation—Pontiac

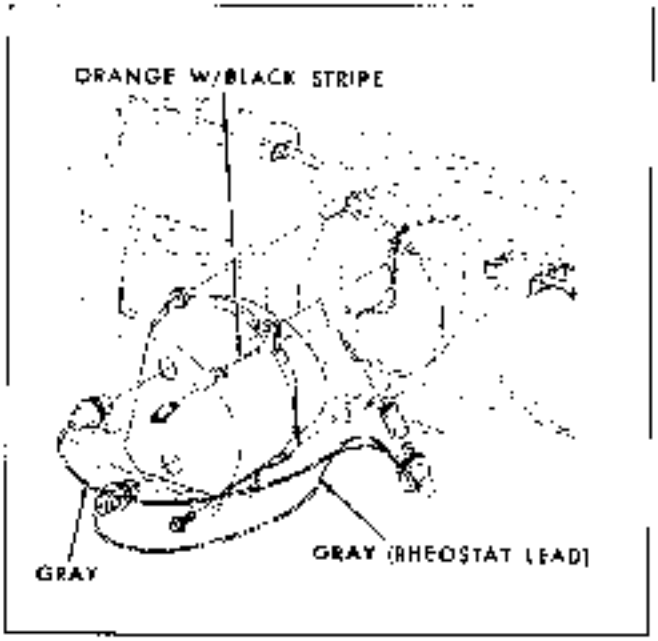


Fig. 15-11 Clock Installation—Tempest

REMOVE AND REPLACE – TEMPEST (Fig. 15-11)

1. Disconnect power lead and remove lamps at rear of clock.

2. Remove two retaining screws from right hand side and loosen two left hand screws.

3. Slide clock to right and remove from back of instrument panel.

4. Replace by reverse of above procedure.

NOTE: On air-conditioned cars it will be necessary to remove the cold air distribution duct.

REMOVE AND REPLACE – FIREBIRD (Fig. 15-12)

1. Remove two screws holding clock to clock housing and pull clock out of housing.

2. Unplug two-wire connector and bulb socket.

3. To replace, reverse above procedure.

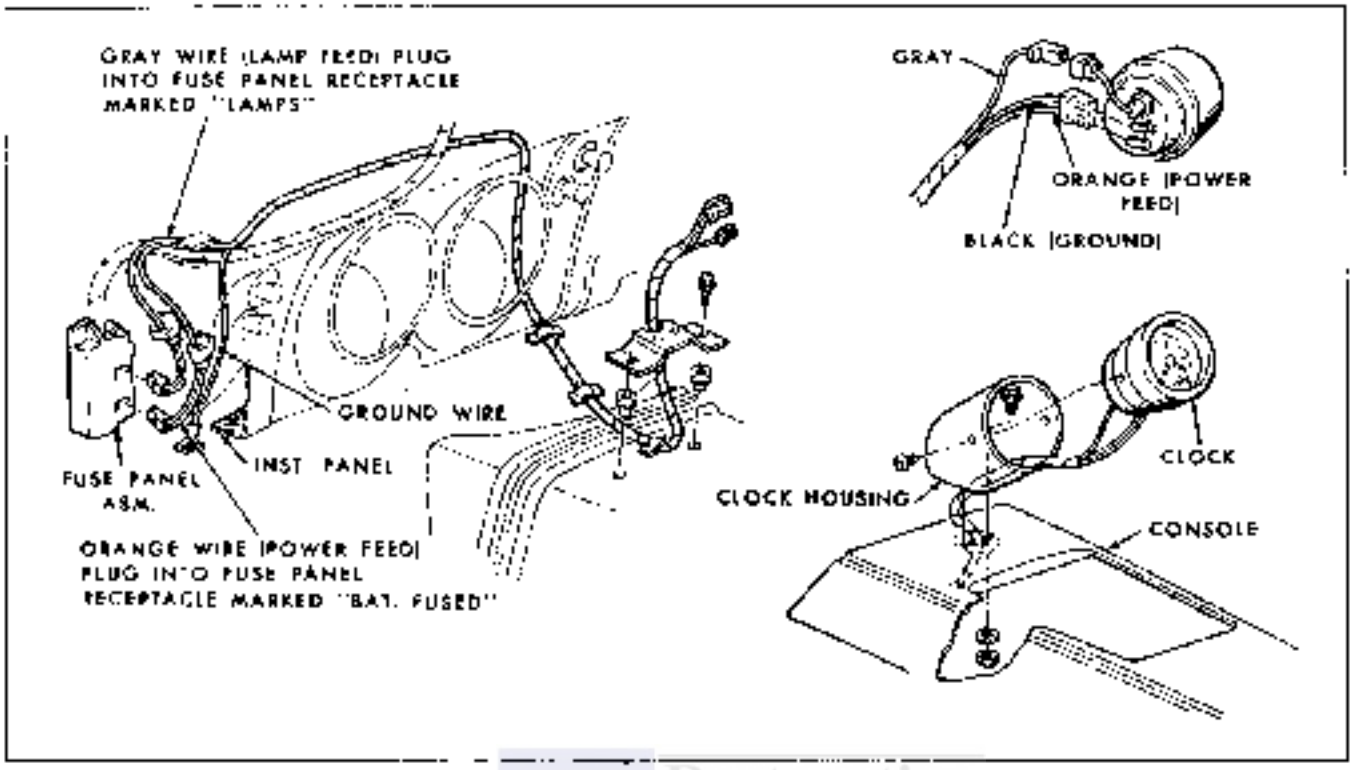


Fig. 15-11 Clock Installation—Pontiac

SAFEGUARD SPEEDOMETER

Refer to Figs. 15-13, 14, and 15 for service of individual components. The speedo head should be sent to the repair station complete. Do not remove safeguard mechanism alone.

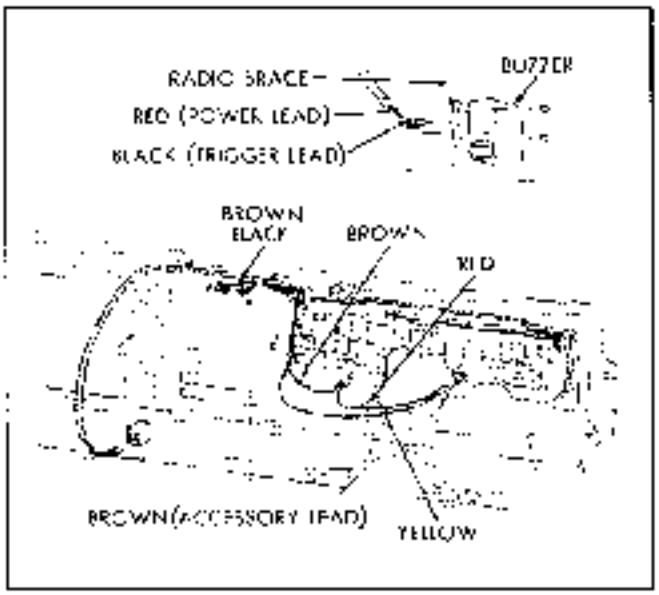


Fig. 15-13 Safeguard Speedometer—Pontiac

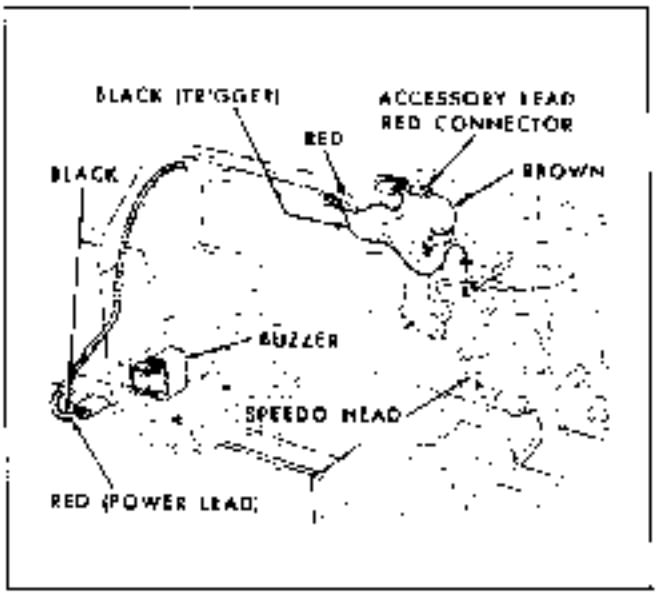


Fig. 15-14 Safeguard Speedometer—Tempest

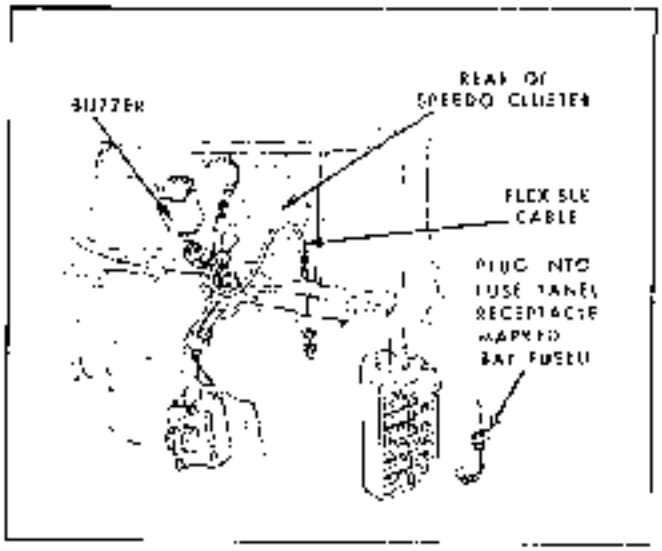


Fig. 15-15 Corvette Speedometer—Removal

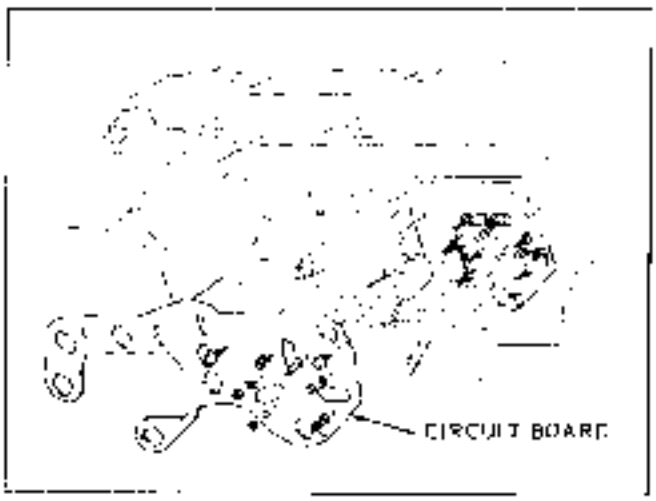


Fig. 15-17 Auxiliary Gauges—Temporary

AUXILIARY GAUGES

Refer to Figs. 15-16, 17, and 18 for service of individual components. Engine water temperature and oil pressure sending units are in the same location as those used with the standard indicator lights.

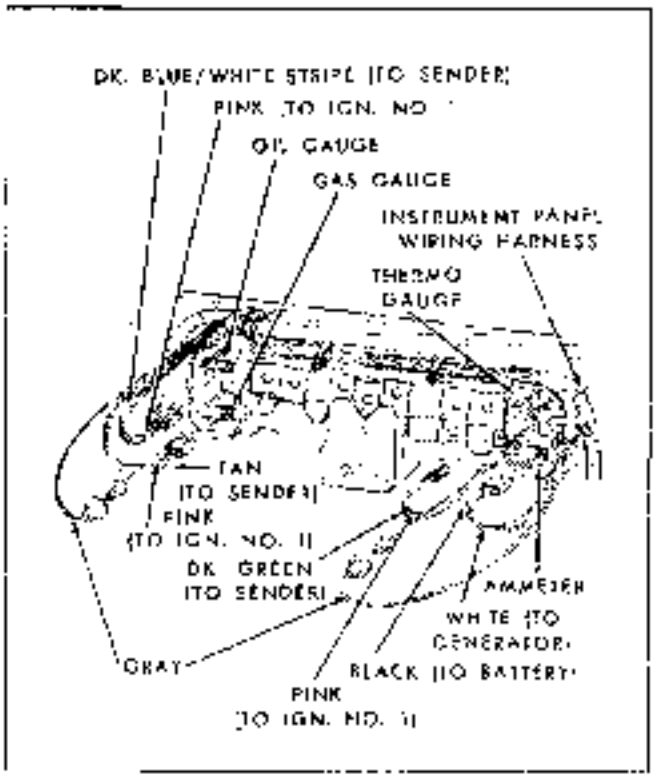


Fig. 15-16 Auxiliary Gauges—Partial

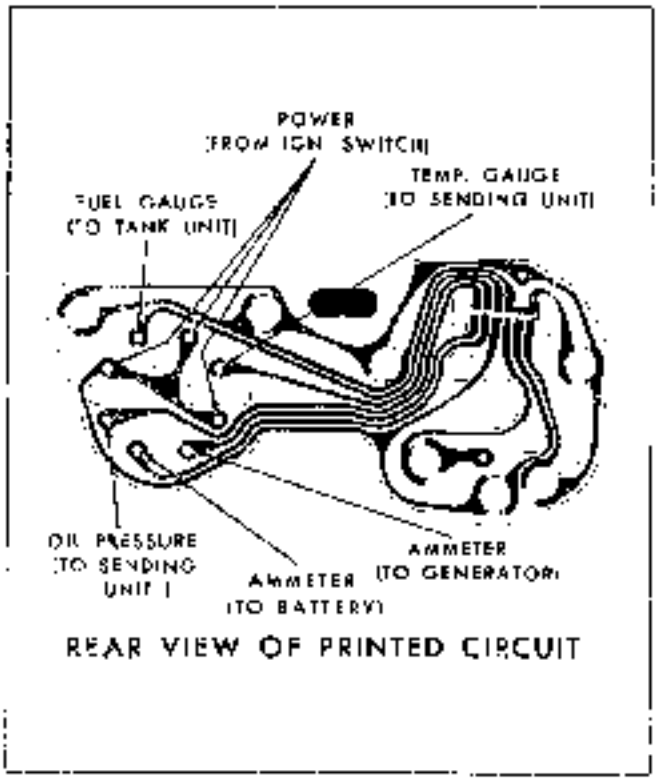


Fig. 15-18 Auxiliary Gauges—Printed

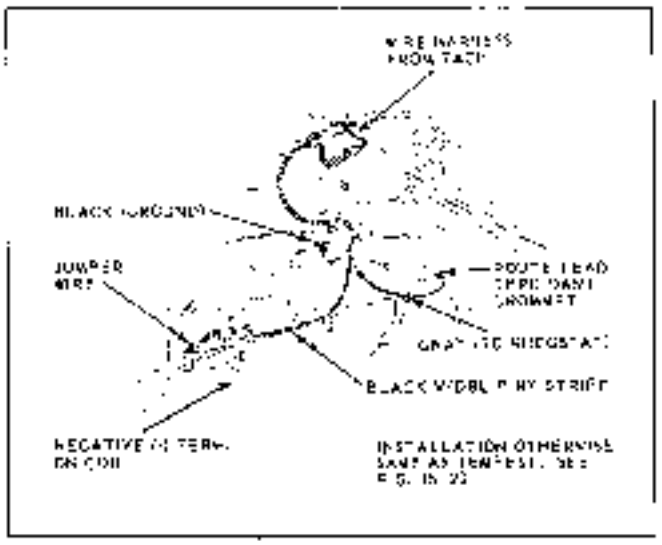


Fig. 15-19 Hood Mounted Tachometer—Pontiac

HOOD MOUNTED TACHOMETER

Refer to Figs. 15-19, 20, and 21 for installation.

NOTE: It is important that rivets are used to re-install unit to hood. If screws are substituted here, the anti-theft feature of this tachometer will be destroyed.

INSTRUMENT PANEL TACHOMETER

Refer to Fig. 15-22 for installation of gauge unit.

Reset Tachometer Needle—Tempest I.P. Mounted Unit

If it becomes necessary to reset the tachometer, a precision tachometer must be hooked up to work in conjunction with assembly in car.

1. Remove cluster and bezel assembly as outlined above, but do not disconnect leads.

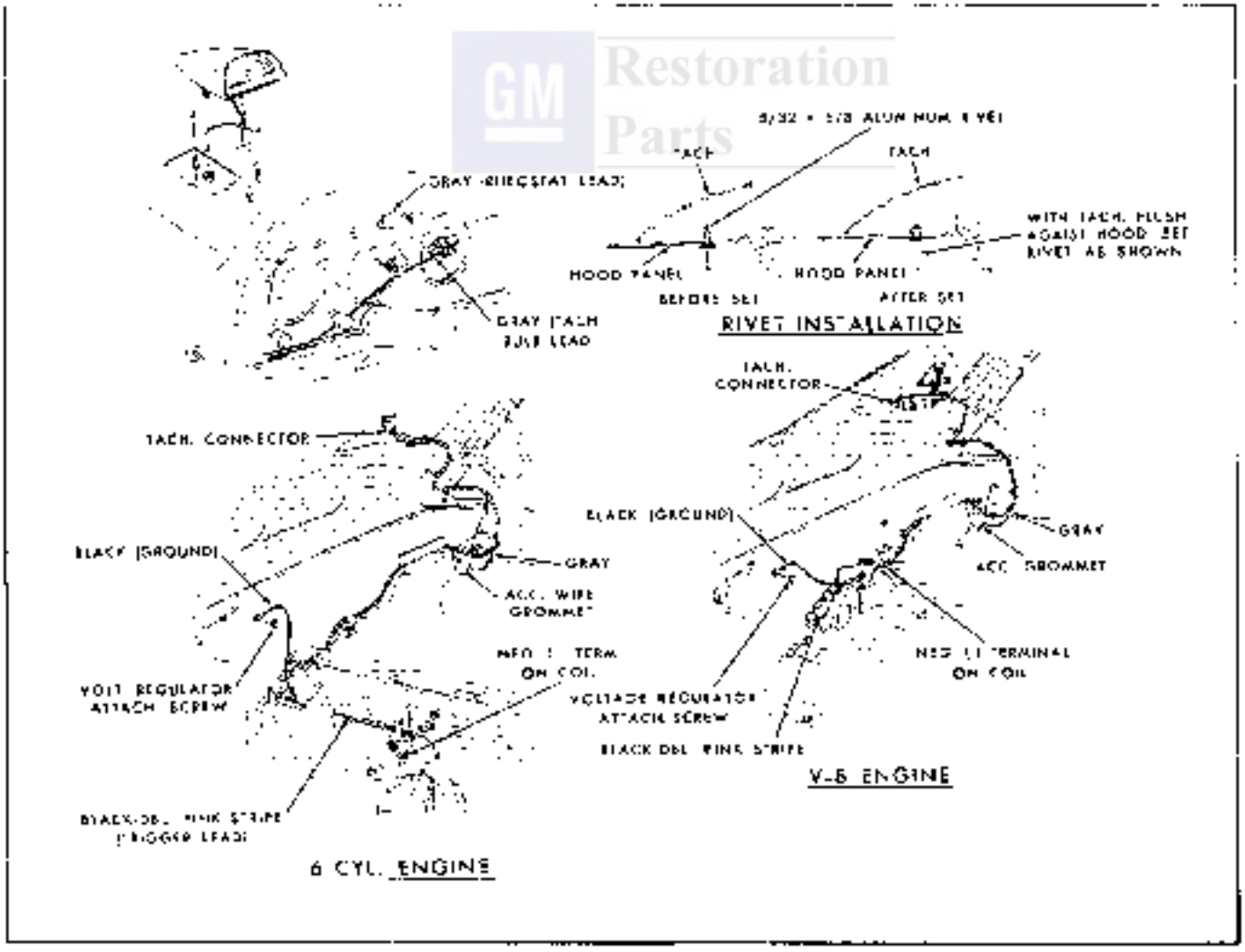


Fig. 15-20 Hood Mounted Tachometer—Tempest

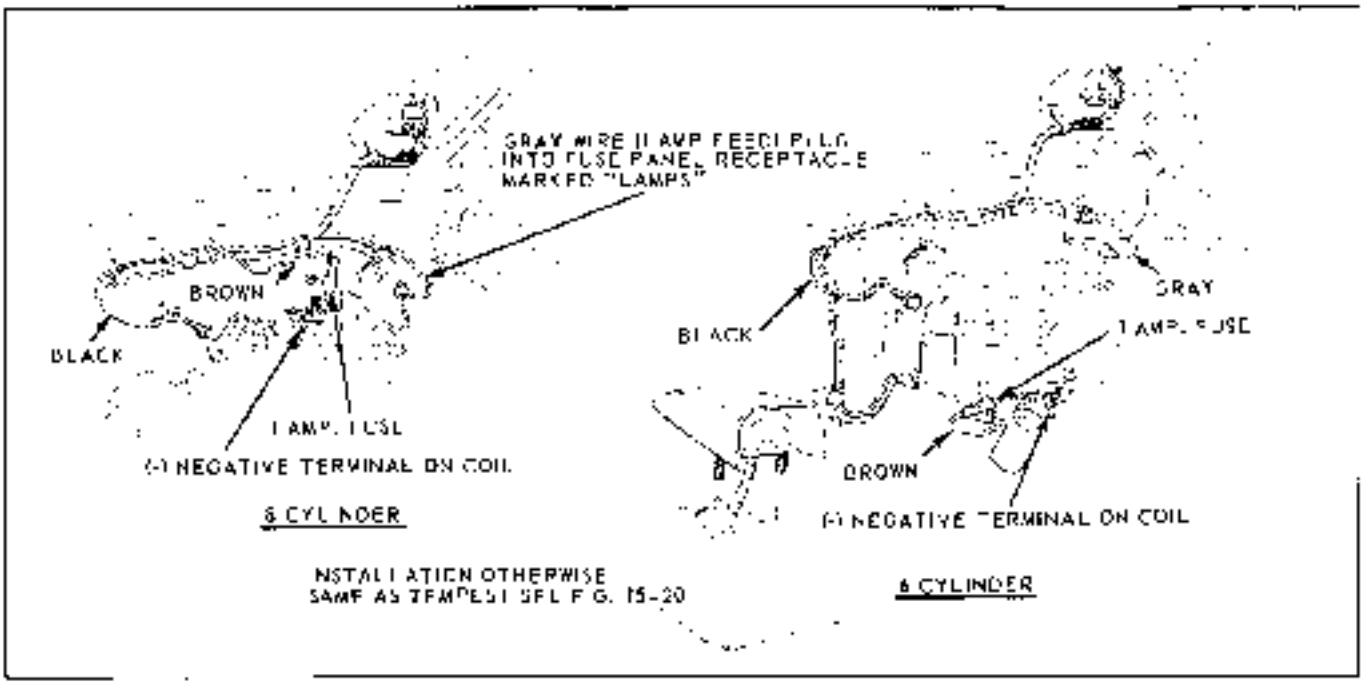


Fig. 15-21 Hood Mounted Tachometer - Firebird

2. Connect precision tachometer to assembly in rear.

3. Remove round metal plug from rear of tachometer housing.

4. Turn engine over at 3500 rpm as indicated on precision tach (lower or higher readings may result in inaccurate needle setting).

