1964 OLDSMOBILE

Service manual

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NO. 1

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SERVICE MANUAL

NUMBER 1

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FOREWORD

This manual is compiled to provide service procedures, adjustments and specifications for the 1964 Oldsmobiles. An understanding of the material contained herein and in monthly issues of the Oldsmobile Service Guild and Dealer Technical Information Bulletins, issued when necessary, will assist service personnel in properly maintaining the quality to which Oldsmobile cars are built.

QUICK REFERENCE INDEX. To use, move either the hand or selection tool directly over the section you desire to reference. Simply click once with the mouse button and the manual will automatically jump to that section.

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SERVICE DEPARTMENT

OLDSMOBILE DIVISION

GENERAL MOTORS CORPORATION

LANSING, MICHIGAN

Litho in U.S.A.
GMP B-1875

GENERAL INFORMATION

CONTENTS OF SECTION 1

1964 MODEL IDENTIFICATION

A four digit number, called the car series and body style designation number, identifies any car as to series and style. Reading from left to right, the digits represent the following:

First and second digits: Series Designation
Third and fourth digits: Body Style

Example: The number 3435 identifies a car as a Dynamic 88 Fiesta sedan. Note that "34" identifies the car as a Dynamic 88 and that "35" represents a Fiesta sedan.

BODY AND STYLE NUMBERS

On F-85 series, the body and style numbers are stamped on a plate which is located under the hood and mounted on the cowl. (Fig. 1-1)

On all 88 and 98 series, the body and style numbers are stamped on a plate which is located under the hood below the right windshield wiper transmission.

This plate shows:

1. Year and Style Number of Body.
2. Body Number
3. Trim Number
4. Paint Number (Color Specification Number)

All Fisher Body numbers are prefixed by a letter or letters indicating the plant at which the body was assembled.

F-85 bodies are coded as follows:

LA - Lansing	BF - Fremont
BA - Baltimore	KC - Kansas City

88 and 98 series are coded as follows:

LA - Lansing	BL - Linden
BA - Doraville	BC - South Gate
BK - Kansas City	BT - Arlington

All 98 series will be assembled at Lansing.

Fiesta sedan bodies are made by the Ionia manufacturing Division of the Mitchell-Bentley Corporation. The body and style number plate is similar to the Fisher Body plate as shown in Fig. 1-1.

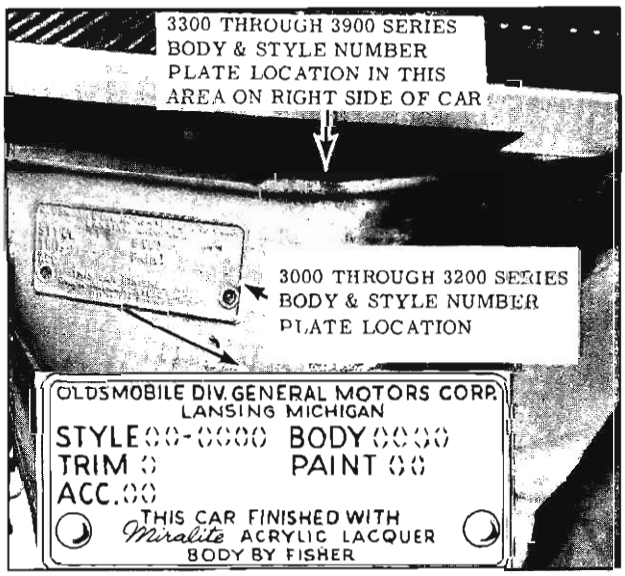


Fig. 1-1 Body and Style Number Plate Location

NOTE: WHEN WRITING SERVICE ORDERS, PREPARING A.F.A.'s OR CORRESPONDENCE, IT IS VERY IMPORTANT THAT ALL LETTERS AND NUMBERS BE INCLUDED FOR CORRECT BODY IDENTIFICATION.

1964 MODEL DESIGNATION

Series	Body Description	Designation Series Style
3000	Club Coupe	3027
F-85	Station Wagon	3035
	Four-Door Sedan	3069
3100	Sports Coupe	3127
Deluxe	Station Wagon	3135
F-85	Four-Door Sedan	3169
3200	Cutlass Coupe	3227
Cutlass	Cutlass Hardtop Coupe	3237
F-85	Cutlass Convertible	3267
3300	Holiday Sedan	3339
Jetstar	Holiday Coupe	3347
"88"	Convertible Coupe	3367
	Celebrity Sedan	3369
3400	Fiesta Sedan	3435
Dynamic	Holiday Sedan	3439
"88"	Fiesta Sedan (3-seat)	3445
	Holiday Coupe	3447
	Convertible Coupe	3467
	Celebrity Sedan	3469
Jetstar-I	Hardtop Coupe	3457
3500	Holiday Sedan	3539
Super 88	Celebrity Sedan	3569
3600	Hardtop Coupe	3657
Starfire	Convertible Coupe	3667
3800	Town Sedan	3819
"98"	Luxury Sedan	3829
	Holiday Sports Sedan	3839
	Holiday Sports Coupe	3847
	Convertible Coupe	3867
3900 "98"	Custom Sports Coupe	3947

VEHICLE IDENTIFICATION NUMBER PLATE

The 1964 vehicle identification number plate is located on the left front door pillar as illustrated in Fig. 1-2.

The vehicle identification number starts with 001001 at each plant and will be in sequential order regardless of series prefix. The vehicle identification number is prefixed by three (3) numbers and one (1) letter. The first prefix number (6 or 8) identifies the engine as a V-6 or V-8. The second number identifies the series (0 for 3000, 1 for 3100 and 2 for 3200 etc.). The third number shows the model year (4 for 1964) and the letter shows the plant the vehicle was assembled.

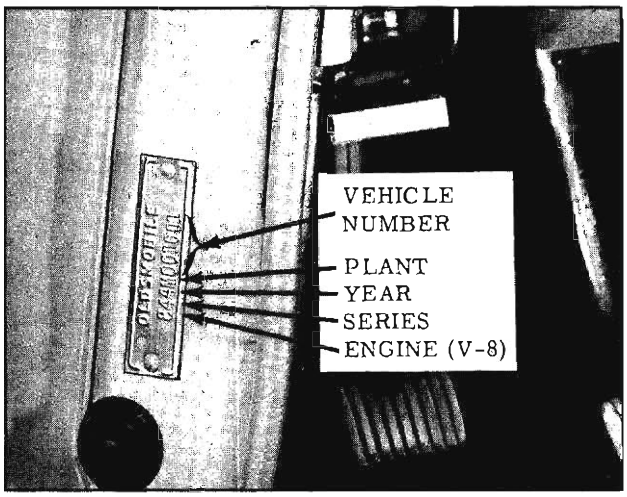


Fig. 1-2 Vehicle Identification Number Plate

(SEE STARTING VEHICLE IDENTIFICATION NUMBER CHART)

SERIES DESIGNATION

0 - F-85 - Standard	(30 Series)
1 - F-85 - Deluxe	(31 Series)
2 - F-85 - Cutlass	(32 Series)
3 - "88" - Jetstar	(33 Series)
4 - Dynamic 88	(34 Series)
5 - Super 88	(35 Series)
6 - Starfire	(36 Series)
7 - Jetstar I	(34 Series)
8 - "98"	(38 Series)
9 - "98" Custom	(39 Series)

ENGINE UNIT NUMBER (For Manufacturing and Service Use)

All V-8 engines will have a unit number stamped as indicated below. The V-6 engine will not have a unit number but will have a date code stamped on the right cylinder block deck face. (Fig. 1-3)

The date code on V-6 engines consists of two letters and three numbers. The first letter indicates the model year ("K" for 1964). The second letter shows engine usage ("H" for standard compression and "J" for export low compression) and the three numbers identify when the unit was built or when an Engineering change was made.

V-8 engines, used in F-85 and Jetstar 88 series,

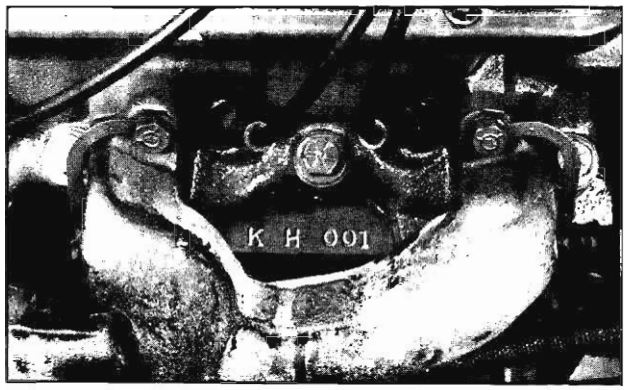


Fig. 1-3 V-6 Engine Unit Date Code Location

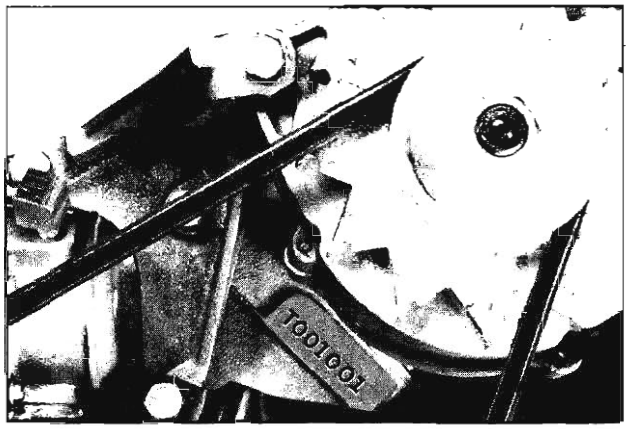


Fig. 1-4 V-8 Engine Unit Number Location (3000 through 3300 Series)

have the unit number stamped on a machined pad at the front of the right cylinder head. (Fig. 1-4)

V-8 engines, used in all other series, have the unit number stamped on a machined pad located on top of center exhaust port on left cylinder head. (Fig. 1-5)

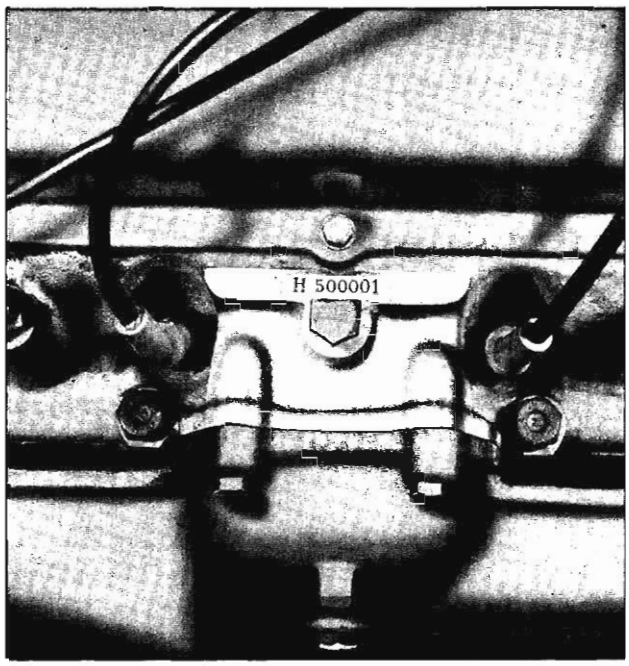


Fig. 1-5 V-8 Engine Unit Number Location (3400 through 3900 Series)

STARTING VEHICLE IDENTIFICATION NUMBERS

All 88s and 98s

Series	Built at Lansing, Michigan	Built at Atlanta, Georgia	Built at Kansas City, Kansas	Built at Linden, New Jersey	Built at South Gate, California	Built at Arlington, Texas
3300 Jetstar 88	834M001006	834A001001	834K001001	834L001001	834C001001	834T001001
3400 Dynamic 88	844M001007	844A001002	844K001002	844L001002	844C001002	844T001002
3500 Super 88	854M001008	854A001003	854K001003	854L001003	854C001003	854T001003
3600 Starfire	864M001009	864A001004	864K001004	864L001004	864C001004	864T001004
3800 "98"	884M001010	BUILT ONLY IN LANSING				
3900 Custom 98	894M001011					

STARTING VEHICLE IDENTIFICATION NUMBERS

F-85s

Series	Built at Lansing, Michigan	Built at Baltimore, Maryland	Built at Fremont, California	Built at Kansas City, Missouri
3000 Standard	604M001001 804M001002	604B001001 804B001002	604F001001 804F001002	604D001001 804D001002
3100 Deluxe	614M001003 814M001004	614B001003 814B001004	614F001003 814F001004	614D001003 814D001004
3200 Cutlass	824M001005	824B001005	824F001005	824D001005

ENGINE IDENTIFICATION

Series	Engine Unit Numbers			Engine Color	Carburetor Type	Head Gasket Thickness	Compression Ratio
	Prefix Code Letter	Starting Unit No.	Suffix Code Letter				
3000 & 3100 (V-6)	KH	000	--	Blue	1-Bbl.	.020"	9.0 :1
3000 & 3100 (V-6) Export Low Comp.	KJ	000	--	Blue	1-Bbl.	.020"	8.3 :1
3000 & 3100 (V-8) Not Avail. in 3300 Series	T	001001		Gold	2-Bbl.	.020"	8.75:1
3000 & 3100 (V-8) Export Low Comp.	T	001001	E	Gold	2-Bbl.	.020"	8.3 :1
3200 (V-8) Opt. in 3000-3100-3300	T	001001	G	Gold	4-Bbl.	.020"	10.25:1
3200 (V-8) Export Low Comp.	T	001001	H	Gold	4-Bbl.	.020"	8.3 :1
3300 (V-8) Not Avail. in 3000 3100-3200	T	001001	K	Gold	2-Bbl.	.020"	10.25:1
3300 (V-8) Export Low Comp.	T	001001	E	Gold	2-Bbl.	.020"	8.3 :1
3400 (V-8)	H	500001		Red	2-Bbl.	.020"	10.25:1
3400 (V-8) Export Low Comp.	H	500001	E	Green	2-Bbl.	.040"	8.3 :1
3400 (V-8) Domestic Low Comp.	H	500001	L	Green	2-Bbl.	.020"	8.75:1
3400-3500-3800	J	500001		Red	4-Bbl.	.020"	10.25:1
3500-3800 Export Low Comp.	J	500001	E	Green	4-Bbl.	.040"	8.3 :1
3457-3600-3900	J	500001	S	Red	4-Bbl.	.020"	10.5 :1

TRANSMISSION SERIAL NUMBERS

Synchromesh Transmission:

No serial number is used on Synchromesh transmission. A code number stamped on the case indicates the date the unit was built.

Jetaway Transmission:

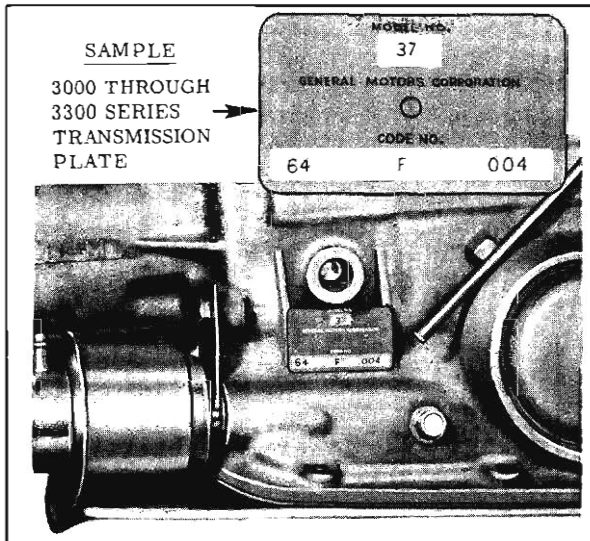
On all F-85 (3000-3100-3200) and Jetstar (3300) series, the transmission model and code numbers are stamped on a blue plate located at the right rear side of case above the line pressure take-off. (Fig. 1-6)

Model number will indicate transmission usage.

Code number consists of two digits for model year, a letter for transmission model number and three digits to indicate the day unit was built.

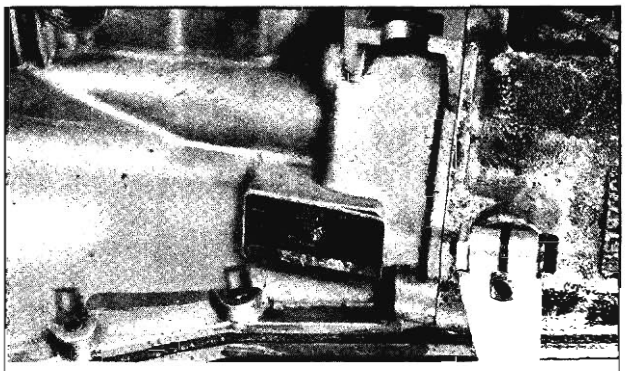
Transmission model number and the letter code equivalent are:

25 - B, 35 - D, 37 - F, 38 - G and 39 - H.



TRANSMISSION MODEL NUMBER	TRANSMISSION MODEL CODE LETTER	ENGINE AND SERIES USAGE
25	B	Std. & Low Comp. V-6 3000 & 3100 Series
35	D	Std. & Low Comp 2-Bbl. V-8 3000 & 3100 Series
37	F	High Comp. 2-Bbl. V-8 3300 Series
38	G	Low Comp. 2-Bbl. V-8 (Export Option) 3300 Series
39	H	High Comp. 4-Bbl. V-8 3237, 3267 & L-74 Option

Fig. 1-6 Jetaway Serial Number Plate



Prefix "O" on Black Plate (O64-1001)	2-Bbl. Carb. Low Comp. & Export Low Comp. 3400 Series Exc. 3457
Prefix "OC" on Orange Plate (OC64-1001)	2-Bbl. Std. Comp. 3400 Series (Except 3457)
Prefix "OA" on Light Green Plate (OA64-1001)	4-Bbl. Carb. Std. Comp. 3400 (Exc. 3457) 3500 & 3800 Series
Prefix "OB" on Dark Green Diagonal Plate (OB64-1001)	4-Bbl. Carb. Std. Comp. 3457, 3600, 3900 & L75 Option on 3500 & 3800 Series
Prefix "OCH" on Taffy Tan Plate (OCH64-1001)	2-Bbl. Heavy Duty 3400 Series
Prefix "OBH" on Yellow Diagonal Plate (OBH64-1001)	4-Bbl. Heavy Duty All 4-Bbl. Carb. Series

Fig. 1-7 Hydra-Matic Serial Number Plate

Hydra-Matic Transmission:

On all Dynamic 88 (3400) through "98" (3900) series, the Hydra-Matic transmission serial number is stamped on a colored plate and is attached to the left side of the transmission case. (Fig. 1-7)

The starting serial number 64-1001 is prefixed by code letters to indicate transmission usage.

NOTE: Always include code number or serial numbers in correspondence concerning Jetaway or Hydra-Matic transmissions.

DIFFERENTIAL RATIOS

On F-85 series (3000, 3100 and 3200), the Differential Ratio Code is stamped on the right rear side of the carrier or on the right rear inboard side of the axle housing tube. (Fig. 1-8)

Markings on carrier = letter shows ratio code, numbers show manufacturing date and an (X) before the ratio code indicates an Anti-Spin.