5. Insert small screwdriver through hole at rear of housing and turn rheostat clockwise to lower needle or counterclockwise to raise needle.

6. When proper needle setting has been obtained as indicated on precision instrument, turn engine off, remove precision tachometer and replace unit by reversing removal procedures.

ELECTRIC DECK LID RELEASE

Refer to Fig. 15-23 for installation of release switch and dash wiring on both Pontiac and Tempest. See Fisher Body Manual for trunk unit installation.

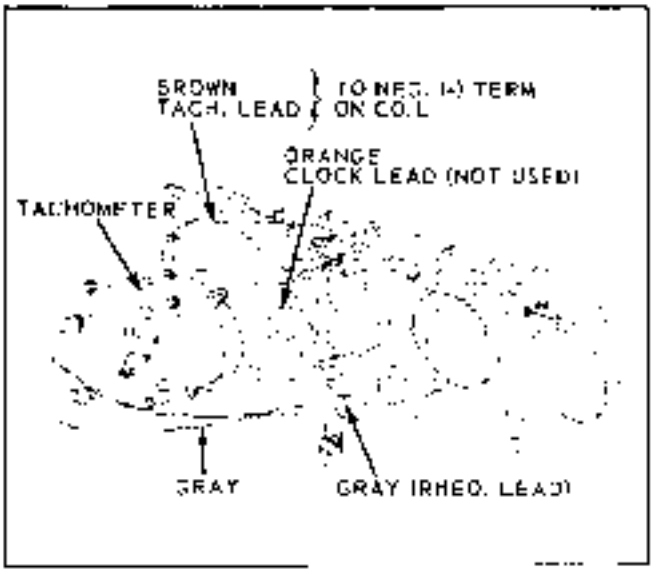


Fig. 15-22 Instrument Panel Tachometer Terminals

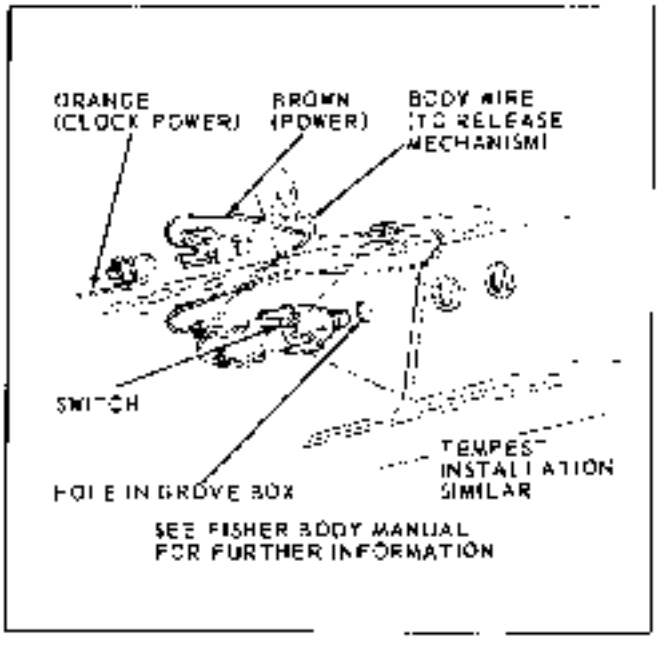


Fig. 15-23 Electric Deck Lid Release - Pontiac

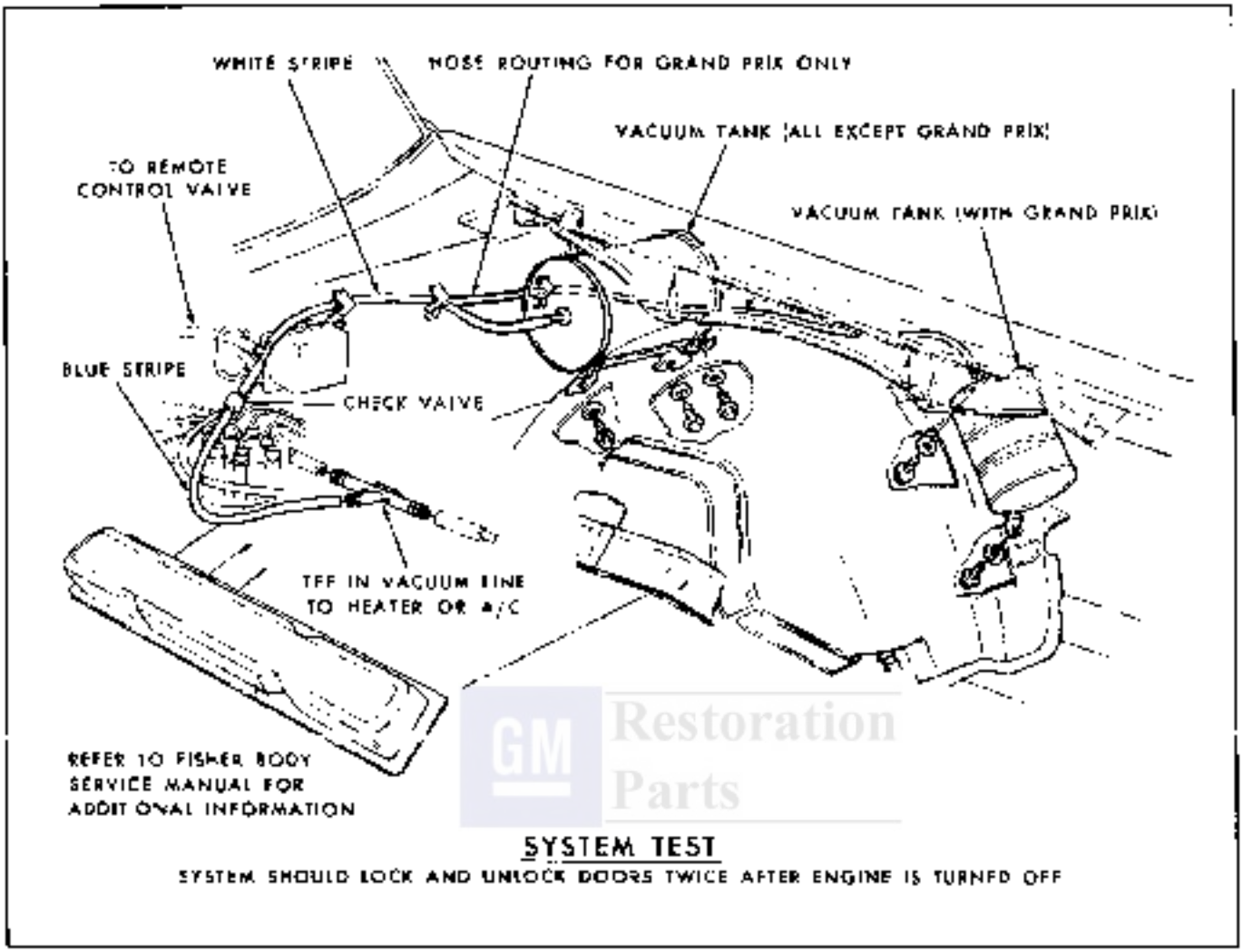


Fig. 15-24 Vacuum Door Locks Pontiac

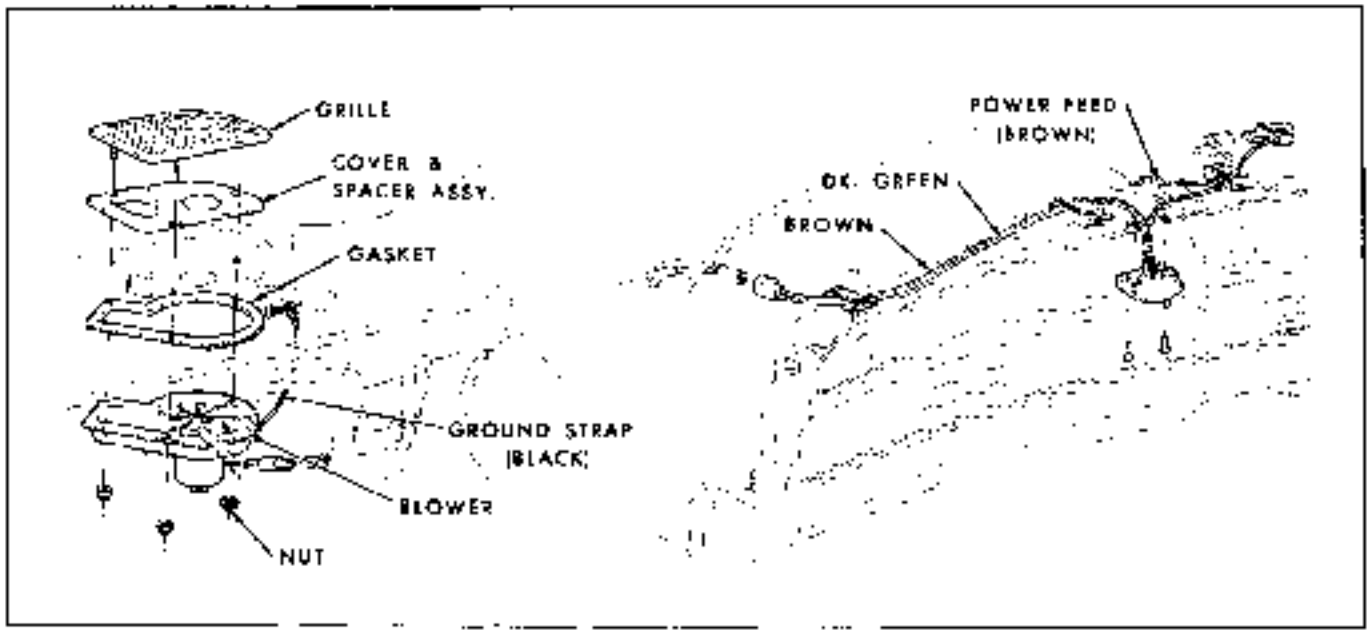


Fig. 15-23 Rear Window Defogger—Pontiac

VACUUM DOOR LOCKS

Refer to Fig. 15-24 for installation of underhood vacuum tank and hoses. See Fisher Body Manual for installation of remote control valve and door lock actuators.

REAR WINDOW DEFOGGER

Refer to Figs. 15-25, 26, and 27 for service of individual components.

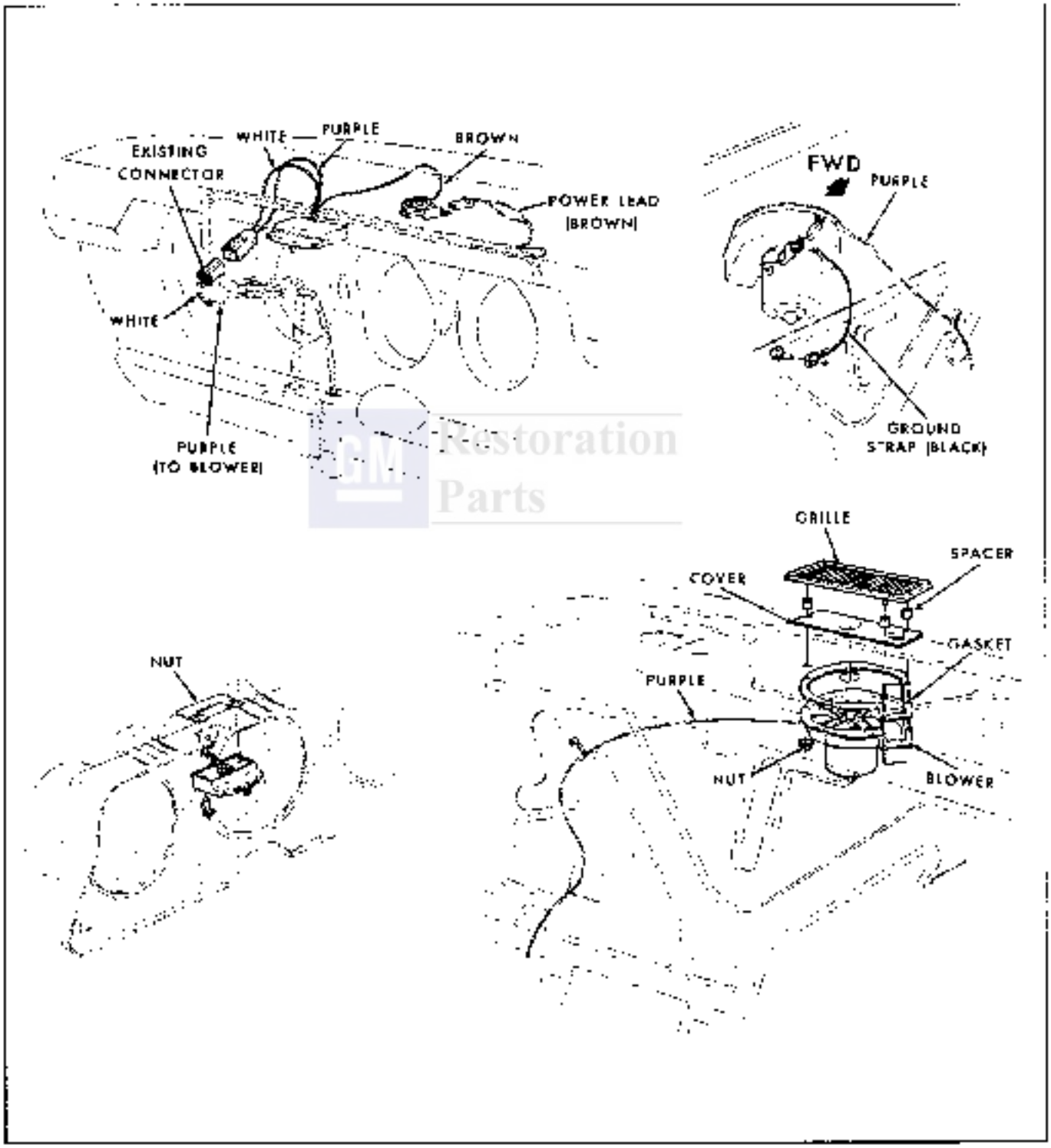


Fig. 15-26 Rear Window Defogger—Tempest

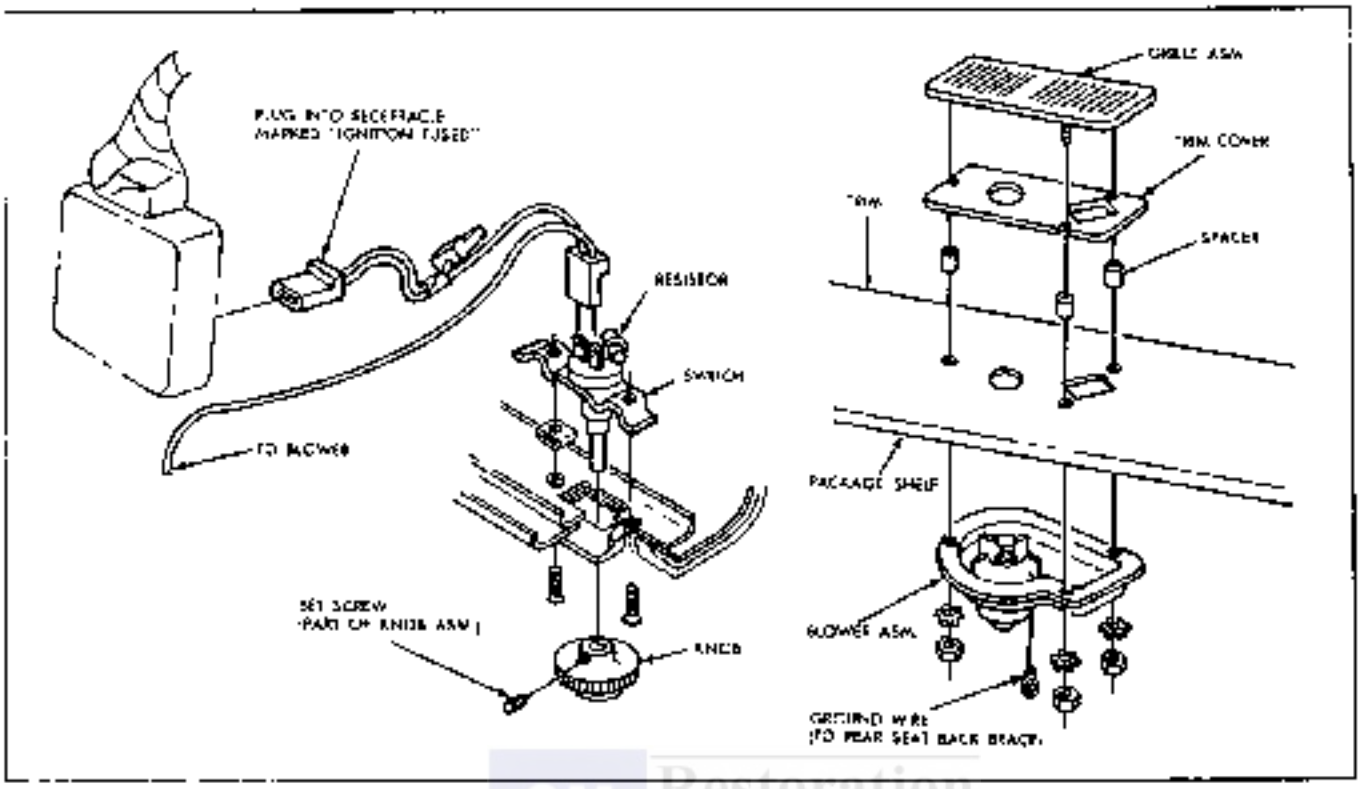


Fig. 15-27 Rear Window Defogger—Firebird

CONSOLE

Refer to Figs. 15-28 thru 15-33 for console installation. See Transmission section of this manual for installation of shifter mechanism.