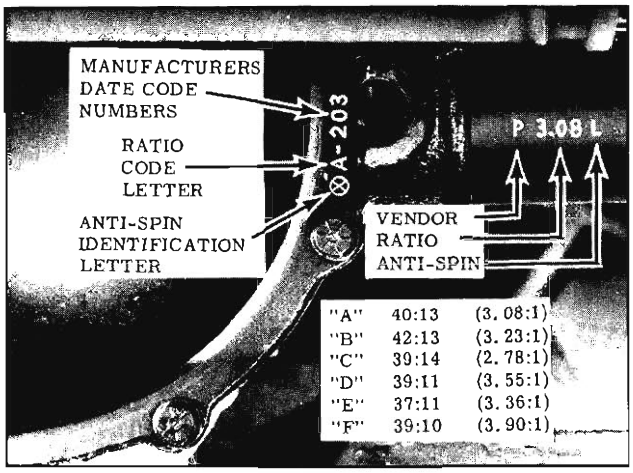
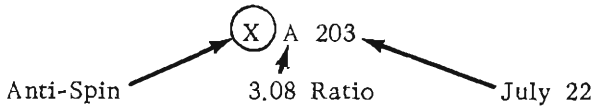


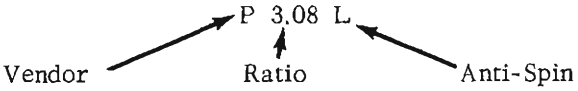
Fig. 1-8 Axle Ratio Code (3000, 3100 and 3200 Series)

Example:



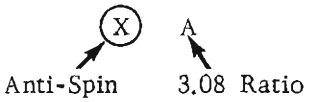
Markings on axle housing tube = letter shows the vendor and numbers show ratio. If a letter "L" follows, it indicates an Anti-Spin assembly.

Example:



On the 3300 series, the ratio code letter is stamped on the left front inboard side of the axle housing tube. If equipped with Anti-Spin, an (X) will also be stamped before the letter code.

Example:



On 3400 through 3900 series, the ratio code number is stamped on the front lower locating boss of the carrier. If equipped with Anti-Spin, a letter "L" will be stamped behind the number code. (Fig. 1-9)

Anti-Spin differential assemblies will also have an Anti-Spin lubrication tag on one of the cover attaching bolts.

RECOMMENDED TIRE PRESSURE

All Series	Front	Rear
All Size Tires	24 psi	*24 psi

*For Station Wagons - When carrying heavy loads for an appreciable distance, it is recommended that the rear tires be increased 4 lbs. to improve steering characteristics.

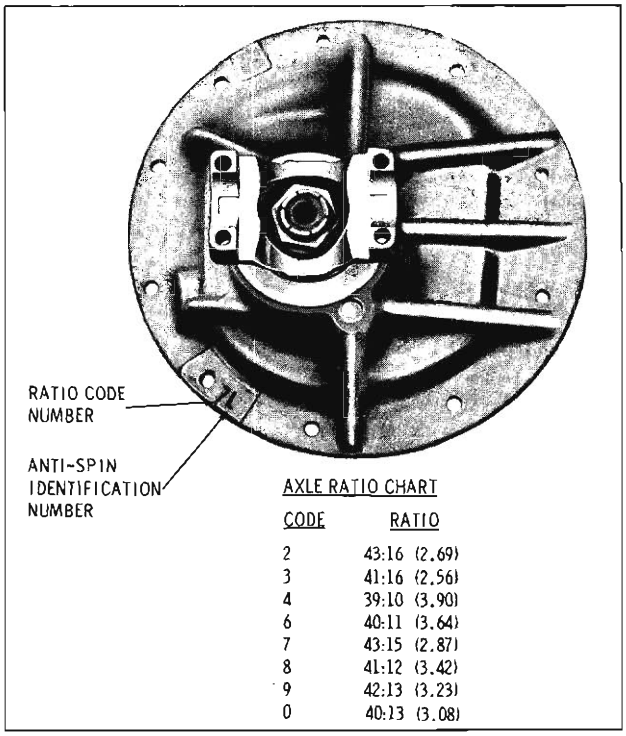


Fig. 1-9 Axle Ratio Code (3400 through 3900 Series)

STARTING CAR WITH BATTERY FAILURE

Jetaway and Hydra-Matic Transmission

For safety reasons, the Jetaway and Hydra-Matic transmission is designed so that in the event of battery failure, the engine cannot be started by pushing the car. To start a car when the battery has failed, use an auxiliary battery with jumper cables.

Synchromesh Transmission

To start the engine by pushing the car, move the gearshift lever to high gear, depress the clutch pedal and turn on ignition switch. When the vehicle reaches a speed of 10 mph, release the clutch pedal slowly.

TOWING PRECAUTIONS

Always place a wooden 4" x 4" adjacent to the bumper back bars and frame crossmember and a rubber mat or other suitable protector between the bumper and tow chains or cables to prevent distortion and/or marring of the bumpers. For front end lift, place the 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 the case of transmission or propeller shaft failures, the propeller shaft must be disconnected from the differential and wired to the exhaust pipe or the car must be towed with the 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 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 the window division channel. Tire to ground clearance should not exceed 6 inches while towing the car and "SPEED SHOULD NOT EXCEED 30 MPH.

HOISTING THE CAR

When supporting car on a floor jack or floor stands, the car should be supported at the suspension points only. Under no condition should the car be supported at the extreme ends of frame or on the frame side rail(s).

When using a frame contact type lift, position the contact pads to lift the frame rail at points shown in Figs. 1-10 and 1-11.

The car should not be lifted at the front or rear bumper with anything other than the bumper jack provided with the car.

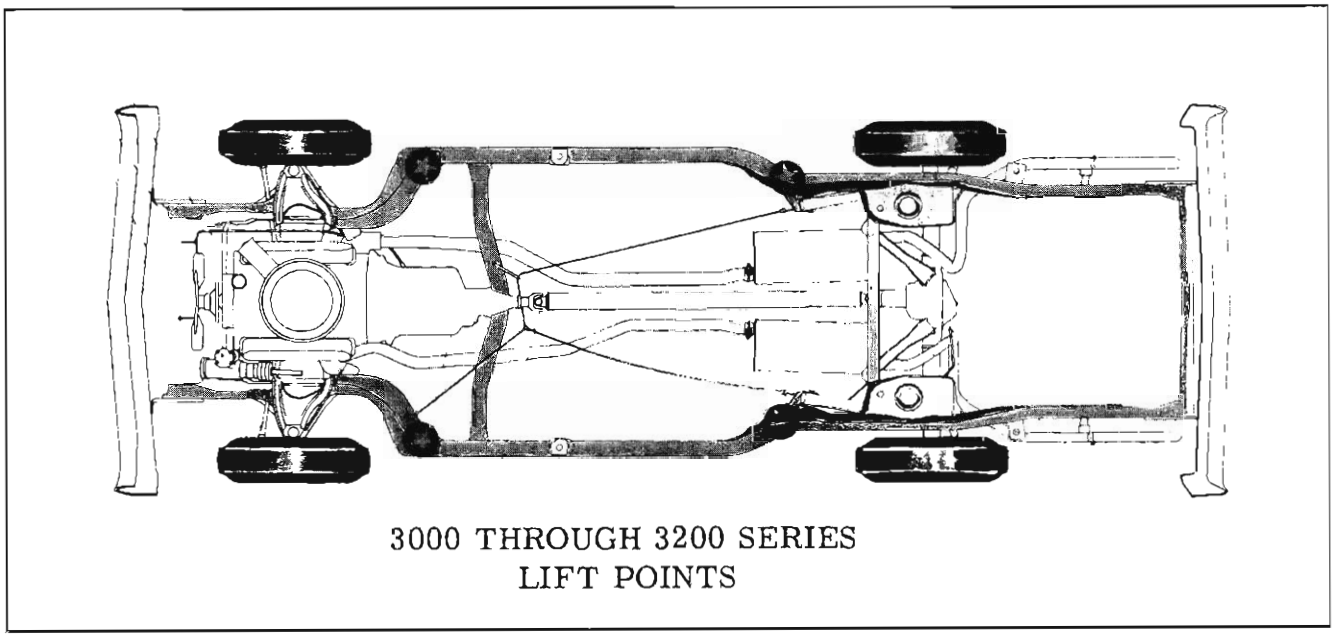


Fig. 1-10 Lift Points (3000, 3100 and 3200 Series)

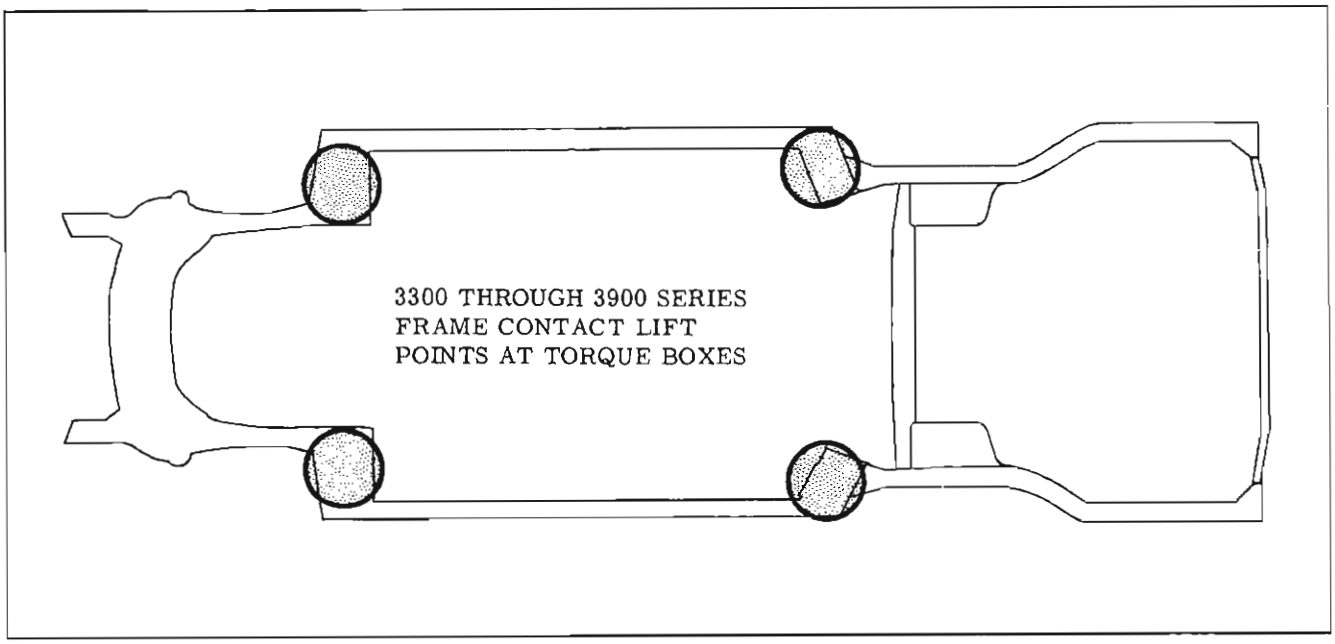


Fig. 1-11 Lift Points (3300 through 3900 Series)

CAPACITIES

Item	F-85 3000-3100-3200 V-6	F-85 3000-3100-3200 V-8	Jetstar 3300	All Others 3400 thru 3900
Differential	2-3/4 Pts.	2-3/4 Pts.	2-3/4 Pts.	5 Pts.
Engine Crankcase Only, Drain and Refill	4 Qts.	4 Qts.	4 Qts.	4 Qts.
Engine Crankcase, Drain and Refill and Filter Change	5 Qts.	5 Qts.	5 Qts.	5 Qts.
Cooling System*				
With Air Conditioning	11-1/4 Qts.	19-1/4 Qts.	18-1/2 Qts.	21-1/2 Qts.
Without Air Conditioning	10-3/4 Qts.	17 Qts.	17 Qts.	19-3/4 Qts.
Gasoline Tank	20 Gal.	20 Gal.	21 Gal.	21 Gal.
Synchromesh Transmission - 3-Speed	2 Pts.	2 Pts.	2 Pts.	2-1/2 Pts.
- 4-Speed	2-1/4 Pts.	2-1/4 Pts.	2-1/4 Pts.	
Hydra-Matic and Jetaway Transmission				
Without Removing Oil Pan	—MUST—	REMOVE—	PAN--	5-1/2 Qts.
With Oil Pan Removed	3 Qts.	3 Qts.	3 Qts.	6-1/2 Qts.
After Complete Overhaul	9 Qts.	9 Qts.	9 Qts.	9 Qts.
Power Steering				
Complete System	1-3/4 Qts.	1-3/4 Qts.	1-3/4 Qts.	1-3/4 Qts.
Pump Only	1 Qt.	1 Qt.	1 Qt.	1 Qt.

*Without Heater - Subtract 3/4 Qts. on F-85 Series
Subtract 1 Qt. on 3400 thru 3900 Series

GENERAL SPECIFICATIONS

Series	F-85 3000-3100-3200		Jetstar 88 3300	Dynamic 88, Super 88, Jetstar-I & Starfire 3400-3500-3600	"98" 3800 & 3900
Wheel Base	115"		123"	123"	126"
Overall Length	203.0"		215.3"	215.3"	222.3"
Overall Width	74.3"		78.0"	78.0"	78.0"
Overall Height*	54.4"		56.0"	56.2"	57.1"
Tread Width					
Front	58.0"		62.2"	62.2"	62.2"
Rear	58.0"		61.0"	61.0"	61.0"
Engine Displacement - Cu. In.	V-6 225	V-8 330	330	394.1	394.1
Compression Ratio	See Engine Identification Chart				

*3000 through 3200 Series - With 5 passenger load and 6.50 x 14 Tires
3300 Series - With 5 passenger load and 7.50 x 14 Tires
3400 through 3600 Series - With 5 passenger load and 8.00 x 14 Tires
3800 and 3900 Series - With 5 passenger load and 8.50 x 14 Tires

PERIODIC MAINTENANCE

CONTENTS OF SECTION 2

LUBRICATION CHART

ENGINE OIL CHANGE

It is recommended that an oil which, according to the label on the can, is (1) "intended for service MS" and (2) "Passes car makers' tests" or "Meets General Motors Standard GM-4745M".

The proper oil viscosity to use depends on the prevailing atmospheric temperature. The following chart will serve as a guide in selecting the proper oil viscosity.

Anticipated Lowest Temperatures	Use SAE Viscosity Number
Above Freezing (+32°F.)	SAE 10W-30, SAE 20 SAE 20W
Below Freezing (+32°F.) and above 0°F.	SAE 5W-20 SAE 10W
Below 0°F.	SAE 5W-20, SAE 5W

RECOMMENDED OIL CHANGE INTERVAL

Oil should be changed every 60 days or 6,000 miles, whichever comes first. This interval applies to the initial change as well as subsequent oil changes and is not dependent upon prevailing daylight temperature.

IMPORTANT: Certain driving conditions such as dust storms, and frequent driving on dusty roads, necessitate more frequent oil changes. If the car has been driven in a dust or sand storm, the oil and filter should be changed as soon as possible.

SERVICE AT TIME OF ENGINE OIL CHANGE INTERVAL OR AS INDICATED

1. Engine Oil - Drain and Refill with MS oil of proper viscosity.

2. Crankcase Breather

   3000 through 3300 Series -

   At every oil change, more often under dusty conditions, remove cap, wash in kerosene and re-oil with SAE 10W-30 oil.

   3400 through 3900 Series -

   At every other oil change, more often under dusty conditions, remove filter element, wash in kerosene, dip in SAE 10W-30 oil and squeeze to remove excess oil.

3. Positive Crankcase Ventilation Valve

   All V-6 Engines -

   Replace positive crankcase ventilation valve at every engine oil filter change interval.

   On All V-8 Engines -

LUBRICATION CHART (Cont'd.)

At every 12,000 miles (or at the oil change period nearest to this interval), wash positive crankcase ventilation valve in kerosene and blow out hoses.

CHECK FLUID LEVEL—REPLENISH

4. Differential
   - Anti-Spin . . . . . Special Lubricant Part No. 531536.
   - Conventional . . . . . SAE 90 Multi-Purpose Lubricant meeting military specification MIL-L-2105B or lubricant Part Number 3531536.
5. Brake Master Cylinder . . . . . GM Brake Fluid No. 11.
6. Jetaway and Hydra-Matic Transmission . . . . . GM Hydra-Matic Fluid type "A" Suffix "A".
7. Synchromesh Transmission . . . . . SAE 80 Multi-Purpose Gear Lubricant
8. Steering Gear (Power) . . . . . GM Power Steering Fluid, Part No. 1099021
9. Steering Gear (Manual) . . . . . SAE 80 Multi-Purpose Gear Lubricant.
10. Battery . . . . . Distilled Water.
11. Radiator . . . . . Inhibited Year Around Coolant.

13. Linkage Pivot Points For Throttle, Transmission (AT & SM), Clutch and Parking Brake (Including felt washers at each end of the clutch release bellcrank, and the clutch pedal bellcrank). Lubricate at each oil change interval with SAE 10W-30 engine oil.

14. BODY LUBRICATION—CHECK AND LUBRICATE AS REQUIRED (Wipe Off Old Lubricant)

Gas Tank Filler Door Hinge - SAE 10W-30 engine oil.

Door Lock Striker Teeth - Light coat of stick type lubricant.

Rotary Lock - Drop or two of SAE 10W-30 oil on lock pivot. Light coat of stick type lubricant on surface of lock housing.

Door Hinge and Hold Open Assembly - Thin film of Lubriplate on friction surfaces. A drop of SAE 10W-30 oil on all pivot points.

Door Jamb Switch - Apply a thin coat of No. 630 AAW Lubriplate or equivalent to end surface of switch plunger.

Hood Hinges - SAE 10W-30 oil at pivot points.

Hood Latch - Thin film of Lubriplate on friction surfaces. A drop of SAE 10W-30 oil on all pivot points.

Rear Compartment Lid and Tailgate - Apply Lubriplate 630 AAW to bolt at striker contact area.

Rear Compartment Lid Hinges and Torque Rods - Apply Lubriplate 630 AAW to hinges and torque rods at friction points. Apply silicone grease to torque rod silencer.

Tailgate Hinges - Lubricate pivot points with SAE 10W-30 oil.

Door Bottom Drain Hole Sealing Strip, and Door Bumpers - Thin film of Silicone Weatherstrip Grease.

Manual Seat Adjuster - Thin film of Lubriplate 630 AAW on seat tracks.

2, 4 and 6-Way Seats - Thin film of Lubriplate 630 AAW on jackscrew.

Folding Top Linkage . Light coat of SAE 10W-30 oil on friction points. Clean and lubricate lift cylinder rods with brake fluid.

EVERY 6,000 MILES

2. Crankcase Breather

   3000 through 3300 Series -

   At every oil change, more often under dusty conditions, remove cap, wash in kerosene and re-oil with SAE 10W-30 oil.

3. Positive Crankcase Ventilation Valve

   All V-6 Engines -

   Replace positive crankcase ventilation valve at every engine oil filter change interval.

12. Front Suspension and Steering Linkage

    3000 through 3200 Series -

LUBRICATION CHART (Cont'd.)

Lubricate front suspension and steering linkage every six months or 6,000 miles, whichever occurs first, with a high quality, water resistant E.P. lubricant.

3300 through 3900 Series -

Once every six months or 6,000 miles, whichever occurs first, the steering linkage (tie rods and tie rod ends) should be lubricated, using a high quality, water resistant E.P. lubricant

The ball joint seals should be inspected for damage each six months or 6,000 miles, whichever occurs first.

EVERY 12,000 MILES

15. Engine Oil Filter

The oil filter should be changed at the engine oil change which comes nearest 6,000 miles or 6 months.

2. Crankcase Breather

3400 through 3900 Series -

At every oil change, more often under dusty conditions, remove filter element, wash in kerosene, dip in SAE 10W-30 oil and squeeze to remove excess oil.

3. Positive Crankcase Ventilation Valve

All V-8 Engines -

At every 12,000 miles (or at the oil change period nearest to this interval), wash positive crankcase ventilation valve in kerosene and blow out hoses.

10. Battery

Clean top of battery and cable terminals. Apply a thin film of petrolatum to battery posts and clamps after installing clamps.

16. Distributor

Lubricate Breaker Cam - Thin film of cam and ball bearing lubricant.