REMOVE AND REPLACE - PONTIAC CONSOLE

Manual Transmission (Fig. 15-28)

1. Remove console compartment box.

2. Remove compartment lamp, remove bulb, and terminal from switch and bulb socket.

3. Remove gearshift knob.

4. Remove two screws holding console to floor pan at the front and two more on each side. Remove console.

5. To disassemble, remove six screws holding console cover to the base.

6. To replace, reverse above.

Automatic Transmission (Fig. 15-29)

1. Remove console back panel (held with two screws).

2. Remove ash tray.

3. Unclip console harness from console at ash tray.

4. Remove four screws - console to I.P.

5. Remove console compartment box.

6. Remove compartment lamp, remove bulb and terminal from switch and bulb socket.

7. Remove gearshift button, knob, and escutcheon.

8. Unplug indicator lamp from housing and remove housing and seal.

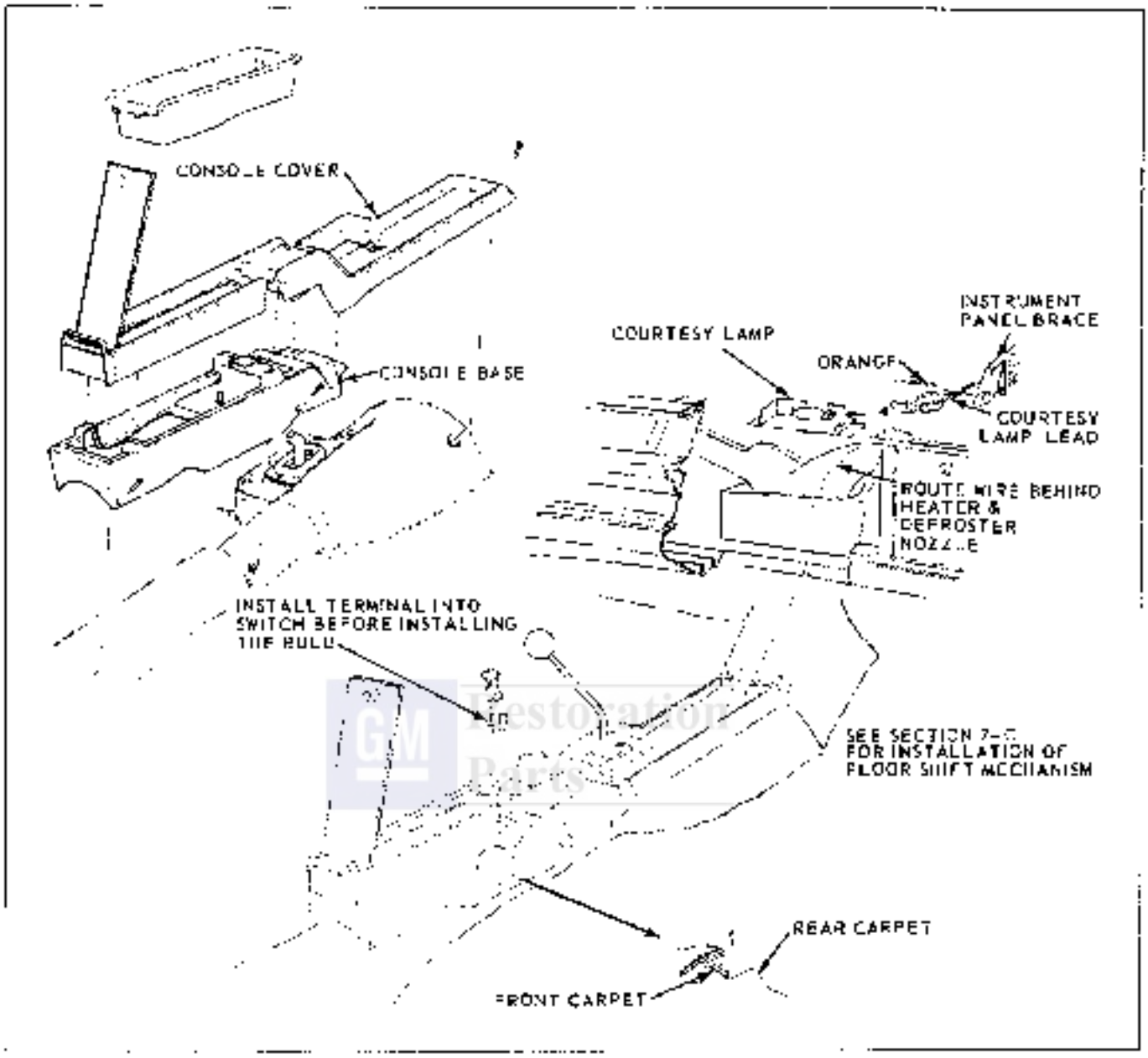


Fig. 15-23 Console—Pontiac Manual Transmission

9. Remove two screws at rear holding console to floor pan. Remove console.

10. To disassemble, remove six screws holding console cover to the base.

11. Remove two screws attaching two halves of console cover.

12. To replace, reverse above.

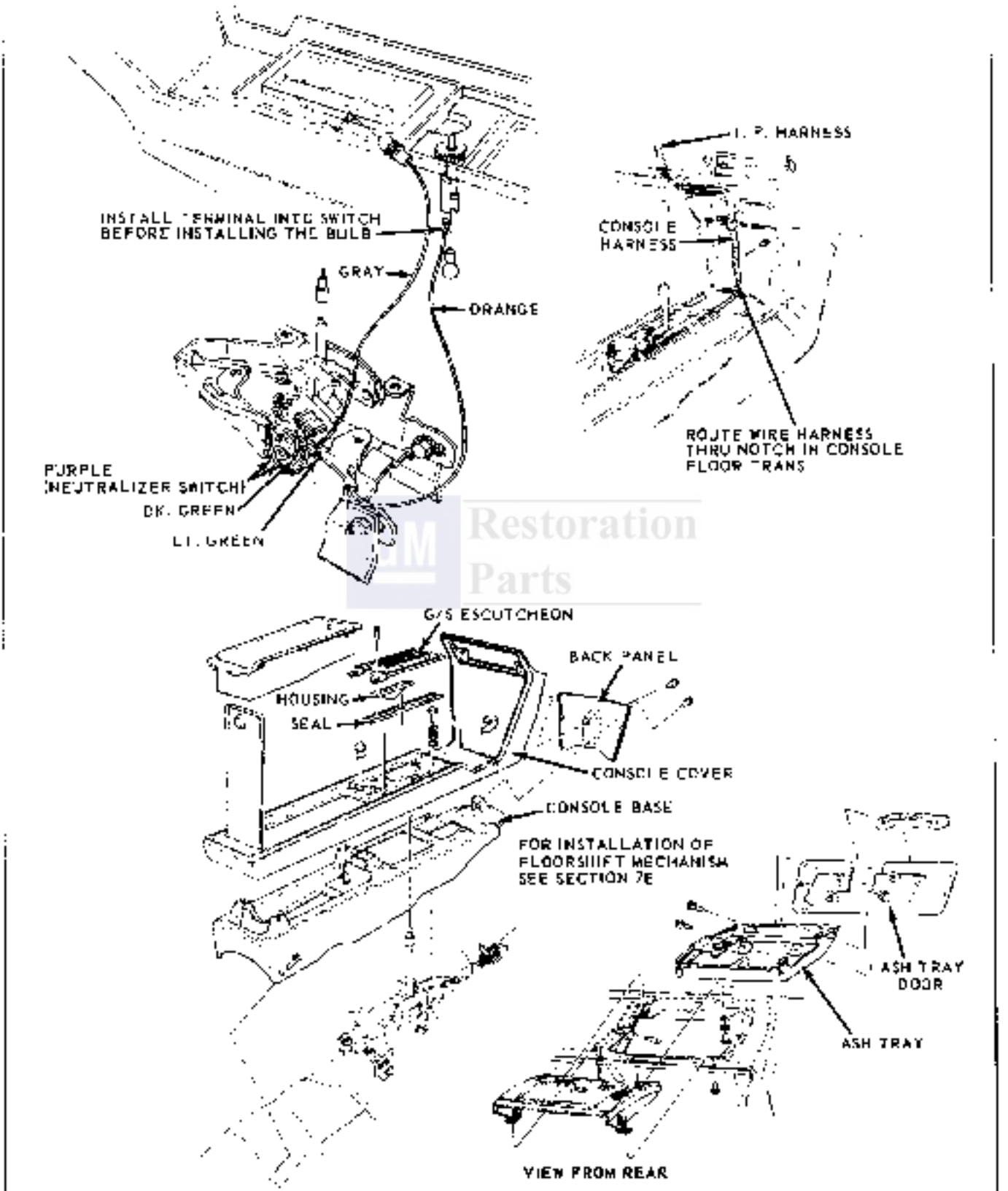


Fig. 15-29 Console—Pontiac Automatic Transmission

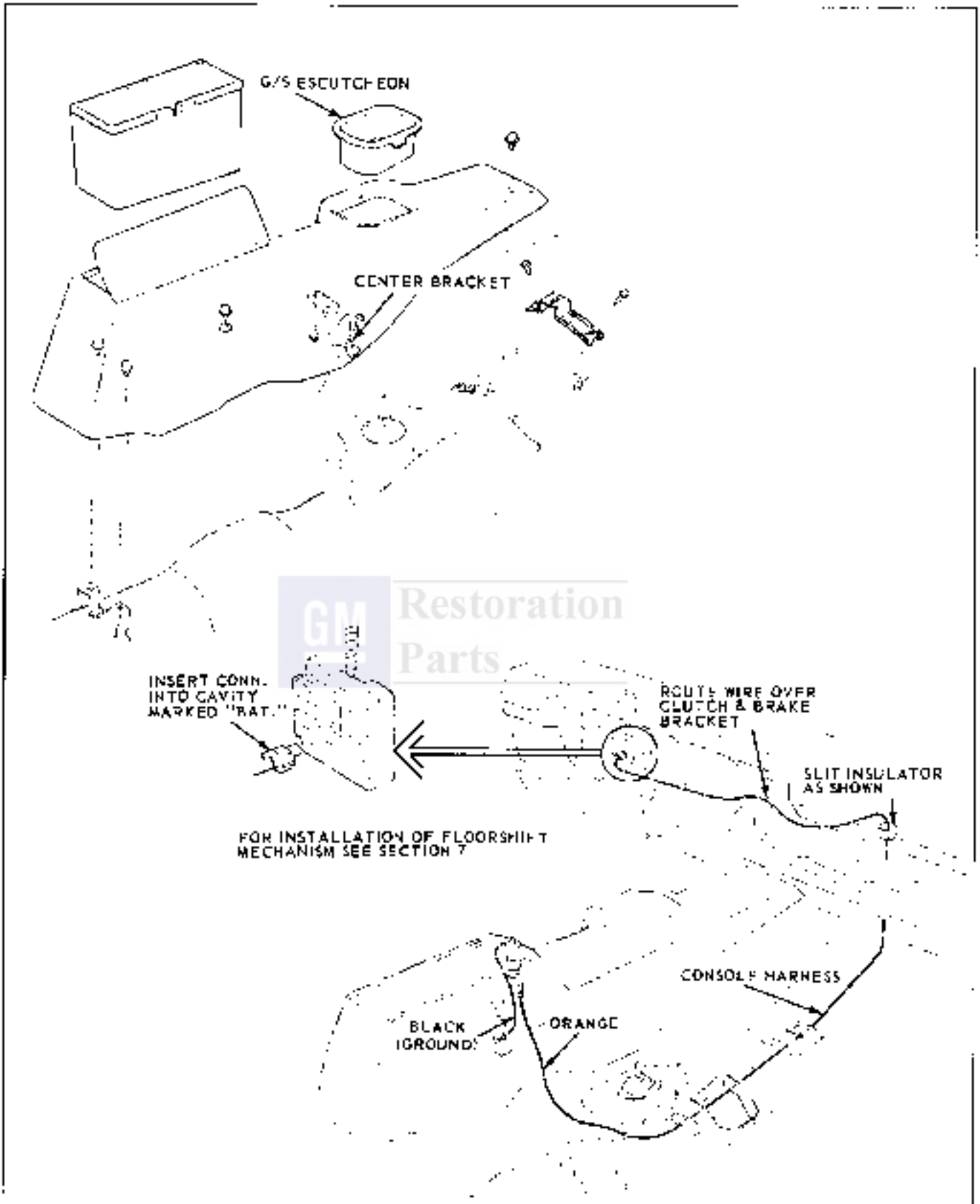


Fig. 15-30 Console—Tempest Manual Transmission

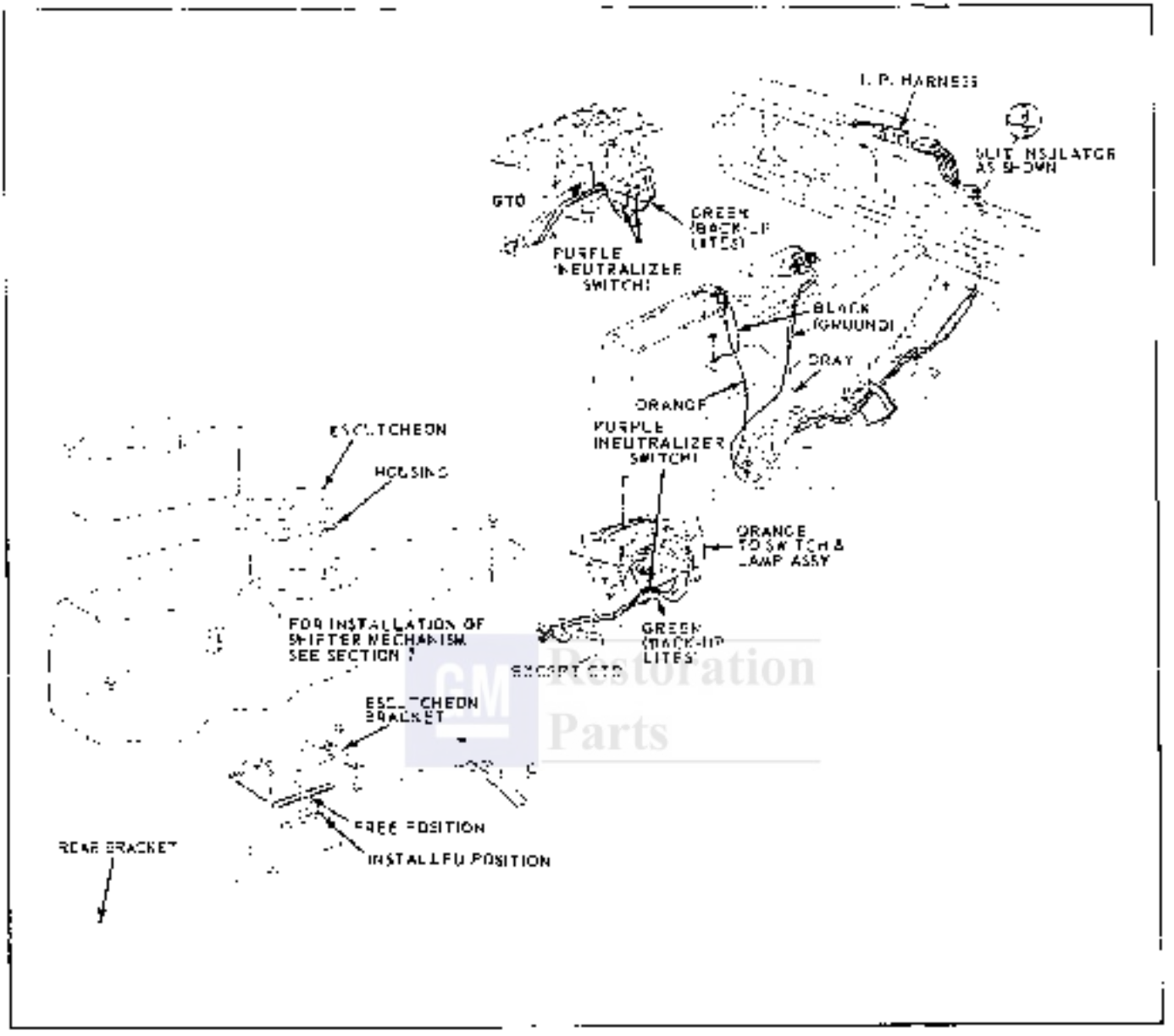


Fig. 15-21 Console—Tempest Automatic Transmission

REMOVE AND REPLACE - TEMPEST CONSOLE

Manual Transmission (Fig. 15-20)

1. Remove console compartment box.

2. Remove compartment lamp, remove bulb and terminal from bulb socket.

3. Remove gearshift knob.

4. Snap out gearshift escutcheon.

5. Remove screw holding center bracket to floor cover.

6. Remove one screw at front and three screws at rear (under compartment box) holding console to floor pan. Remove console.

7. To replace, reverse above.

Automatic Transmission (Fig. 15-21)

1. Perform steps 1 thru 4 of manual transmission procedure above.

2. Unplug indicator bulb and remove housing.

3. Remove three screws holding gearshift escutcheon bracket to floor cover.

4. Remove one screw at front and three screws at rear (under compartment box) holding console to floor pan. Remove console.

5. To replace, reverse above.

REMOVE AND REPLACE - FIREBIRD CONSOLE

Manual Transmission (Fig. 15-32)

1. Remove gearshift knob.

2. Remove one screw at each side - console to floor bracket.

3. Remove rear applique.

4. Remove one screw under rear applique and another in compartment box.

5. Slide console assembly up off shift lever.

6. To disassemble, remove screws holding upper frame assembly to console. Remove nuts and remove applique and gearshift escutcheon.

7. To replace, reverse above.

Automatic Transmission (Fig. 15-32)

1. Remove gearshift handle.

2. Remove gearshift escutcheon by prying straight up.

3. Remove shift indicator housing.

4. Remove three screws holding bracket to shifter assembly.

5. Remove rear applique (see Fig. 15-32) and screw underneath.

6. Remove one screw in compartment box to floor pan and remove console assembly.

7. To disassemble (See Fig. 15-32), remove screws holding upper frame assembly to console. Remove nuts and remove applique and gearshift escutcheon.

8. To replace, reverse above.

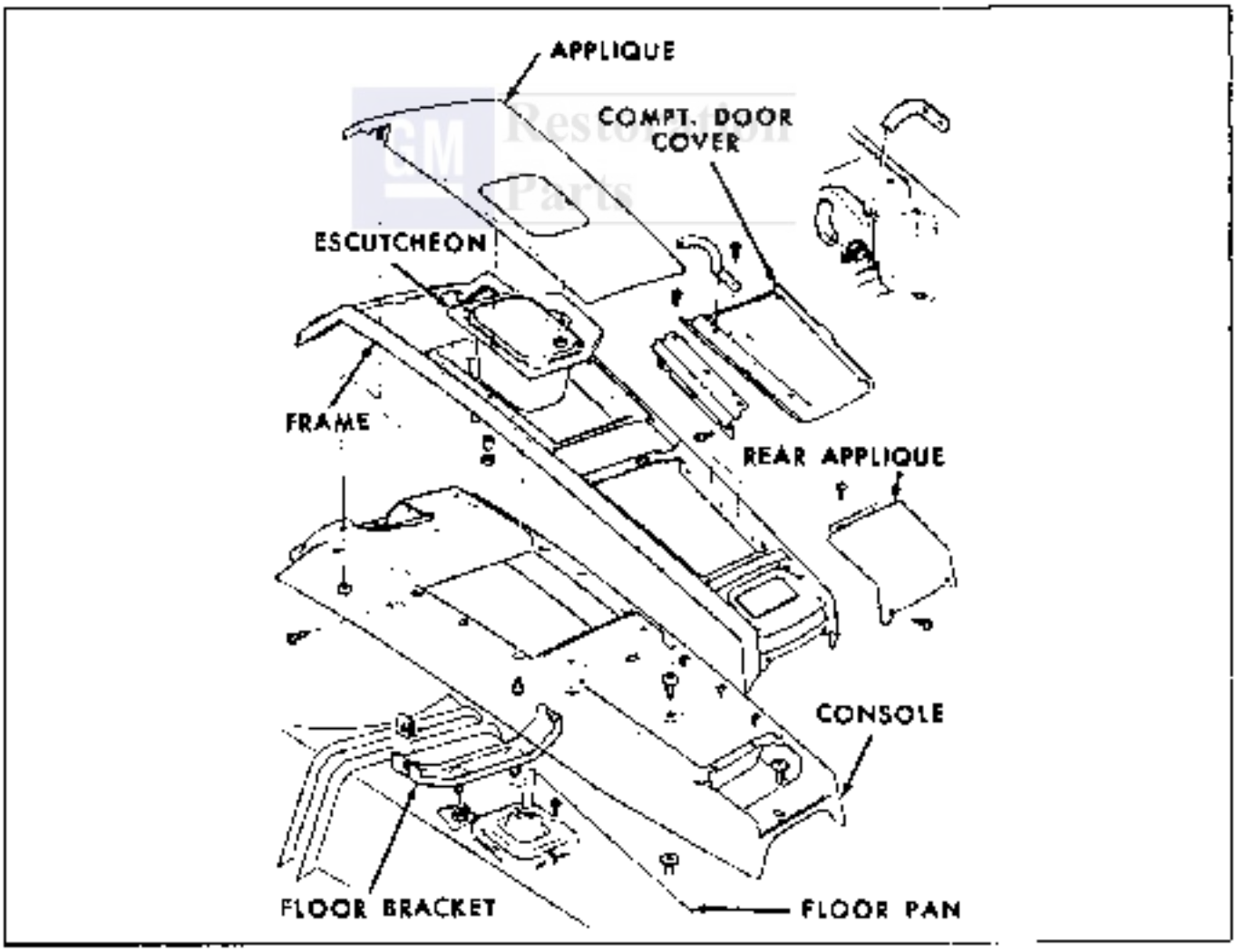


Fig. 15-32 Console—Firebird Manual Transmission

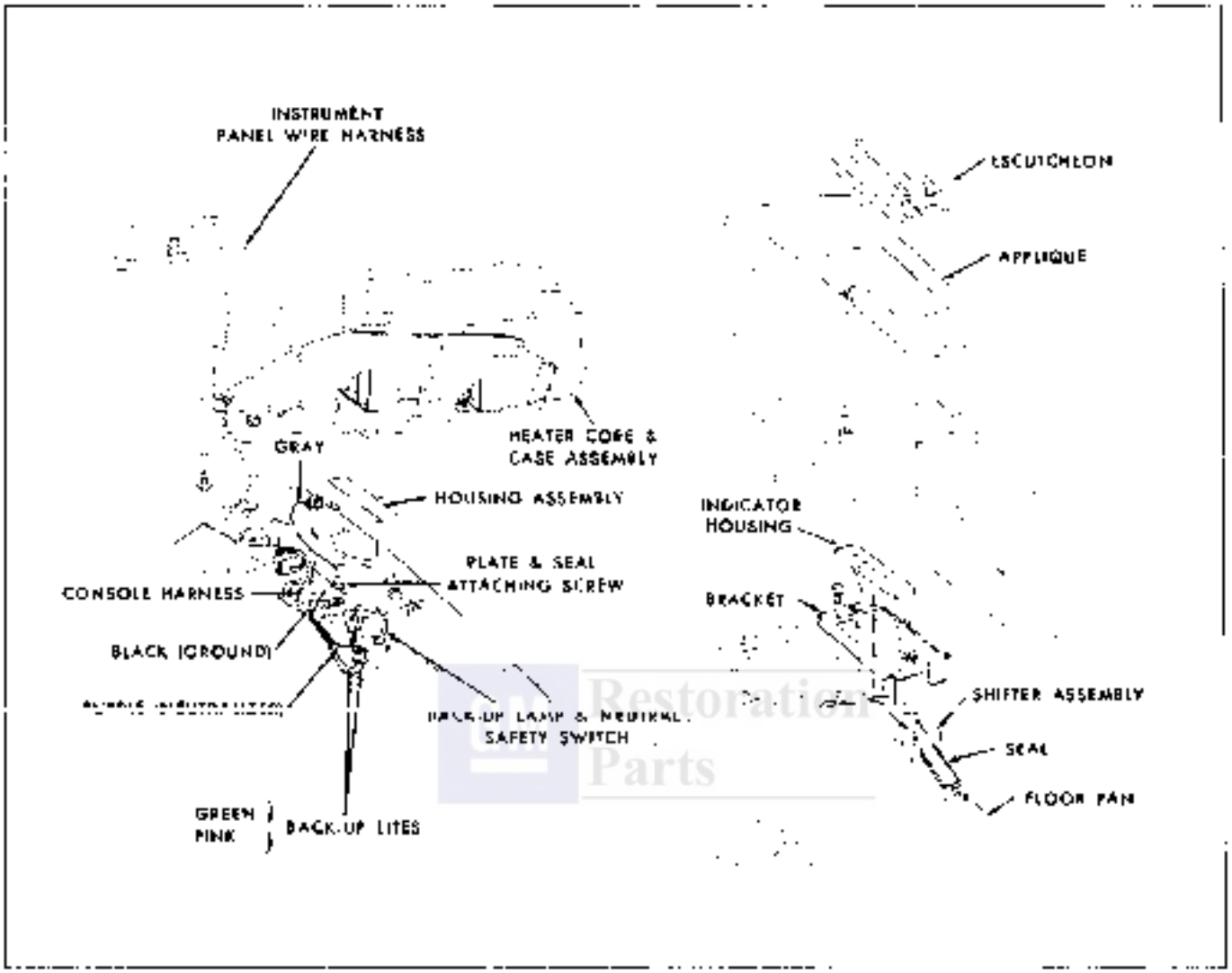


Fig. 15-63 Console—Floor Automatic Transmission

RADIO

REMOVE AND REPLACE PONTIAC RADIO (Figs. 15-34 and 15-48)