17. Air Cleaner (Non-Disposable Element Type).

V-6 Engines -

At every other oil change, more often under dusty conditions, remove filter element, wash in kerosene, dip in SAE 10W-30 oil and squeeze to remove excess oil.

EVERY 18,000 MILES

17. Air Cleaner (Disposable Element Type)

All V-8 Engines -

Replace element.

EVERY 24,000 MILES

6. Jetaway and Hydra-Matic Transmission

Drain and refill with GM Hydra-Matic Fluid Type A. Suffix "A"

18. Speedometer Cable

Lubricate lower 2/3 with Speedometer Grease.

19. Windshield Wiper Transmission Bearing - Lubricate bearing with 10W-30 oil.

EVERY 30,000 MILES

12. Ball Joint Lubrication

3300 through 3900 Series -

After 30,000 miles, upper and lower ball joints should be serviced (clean and re-lubricate lower ball joints, re-lubricate upper ball joints). Lubricant, Part No. 585617 or equivalent, should be used for ball joint lubrication.

FOR DETAILED RECOMMENDATIONS, REFER TO CORRESPONDING NUMBERS ON FOLLOWING PAGES.

1. ENGINE CRANKCASE OIL

It is recommended that an oil which, according to the label on the can, is (1) "Intended for service MS" and (2) "Passes car makers' tests" or "Meets General Motors Standard, GM-4745M".

The proper oil viscosity to use depends on the prevailing atmospheric temperature.

The following chart will serve as a guide in selecting the proper oil viscosity.

Anticipated Lowest Temperatures	Use SAE Viscosity Number
Above Freezing (+32°F.)	SAE 10W-30, SAE 20 SAE 20W
Below Freezing (+32°F.) and above 0°F.	SAE 10W SAE 10W
Below 0°F.	SAE 5W-20, SAE 5W

RECOMMENDED OIL CHANGE INTERVAL

Oil should be changed every 60 days or 6,000 miles, whichever comes first. This interval applies to the initial change as well as subsequent oil changes and is not dependent upon prevailing daylight temperatures. An MS oil which meets General Motors Standard GM-4745M was installed in the engine at the factory.

NOTE: When changing the oil during the fall and winter seasons, consider the lowest anticipated temperature for the next 60 days. If the temperature is expected to be occasionally below 0°F., 5W-20 oil is recommended. In areas where the temperature will be consistently 0°F. or below, 5W is recommended.

SAE 5W oil is not recommended for sustained high speed driving when the temperature is above 60°F.

SAE 30 oil may be used when the prevailing daylight temperature is above 90°F.

Certain driving conditions, such as dust storms and frequent driving on dusty roads, necessitate more frequent oil changes.

If higher detergency is required to reduce varnish and sludge formation, a thoroughly tested and approved concentrate - "High Detergency Concentrate" - is available.

The use of "break-in" oil, "tune-up" compounds, "friction reducing" compounds, etc. in Oldsmobile engines is specifically NOT recommended.

When changing oil, drain the crankcase after the engine has reached normal operating temperature to insure complete removal of the oil. Oil pan drain plug torque is 30 to 45 ft. lbs.

CRANKCASE CAPACITY

Oil change only, 4 qts.

Oil change and filter change, 5 qts.

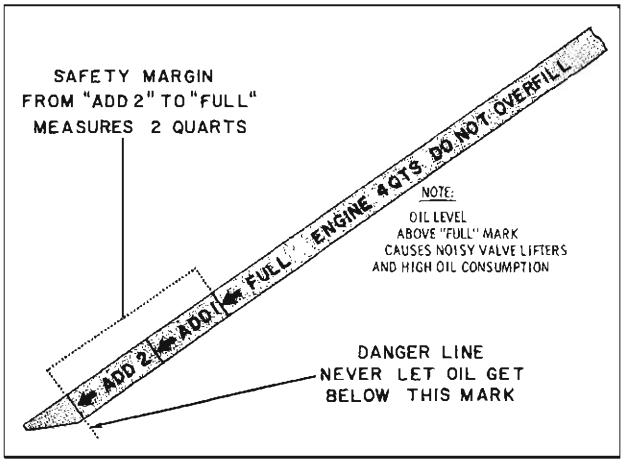


Fig. 2-1 Engine Oil Dipstick

OIL LEVEL (Fig. 2-1)

The engine oil dipstick, located on the left side of the engine, is marked "Full", "Add 1", and "Add 2". The oil level should be maintained in the safety margin, neither going above the "Full" line nor under the "Add 2" line. The oil level should be checked at every refueling and oil added to maintain the proper level.

2. CRANKCASE BREATHER

3000 through 3300 Series

At every oil change, more often under dusty conditions, remove cap, wash in kerosene and re-oil with 10W-30 oil.

3400 through 3900 Series

At every other oil change, more often under dusty conditions, remove filter element, wash in kerosene, dip in SAE 10W-30 oil and squeeze to remove excess oil.

3. POSITIVE CRANKCASE VENTILATION VALVE

All V-6 Engines -

Replace positive crankcase ventilation valve at every engine oil filter change interval.

All V-8 Engines -

At every 12,000 miles (or at the oil change period nearest to this interval), remove the ventilation valve and hoses from engine and clean as follows:

A. Blow compressed air through both hoses.

B. Submerge valve in kerosene and slosh around in fluid. Blow compressed air through small tubing of valve assembly.

C. Clean bleed hole in connector at carburetor with 1/16" diameter wire or drill. It is not

necessary to remove connector; however, if carburetor service is performed, clean out hole with kerosene and compressed air.

4. DIFFERENTIAL

Periodic or seasonal lubricant changes are not recommended. If lubricant addition is required, add:

Conventional differential: Special lubricant (Part No. 531536) or SAE 90 Multi-Purpose Gear Lubricant meeting the requirements of military specifications MIL-L2105B.

Anti-Spin differential: Only special lubricant (Part No. 531536).

IMPORTANT: Use of other than the above mentioned type of lubricant in the Anti-Spin differential may cause chatter. If the wrong type of lubricant is used in the Anti-Spin, it will require draining the differential and installing the recommended lubricant (Part No. 531536). It may be necessary to drive Anti-Spin equipped cars for distances of 50 miles or more to allow the new lubricant to work through the plates before the chatter will disappear.

CAUTION: Always clean dirt or foreign material from around plug opening before removing filler plug.

Capacity of the differential is:

3000 through 3300 Series - 2-3/4 Pints

3400 through 3900 Series - 5 Pints

5. SERVICE BRAKES

The fluid level in the master cylinder located at the left rear side of the engine compartment should be checked at each engine oil change interval. If necessary to add fluid, use GM Brake Fluid No. 11. On all standard and Power Brakes, the fluid level must be maintained at 1/4" below the top of the reservoir.

CAUTION: Extreme care must be exercised to prevent entry of dirt into the master cylinder.

NOTE: Brake linings should be periodically inspected for wear. The frequency of this inspection depends upon driving conditions such as traffic or terrain, and also the driving techniques of individual owners.

6. JETAWAY AND HYDRA-MATIC TRANSMISSION

GM Hydra-Matic Fluid

Hydra-Matic fluid is an all season fluid, designed for year-round operation. Only fluid with the following identification on the container should be used: brand name, including the words ". . . . Fluid Type A", plus the mark AQ-ATF and number and a letter "A" embossed on top of can as follows: "AQ-ATF-number-A".

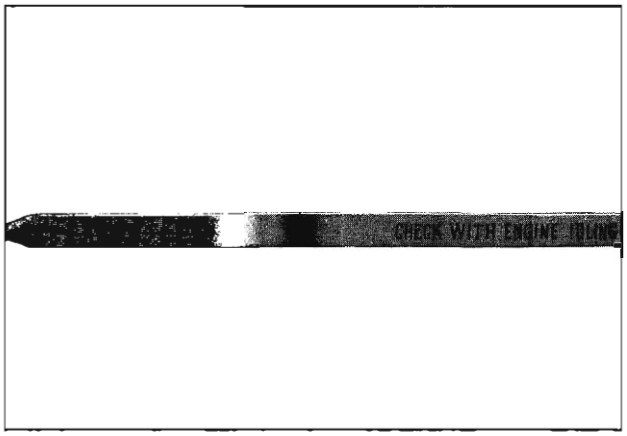


Fig. 2-2 Jetaway Oil Level (3000 through 3300 Series)

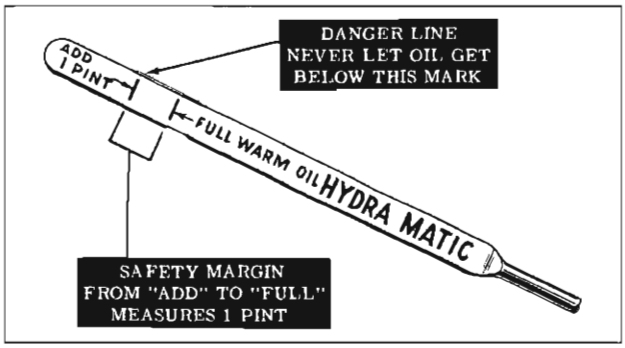


Fig. 2-3 Hydra-Matic Oil Level (3400 through 3900 Series)

Checking Hydra-Matic Fluid Level (Figs. 2-2 & 2-3)

Fluid level should be checked at the oil filler tube, located at the rear of the right exhaust manifold, at each engine oil change interval. Check must be made with the engine idling and the selector lever in the park position. Fluid level must be maintained at the full mark (transmission warm).

CAUTION: Do not fill above full mark as this will cause foaming and will result in improper operation.

DRAINING JETAWAY AND HYDRA-MATIC TRANSMISSION

The Hydra-Matic fluid should be changed every 24,000 miles.

Jetaway (3000 through 3300 Series)

A. Remove oil pan and permit fluid to drain.

B. Clean oil pan. Install new gasket and reassemble to transmission.

C. Add three quarts of Hydra-Matic fluid.

D. With the selector lever in "P" position and the car on a level surface, start engine. With engine running, add fluid to bring level to "Full" mark on dipstick.

NOTE: Approximately three quarts of fluid are required to fill the Jetaway transmission when the fluid is drained by removing the pan. Nine quarts are required after an overhaul.

Hydra-Matic (3400 through 3900 Series)

A. Remove oil filler pipe from transmission oil pan permitting fluid to drain.

B. Connect filler pipe to oil pan.

C. Add 5 quarts of Hydra-Matic fluid to the transmission.

D. Put the selector lever in park position and start engine. With engine running add fluid to bring level to "Full" mark on the dipstick.

Approximately 5-1/2 quarts of oil are required to fill the Hydra-Matic transmission after the transmission has been drained. Approximately 6-1/2 quarts will be required to fill the transmission if the oil pan is removed and drained at the same time that the fluid is changed. Approximately 9 quarts are required after an overhaul.

NOTE: AFTER FLUID HAS BEEN ADDED AND TRANSMISSION IS WARM, FLUID SHOULD BE CHECKED TO MAKE SURE THAT IT IS AT THE "FULL" MARK ON THE OIL LEVEL DIPSTICK.

7. SYNCHROMESH TRANSMISSION

Remove the filler plug from the transmission case and fill to the level of the opening with SAE 80 Multi-Purpose Gear Lubricant. The lubricant level should be checked at each engine oil change interval. Periodic or seasonal change of lubricant is not recommended.

CAUTION: Always clean dirt or foreign material from around plug before removing.

CAPACITIES OF TRANSMISSIONS ARE AS FOLLOWS:

3000 through 3300 (3 Speed)	2 Pint
(4 Speed)	2-1/4 Pints
3400 and 3500 Series	2-1/2 Pints

8. POWER STEERING GEAR AND PUMP

Check at each engine oil change interval and maintain oil level at "full" mark. Oil must be warm when checking oil level. Use power steering fluid, Part No. 1099021. (When system requires less than one pint of fluid, it is permissible to add Hydra-Matic transmission fluid to fill reservoir. When more than one pint is required to fill system, use power steering fluid Part No. 1099021.) Power steering gear lubrication is accomplished by the oil supplied to the gear by the power steering pump.

Capacities Of The Power Steering Units Are:

COMPLETE SYSTEM

All Series . . . . . 1-3/4 Qts.

PUMP ASSEMBLY

All Series . . . . . 1 Qt.

9. MANUAL STEERING GEAR

Check steering gear lubricant level at each engine oil change interval. The necessity for frequent addition of lubricant indicates leakage and the source of leakage must be found and corrected. Use SAE 80 Multi-Purpose Gear Lubricant. Regular or seasonal changes are unnecessary.

10. BATTERY

Check battery liquid level at each engine oil change interval or once a month or more often, when refueling, in hot weather. Level should reach the bottom of the split ring in the vent well.

CAUTION: DO NOT OVERFILL.

Clean top of battery and terminals every 12,000 miles and check tightness of battery hold-down bolt. To properly clean battery:

A. Make sure vent plugs are closed tight.

B. Remove battery cables from battery.

C. Clean battery with a diluted ammonia or soda solution. When the solution stops foaming, rinse with clear water.

D. Clean battery cable clamps with diluted ammonia or soda and rinse with clear water. Apply a thin coating of petrolatum to terminals and clamps, after installing clamps.

11. COOLING SYSTEM

The coolant should be kept at a level below top of filler neck seat as follows:

COOLANT PROTECTION CHART

Series			Quarts of Ethylene-Glycol Year-Around Coolant Part No. 982209 or Equivalent							
			5	6	7	8	9	10	11	12
3000 & 3100 With V6 Engine	Temperature Protection Point	Without Air Conditioning	-25°F	-50°F						
		With Air Conditioning	-21°F	-43°F						
3000, 3100 & 3200 With V8 Engine	Temperature Protection Point	Without Air Conditioning				-25°F	-40°F	-58°F		
		With Air Conditioning					-25°F	-37°F	-54°F	
3300	Temperature Protection Point	Without Air Conditioning				-25°F	-40°F	-60°F		
		With Air Conditioning				-20°F	-30°F	-42°F		
3400 Through 3900	Temperature Protection Point	Without Air Conditioning					-23°F	-35°F	-50°F	
		With Air Conditioning						-25°F	-35°F	-50°F

3/4" - Coolant Cold
1/4" - Coolant Hot

The coolant system should be periodically inspected for leaks and where found, corrected.

The cooling system is designed for use of a highly inhibited "year around" ethylene-glycol solution both summer and winter.

Every two years, the system should be completely drained. When refilling, use Oldsmobile "year around" Ethylene-Glycol, Part No. 982209 or equivalent Ethylene-Glycol coolant labeled as meeting specification GM1899-M.

For desired degree of protection, the above chart may be used as a guide.

12. FRONT SUSPENSION AND STEERING LINKAGE

3000-3100 & 3200 Series

The front suspension and steering linkage should be lubricated every 6 months or 6,000 miles, whichever occurs first, using a high quality water resistant E.P. Lubricant.

Lubrication fitting locations are listed below.

Lower Control Arm Ball Joints . . . . . 2 Points
Upper Control Arm Pivot Shafts . . . . . 4 Points
Upper Control Arm Ball Joints . . . . . 2 Points
Tie Rod Ends . . . . . 2 Points
Relay Rod . . . . . 2 Points

3300 THROUGH 3900 SERIES

Once every six months or 6,000 miles, whichever occurs first, the steering linkage (tie rods and tie rod ends) should be lubricated, using a high quality, water resistant E.P. Lubricant.

The ball joint seals should be inspected for damage every six months or 6,000 miles, whichever occurs first.

30,000 Mile Ball Joint Lubrication

After 30,000 Miles, upper and lower ball joints should be serviced (clean and re-lubricate lower ball joints, re-lubricate upper ball joints). Lubricant, Part No. 585617 or equivalent, should be used for ball joint lubrication.

Lower Ball Joint

A. Support lower control arm and disconnect ball joint from steering knuckle.

B. Clean exterior of ball joint.

C. For Inland joints, drive seal retaining ring from ball joint and remove seal.

For Saginaw joint, pry garter spring from bottom of seal, then remove garter spring and seal.

NOTE; Inspect seal and retainer or spring; if damaged, use new parts upon reassembly.

CAUTION: Exercise care while performing the following operations to prevent entry of dirt into the ball joints.

D. Clean joint pivot and stud thoroughly and wipe out as much old grease as possible.

E. Remove plug from ball joint cover.

F. Using a hand operated ball type nozzle grease gun, filled with ball joint grease Part No. 585617, lubricate ball joint until clean grease fills the ball joint reservoir.

G. Reinstall plug in ball joint cover, then clean grease from ball joint stud and sealing area with a clean dry cloth.

H. Apply a thin film of ball joint grease to outside area of seal to aid installation of Tool J-8761 (Inland) or garter spring installer J-6119 (Saginaw).

I. The saw tooth area of the seal that fits around the ball stud should be coated with ball joint grease.

J. For Saginaw type, stretch garter spring around Tool J-6119. Do not stretch garter spring any more than necessary when installing on tool. Place seal on ball joint and install garter spring in place.

For Inland type, place seal inside of seal installing Tool J-8761, drive seal onto ball joint. Make sure that seal is driven on squarely without cocking. (For illustrations, refer to Front Suspension Section)

K. Reassemble ball joint stud to steering knuckle. Torque stud nut to 40 ft. lbs. (minimum)

Upper Ball Joint

A. Support lower control arm and disconnect upper ball joint from steering knuckle.

B. Clean exterior of ball joint.

C. Remove plug from ball joint cover.

D. Using a hand operated ball type nozzle grease gun, filled with ball joint grease Part No. 585617, lubricate ball joint until clean grease starts to appear from the seal.

E. Replace plug in ball joint cover.

F. Squeeze out all the grease possible from beneath the seal. Then wipe ball stud with dry clean cloth to remove the grease.

G. Reassemble to steering knuckle and torque to 40 ft. lb. (minimum).

13. THROTTLE, TRANSMISSION, CLUTCH AND PARKING BRAKE LINKAGE

At each engine oil change interval, all friction and bearing surfaces in the linkage for the throttle, transmission, clutch and parking brake should be lubricated with SAE 10W-30 oil. Ball and socket in the throttle linkage should be lubricated with special lubricant, Part No. 567196, only whenever they are disassembled.

14. BODY LUBRICATION

Door Lock Striker and Fork Bolt

Wipe off dirt and apply a thin coat of stick type lubricant to top surface of lock bolt striker teeth indicated in Fig. 2-4 and 2-5. After lubrication, close door several times and remove excess lubricant along the side edge of teeth.

Door Locks

Wipe off dirt and apply a thin coat of stick type

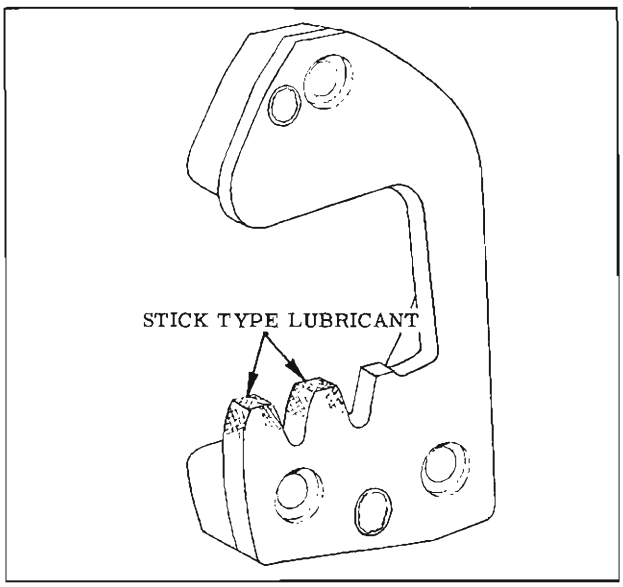


Fig. 2-4 Door Lock Striker Lubrication (3300 through 3900 Series)

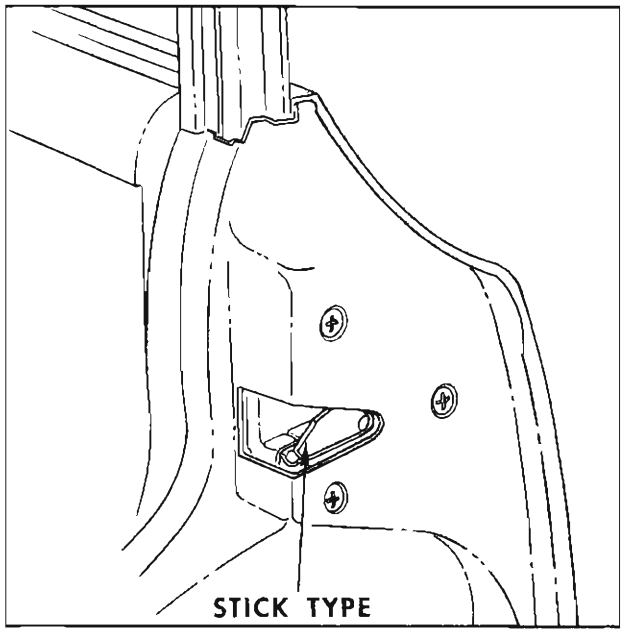


Fig. 2-5 Door Lock Fork Bolt Lubrication (3000, 3100 & 3200 Series)

lubricant and oil as indicated in Fig. 2-6.

Door Hinge and Hold Open Assembly

Wipe off dirt and apply a light coat of Lubriplate 630 AAW or its equivalent at points indicated in Fig. 2-7 thru 2-9. The hinge pins should be lubricated with SAE 10W-30 oil.

Door Jamb Switch

Apply a thin coat of No. 630 AAW Lubriplate or equivalent to end surface of switch plunger.

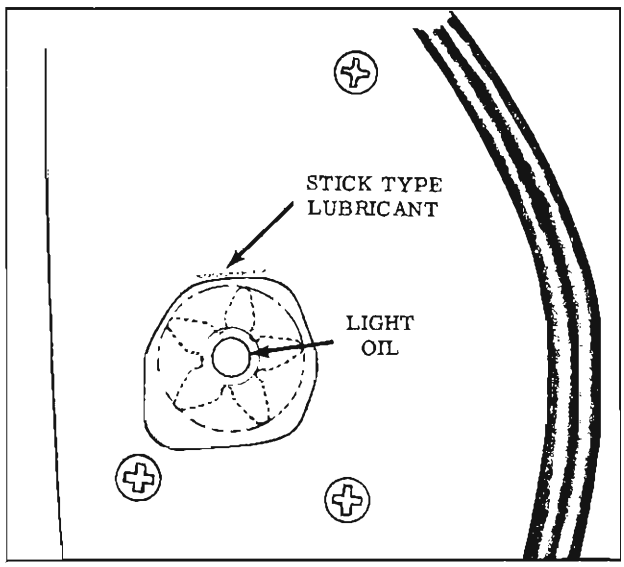


Fig. 2-6 Door Rotary Bolt Lubrication (3300 through 3900 Series)

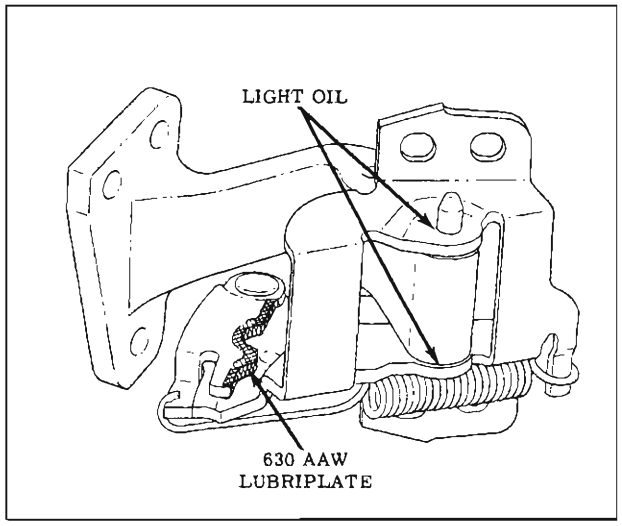


Fig. 2-7 Front Door Hinge (3300 through 3900 Series)

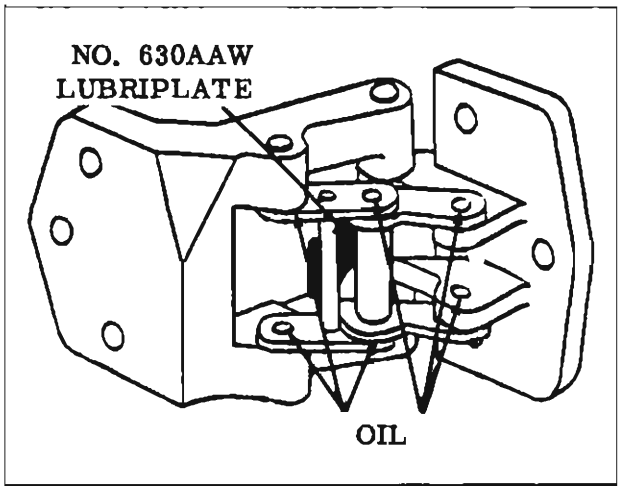


Fig. 2-8 Rear Door Hinge (3300 through 3900 Series)

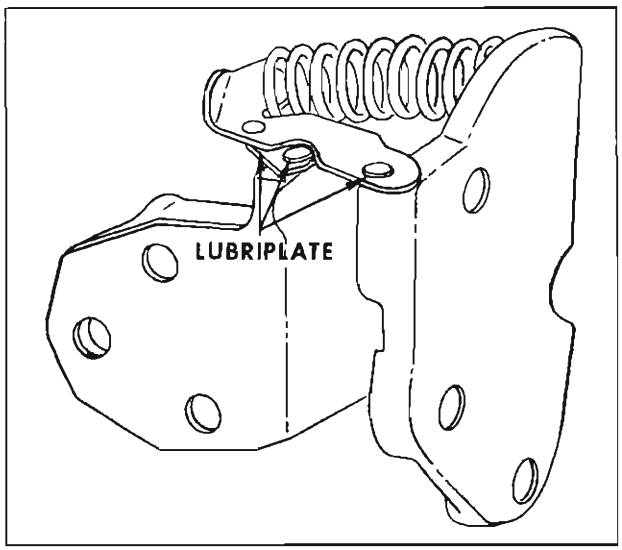


Fig. 2-9 Front and Rear Door Hinge (3000, 3100 & 3200 Series)

Hood Hinges

SAE 10W-30 oil should be used to lubricate the hood hinges, care being taken not to allow the oil to drop on fenders or other exposed painted surfaces.

Hood Latch

Lubricate the latch pilot bolts and latch locking plates with a thin film of No. 630 AAW Lubriplate. Use a light oil for pivot points.

Gas Tank Filler Door Hinge

Apply a few drops of SAE 10W-30 oil to friction points of door hinge. Work door several times and wipe off excess lubricant.

Rear Compartment Lid and Tailgate Locks

On rear compartment lid locks, apply a thin film of Lubriplate 630 AAW or its equivalent (Fig. 2-10).

On tailgate locks, apply a thin film of Lubriplate 630 AAW or its equivalent to the bolt at the striker contact areas.

Tailgate Lock Striker

Apply a thin coat of stick-type lubricant to surface of lock bolt striker teeth (Fig. 2-11). After Lubrication, close door several times and remove excess lubricant.

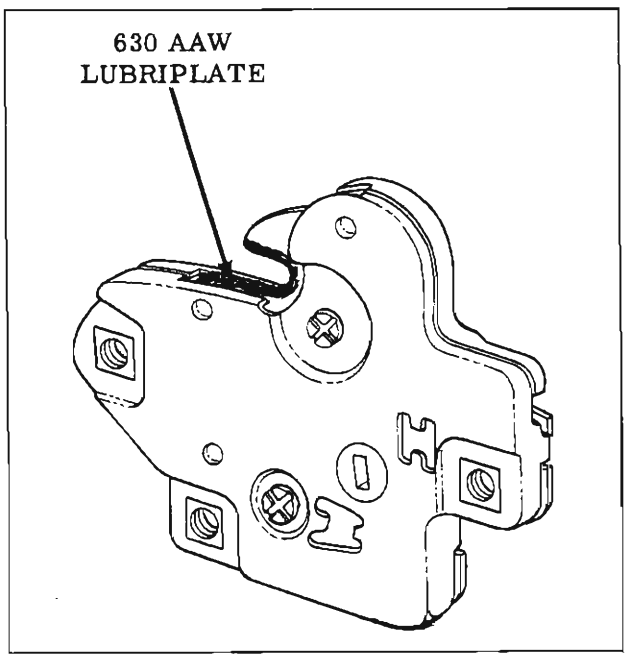


Fig. 2-10 Rear Compartment Lock Bolt

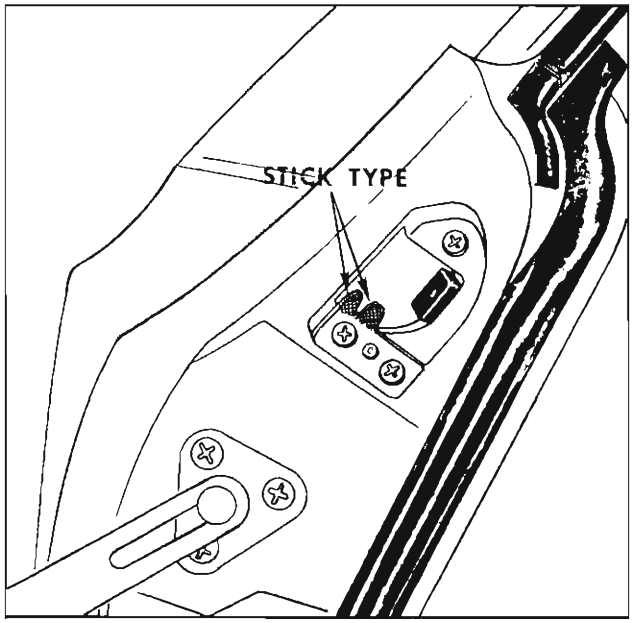


Fig. 2-11 Tailgate Striker

Rear Compartment and Tailgate Lock Cylinders

A small quantity of lock lubricant occasionally applied to the lock cylinders will prevent sticking.

Rear Compartment Lid Hinges and Torque Rods

Apply Lubricate 630 AAW or equivalent to hinges and torque rods at friction points (Fig. 2-12).

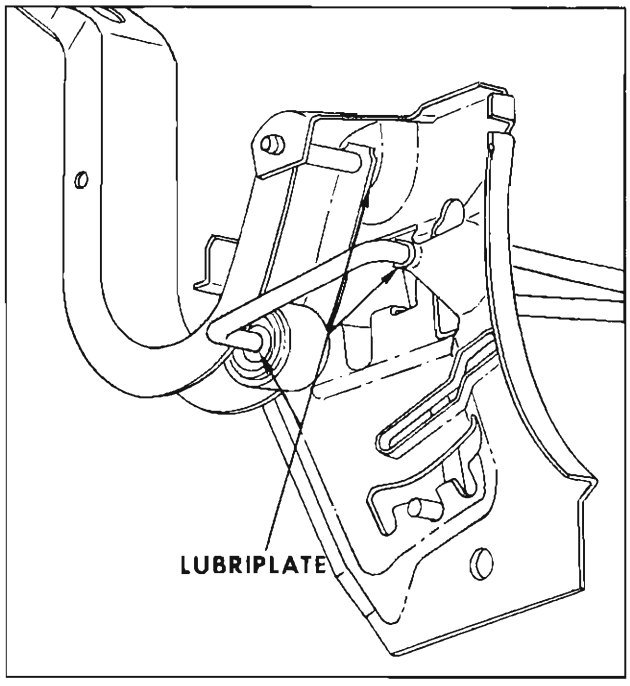


Fig. 2-12 Rear Compartment Lid Hinge

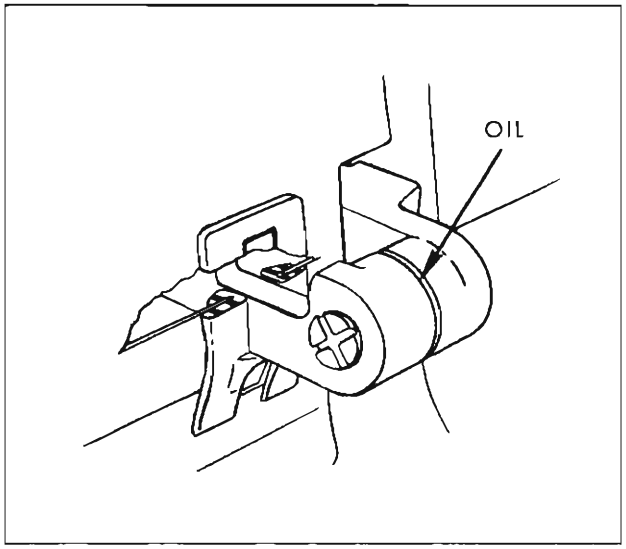


Fig. 2-13 Tailgate Hinges

Tailgate Hinges

The hinges should be lubricated lightly at all pivot points with SAE 10W-30 (Fig. 2-13).

Weatherstrip and Door Bumpers

A thin film of silicone lubricant can be used on all weatherstrips, door bumpers, hood and lacings to prevent squeaking.

Front Seat Adjuster Mechanism

MANUAL SEAT

A thin film of Lubriplate 630 AAW or its equivalent should be applied to the seat tracks as needed.

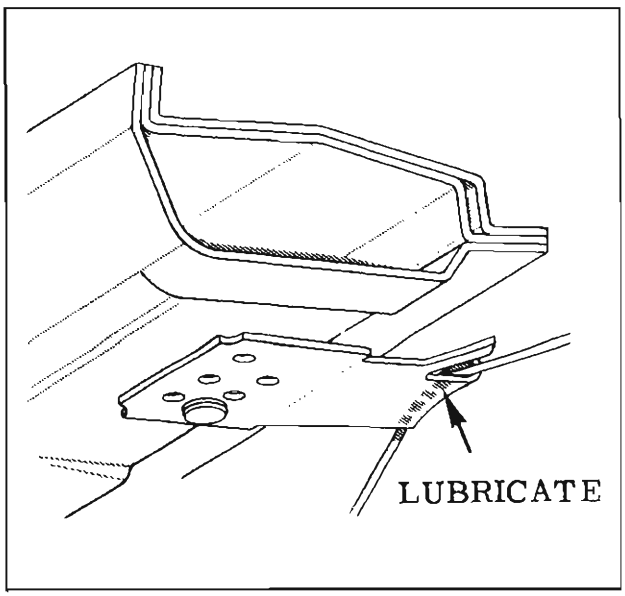


Fig. 2-14 Seat Adjuster Locking Wire Retainer

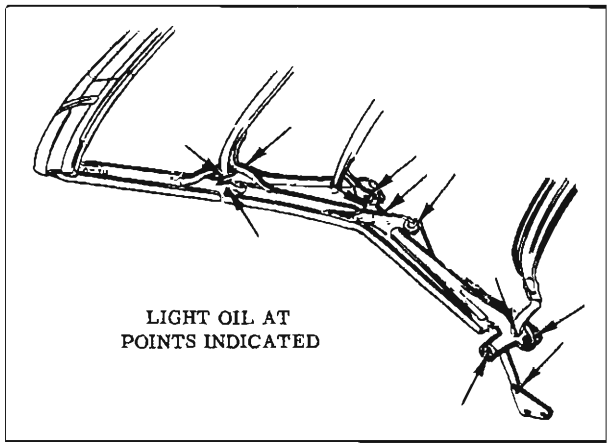


Fig. 2-15 Folding Top Linkage

Seat Adjuster Locking Wire Retainer

Wipe off dirt and apply No. 630 AAW Lubriplate or equivalent to frictional area of retainer indicated in Fig. 2-14.

2, 4 and 6-Way Electric Seats

Thoroughly wipe off old lubricant, to clean jack screw. Apply a thin film of Lubriplate 630 AAW or its equivalent to jack screw being careful not to soil seat trim. Operate the seat adjuster to limit of all positions. Apply a small amount of oil to linkage. Wipe off excess lubricant.

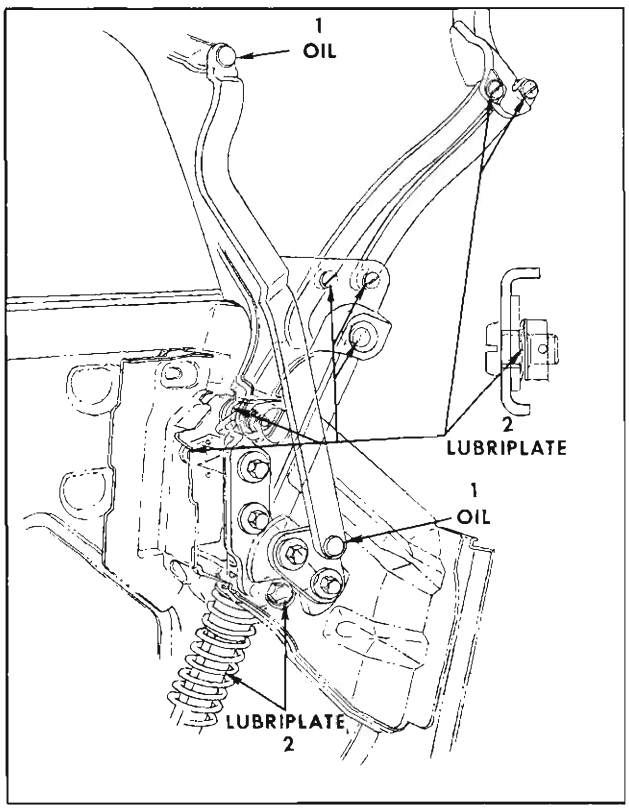


Fig. 2-16 Top Linkage

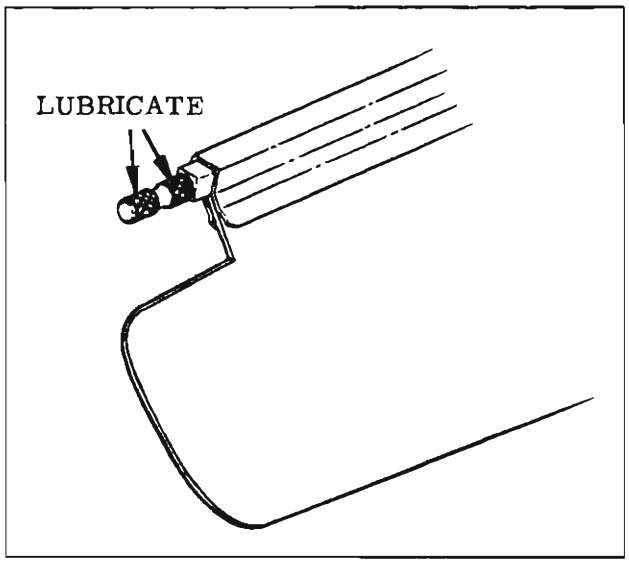


Fig. 2-17 Sunshade Rod

Folding Top Linkage (Convertible)

Apply a sparing amount of light oil to bearing points indicated in Fig. 2-15 & 2-16. Wipe off excess lubricant to prevent soiling trim.

Folding Top Lift Cylinder Piston Rods

With folding top in raised position, wipe exposed portion of each top lift cylinder piston rod with a cloth dampened with brake fluid to remove any oxidation or accumulated grime. With another clean cloth, apply a light film of brake fluid to the piston rod to act as a lubricant.

NOTE: Use caution so that brake fluid does not come in contact with any painted or trimmed parts of the body.