1. Remove stereo tape player, if so equipped.

2. Remove knobs, springs, nuts and bezels from control bushings. Use J 8653 to remove nuts.

3. If car is equipped with A/C, remove three phillips screws holding bottom A/C air duct and remove duct.

4. Disconnect stereo multiplex plug from radio, if so equipped.

5. Remove antenna lead-in and speaker connector.

6. Remove hex screw holding right side of radio to brace.

7. Disconnect dial light socket and lower radio to floor.

8. Remove Multiplex Adapter, if so equipped. (See Below)

9. To replace, reverse above procedure.

REMOVE AND REPLACE PONTIAC FRONT SPEAKER (Fig. 15-34)

1. Remove radio as outlined above.

2. Remove four 3/8" nuts from speaker to speaker brace and remove speaker.

3. To replace, reverse the above.

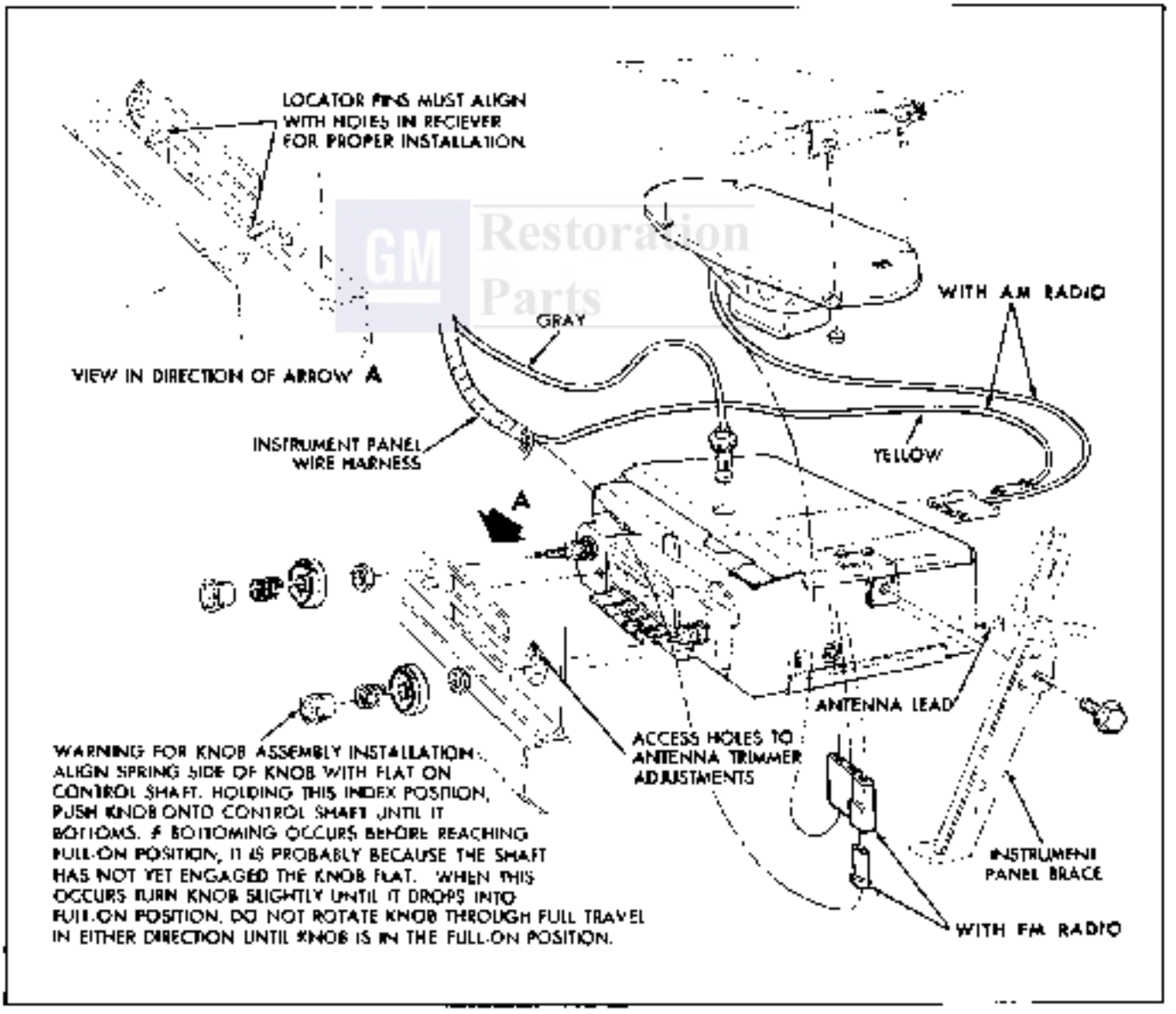


Fig. 15-34 Radio Receiver and Front Speaker - Pontiac

REMOVE AND REPLACE TEMPEST RADIO
(Figs. 15-35 and 15-49)

1. Remove stereo tape player if so equipped.

2. Remove knobs, springs, nuts and bezels from control bushings.

3. Remove lower A/C distribution duct and outer outlet duct if so equipped.

4. Disconnect antenna and speaker leads.

5. Remove two 5/16" screws from bottom radio brace and remove brace.

6. Remove dial light socket and lower radio to floor.

7. To replace, reverse above procedure.

REMOVE AND REPLACE TEMPEST FRONT SPEAKER
(Fig. 15-49)

1. Remove radio as outlined above.

2. Remove hex speaker mounting bracket screw.

3. Remove speaker and lower it to floor.

4. Replace by reversing the above.

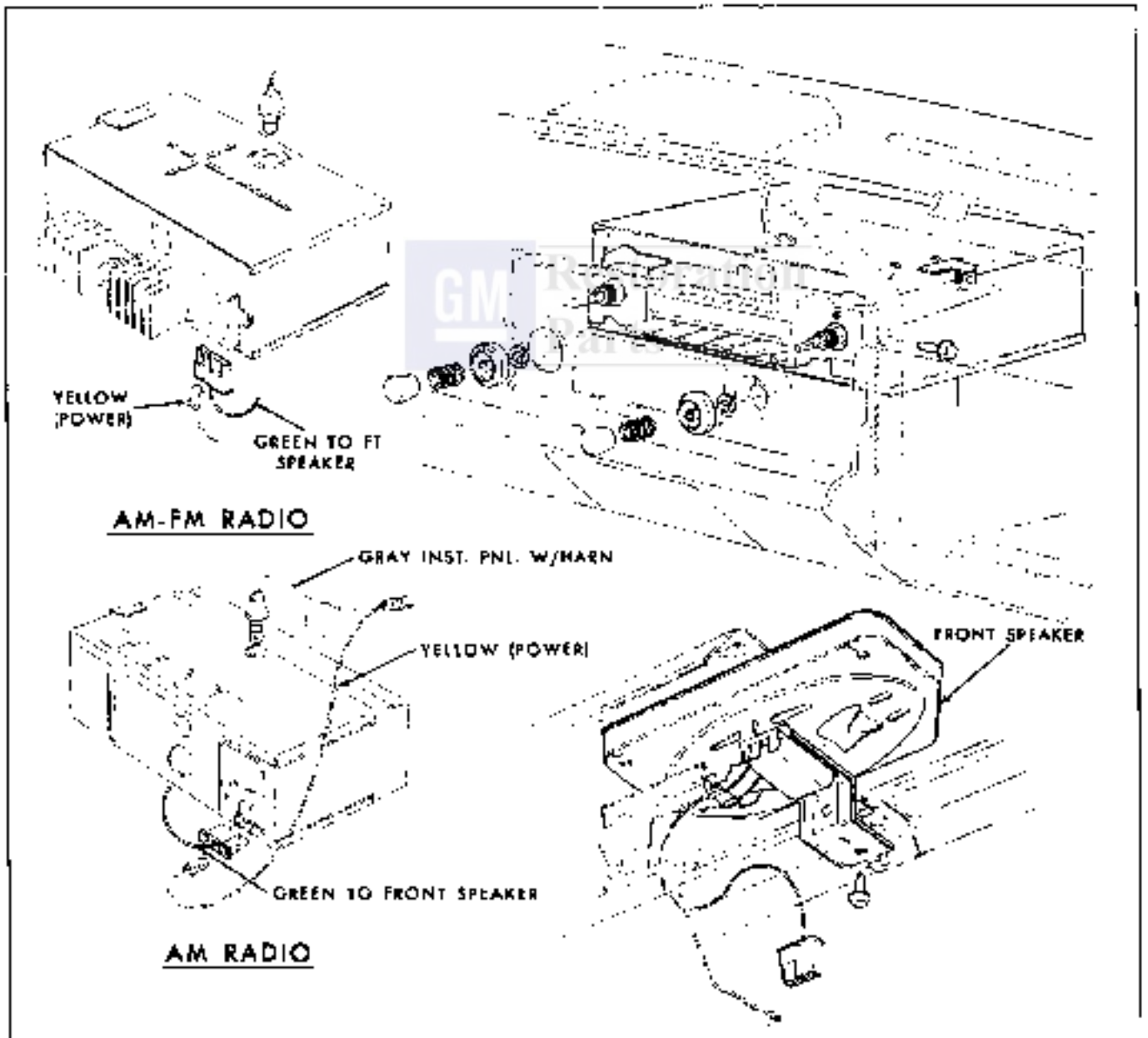


Fig. 15-35 Radio Receiver and Front Speaker—Tempest

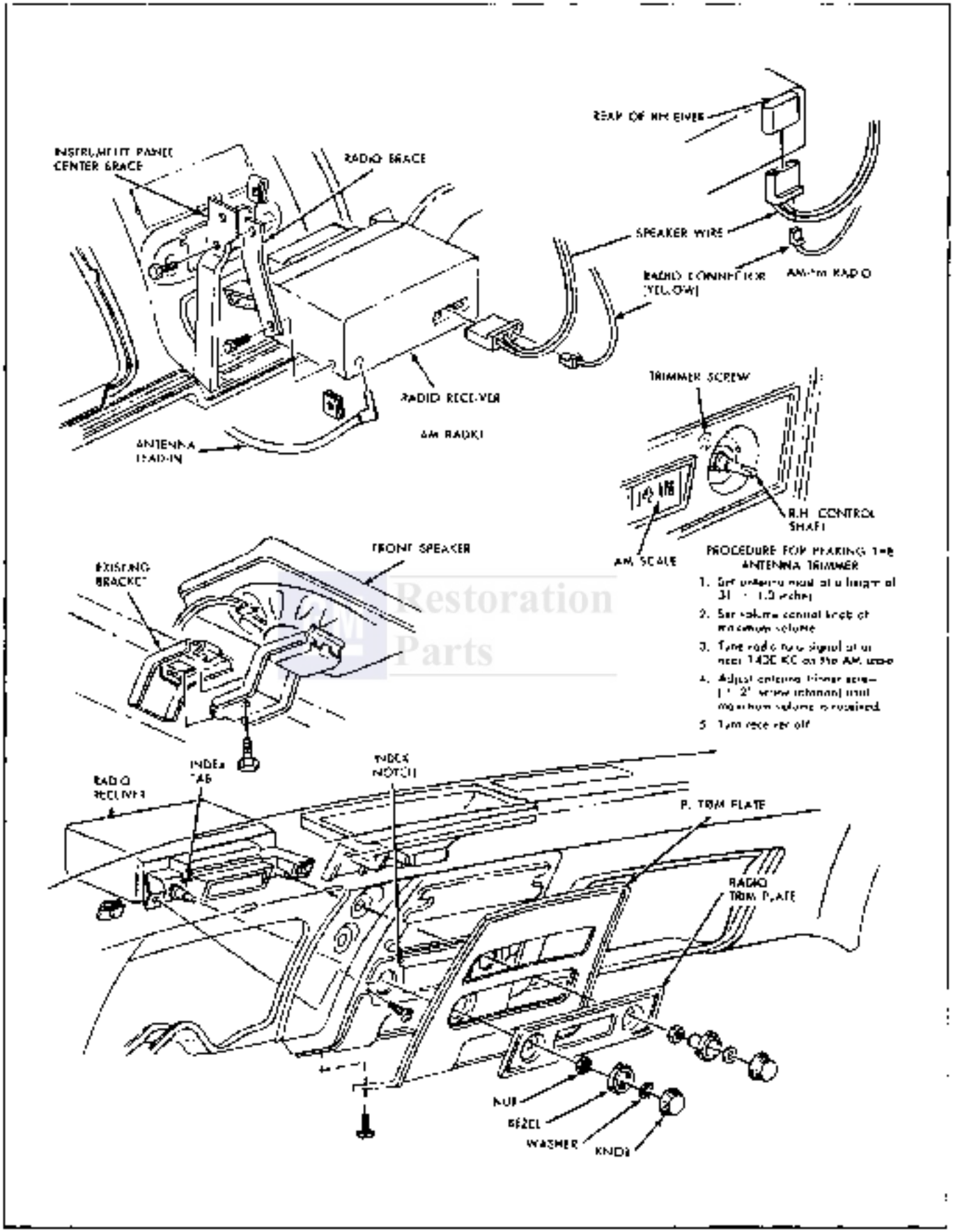


Fig. 15-26 Radio Receiver and Front Speaker—Firebird

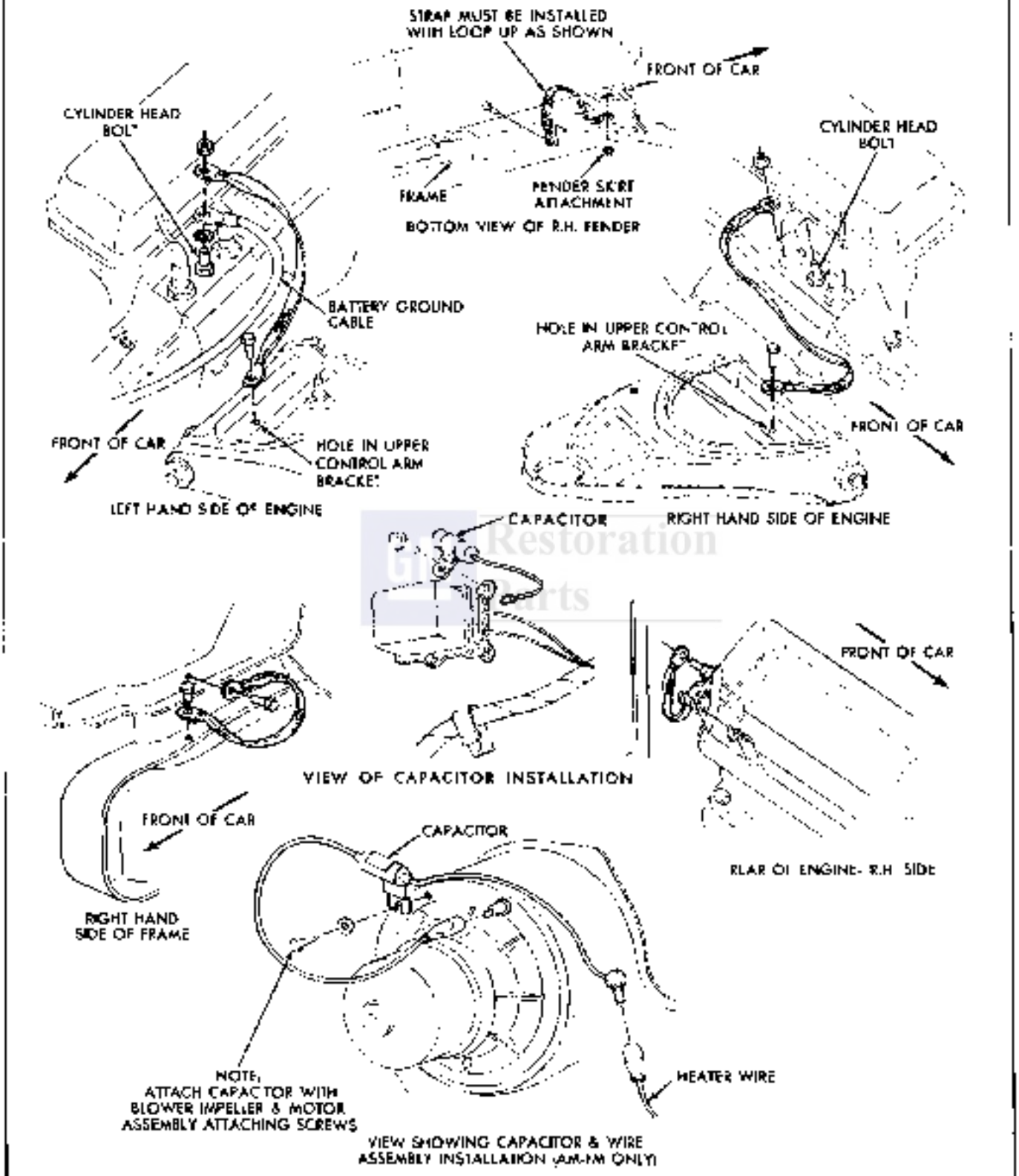


Fig. [illegible] Radio Suppressier Equipment Pontiac

REMOVE AND REPLACE FIREBIRD RADIO RECEIVER (Fig. 15-36)

1. Remove tape player and/or multiplex adapter if so equipped.

2. Remove radio knobs by pulling straight out. Remove bezels, nuts, and radio trim plate.

3. Remove ash tray.

4. Remove four screws from lower edge of I.P. trim plate (two retain ash tray housing). Remove trim plate by pulling bottom of plate outward and upward to disengage from plastic retainer at top of I.P.

5. On A/C cars -

a. Remove right and left hand hoses from distribution ducts to I.P. outlets.

b. Remove center distribution duct and left hand plenum together.

6. Remove one screw from ash tray housing and remove housing.

7. Disconnect all leads to radio receiver.

8. Remove radio brace to receiver screw.

9. Remove two screws at sides of radio controls, and lower receiver out left side of I.P.

10. Reverse above procedure to install.

11. If radio receiver was removed for service, readjust trimmer.

Whenever the AM-FM Radio, that is fitted with a multiplex adapter, is removed for service, the multiplex adapter should also be sent to the radio service station, since the problem could originate in either unit.

CAUTION: On Firebird - Never operate AM-FM Radio without either jumper plug (GM part 7292146 or equivalent) or multiplex adapter plug plugged into radio receiver.

On Pontiac and Tempest: The Stereo Radio cannot be operated without the Multiplex Adapter connected to it.