Sunshade Rod

Remove sunshade from support and apply a thin film of stick type lubricant to end of sunshade rod (Fig. 2-17).

15. OIL FILTER

The full flow oil filter filters 100% of the oil delivered by the oil pump. For this reason, the interval of change is very important. The oil filter shall be changed at the engine oil change which comes nearest 6,000 miles, or 6 months, whichever occurs first. Operating conditions may require more frequent replacement.

Replace Oil Filter as Follows:

A. Loosen filter with wrench, then remove and discard filter.

B. Clean out filter body casting.

C. With a new seal seated on face of new filter, install filter and tighten 15 to 17 ft. lbs.

D. Add oil, start engine and check for leaks.

16. DISTRIBUTOR

The breaker cam should be lubricated with a thin film of Ball Bearing Lubricant every 12,000 miles or whenever the contact assembly is replaced. No other lubrication is required.

17. AIR CLEANER

Non-Disposable Type (V-6 Engines)

At every other oil change, more often under dusty conditions, remove filter element, wash in kerosene, dip in SAE 10W-30 oil and squeeze to remove excess oil.

Disposable Element Type (V-8 Engines)

This air cleaner incorporates a disposable air filter element. The outside surface of the element is covered with a coarse material for primary filtering of large particles. The inner surface is less porous material for filtering fine particles. Soft plastic flanges are used as self contained gaskets which seal the air cleaner body and cover. Therefore, all air must pass through the filter element.

The air filter element should be replaced every 18,000 miles under normal driving conditions, and more frequently under dusty driving conditions. Do not attempt to service the element.

The filter element should be replaced as follows:

A. Remove air cleaner assembly to prevent dirt from falling into carburetor.

B. Remove filter element from air cleaner.

C. Clean dust and dirt from metal surfaces of air cleaner body and install new filter element.

D. Install air cleaner assembly on carburetor.

18. SPEEDOMETER CABLE

The cable should be lubricated every 24,000 miles. Apply a coating of Speedometer Cable Grease to the lower two-thirds of the cable only.

This will properly lubricate the upper one-third of the casing giving an even coating of lubricant the full length of the flexible cable, without danger of excess grease working up into the speedometer head.

NOTE: Care must be exercised to prevent entrance of dirt into the speedometer casing.

19. WINDSHIELD WIPER TRANSMISSION BEARING

Lubricate windshield wiper transmission bearing with 10W-30 oil every 24,000 miles.

ENGINE

(34-35-36-38-39 SERIES)

CONTENTS OF SECTION 3

PERIODIC MAINTENANCE

For periodic engine lubrication and maintenance refer to PERIODIC MAINTENANCE - SECTION 2.

Remove dirt and foreign materials from radiator cooling fins with compressed air when necessary. If equipped with air conditioning, also remove dirt and foreign material from condenser cooling fins.

For cooling system service recommendations, refer to PERIODIC MAINTENANCE - SECTION 2.

GENERAL DESCRIPTION

Regular fuel engines have a compression ratio of 8.75:1, premium fuel engines except Starfire, have a compression ratio of 10.25:1. Starfire engines have a compression ratio of 10.50:1.

MANIFOLDS

The intake manifold for both banks of cylinders is of one casting, while each bank has a separate exhaust manifold.

Preheating of the gasoline mixture is obtained by the exhaust gas passage through the intake manifold, which directly connects the two exhaust manifolds, forcing the hot exhaust gases to circulate around the choke heat tube when the heat control valve is closed or partially closed. (Fig. 3-1)

Cast integral with the intake manifold at the front is a passage which returns the water from the cylinder heads to the water outlet and the radiator core.

An elbow is incorporated on the lower end of the choke heat tube to prevent water from being drawn up the heat tube and into the carburetor. (Fig. 3-1) The elbow must be installed with the tube end up.

INTAKE MANIFOLD AND/OR GASKET

Remove

1. Drain radiator, then disconnect radiator upper hose from water outlet.

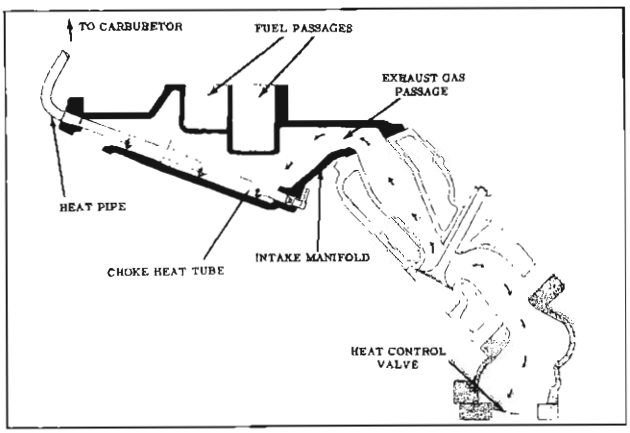


Fig. 3-1 Exhaust Flow (Heat Control Closed)

2. Remove air cleaner.
3. Disconnect spark plug wires.
4. Disconnect throttle linkage.
5. Remove fuel and vacuum lines from carburetor.
6. Disconnect wiring from coil.
7. If equipped with power steering, disconnect power steering pump and bracket as an assembly.
8. If equipped with air conditioning, disconnect Delcotron, then remove attaching bolts and tip compressor and bracket rearward to obtain clearance for manifold removal.
9. Remove intake manifold with coil and carburetor attached.
10. Clean cylinder head and manifold machined surfaces.

Install

1. Reverse sequence of removal operations, using new graphite coated metal gaskets between the head and intake manifold. Apply No. 3 sealer (Part No. 557622) on both sides of gasket.
2. Dip threads of intake manifold bolts in C.P. No. 9 sealer (Nat. Machine Prod. Co.). Install manifold bolts and nuts and torque 22 to 34 ft. lbs. in sequence as shown in Fig. 3-2.
3. If equipped with power steering or air conditioning, adjust belt tension with BT 33-70.
4. After installation of manifold is completed, adjust throttle linkage. (Refer to Hydra-Matic or Syncromesh, Section 6)

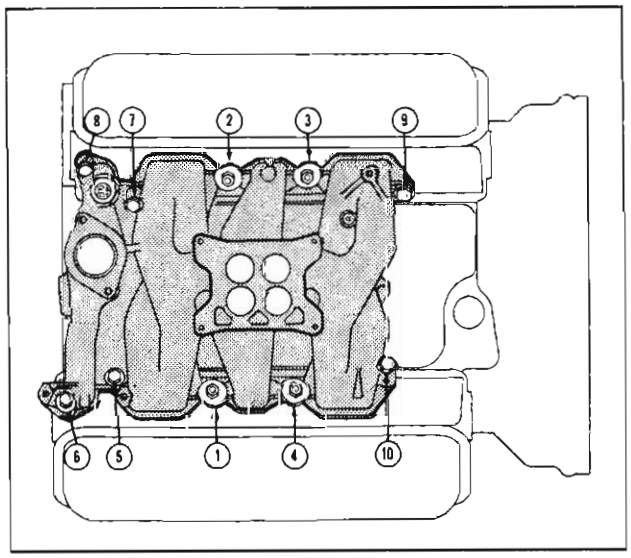


Fig. 3-2 Intake Manifold Torque Sequence

MANIFOLD HEAT CONTROL VALVE (Fig. 3-3)

The manifold heat control valve assembly is mounted on the left exhaust manifold. The valve regulates the amount of heat by-passed through the intake manifold so that a sufficient amount of heat is transferred to insure a uniform vaporization of the intake mixture under all operating conditions.

The offset valve, counterweight, and thermostat are calibrated to give proper intake manifold heat under all driving conditions.

The manifold heat control valve must be in proper operating condition to insure good performance and economy. A heat valve that does not close causes poor warm-up and rich carburetion. A heat valve that does not open will cause unsatisfactory operation during normal engine temperature operation, especially in hot weather. The thermostatic spring is designed to close the valve as the engine cools. As the spring warms and the engine speed increases, the counterweight and exhaust gas pressure opens the valve.

Inspection

With a cool exhaust manifold, start the engine and flash the throttle quickly. The heat control valve should open and return to the closed position. The valve opens when the weight rotates downward. If the valve does not operate and the counterweight shaft is free, it indicates that either the valve is loose on the shaft or the shaft is broken. If the shaft is tight, it may be freed-up by rotating the counterweight.

CAUTION: Never oil the heat control valve shaft bearing surfaces as carbon may form and "freeze" the shaft.

A rattling or "buzzing" noise indicates that the shaft bushings are worn. If the manifold heat control valve is noisy or inoperative, the assembly should be replaced.

The manifold heat control valve must be assembled as shown in Fig. 3-4.

Remove and Install

The manifold heat control valve can be removed by disconnecting the crossover pipe to exhaust manifold attaching nuts (on cars with the single exhaust system) or by disconnecting the L.H. exhaust pipe to manifold (on cars with the dual exhaust system).

NOTE: Always use new gasket and "Seez-Pruf" nuts when replacing the heat control valve.

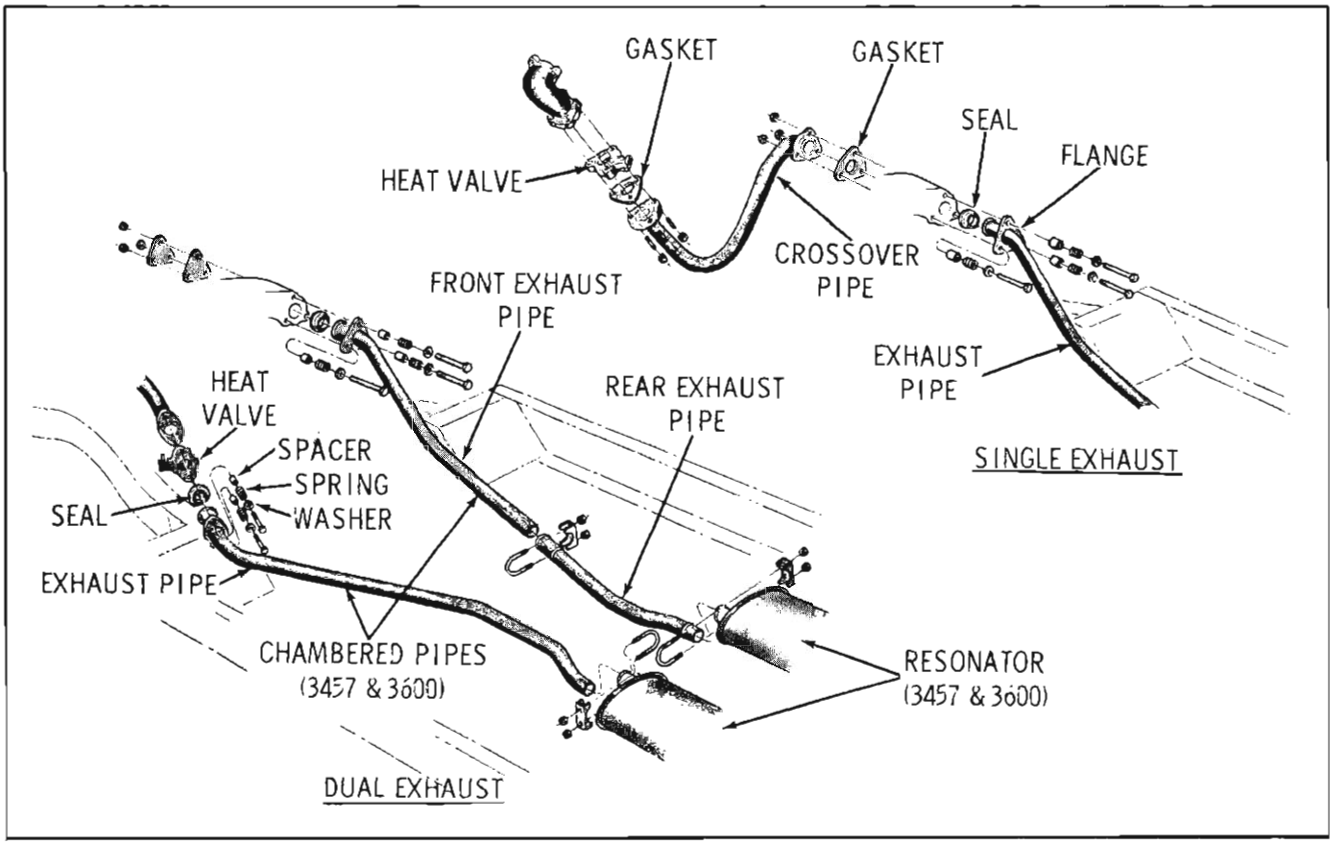


Fig. 3-3 Exhaust Systems

Torque crossover pipe to manifold nuts 25 to 35 ft. lbs. Torque flex-joint nuts 7 to 10 ft. lbs.

EXHAUST MANIFOLD

Remove

1. Disconnect exhaust pipe or crossover pipe.
2. L.H. Manifold: Remove manifold heat control valve.

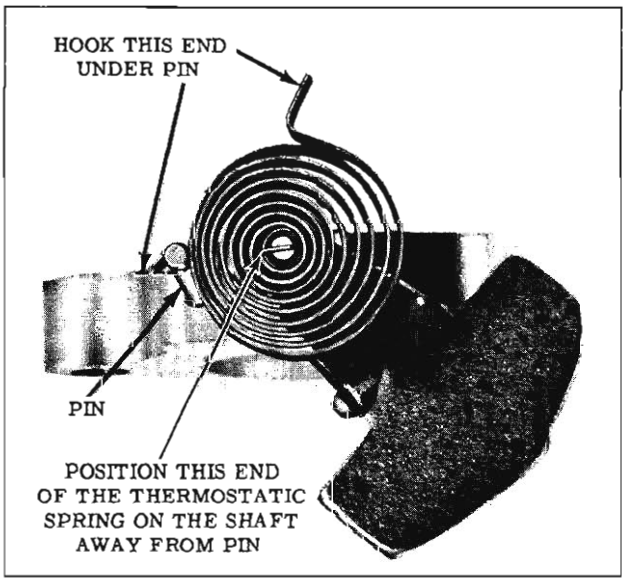


Fig. 3-4 Spring Installation

3. Raise front of engine as outlined under RAISING FRONT OF ENGINE.
4. L.H. Manifold: Remove the power steering hoses at the steering gear and position hoses above level of power steering pump to prevent oil loss.
5. Remove manifold to head attaching nuts and front bolt and remove manifold.
6. Clean manifold and cylinder head machined surfaces.

Install

1. Apply Graphite Grease Part No. 581823 to the sealing surfaces of the exhaust manifold center and end port flanges.

   NOTE: Gaskets are not used between the cylinder head and the exhaust manifold.

2. Position the exhaust manifold onto the head.
3. If manifold studs show signs of coolant leakage, remove the studs and apply C.P. No. Nine Sealer to the stud threads.

4. Apply C.P. No. Nine Sealer to the front attaching bolt and fasten the manifold to the head. Torque the bolt and nuts 19 to 25 ft. lbs.

5. Reverse Steps 1 thru 4 of the exhaust manifold removal procedure.

6. Check power steering gear pump oil level.

HEAD AND VALVE MECHANISM

ROCKER ARM SHAFT ASSEMBLY

Remove

1. R.H. rocker arm shaft: Remove the crankcase ventilation valve from rocker arm cover.

2. Remove rocker arm cover. If equipped with air conditioning, disconnect battery cable then remove compressor and Delcotron bracket attaching bolts and tip compressor and Delcotron rearward to remove R.H. rocker arm cover. If equipped with power steering, remove pump mounting bracket attaching bolts and move assembly to one side to gain access to L.H. rocker arm cover.

3. Remove rocker arm bracket bolts.

4. Remove rocker arm shaft assembly.

5. To disassemble rocker arm, remove brackets and rocker arms from shaft. (Fig. 3-5)

NOTE: One bracket is attached to the shaft by an anchor pin. (Fig. 3-6) It is not necessary to remove this bracket unless either the bracket, shaft, or pin has to be replaced. If necessary to remove, insert a drift through the oil passage in the bracket and drive out pin.

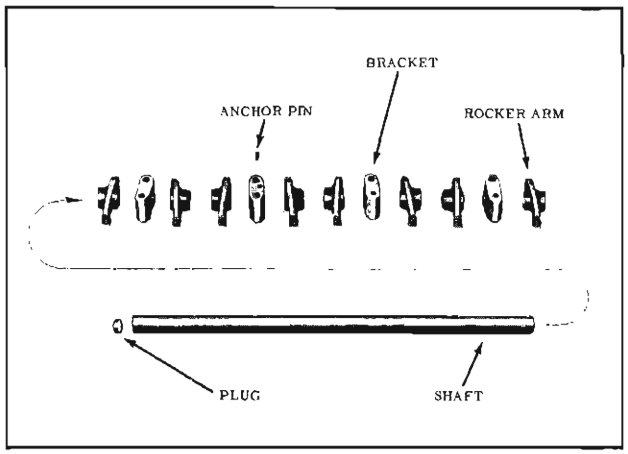


Fig. 3-5 Rocker Arm Assembly

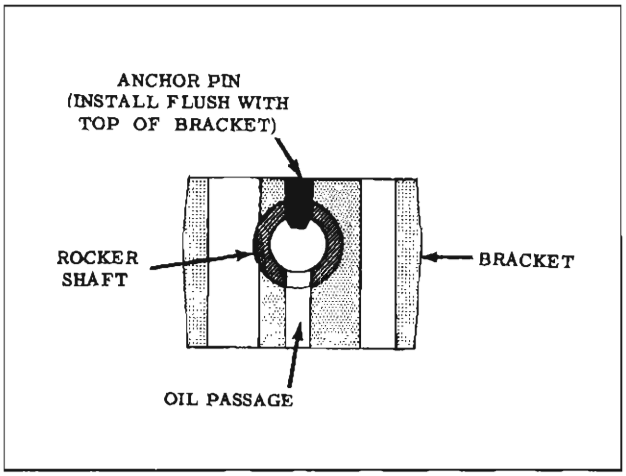


Fig. 3-6 Bracket and Anchor Pin

If necessary to remove a rocker shaft plug, punch hole in plug, then pry plug from end of shaft.

Assemble

1. If shaft, pin, or pinned bracket was removed, install a new pin. Drive pin flush with bracket. (Rocker arm shaft oil ports must face down)

2. If a rocker shaft plug was removed, position a new plug in end of shaft, and install plug until outer shoulder is 9/32" into end of shaft. stake end of shaft to retain plug.

3. Lubricate all frictional surfaces of the rocker arms, brackets and shaft, then assemble rocker arm shaft assembly as shown in Fig. 3-5.

Install

1. Position rocker arm shaft assembly on cylinder head and reverse removal procedure.
2. Align assembly and tighten bolts evenly.
3. Torque large bolts 60 to 80 ft. lbs., small bolts 14 to 22 ft. lbs.

VALVE SPRING

Remove and Install (On Car)

To replace a worn or broken valve spring without removing the cylinder head, proceed as follows:

1. Remove the rocker arm shaft assembly.

2. Remove spark plug and install Air Hose Adapter BT-72-1B. Connect an air hose to the adapter to hold the valve on its seat.

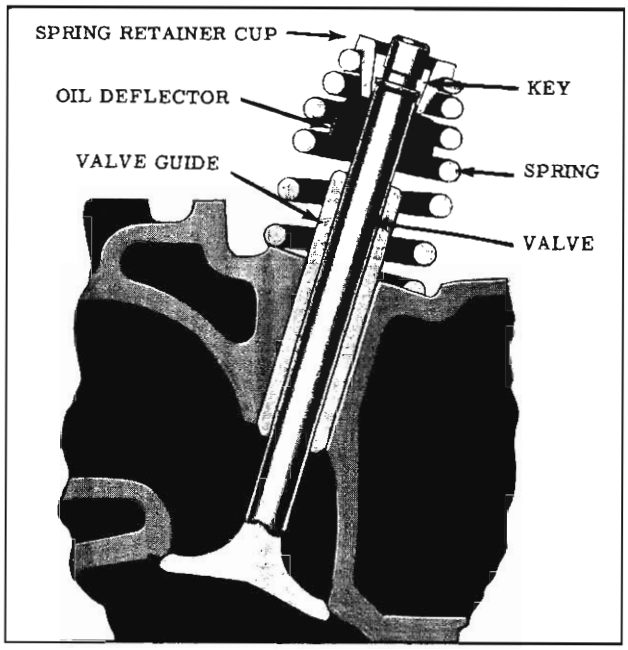


Fig. 3-7 Valve Assembly

3. Install valve compressor on cylinder head as shown in Fig. 3-8. Compress valve spring until valve keys are accessible, then remove keys, spring retainer cup and spring. (Fig. 3-7.

To install valve springs, reverse the removal procedure.

CYLINDER HEAD AND/OR GASKET

Remove

1. Drain radiator and cylinder block.
2. Remove intake manifold.
3. Remove Delcotron.
4. Disconnect exhaust pipes.
5. R.H.head: Remove the crankcase ventilation valve from the R.H. rocker arm cover.
6. Remove rocker arm cover. If equipped with air conditioning, remove compressor and Delcotron bracket attaching bolts and tip compressor rearward to remove R.H. rocker arm cover. If equipped with power steering, remove pump mounting bracket attaching bolts and move assembly to one side to gain access to L.H. rocker arm cover.
7. Remove rocker arm shaft assembly. Disconnect ground strap from rear of cylinder head.
8. Remove push rods. Keep rods grouped so they can be installed in their original location.
9. Remove cylinder head bolts then remove cylinder head with exhaust manifold attached.

Disassembly

1. Remove spark plugs.
2. Remove exhaust manifold.
3. Remove valve keys by compressing valve spring with a tool such as BT-72-2 or OTC-CF-11.
4. Remove valve spring retainer cups and springs. (Fig. 3-7) Keep all parts grouped so they can be installed on their original valves.
5. Remove oil deflectors from valve stems.
6. Invert heads and remove valves. Keep valves separated so they can be installed in their original location.
7. If necessary to remove valve guides, support head on wood blocks then drive out with Valve Guide Remover Tool J-3062 (Fig. 3-9)

To install valve guides, proceed as follows:

Lay Gauge Washer J-5158-3 on the valve spring seat. Install guide into cylinder head (with grooved end of guide up) by driving on Tool J-5158-2 until the tool seats against the gauge washer. (Fig. 3-10) This will allow the valve guides to extend 25/32" above the face of the valve spring seat.

When reconditioning valves and valve seats, only precision equipment should be used and the recommendations of the equipment manufacturer should be followed. Clean carbon from heads and also from valve guides. Whenever valves are ground or new valves and guides are installed, the valve seats must be reconditioned. Cutters (45^{O}) are required for reseating, and a snug fitting solid pilot of the correct size should be used. New guides, if required, should be in place at the time seats are cut. Service guides are Parco-Lubrited and finished to size, and should NOT be reamed. Oversize guides (.010" O.D.) can be identified by a groove on the O.D. of the guide.

IMPORTANT: To insure satisfactory service, it is necessary that valve seat width be maintained within specifications. (Intake and exhaust seat width should be .037" to .075"). A 15^{O} cutter should be used to narrow the seat as necessary.

Assembly

1. Install valves in their respective guides.

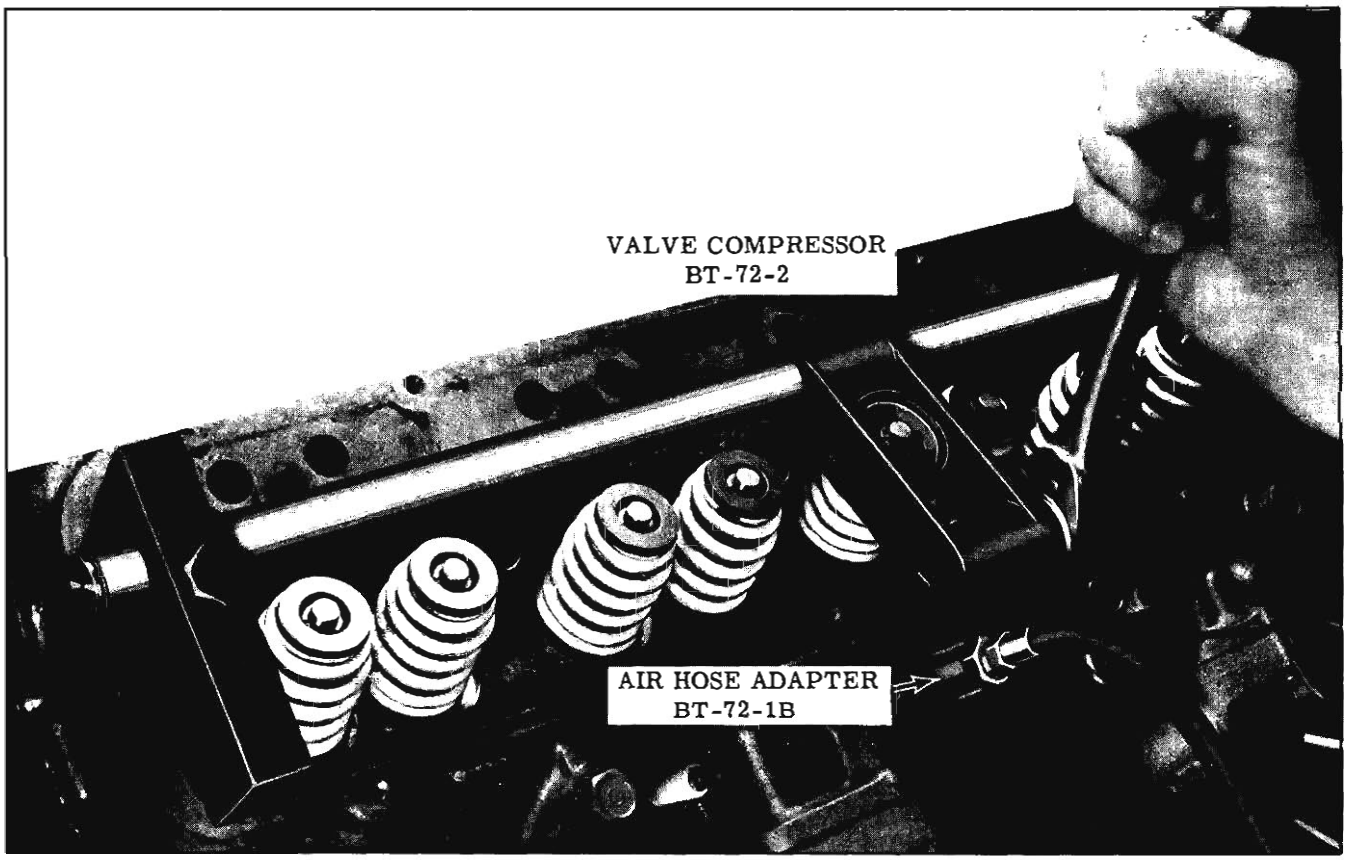


Fig. 3-8 Compressing Valve Springs

2. Install new oil deflectors over valve stem. Force deflectors down as far as possible on valve stem. The deflectors will correctly position themselves when the engine is started.

3. Position valve springs over valve stems.

4. Install valve lock retainer cups, then compress springs with a tool such as BT-72-2 or OTC-CF-11.

5. Install valve stem keys.

6. Check valve springs and keys to be sure they are properly seated.

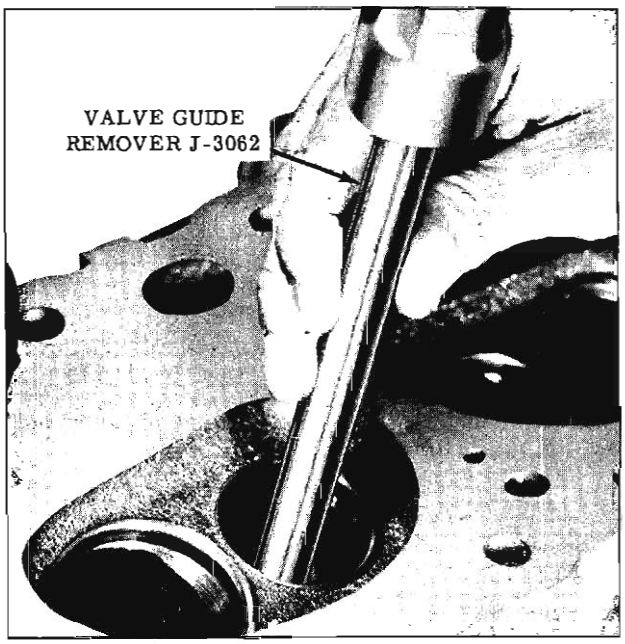


Fig. 3-9 Removing Valve Guide

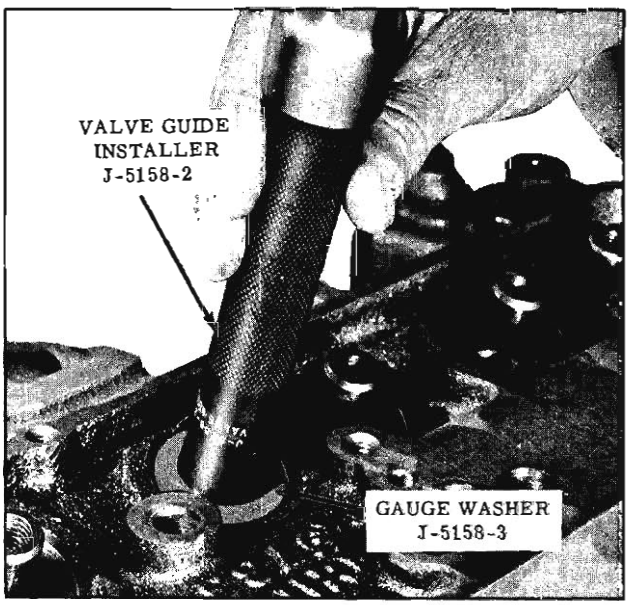


Fig. 3-10 Installing Valve Guide

7. Before assembling the exhaust manifold to the head, apply Graphite Grease Part No. 581823 to the sealing surfaces of the exhaust manifold center and end port flanges.

   NOTE: Gaskets are not used between the cylinder head and exhaust manifold.

   If the manifold attaching studs show signs of coolant leakage, remove studs and apply a sealer such as C.P. No. Nine to the stud threads, then reinstall threads.

   Torque manifold to head nuts 19 to 25 ft. lbs.

8. Set spark plug gap to .030" and reinstall plugs. Torque 35 ft. lbs.

Install

1. Install cylinder head guide studs J-3455 in cylinder head bolt holes at each end of block.

2. Apply sealer, Part No. 557622, to both sides of a new head gasket and position gasket over guide studs.

3. Place cylinder head in position. Apply a sealer such as C.P. No. Nine to head bolts. Install the center and lower row of attaching bolts finger tight, after removing guide studs.

4. Install push rods and rocker arm shaft assembly making sure that the push rods are properly seated in the rocker arms and valve lifters.

5. Tighten rocker arm shaft bracket and cylinder head attaching bolts in sequence as shown in Fig. 3-11.

6. Connect ground strap to rear of cylinder head.

7. Cement new gasket to rocker arm cover, then install cover.

8. R.H. head: Install crankcase ventilation valve and hoses on R.H. rocker arm cover.

9. Connect exhaust pipes to exhaust manifold using new gaskets.

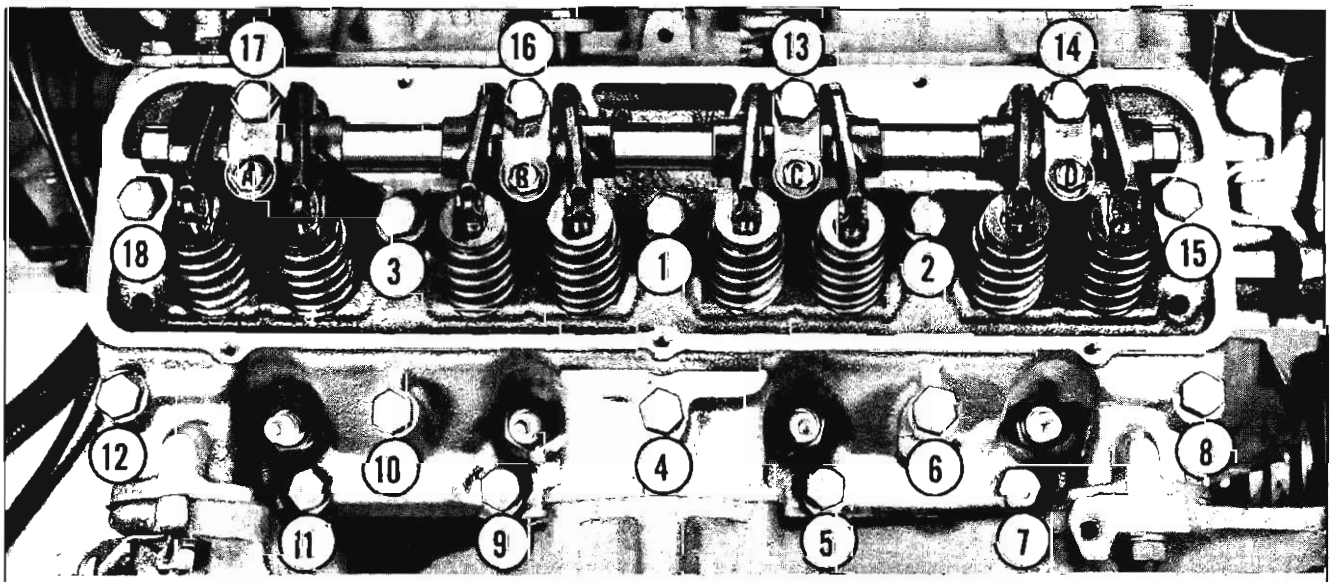
10. Install Delcotron and compressor, if so equipped.

11. Adjust belts with BT-33-70.

12. Apply sealer to the attaching bolts and install intake manifold. Torque nuts and bolts 22 to 34 ft. lbs.

13. Fill radiator.

14. After engine reaches operating temperature,



A. TIGHTEN ALL BOLTS SNUG.

B. TIGHTEN NUMBERED BOLTS IN SEQUENCE SHOWN 50 TO 60 FT. LBS.

C. TIGHTEN LETTERED BOLTS 14 TO 22 FT. LBS.

D. RETIGHTEN NUMBERED BOLTS IN SEQUENCE SHOWN 60 TO 80 FT. LBS.

E. RETIGHTEN LETTERED BOLTS 14 TO 22 FT. LBS.

Fig. 3-11 Head Bolt Torque Sequence

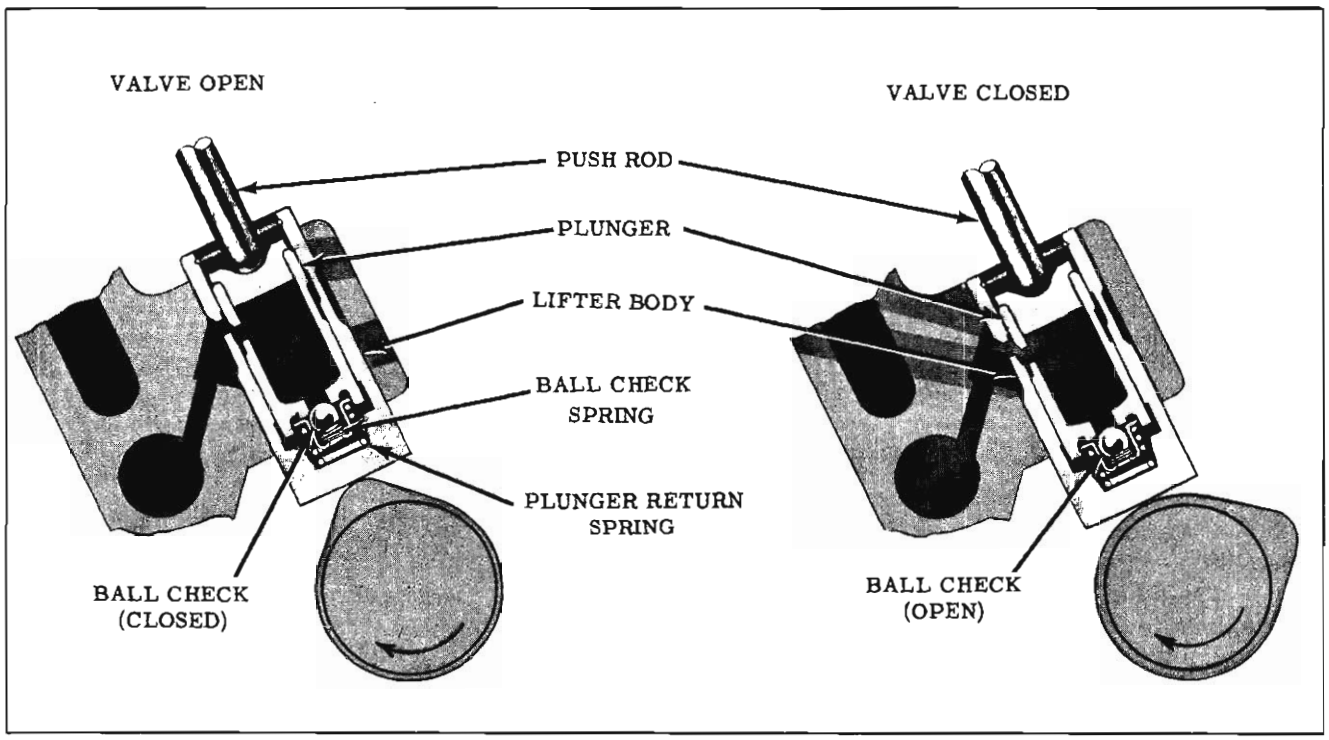


Fig. 3-12 Lifter Action on Camshaft

finish filling radiator until coolant level is 1/4" below filler neck.

VALVE LIFTERS

OPERATION (Fig. 3-12)

Oil is supplied to the lifter through a hole in the side of the lifter body which indexes with a groove and hole in the lifter plunger.

When the lifter begins to ride up the cam lobe, the ball check is held against its seat in the plunger by the ball check spring which traps the oil in the base of the lifter body below the plunger. The plunger and lifter body then raise as a unit, pushing up the push rod to open the valve. The force of the valve spring which is exerted on the plunger through the rocker arm and push rod causes a slight amount of leakage between the plunger and lifter body. This "leak down" allows a slow escape of trapped oil in the base of the lifter body. As the lifter rides down the other side of the cam lobe and reaches the base circle or "valve closed" position, the plunger spring quickly moves the plunger back (up) to its original position. This movement causes the ball check to open against the ball spring and oil from within the plunger is drawn into the base of the lifter. This restores the lifter to zero lash.

VALVE LIFTER SIZES

Valve lifters may be one of three sizes: Standard, .001", or .010" oversize. It is important when replacing valve lifter assemblies that the proper size lifter be ordered. An identification numeral is etched on all lifter bodies except standard. The cylinder block is marked 1 or 10, for lifter size, on the rail under the engine top cover. No mark indicates standard size lifter.

Remove and Install

IMPORTANT: Valve lifters and push rods should be kept in order so they can be reinstalled in their original position in the cylinder block.

1. Remove intake manifold, engine top cover, rocker arm covers and rocker arm shaft assemblies.
2. Remove push rods.
3. On varnished lifters, apply cleaning solvent to lifter body. Allow five minutes for solution to remove varnish.
4. Remove valve lifters. The use of Tool 23-15 will aid in removal of varnished lifters. (Fig. 3-13)

Reverse removal procedure for installation. Check lifters for free movement in the bore and to see that there is no perceptible side play.