REMOVE AND REPLACE FIREBIRD RADIO FRONT SPEAKER (Fig. 15-36)

1. Remove radio receiver.

2. Remove four screws holding heater control to I.P. and let control hang by cables.

3. Remove screw holding speaker bracket to I.P. bracket, and remove speaker.

4. To install-reverse above procedure.

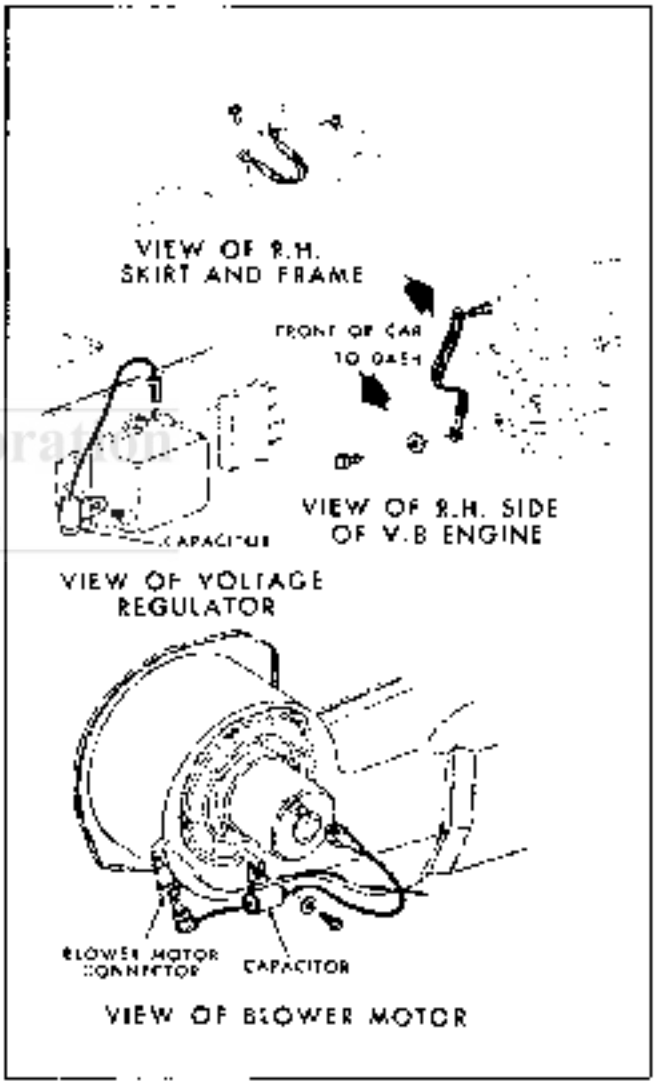


Fig. 15-36 Radio Suppression Equipment-Typical

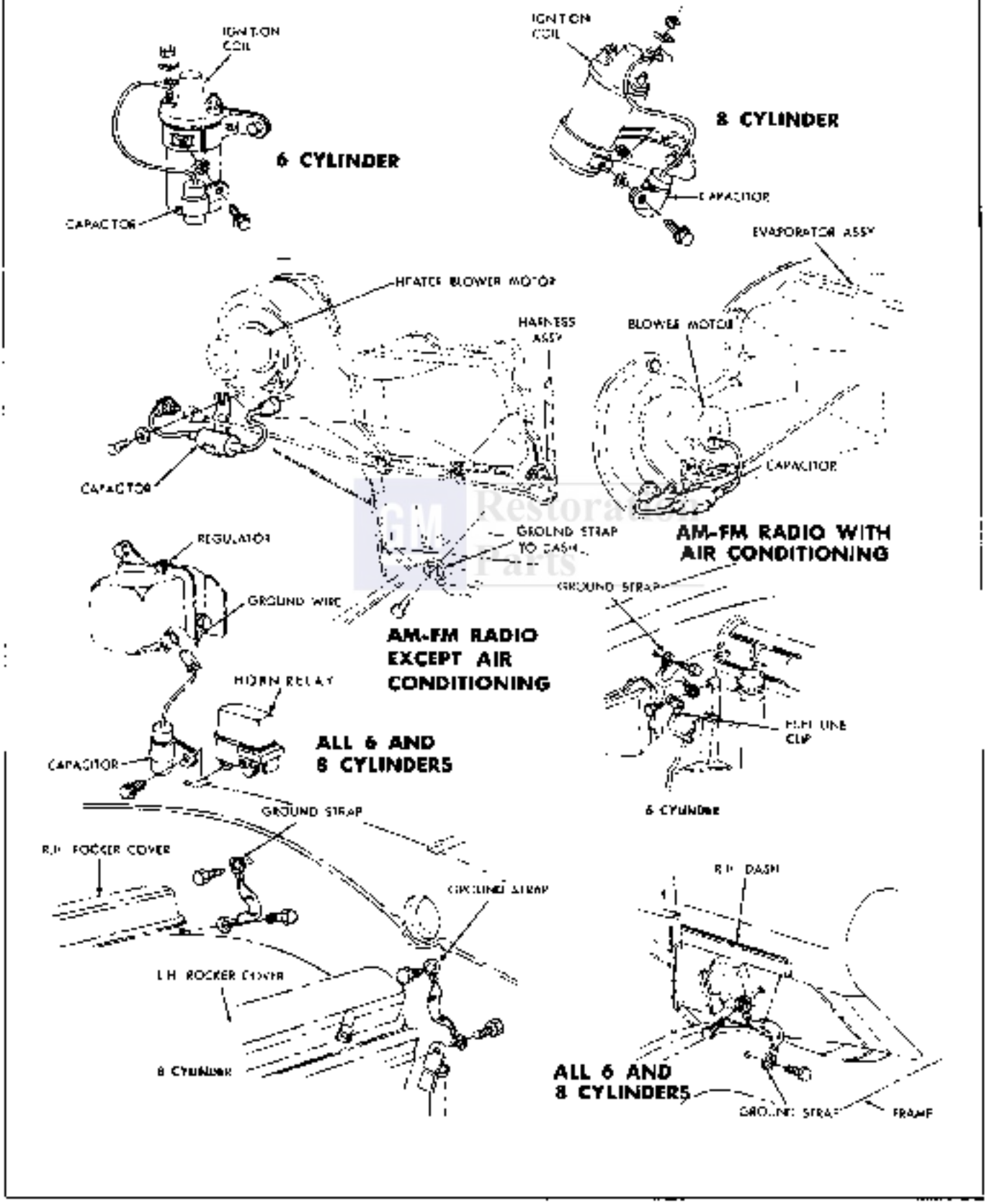


Fig. 15-29 Radio Suppression Equipment—Firebird

ELECTRIC ANTENNA

REMOVE AND REPLACE—PONTIAC
(Figs. 15-43 and 15-44)

1. Fully lower antenna.

2. Remove spare tire if necessary.

3. Disconnect ground wire, power wire, and antenna lead-in.

4. Remove bolt attaching lower antenna bracket to wheelhouse flange.

5. Remove horseshoe spring clip attaching bezel to outer fender panel.

6. Remove bezel from mast support tube by rotating clockwise to disconnect bayonet socket.

7. Remove antenna.

8. To install antenna, reverse removal procedure, making sure antenna is properly mounted onto wheelhouse flange. Adjust nut which retains lower bracket to antenna by tightening finger tight, plus four full turns.

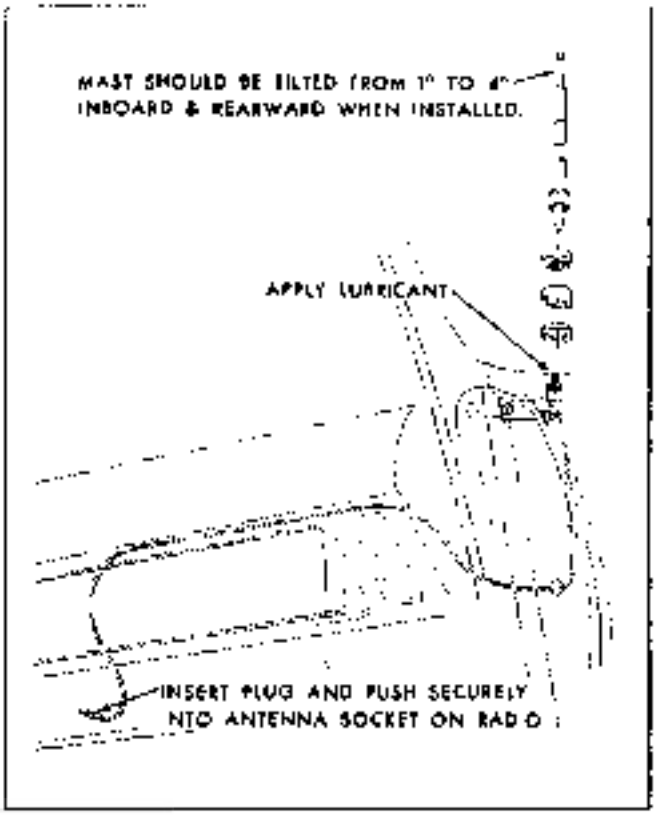


Fig. 15-43 Manual Antenna—Tempest

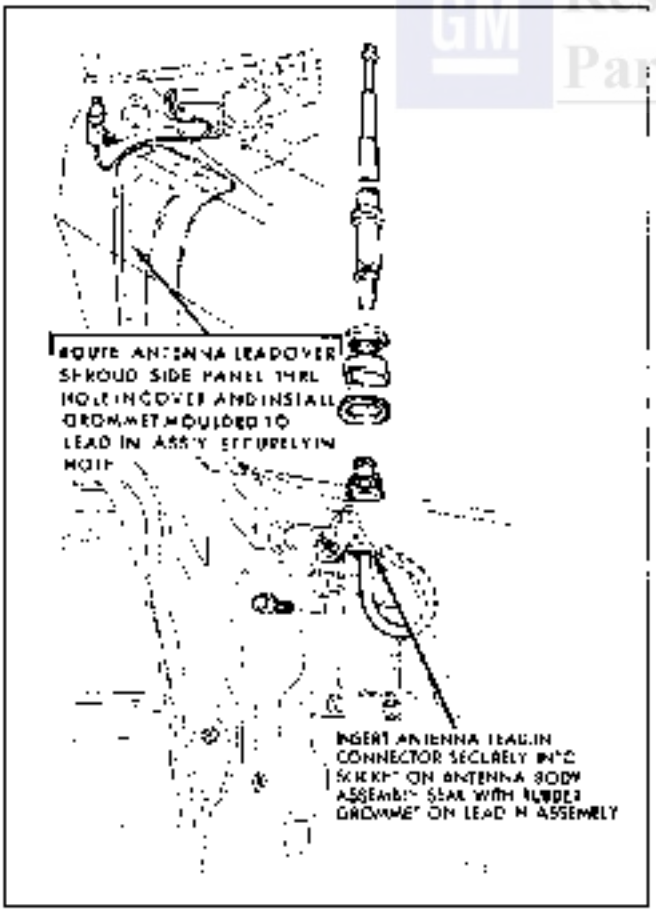


Fig. 15-44 Manual Antenna—Pontiac

REMOVE AND REPLACE—TEMPEST (Fig. 15-45)

1. Fully lower antenna.

2. Remove bezel nut at outer fender panel.

3. Remove spare tire, if necessary.

4. Disconnect ground wire, power wire, and lead-in.

5. Remove bolt attaching lower antenna bracket to wheelhouse flange.

6. Remove antenna.

7. To install antenna, reverse removal procedure, making sure antenna is properly mounted onto wheelhouse flange. Adjust nut which retains lower bracket to antenna by tightening finger tight, plus four full turns.

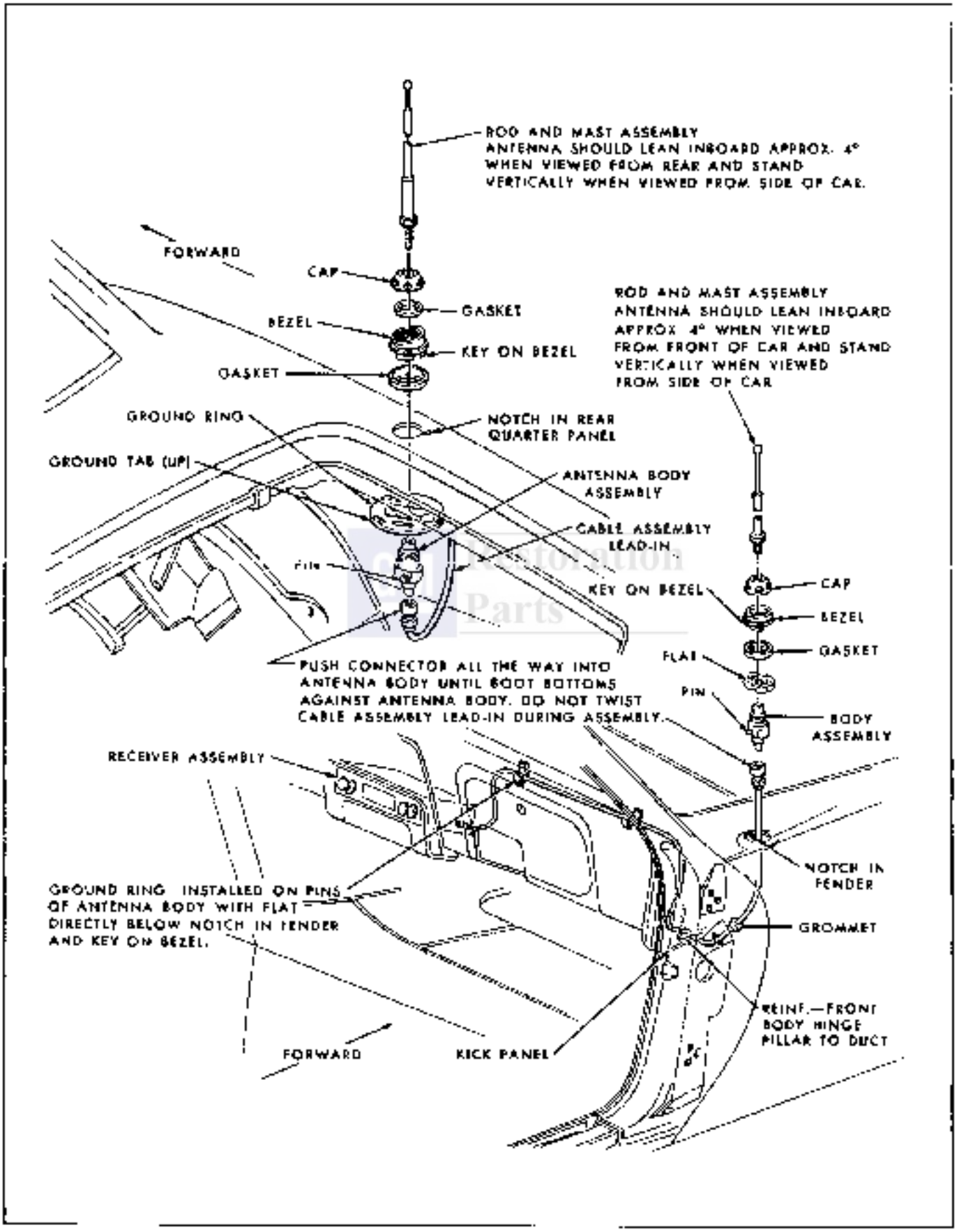


Fig. 15-42 Manual Antenna - Firebird

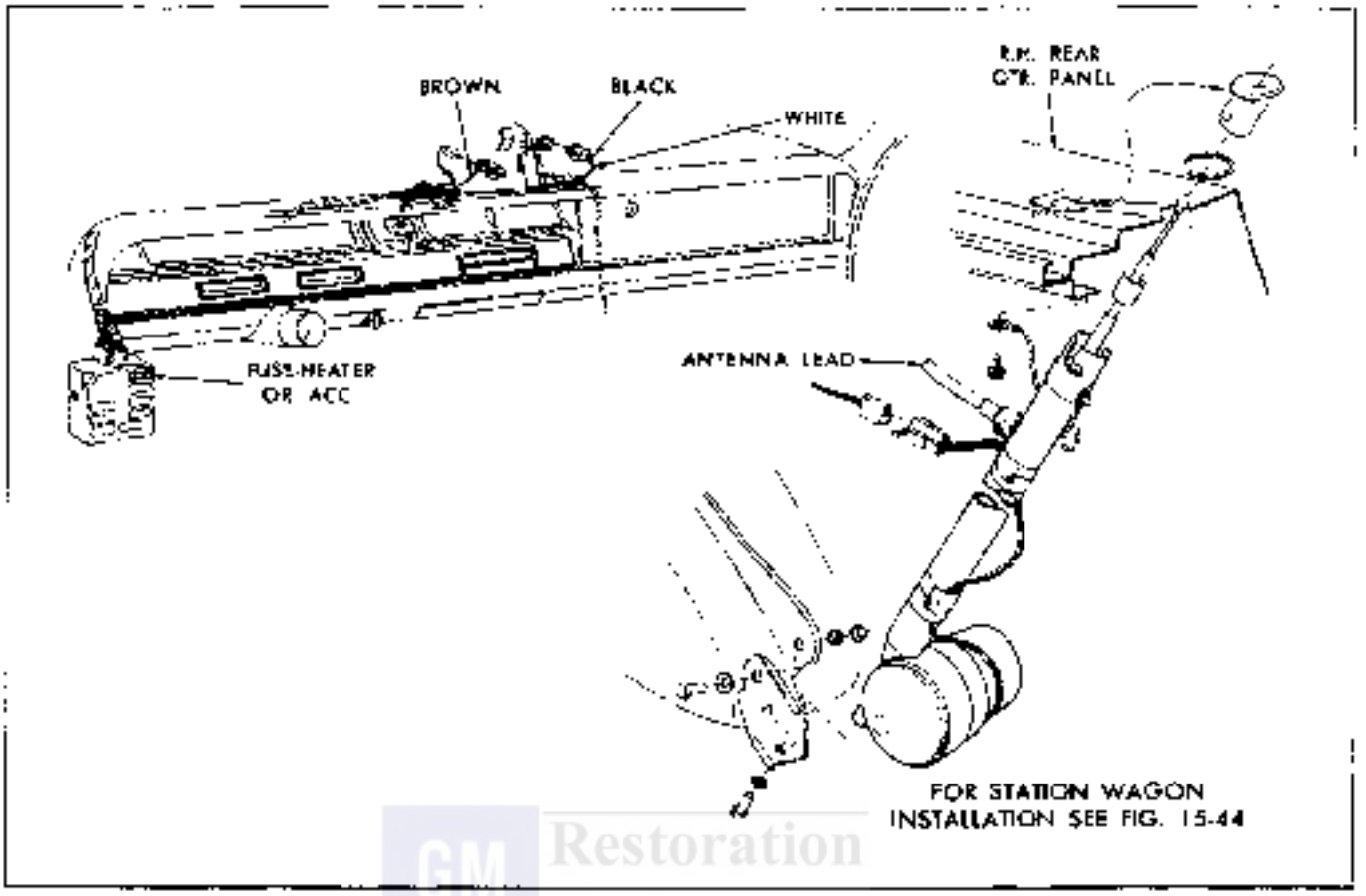


Fig. 15-43 Electric Antenna—Pontiac Shown

OVERHAUL ANTENNA

Replace drive, mast or support tube as follows:

CAUTION: Before attempting replacement of any of these major sub-assemblies listed below, the hook-up wire should be removed from lead-in plug pin and insulator assembly to prevent this wire from being broken where it is soldered to first tube section of mast.

1. Remove two screws holding lead-in flange to support tube.

2. Remove flange from pin and insulator assembly.

3. Unsolder hook-up pin from wire.

NOTE: Do not overheat pin by slow soldering as this will destroy pin insulator. Use needle-nose pliers to hold pin while soldering.

4. Remove pin and insulator assembly. If replacement of drive, support tube or mast is indicated, continue following steps as required.

5. Remove three screws which hold support tube to drive assembly.

6. Holding drive in one hand and supporting tube in other hand, pull (applying back-and-forth rotary motion at same time) until support tube is removed from antenna.

To replace support tube:

7. If only replacing a damaged support tube assembly, apply the reverse of steps 1 through 6, making sure that hook-up wire is extended through proper hole in support tube.

If replacement of drive or mast is indicated:

8. Holding drive in one hand and mast in other hand (grasp near bottom of mast), rock mast back and forth and pull at same time. This will remove insulator bushing and .400 tube section from tubular fitting on drive.

9. Apply 12 volts D.C. (up direction on mast) to power leads until entire length of nylon cord has been expelled from drive. To prevent kink or bend in nylon cord, keep it taut by pulling on mast.

NOTE: If drive assembly is inoperative, it will be necessary to manually remove nylon cord from drive. To remove nylon cord from disabled drive, place assembly in vise so normal plane of nylon cord is parallel with floor. Then, using both hands, pull on .200-diameter mast tube until nylon cord is removed completely from drive.

CAUTION: DO NOT attempt service on components of drive assembly. This must be serviced as a complete unit.

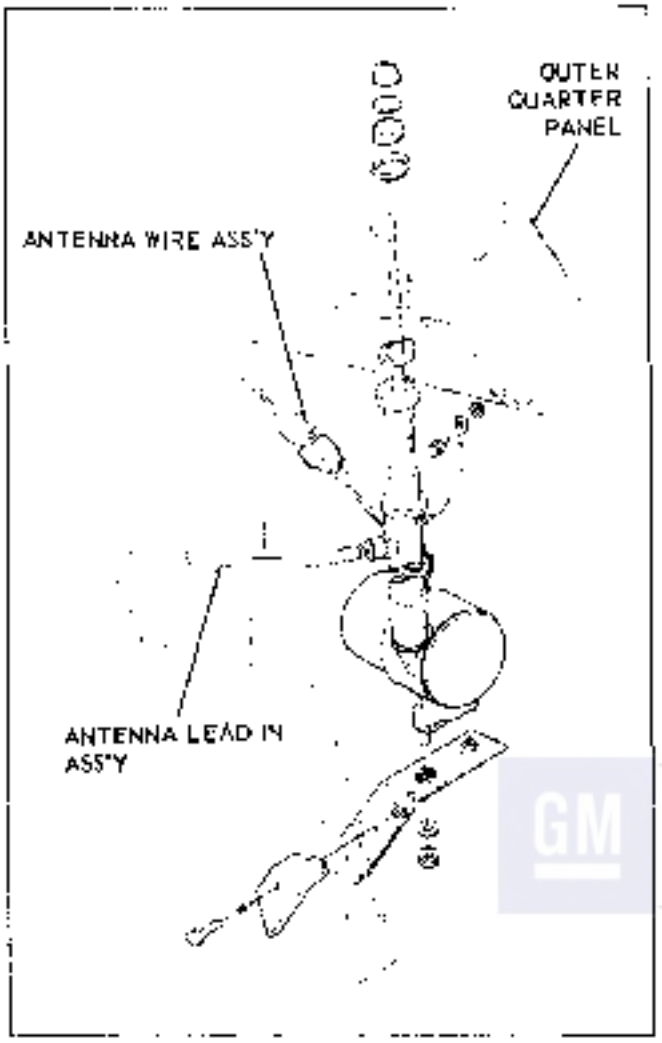


Fig. 15-44 Electric Antenna—Pontiac Wagon

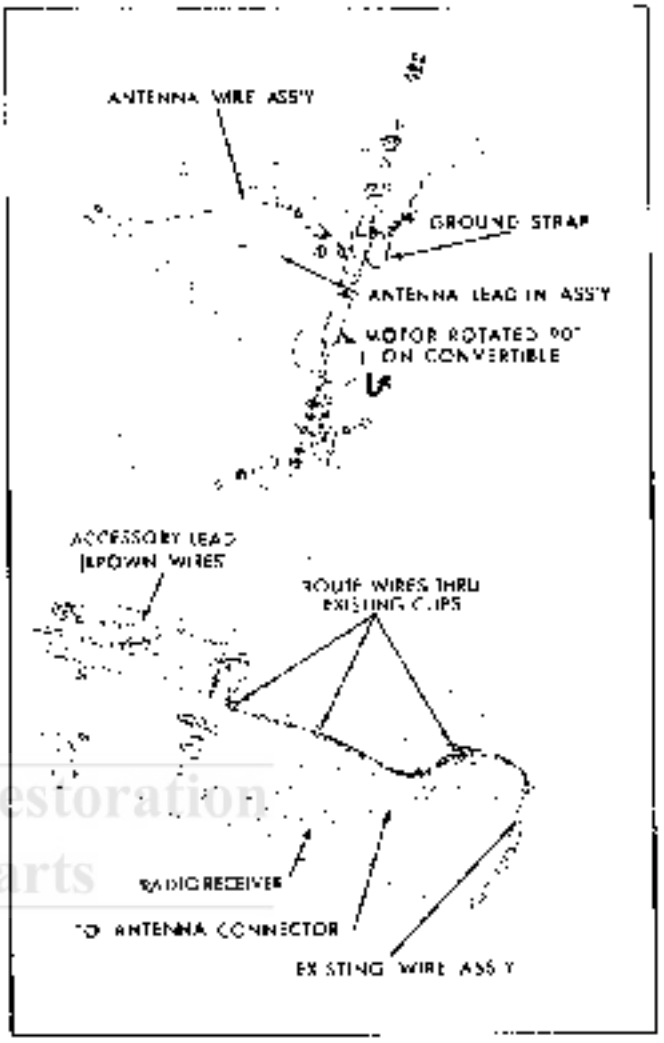


Fig. 15-45 Electric Antenna—Tempest

10. Remove bottom insulator and water seal washer from tubular fitting, using wire hook or long-nose pliers.

11. Thread nylon cord through bottom insulator with small diameter end down. Then thread nylon cord through water seal washer.

12. Apply 12 volts D.C. (down direction of mast) to power leads and feed nylon cord into drive assembly. Do not allow bend or kink to appear in nylon cord.

NOTE: Push water seal washer and bottom insulator all the way down into tubular fitting before nylon cord completely disappears into drive assembly. Remove power, if necessary, to seat these parts.

13. Push .400 tube section down into tubular fitting on drive. Make sure that upper edge of flange on insulator bushing is below center of 3 holes in tubular fitting.

14. Install support tube (minus lead-in flange, pin and insulator assembly) in proper position, making sure hook-up wire is extended through proper hole in support tube.

15. Install three screws to hold support tube to drive assembly.

16. Solder hook-up wire to pin and insulator assembly.

CAUTION: Do not overheat by slow soldering.

17. Assemble flange over pin and insulator assembly and install two screws.

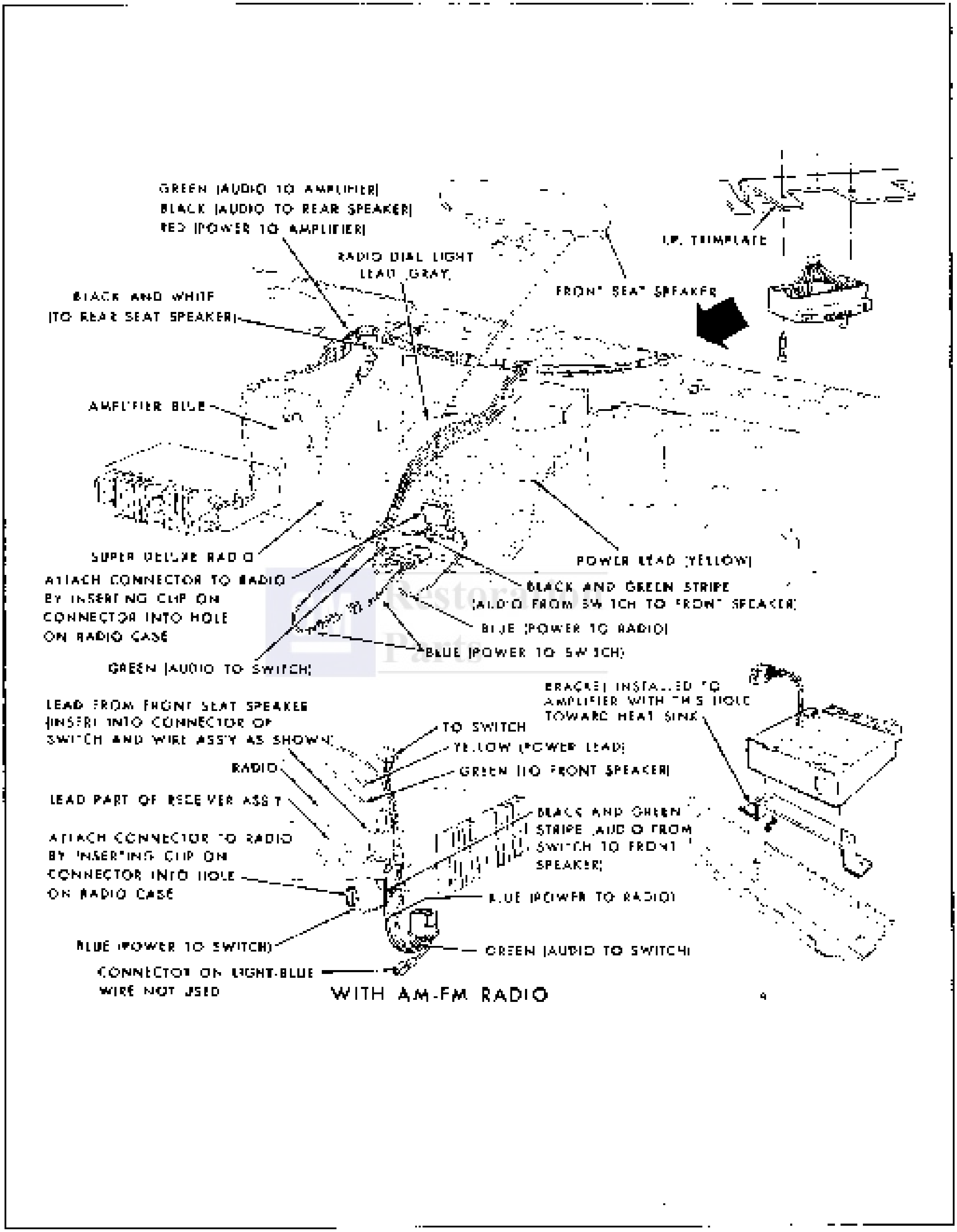


Fig. 15-66 Verso-Phonic System—Pontiac

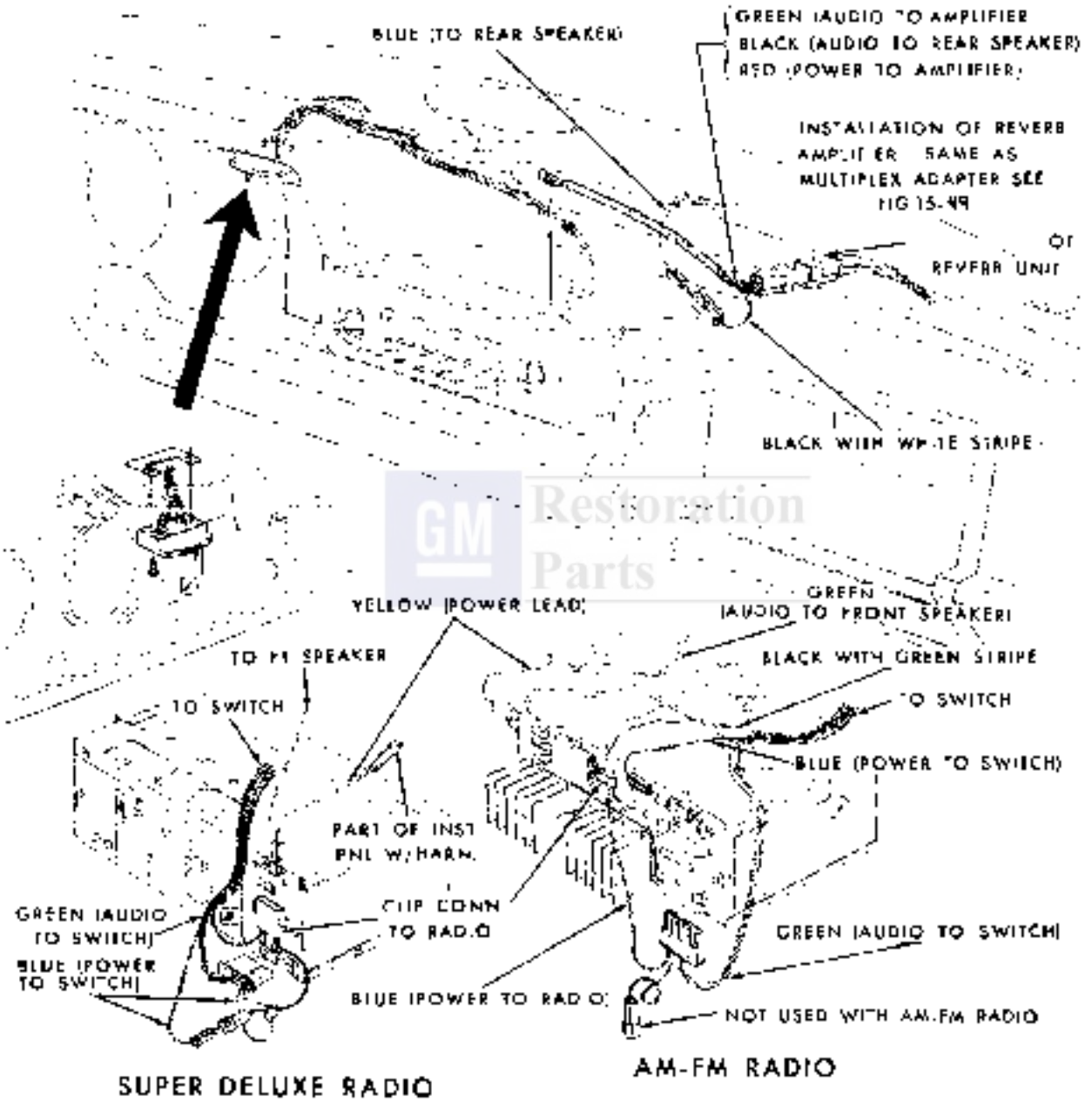


Fig. 15-47 Verbo-Phonic System—Typical

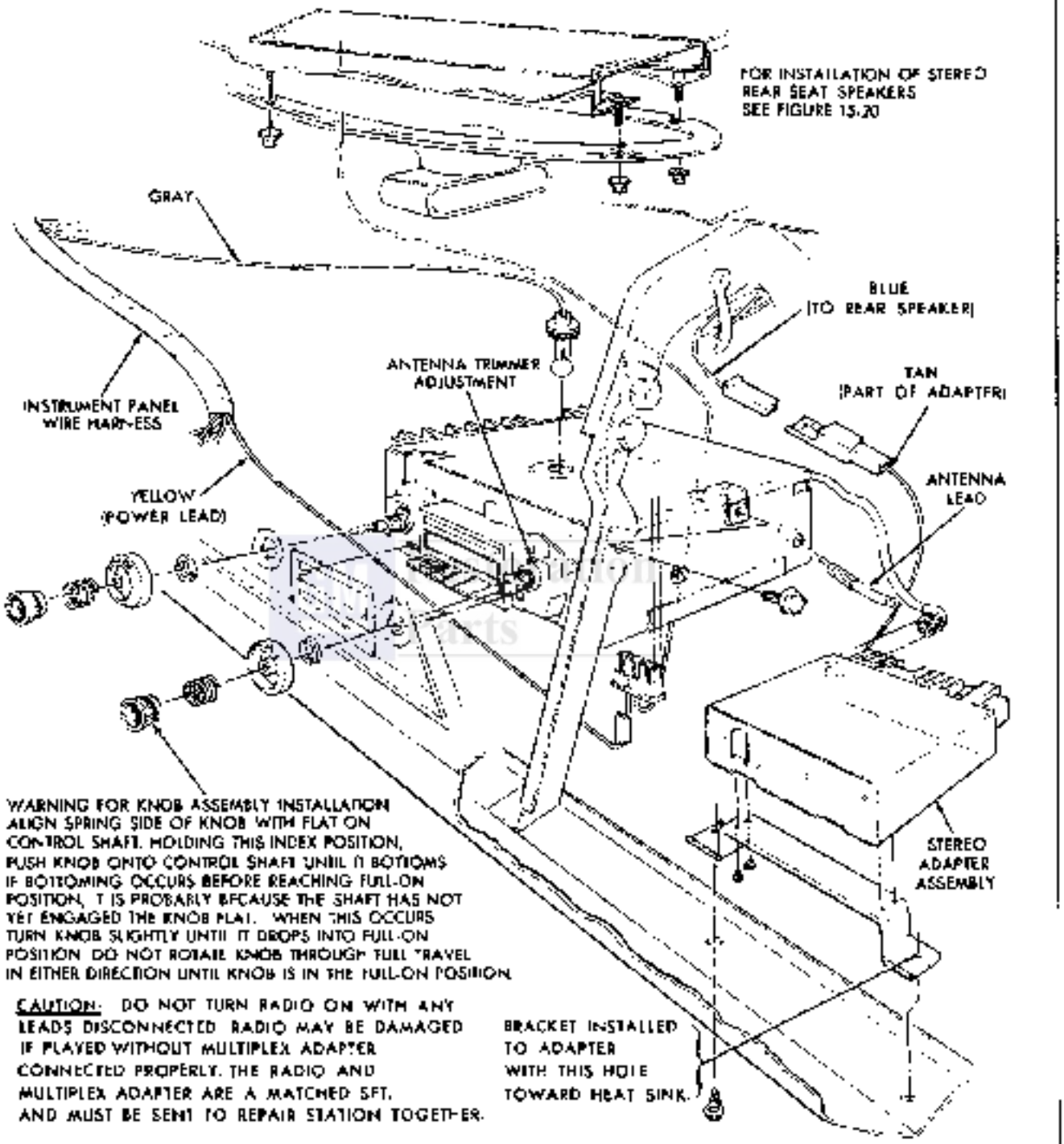


Fig. 15-48 FM Stereo Radio—Pontiac

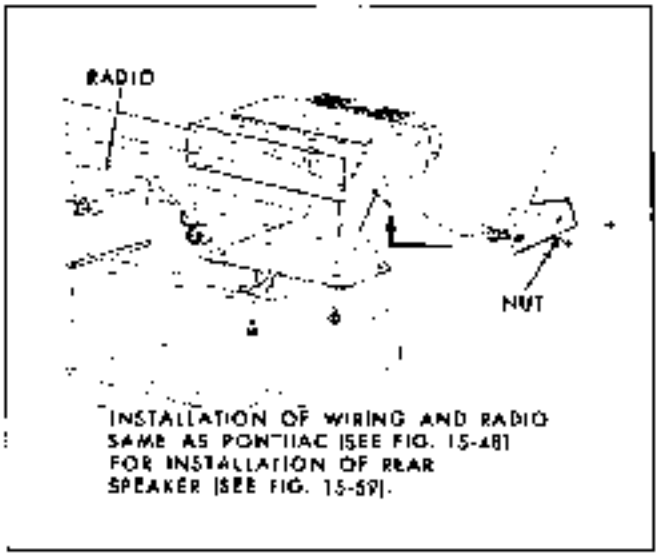


Fig. 15-49 FM Stereo Radio - Tempest

REMOVE AND REPLACE PONTIAC FM MULTIPLEX ADAPTER (Fig. 15-48)

CAUTION: FM STEREO RADIO AND MULTIPLEX ADAPTER ARE A MATCHED SET - DO NOT SEPERATE.

1. If equipped with A/C, remove three phillips head screws and lower cold air duct.

2. Remove two 3/8" screws holding adaptor to bottom of dash and, disconnecting multiplex plug and power lead, remove multiplex adapter.

3. To replace, reverse the above.

REMOVE AND REPLACE—TEMPEST FM MULTIPLEX ADAPTER (Fig. 15-49)

1. Remove radio.

2. Disconnect tan wire (part of adapter).

3. Remove upper R.H. glove box screw.

4. Remove two screws holding adapter bracket to dash and remove adapter and bracket assembly.

NOTE: It may be necessary to remove glove box.

5. Remove bracket from adapter.

CAUTION: Multiplex adapter and stereo radio are a matched set. Do not separate. Both units must be used to replace station together.

6. To replace, reverse above.

REMOVE AND REPLACE FIREBIRD MULTIPLEX ADAPTER (Fig. 15-50)

1. Disconnect adapter plug from bottom of radio receiver.

2. Unclip ground wire from speaker bracket (above radio).

3. Disconnect power feed to radio (yellow wire) - (black wire when also equipped with tape player).

4. Disconnect adapter connector from back of radio receiver.

5. Disconnect six-wire speaker connector from stereo speaker connector (or from connector to multiplex-tape player switch-connector C in figure 15-54 if also equipped with tape player).