Disassembly

1. Remove retainer spring with Tool BT-31 or a

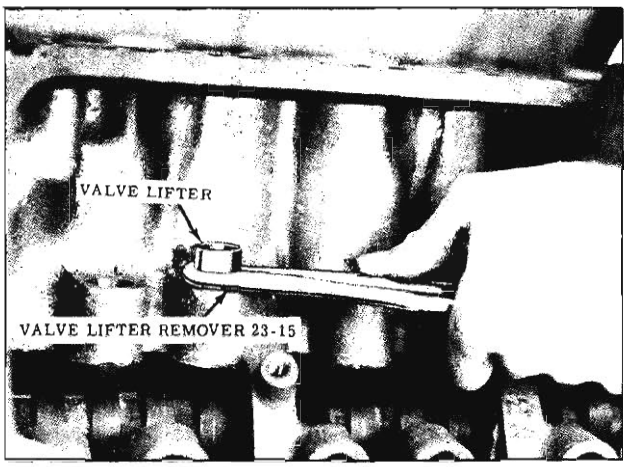


Fig. 3-13 Removing Lifter

small screw driver.

2. Remove push rod seat.

3. Remove plunger and plunger spring. If plunger is stuck tight, allow lifter to soak in cleaning solvent for approximately five minutes, then remove plunger. Tool 23-16 may be used if plunger does not fall out. (Fig. 3-14)

4. Remove ball check retainer from plunger, then remove ball and spring.

Clean and Inspect

After lifters are disassembled, all parts should be cleaned in clean solvent, using cleaning brush J-5099. A small particle of foreign material under the ball check valve will cause malfunctioning of the lifter. Close inspection should be made for

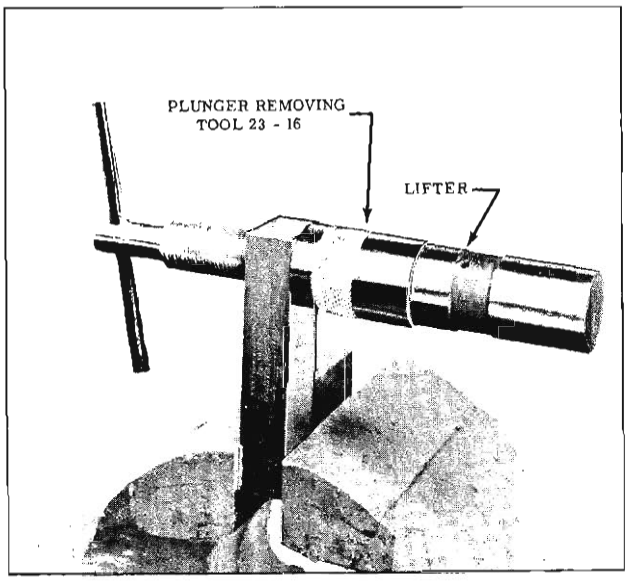


Fig. 3-14 Removing Plunger

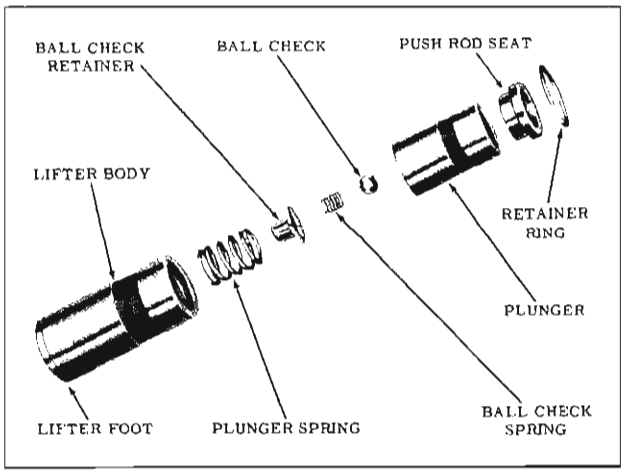


Fig. 3-15 Hydraulic Valve Lifter

nicks, burrs, or scoring of parts. If either the body, plunger or internal parts are defective, replace with a new lifter assembly.

IMPORTANT: DO NOT CONDEMN VALVE LIFTERS THAT HAVE A SLIGHT GAP OR SHOW EVIDENCE OF LEAKAGE WHERE THE LIFTER FOOT IS WELDED TO THE LIFTER BODY (FIG. 3-15) UNLESS THE LEAK-DOWN RATE IS NOT WITHIN SPECIFICATIONS. (SEE VALVE LIFTER LEAK-DOWN)

NOTE: Whenever lifters are removed, always check the lifter foot for wear as follows:

1. Place a straight edge across the lifter foot.

   NOTE: Lifter foot must be clean and dry.

2. While holding the lifter at eye level, check for light between the straight edge and lifter foot.

3. If light indicates a flat or concave surface of the lifter foot, the lifter should be replaced and the camshaft inspected for wear. Wear at

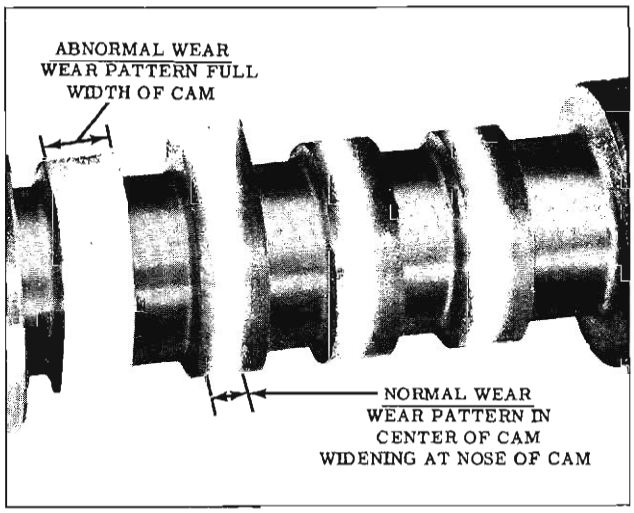


Fig. 3-16 Camshaft Wear Patterns

the CENTER of the cam base circle is NORMAL. (Fig. 3-16) The camshaft should be replaced ONLY when wear is present across FULL WIDTH of cam base circle.

Assembly and Leak-Down Test

IMPORTANT: Lifters must be assembled while submerged under Hydraulic Lifter Test Fluid BT-59 and leak-down tested before placing into service.

1. Install Adapter 105-2 in reservoir of Tester BT-60, then fill reservoir with Hydraulic Lifter Test Fluid BT-59, 1/2" below top of reservoir.
2. Assemble ball check, spring and retainer into plunger. (Fig. 3-17) Make sure retainer flange is pressed tight against bottom of recess in plunger.
3. Install plunger spring over ball check retainer.
4. Hold plunger with spring up and insert into lifter body. Hold plunger vertical to prevent cocking spring.
5. Place assembly into the tester cup then position push rod seat onto plunger.
6. Position the 1/4" steel test ball on the push rod seat. Lower tester ram until it contacts the steel ball.
7. Allow ram to move downward by its own weight until air bubbles disappear.
8. Raise ram, then allow to lower as in step 7. Repeat this procedure several times or until all air is expelled from lifter.

CAUTION: DO NOT ATTEMPT TO EXPEL AIR FROM LIFTER BY PUMPING RAM.

9. After all air is expelled, allow ram to bleed down lifter until retaining ring groove is exposed.
10. Install retaining ring.
11. Adjust ram screw so that it contacts the steel ball in the push rod seat when the pointer is at the start line.
12. Raise arm, then start test by resting ram on steel ball. Rotate reservoir one revolution every two seconds and time the indicator from the start to the stop line. (Fig. 3-18) Allowable tolerance for leak-down rate is 12 to 90 seconds (for used lifters) and 20 to 90 seconds (for new lifters).
13. If leak-down tolerance is within specifications, the lifter can be placed in service without removing test fluid. If leak-down tolerance is not within specifications, the lifter should be replaced.

VALVE LIFTER DIAGNOSIS

1. Momentarily Noisy When Car is Started:

This condition is normal. Oil drains from the lifters which are holding the valves open when the engine is not running. It will take a few seconds for the lifter to fill after the engine is started.

2. Intermittently Noisy on Idle Only, Disappearing When Engine Speed is Increased:

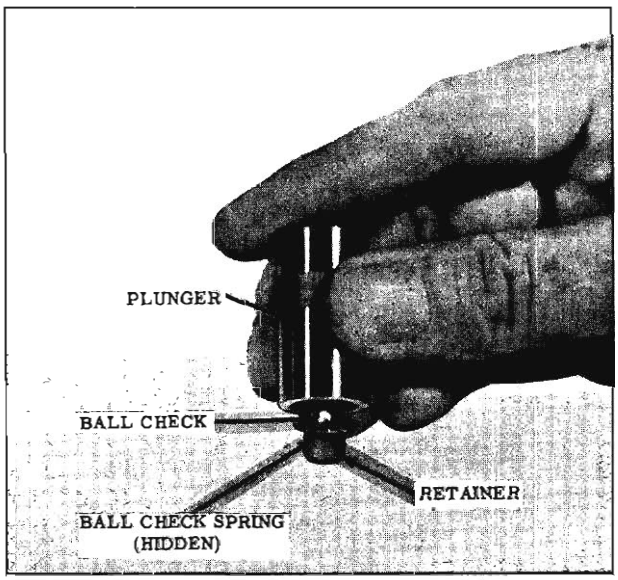


Fig. 3-17 Assembling Retainer in Plunger

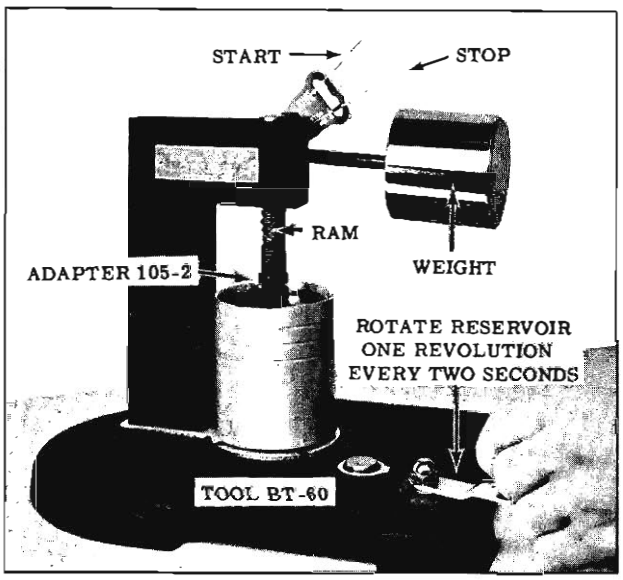


Fig. 3-18 Testing Lifter

Intermittent clicking is an indication of a flat or pitted ball. It may also be caused by dirt.

Correction: Clean lifter and inspect the ball. If ball is defective, replace lifter.

3. Noisy at Slow Idle or With Hot Oil, Quiet With Cold Oil or as Engine Speed is Increased:

Insert a .015" feeler gauge between the rocker arm and valve stem. If noise momentarily disappears and then reappears after a few seconds with the feeler still inserted, it is an indication that the lifter "leak-down" rate is too fast.

Correction: The lifter should be cleaned and tested.

4. Noisy at High Car Speeds and Quiet at Low Speeds:

a. High oil level - Oil level above the "Full" mark allows crankshaft counterweights to churn the oil into foam. When foam is pumped into the lifters, they will become noisy since a solid column of oil is required for proper operation.

Correction: Drain oil until proper level is obtained. See PERIODIC MAINTENANCE Section.

b. Low oil level - Oil level below the "Add 2" mark allows the pump to pump air at high speeds which results in noisy lifters.

Correction: Fill until proper oil level is obtained. See PERIODIC MAINTENANCE Section.

5. Noisy at Idle Becoming Louder as Engine Speed is Increased to 1500 RPM:

a. This noise is not connected with lifter malfunction. It becomes most noticeable in the car at 10 to 15 mph "L" range, or 30 to 35 mph "S" range, and is best described as a "hashy" sound. At slow idle, it may disappear entirely or appear as a light ticking noise in one or more valves. It is caused by one or more of the following:

(1) Badly worn or scuffed valve tip and rocker arm pad.

(2) Excessive valve stem to guide clearance.

(3) Excessive valve seat runout.

(4) Off-square valve spring.

(5) Off-square rocker arm pad.

(6) Excessive valve face runout.

Diagnosis:

Remove rocker arm covers and while listening with a length of heater hose or Stethoscope BT-37, locate noisy valves by increasing engine speed slightly above idle, about 1000 rpm. With gloved hand, push sideways on valve spring. Noise will change, either becoming louder or disappearing completely. Some noise will be present in all valve locations. It is necessary to determine which are actually responsible for the customer complaint.

Correction:

a. Occasionally this noise can be eliminated by rotating the valve spring and valve. Crank engine until noisy valve is off its seat. Rotate spring 90°. This will also rotate valve. Repeat until valve becomes quiet. If correction is obtained, check for an off-square valve spring. If spring is off square more than 1/16" in free position, replace spring. (Fig. 3-19)

b. Observe rocker arm pad for excessive wear or excessive off square. Replace as required. (Fig. 3-20)

c. If correction is not obtained, remove cylinder head and check for excessive valve stem to guide clearance. Correct as required.

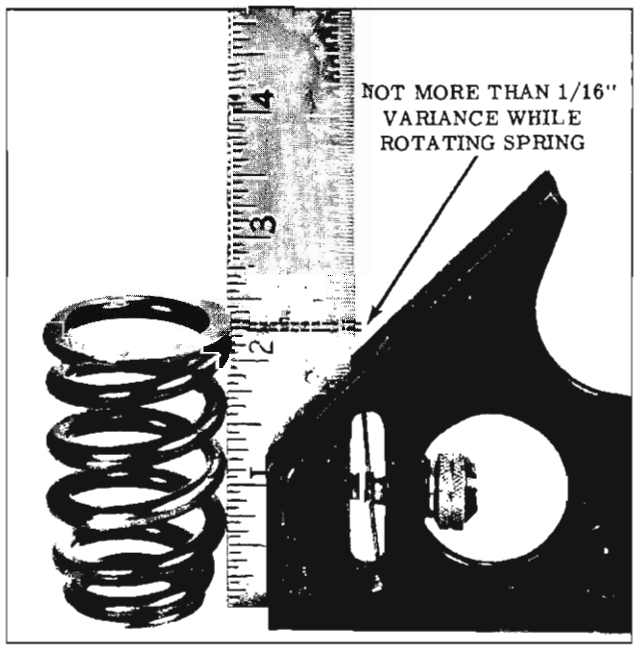


Fig. 3-19 Checking Valve Spring for Distortion

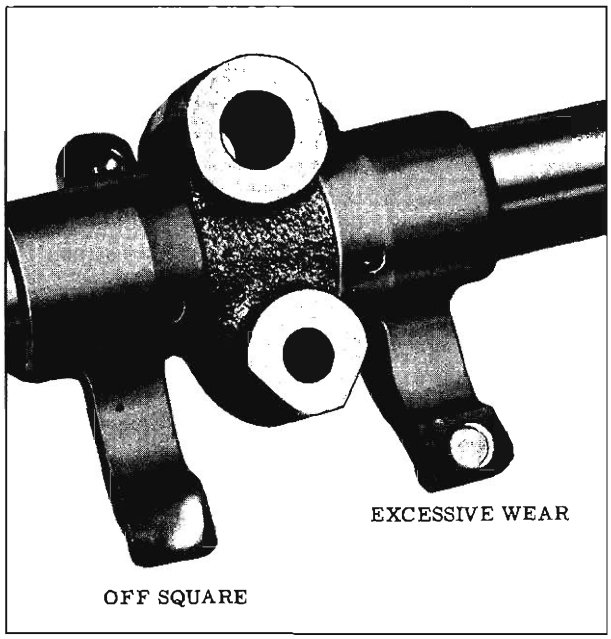


Fig. 3-20 Rocker Arm Wear Patterns

Check valve seat runout. Repair as required by cutting seat. Reface valve and lap valve to seat lightly.

CAUTION: Heavy lapping which results in a groove in the valve face can cause early burning.

6. Valves Noisy Regardless of Engine Speed:

Correction: This condition can be caused by any of the following factors:

a. With transmission in neutral and parking brake on, run the engine at a high rpm. If a foreign particle in the lifter is restricting proper operation, this method sometimes proves successful in dislodging the particle. If this method does not quiet the lifter, strike the rocker arm above the push rod with a mallet while the engine is idling. This method of correction has proven successful for dislodging a foreign particle which is preventing the ball from seating properly.

b. Check for valve lash by turning engine so the piston in that cylinder is on T.D.C. of firing stroke. If valve lash is present, the push rod can be freely moved up and down a certain amount with rocker arm held against valve.

Valve lash indicates one of the following:

(1) Worn push rod.

(2) Worn rocker arm.

(3) Lifter plunger stuck in down position due to dirt or varnish.

(4) Defective lifter.

CHECKING OF THE ABOVE FOUR ITEMS:

Remove the rocker arm shaft assembly, then proceed as follows:

1. Observe upper end of push rod. Excessive wear of the spherical surface indicates one of the following conditions:

   (a) Improper hardness of the push rod. The rod must be replaced.

   (b) Improper lubrication to the push rod. The push rod and rocker arm must be replaced. The oiling system to the push rod should be checked.

2. If push rod appears in good condition and has been properly lubricated, replace rocker arm and recheck valve lash.

3. & 4. If valve lash exists and push rod and rocker arm are satisfactory, trouble is in lifter. Lifter should be replaced.

RAISING FRONT OF ENGINE

When removing the exhaust manifold, oil pan, front cover or the engine front mount, the front of the engine must be raised to provide clearance. This is accomplished as follows:

1. Remove the engine front mount to front cross member attaching nuts.

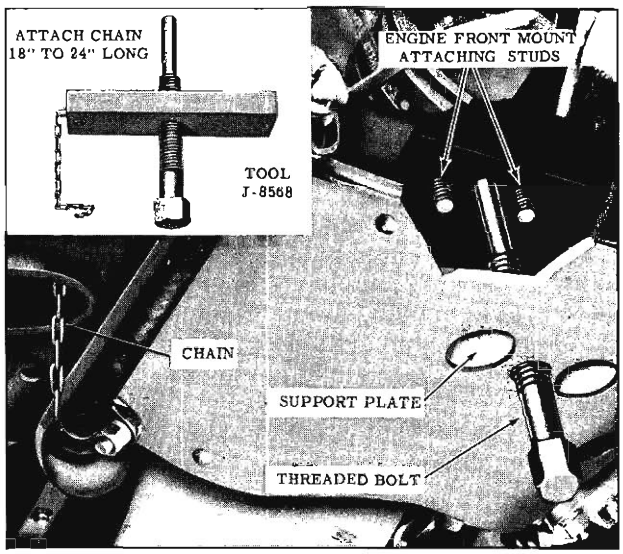


Fig. 3-21 Raising Front of Engine

2. Remove the threaded bolt of Tool J-8568 from the support plate. Feed the support plate through the large opening in the underside of the front cross member. Align the hole in the support plate with the center hole in the front cross member.

   NOTE: Attach a chain 18 to 24 inches long to Tool J-8568 to aid in positioning the Tool in and out of the front cross member. (Inset, Fig. 3-21)

3. Insert the threaded bolt into the support plate. Rotate the threaded bolt until it contacts the engine front mount. (Fig. 3-21) Raise engine until proper clearance is obtained.

   NOTE: When raising engine, do not allow rear of engine or engine components to contact the cowl.