6. Remove four screws holding multiplex adapter to I.P. bracket, and slide adapter out.

7. To install- reverse above procedure.

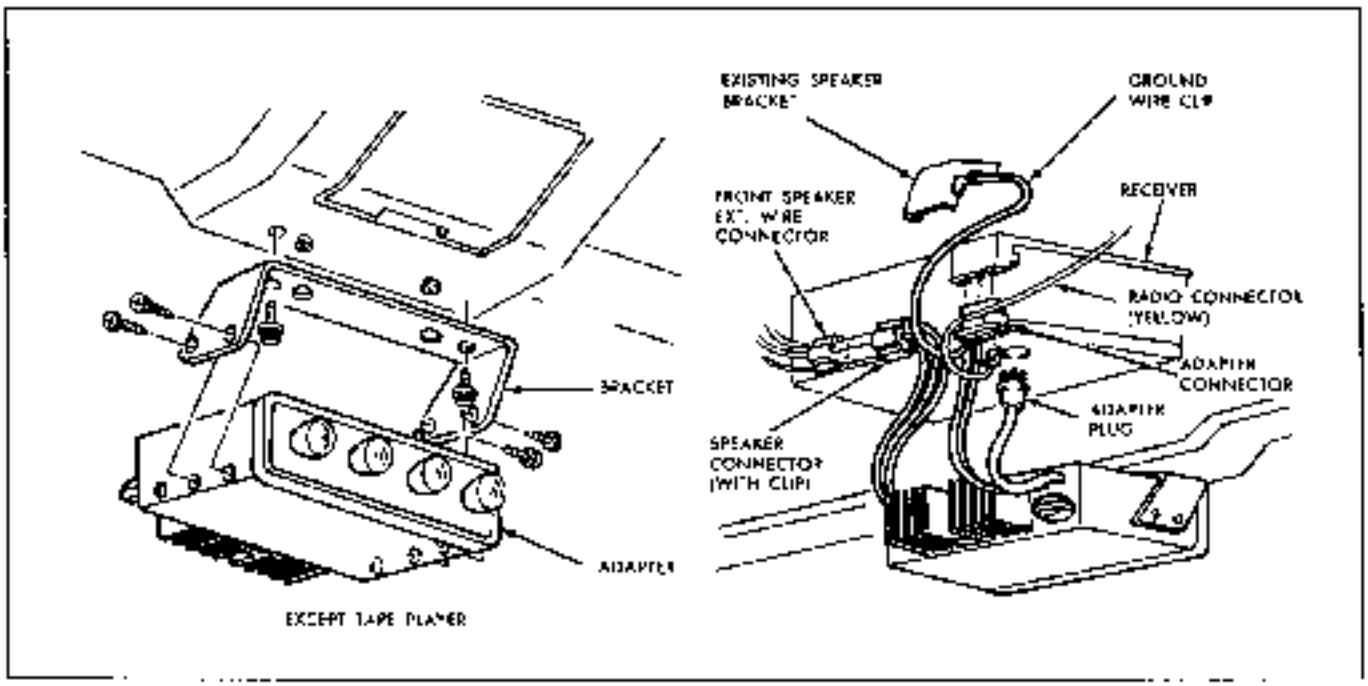


Fig. 15-50 FM Stereo Radio—Firebird

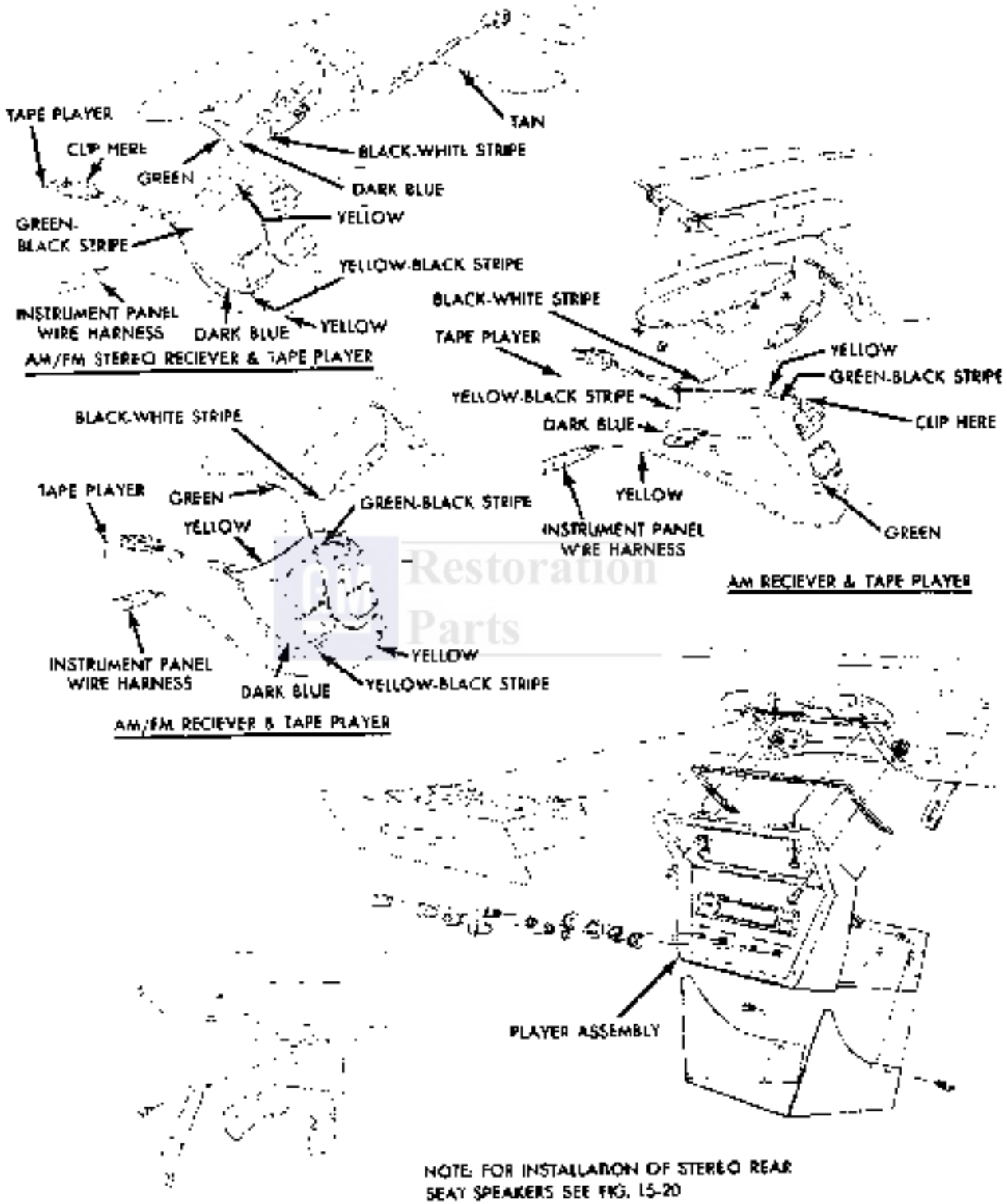


Fig. 15-51 Stereo Tape Player - Pontiac

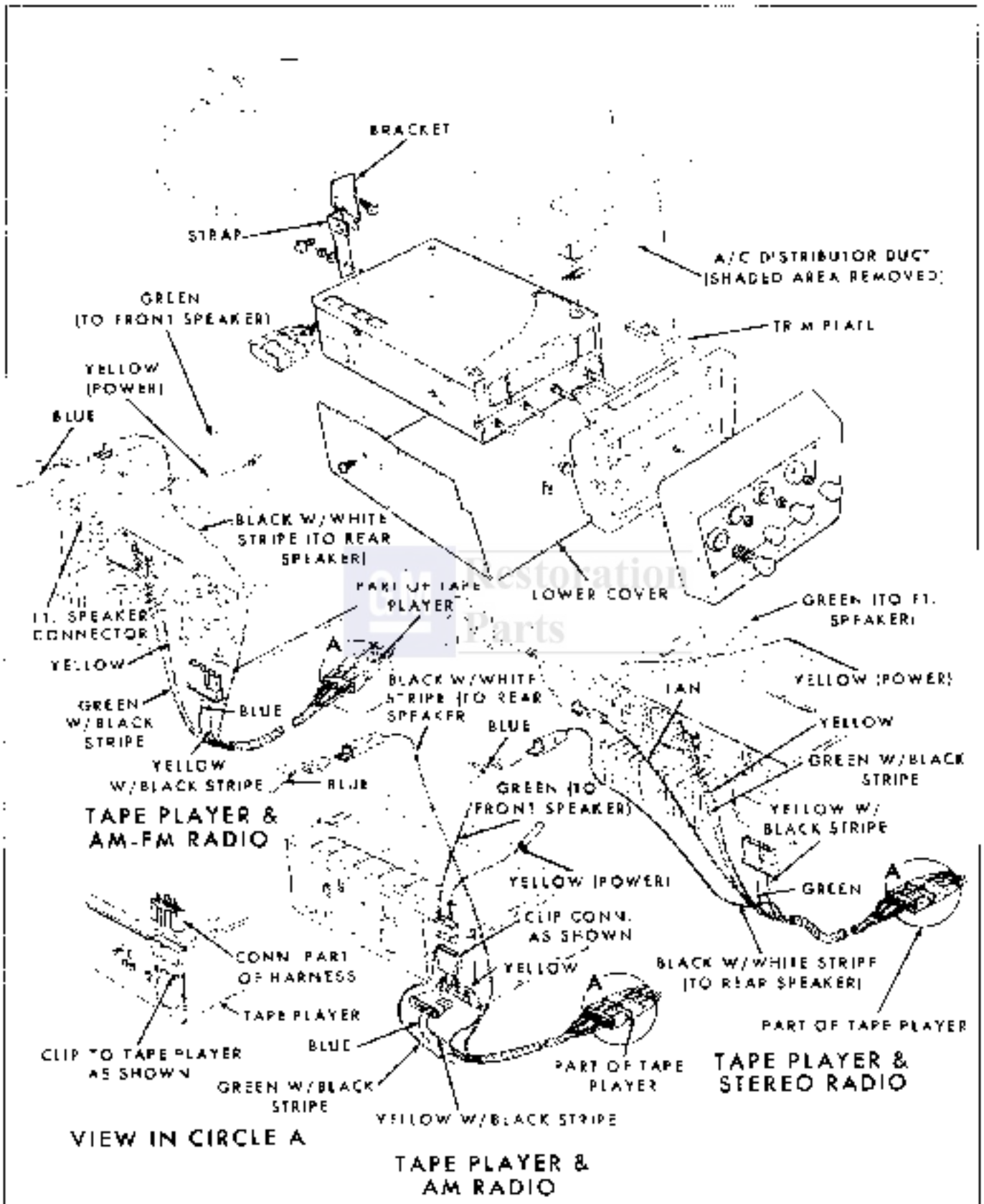


Fig. 10-52 Stereo Tape Player—Tempest

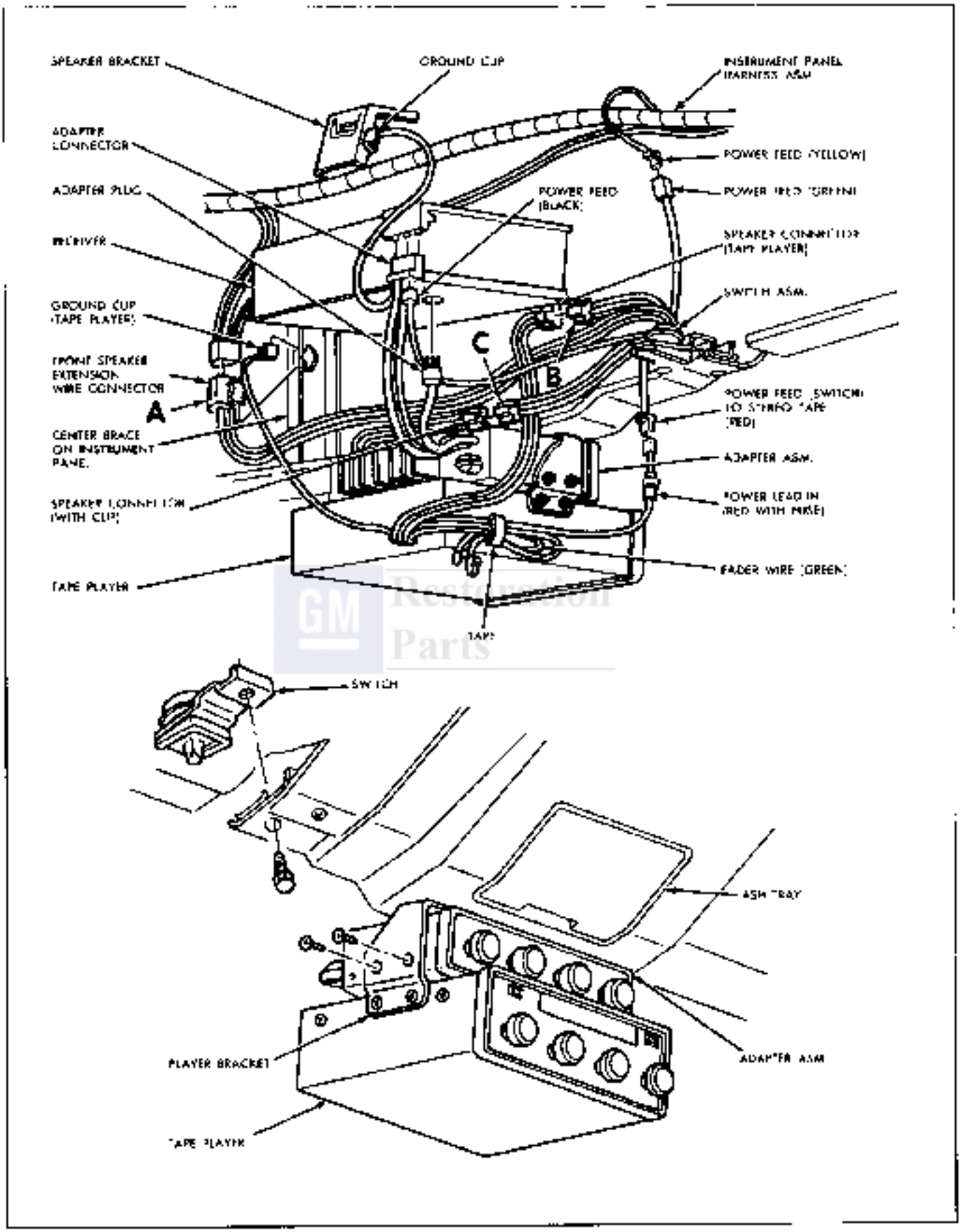


Fig. 15-54 Stereo Tape Player with Multiplex—Firebird

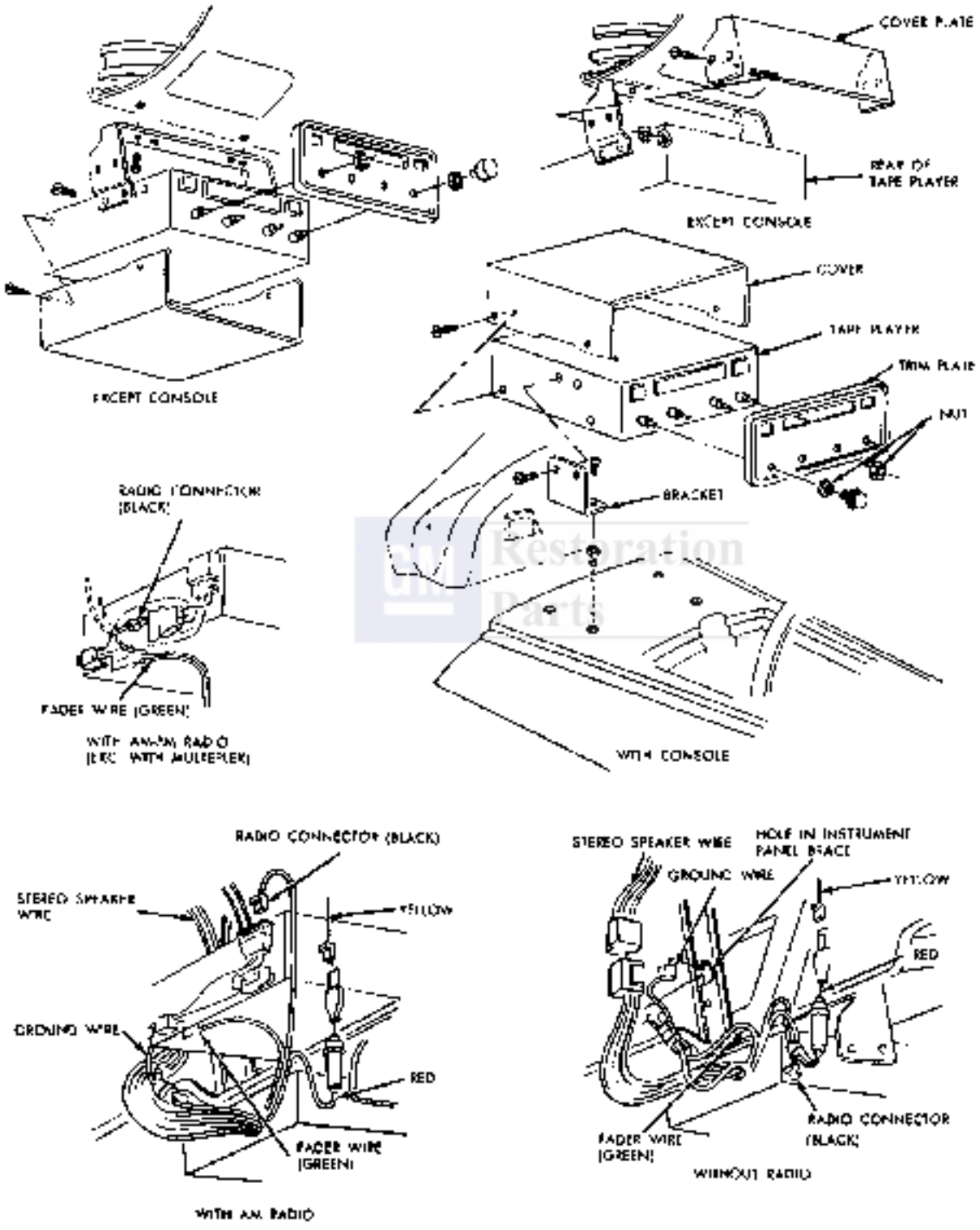


Fig. 15-53 Stereo Tape Player Installed

STEREO TAPE PLAYER

REMOVE AND REPLACE—PONTIAC (Fig 15-51)

1. Remove stereo tape player side trim panel(s) by removing two phillips head screws.

2. Remove control knobs, spring, 1/2" nuts and bezels from control bushings.

3. Remove screw retaining heater divider duct and remove duct.

4. Remove rear brace to player assembly 7/16" nut and star washer and position brace to provide clearance.

5. Unplug tape player wiring harness and remove player.

6. To replace, reverse the above.

REMOVE AND REPLACE—TEMPEST (Fig 15-52)

1. Remove stereo tape player side trim panel by removing two phillips head screws.

2. Remove control knobs, spring, 1/2" nuts and bezels from control bushings.

3. Remove heater divider duct from behind tape player.

4. Remove screws from tape player front support brackets to dash.

5. Remove rear brace to player nut and position brace to provide clearance.

6. Unplug tape player wiring harness and remove player.

7. To replace, reverse above procedure.

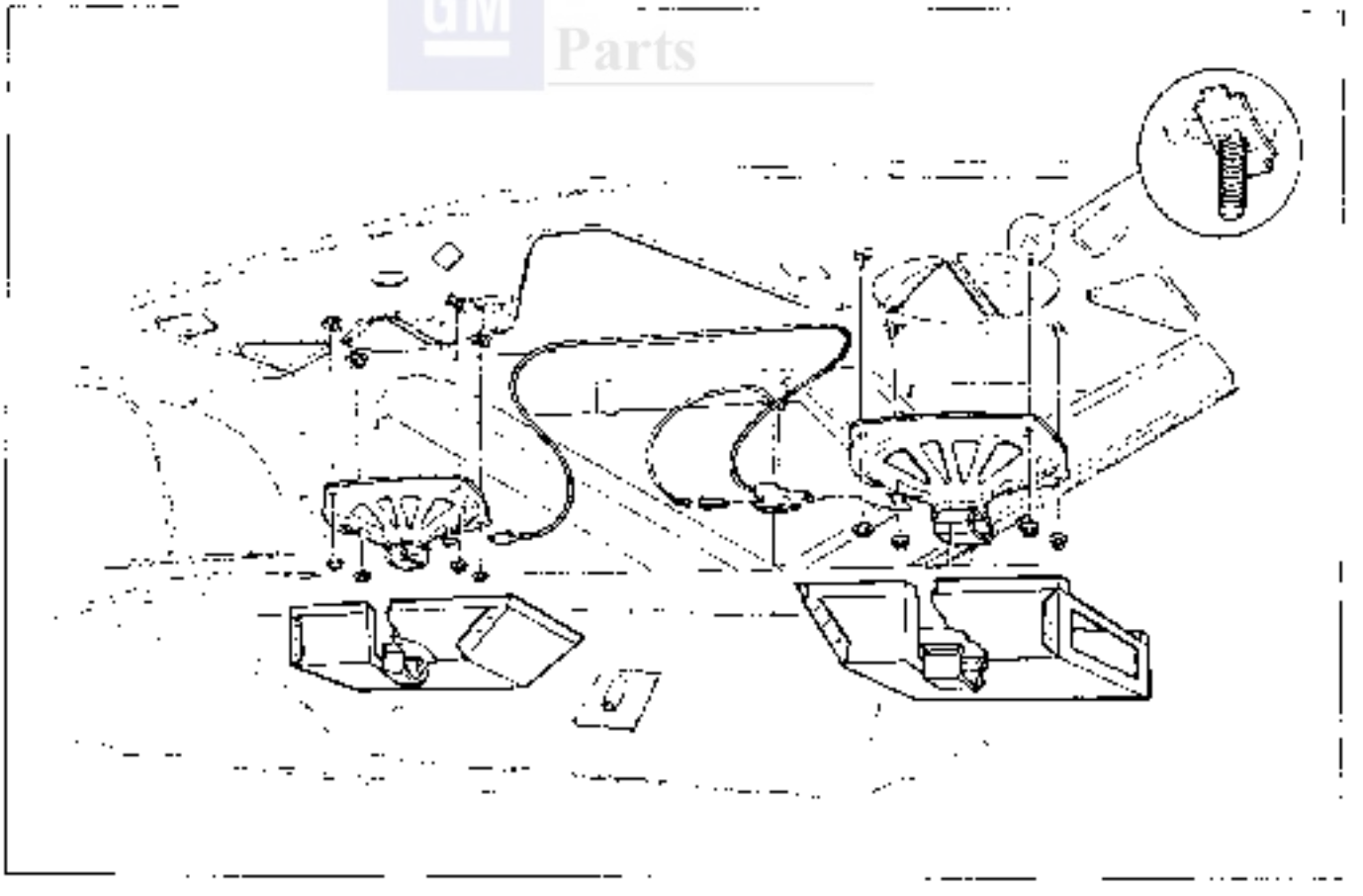


Fig. 15-51 Stereo Rear Speakers—Pontiac

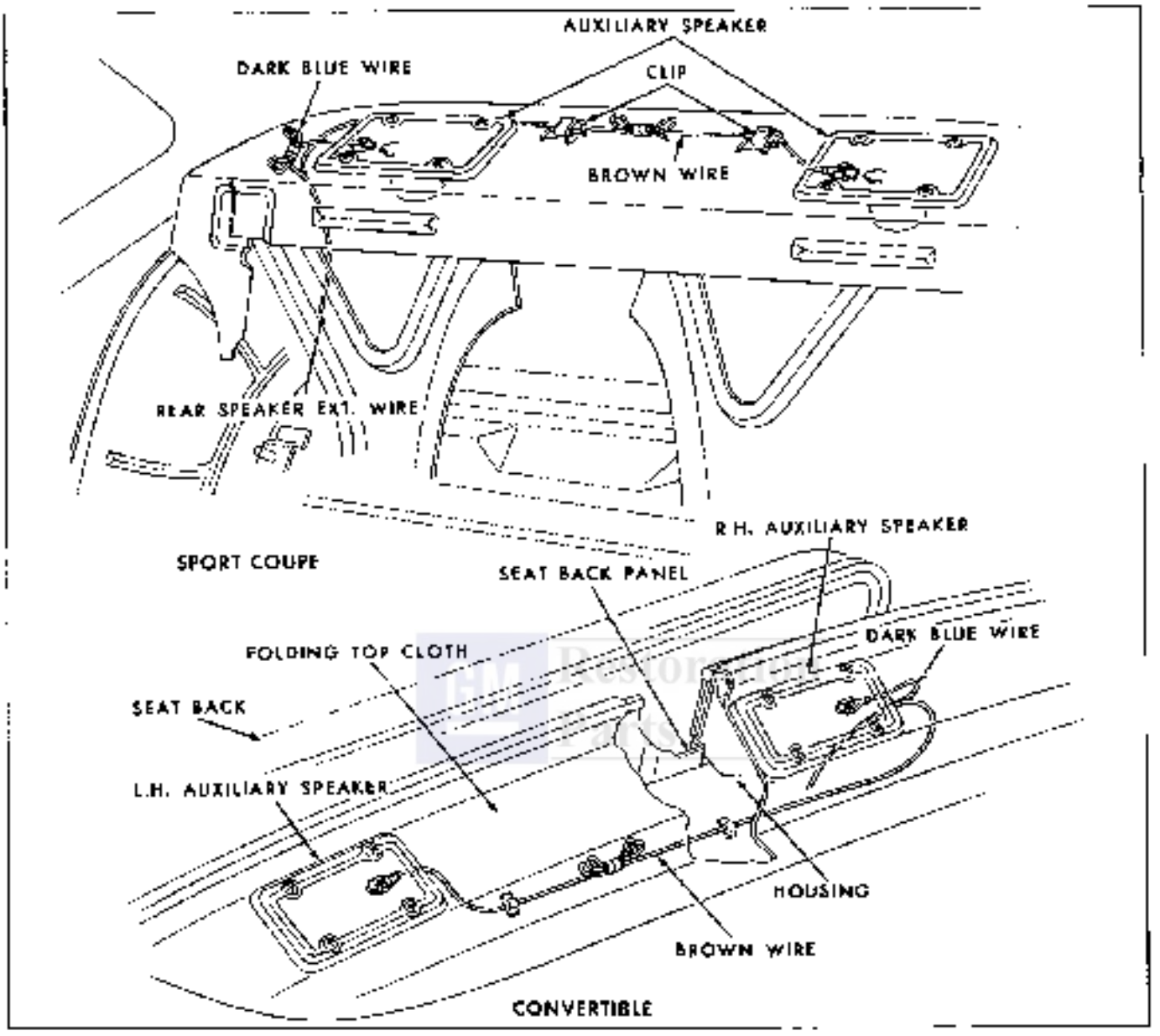


Fig. 15-54 Stereo Rear Speakers—Firebird

REMOVE AND REPLACE—FIREBIRD (Fig. 15-53)

1. Disconnect radio connector (black wire) from front speaker connector at back of radio.

2. Disconnect red lead (with fuse) from power feed connector (yellow wire). - (Red wire when also equipped with multiplex).

3. Unclip tape player ground wire from I.P. brace (right side of radio).

4. Disconnect fader lead (green wire) from connector at back of radio.

5. Disconnect tape player speaker connector (six-wire connector) from stereo speaker connector. If also equipped with multiplex adapter, this wire will be connected to a six-wire connector from the tape player-multiplex switch assembly (see Fig. 15-54).

6. Remove knobs and nuts from trim plate (Fig. 15-53) and remove trim plate.

7. Remove four screws holding tape player cover to tape player and remove cover.

8. Remove four screws holding tape player to mounting bracket and remove tape player.

9. To replace-reverse above procedure.

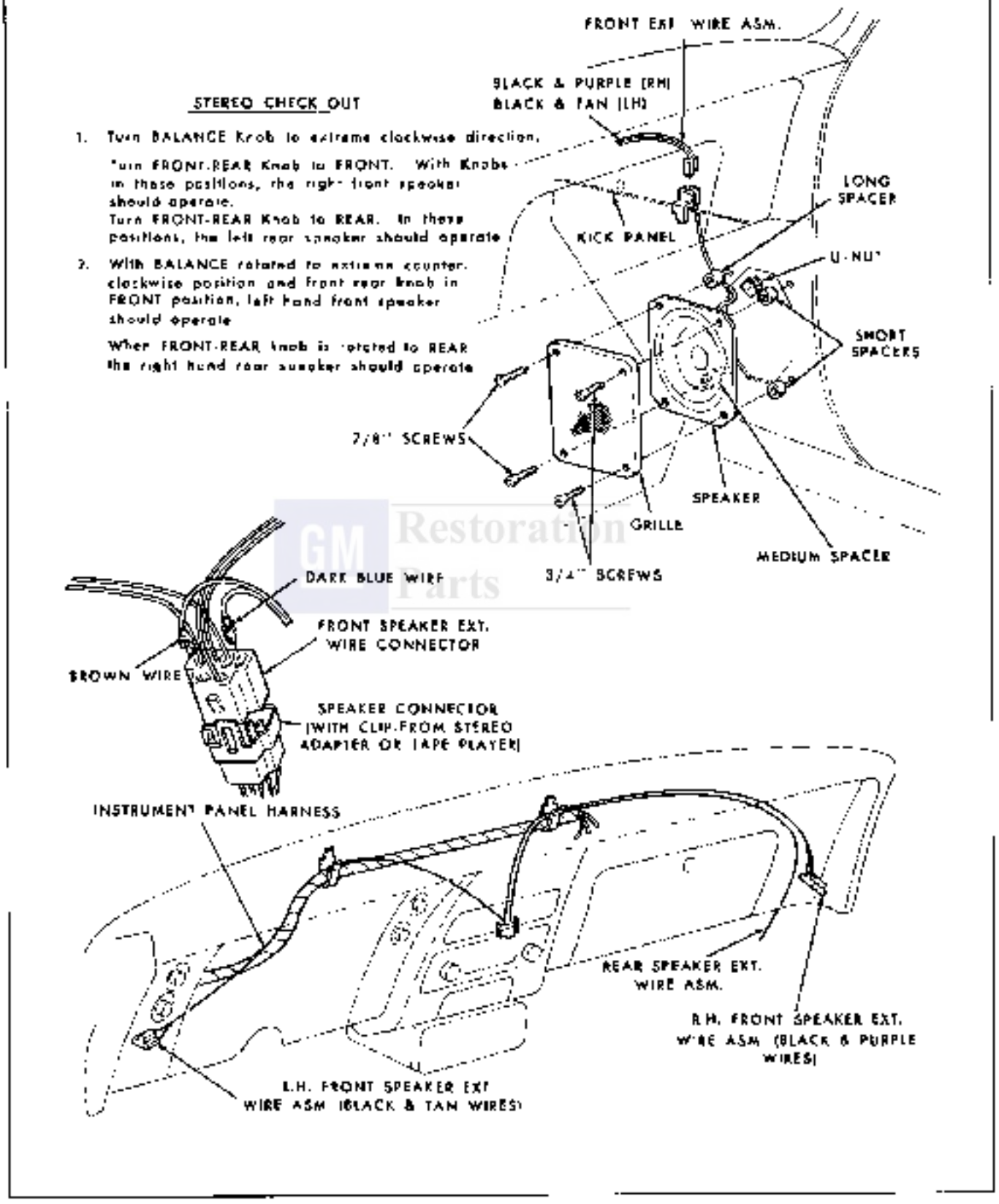


Fig. 15-57 Stereo Front Speakers—Firebird

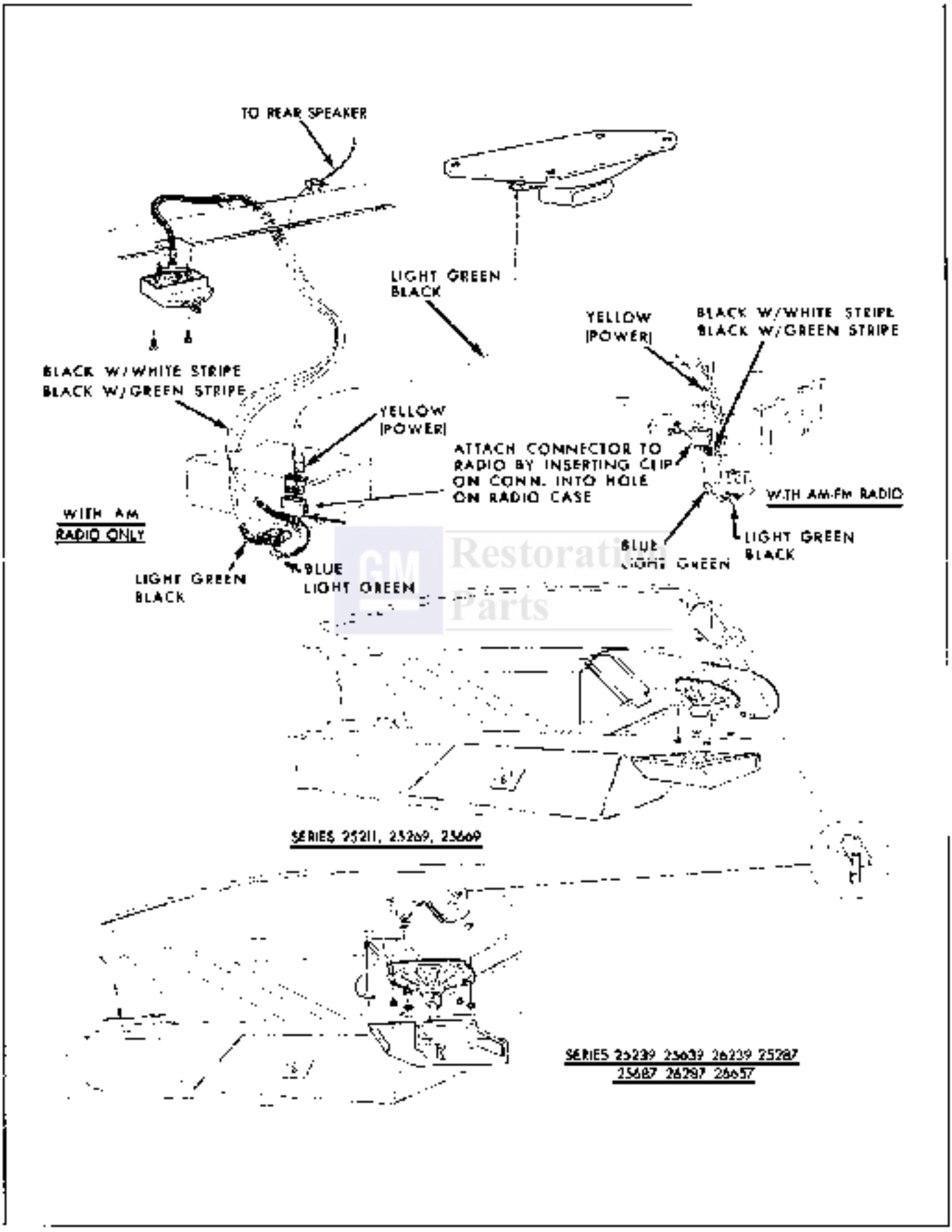


Fig. 15-63 Rear Seat Speaker—Partial

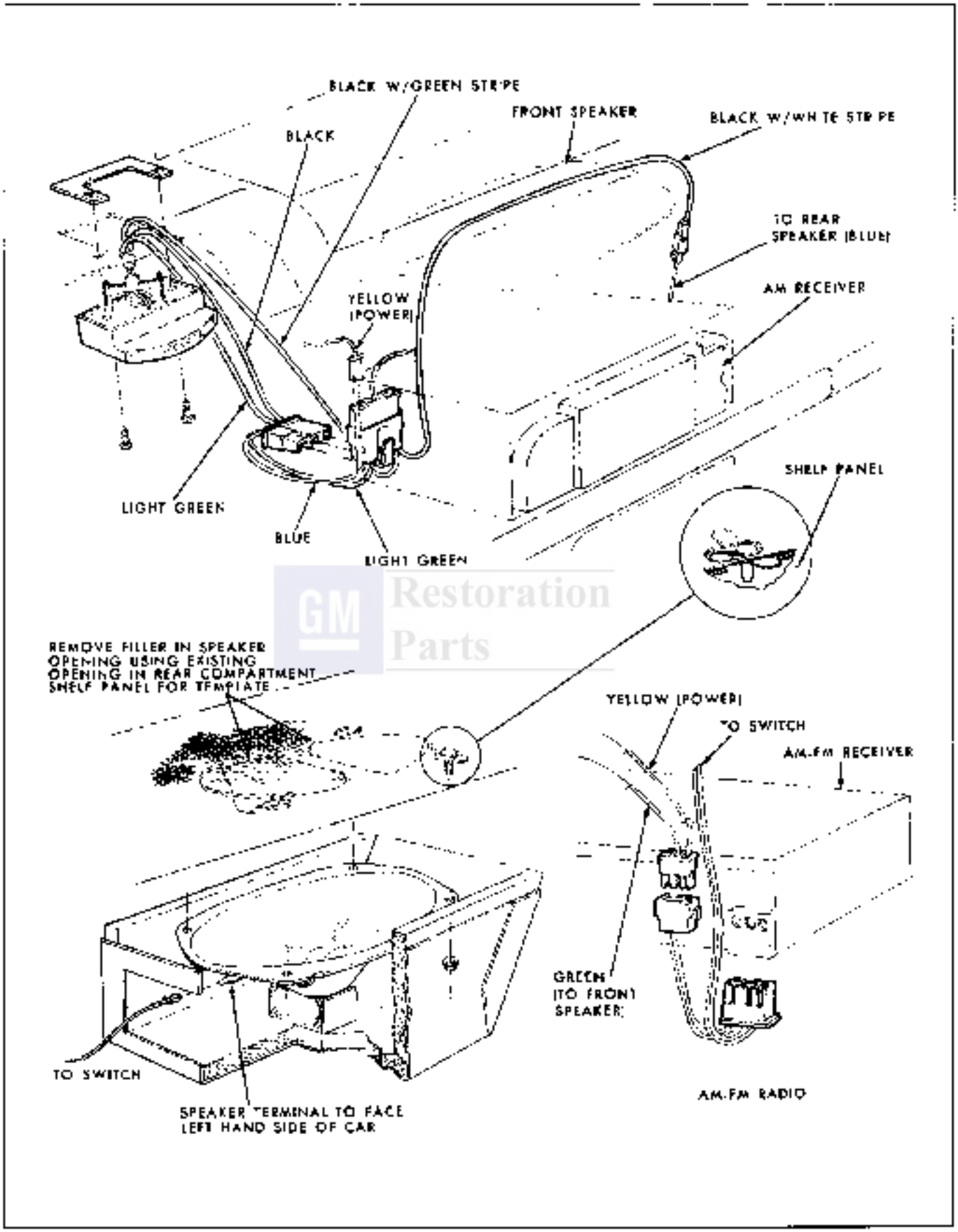


Fig. 15-59 Rear Seat Speaker—Tempest

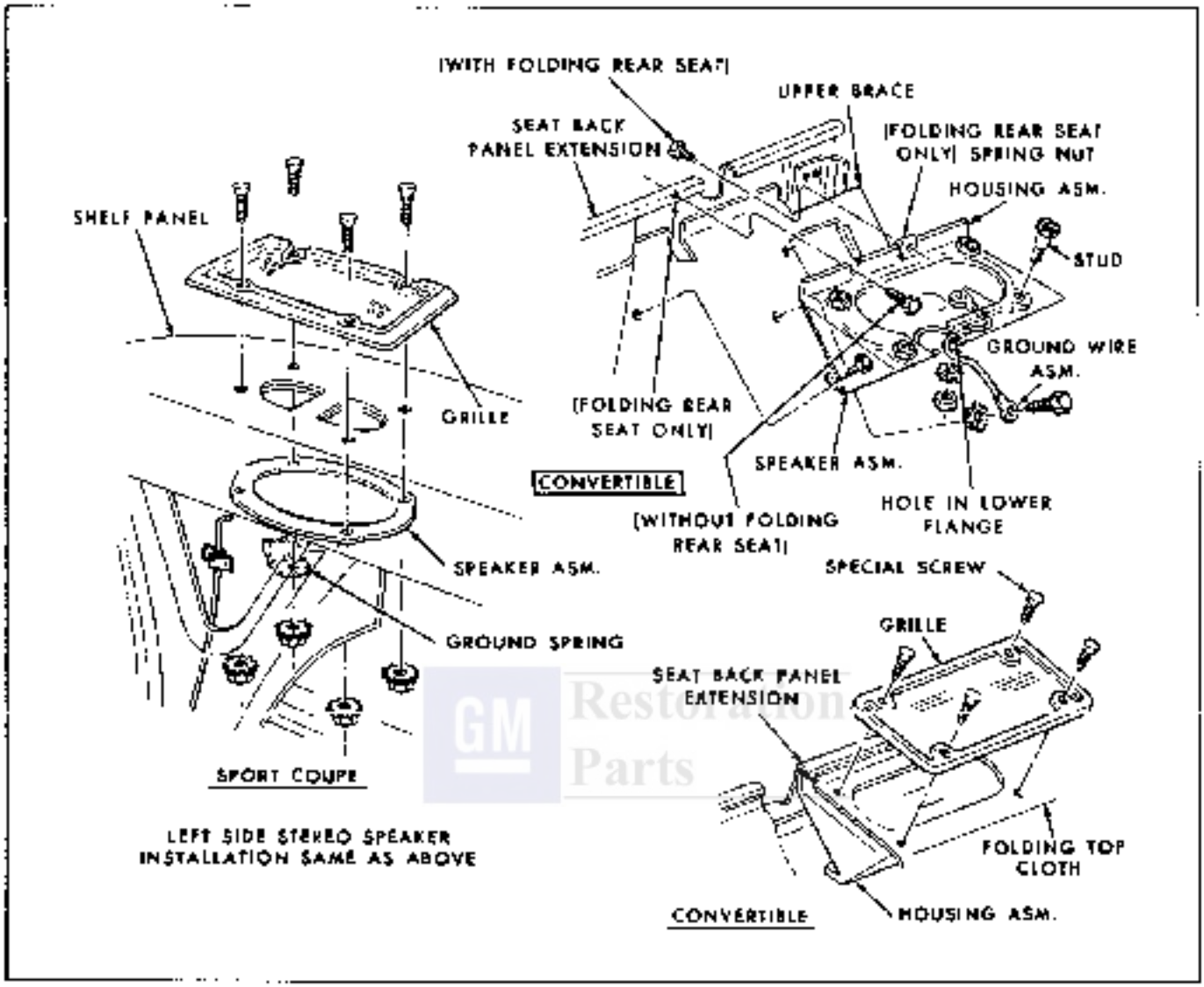


Fig. 15-60 Rear Seat Speaker—Prestige

REMOVE AND REPLACE MULTIPLEX-TAPE PLAYER SWITCH (Fig. 15-54)

1. Disconnect power feed from switch (green wire) from power feed from I.P. harness (yellow wire).

2. Disconnect power feed (black wire) from back of radio receiver.

3. Disconnect power feed from switch (red wire) from power feed to tape player (red wire with fuse).

4. Disconnect three six-wire connectors (marked A, B, and C on Fig. 15-54.

5. Remove screw holding switch to I.P. and remove switch.

6. To install—reverse above procedure.

STEREO REAR SPEAKERS

Refer to Figs. 15-55 thru 15-60 for installation.

REAR SEAT SPEAKER

Refer to Figs. 15-58 thru 15-60 for installation.

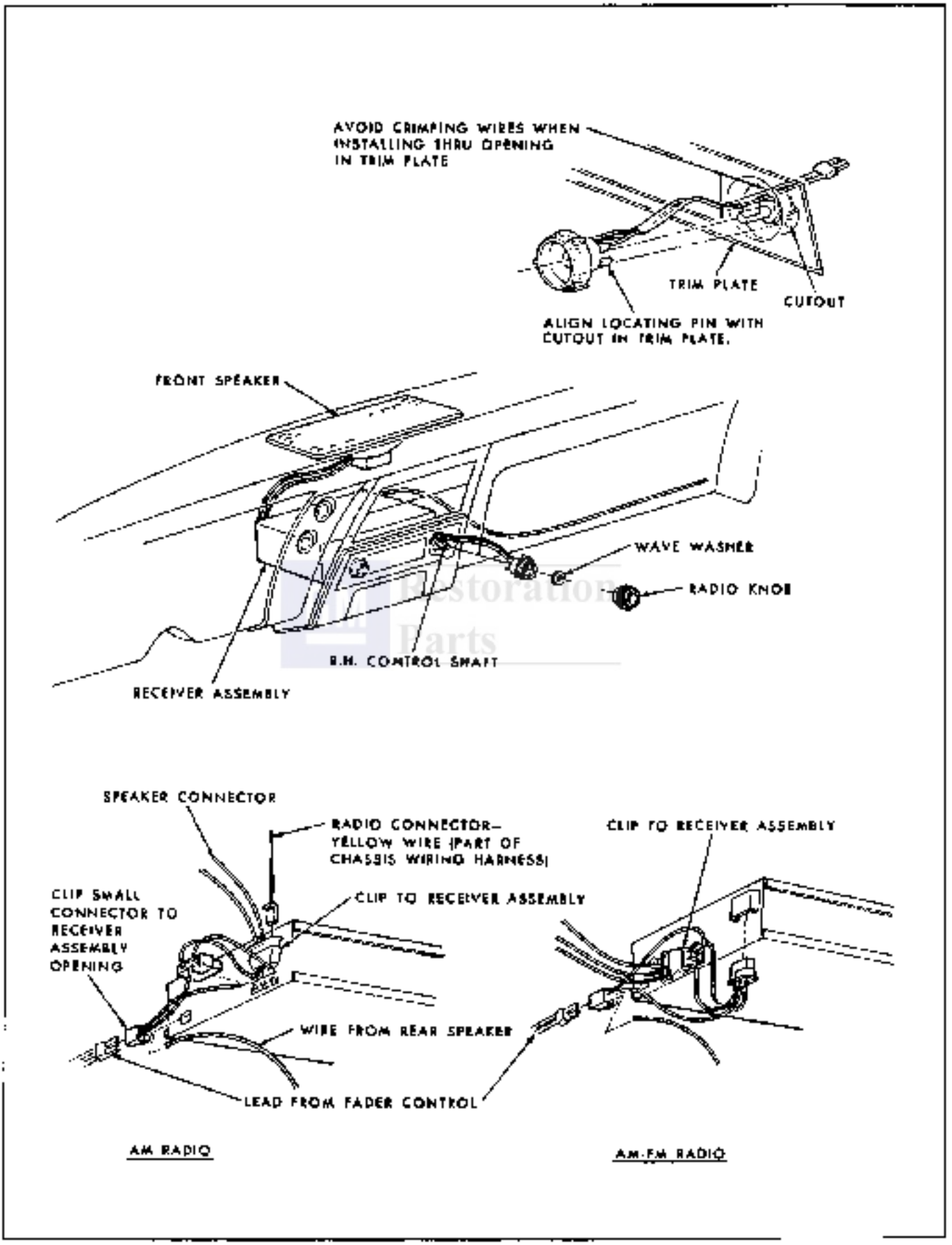


Fig. 15-51 Rear Speaker Controls—Firesweep

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