4. When removing the engine front cover or the engine front mount, raise the engine to the desired height then insert wood blocks between the exhaust manifolds and the front cross member. Lower engine until the engine is supported by the wood blocks. The threaded bolt can now be lowered away from the engine front mount.

   After the service operations have been performed, lower the engine. Remove the threaded bolt from the support plate then pull the plate out of the cross member. Install the engine mount nuts. Torque nuts 45 to 50 ft. lbs.

OIL PAN AND PUMP

OIL PAN

Remove

1. Position No. 1 piston on bottom of stroke. This moves the No. 1 and No. 2 crankshaft counterweights out of the way to aid in pan removal and installation.

2. Disconnect battery cable.

3. On cars equipped with single exhaust systems, remove the exhaust crossover pipe.

4. Disconnect idler arm support from frame.

5. Remove attaching bolts and position starter away from engine.

6. Remove the two engine front mount attaching nuts. Raise engine with Tool J-8568. (Refer to RAISING FRONT OF ENGINE.)

7. Drain oil from pan, then remove pan.

   NOTE: Holes are provided in the frame cross member for access to the front oil pan bolts.

8. Clean oil pan. Use lacquer thinner to clean old sealer from pan.

Install

1. Apply sealer, Part No. 557622 to the bottom side of new fiber gaskets and install gaskets on pan.

2. Install new front and rear synthetic rubber seals on oil pan. Apply a light coat sealer Part No. 557622 to exposed surfaces of seals, to insure that seals do not hang up on the front cover and rear main bearing cap sealing surfaces during oil pan installation.

3. Apply cement, Part No. 557621, to both sides of the rear main bearing cap and install two new cork seals.

4. To install oil pan reverse removal procedure making sure that all seals are in position before pan is tightened.

5. Torque oil pan bolts evenly 10 to 15 ft. lbs.

6. Lower engine. (Refer to RAISING FRONT OF ENGINE).

OIL PUMP

Remove and Install

1. Remove oil pan. (Refer to OIL PAN - Remove)

2. Remove the oil pump baffle.

3. Remove the oil pump to rear main bearing cap attaching screws, then remove pump and drive shaft extension.

To install, insert the drive shaft extension through the opening in the block until the shaft mates into the distributor drive gear. Position pump onto the rear main bearing cap, torque the attaching bolts 24 to 34 ft. lbs. Install the oil pump baffle then install oil pan. (Refer to OIL PAN - Install)

Disassembly (Fig. 3-22)

1. Remove the oil pump drive shaft extension.

   NOTE: Do not attempt to remove the washers from the drive shaft extension. The drive shaft extension and washers must be serviced as an assembly.

2. Remove the retaining pin, cup and the pressure regulator, spring and valve.

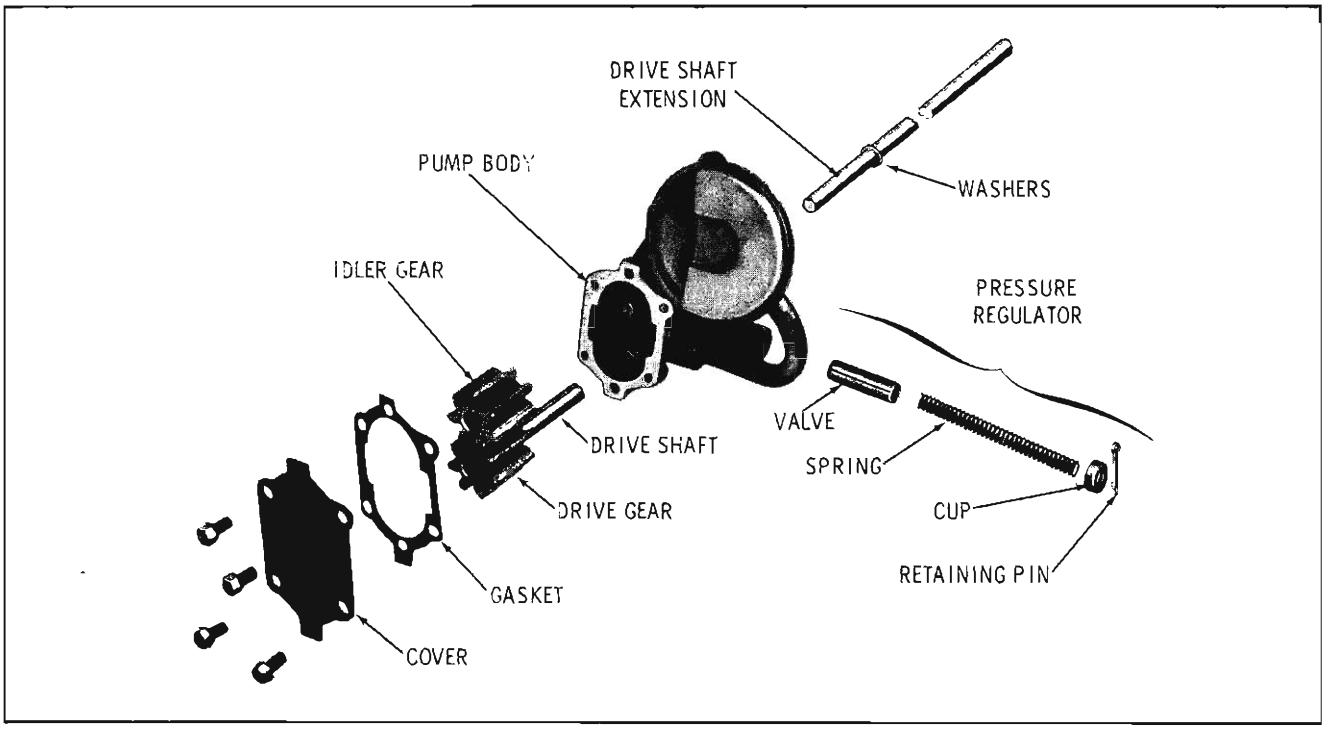


Fig. 3-22 Oil Pump Assembly

Caution: Position thumb over pressure regulator bore before removing pin, as the spring is under tension.

3. Remove the oil pump cover attaching screws and remove the oil pump cover and gasket.

4. Remove the drive gear and idler gear from the pump body.

Cleaning and Inspection

1. Wash all parts in clean solvent and blow out passages with compressed air.

2. Inspect all moving parts for scoring. Small imperfections can be cleaned up with a fine hone.

3. Check pressure relief valve clearance in bore. Clearance should be .0025" to .005". Too much clearance can affect oil pressure at idle.

(The oil pressure warning light on the instrument panel is calibrated to light when oil pressure is less than three lbs.)

4. Check end clearance of gears. End clearance of gears should be .0025" to .0065".

Assembly

1. Install the drive gear into the pump body with the hex ID of the drive shaft toward the oil pump mounting pad, then install the idler gear.

2. Position a new gasket on the pump body and install the oil pump cover. Tighten the cover screws 5 to 8 ft. lbs.

3. Position the pressure regulator valve into the pump cover, closed end first; then install the spring, cup and retaining pin.

IMPORTANT: When assembling the drive shaft extension to the drive shaft, the END OF THE EXTENSION NEAREST THE WASHERS MUST BE INSERTED INTO THE DRIVE SHAFT.

CONNECTING ROD AND PISTON ASSEMBLY

Three types of pistons are used and can be identified by referring to Fig. 3-23.

ROD AND PISTON ASSEMBLY—REMOVE

1. Remove cylinder head or heads.

2. Remove oil pan.

IMPORTANT: If more than one piston and rod assembly is to be removed, the corresponding cylinder number should be stamped on the machined surfaces of the connecting

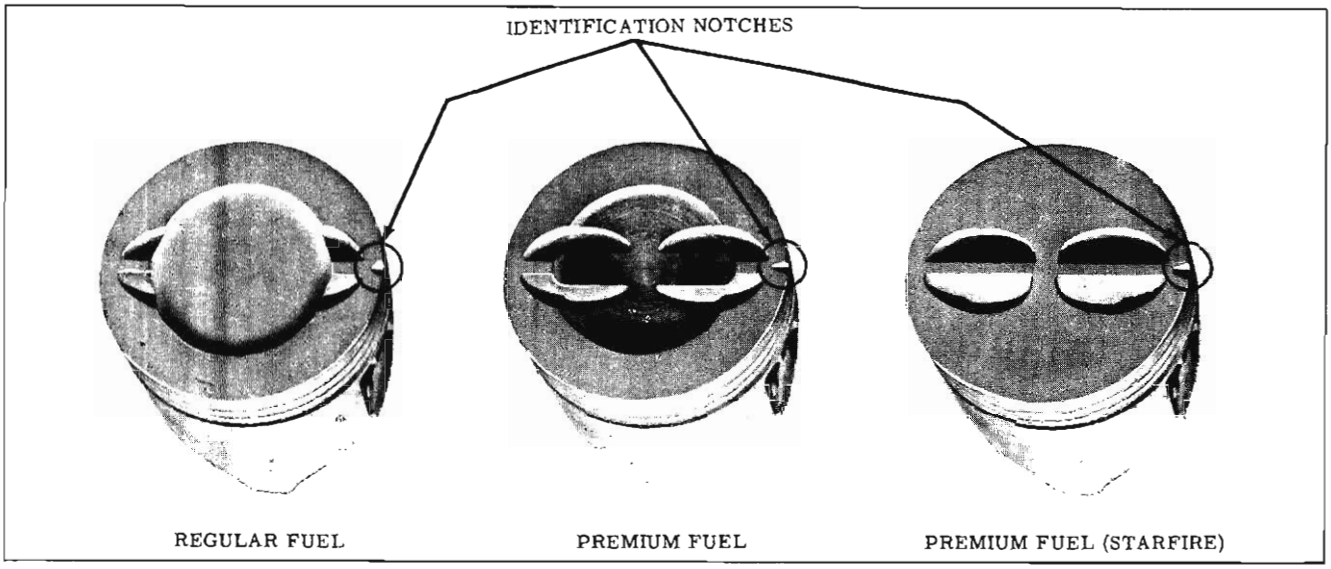


Fig. 3-23 Piston Identification

rod and cap (on side opposite spit hole) for identification when reinstalling. If the pistons are to be removed from the connecting rod, mark but DO NOT STAMP cylinder number on piston.

CAUTION: To prevent damage to the rods, the stamping operation must be performed while the connecting rods are still attached to the crankshaft.

3. Remove the ridge at the top of the cylinder bore before attempting to remove the piston and rod assembly.

4. After removing bearing caps and bearings, place guide Tool BT-22 over the threads of connecting rod bolts to prevent damaging the bearing journals, then tap rod and piston assembly through the top of the cylinder bore. (Fig. 3-24) Pistons should only be removed from the top of the cylinder block.

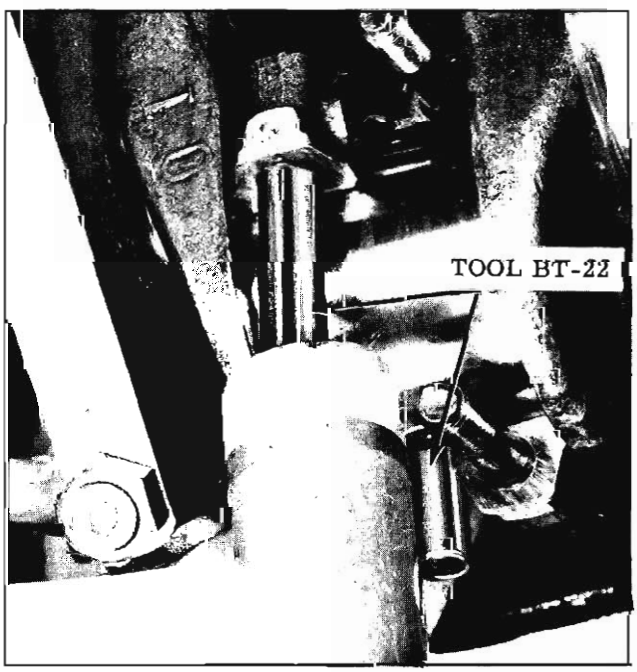


Fig. 3-24 Connecting Rod Removal

CYLINDER BORE

Cylinder bore size can be measured with inside micrometers. Maximum allowable taper of the cylinder bore is .010".

Reconditioned cylinder bores should be held to not more than .001" out of round and .001" taper (larger at the bottom)

It is important that reconditioned cylinder bores be thoroughly washed with a large brush and a soap and water solution to remove all traces of abrasive material to eliminate rapid wear.

CLEANING PISTON

Clean the pistons by scraping carbon off the top of the piston and immerse the pistons in a solvent. Deposits in the ring grooves can be removed by using a broken piston ring or a suitable groove cleaning tool.

MEASURING PISTON (Fig. 3-25)

When measuring piston for size or taper, measurement must be made on skirt 90° from piston pin hole (with the piston pin removed).

When measuring taper, the largest reading must be at the bottom of the skirt. Allowable taper is .000" to .001".

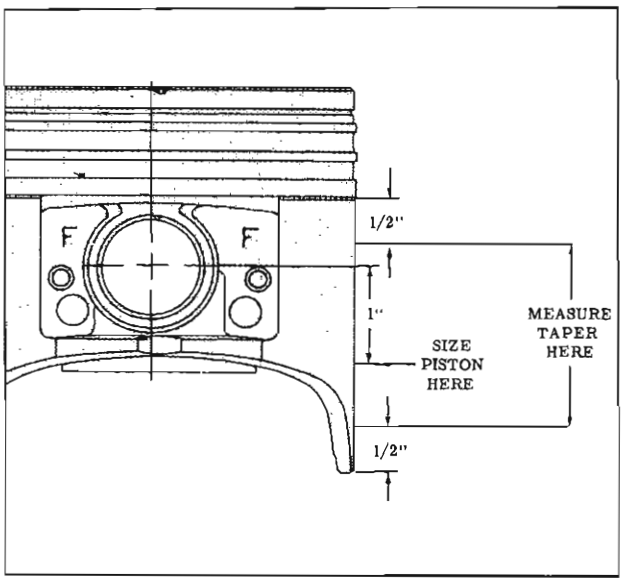


Fig. 3-25 Measuring Piston

NOTE: On some cars, oversize pistons may be found. These pistons will be either .005" or .010" oversize.

FITTING PISTON

NOTE: The piston and cylinder bore must be free of oil and at the same temperature.

1. Place a 1/2" x 12" x .0015" ribbon attached to scale J-5515 against the upper side of the bore, at 90° to the normal piston pin location. (Fig. 3-26)

2. Insert piston (with pin and rings removed) into bore with head downward.

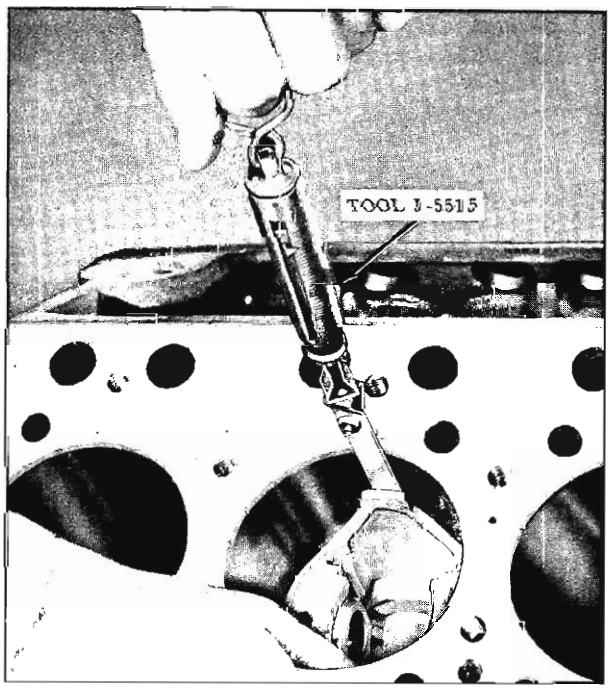


Fig. 3-26 Fitting Piston to Cylinder

3. While holding the piston in the center of its normal travel, slowly pull the scale in a straight line and note the reading on the scale. The reading should be 3 to 12 pounds.

Each piston should be fitted to its individual cylinder and marked for that cylinder.

PISTON PIN

Piston pins are available in three sizes: Standard, .001", and .003" oversize. Honing of the piston pin hole for installation of oversize pins is the most satisfactory method of sizing.

The correct piston pin fit in the piston and in the connecting rod is .0003" to .0005" loose. If the pin to piston clearance is to the high limit (.0005"), the pin can be inserted in the piston with very little hand pressure. The pin will fall through the piston by its own weight. If the pin to piston clearance is to the low limit, .0003", very little hand pressure will be required to insert the pin into the piston. The pin will not slide through the piston by its own weight. It is important that both the pin and piston pin hole be clean and free of oil when checking pin fit, and that the piston pin hole is not more than .0005" out of round.

Whenever the replacement of a piston pin is necessary, the size pin required should be determined by trying standard, .001" or .003" oversize pins.

CONNECTING ROD BUSHINGS

In rod bushing replacement, the bronze bushing, after having been pressed into the rod, should be burnished and then finished to size with a hone.

The fit of the piston pin in the connecting rod bushing should be .0003" to .0005" loose.

CHECKING CONNECTING ROD

After the connecting rods and pistons are separated, the rods should be checked for alignment. If a rod is twisted or bent, a new rod must be installed. NO ATTEMPT SHOULD BE MADE TO STRAIGHTEN CONNECTING RODS.

ROD AND PISTON

Assembly

Lubricate piston pin hole and piston pin to facilitate installation of pin, then position connecting rod with its respective piston as shown in Fig. 3-27. Install piston pin and pin retainers.

Rings

The pistons have three rings (two compression

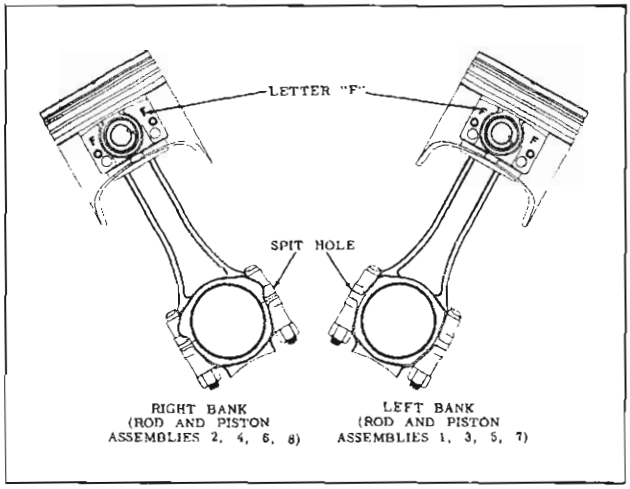


Fig. 3-27 Assembly of Rod to Piston

rings and one oil ring). Production rings are supplied from two sources and are of similar design. On both types of rings, the outside diameter of the top compression ring is chrome plated; the second compression ring is of the step type and has a black finish. Both types of oil rings consist of two rails and an expander.

To determine which make of production rings were installed in the engine, the following identification may be observed: Muskegon compression rings have an "O" marked on the top of the rings. Sealed power compression rings have a dot "." marked on the top of the rings.

Ring Tolerances

When installing new rings, ring gap and side clearance should be checked as follows:

Piston Ring and Rail Gap

Each ring and rail gap must be measured with the ring or rail positioned squarely and at the bottom of the ring-travel area of the bore. (Fig. 3-28)

If the gap measurement is not within the specifications shown in Fig. 3-28, file the ends of rings and rails until the minimum gap is obtained. Ends of rings and rails must be filed square.

Side Clearance

Each ring must be checked for side clearance (see chart) in its respective piston groove by inserting a feeler gauge between the ring and its upper land. (Fig. 3-29) The piston grooves must be cleaned before checking ring for side clearance.

NOTE: To check oil ring side clearance, the oil rings must be installed on the piston.

ALLOWABLE SIDE CLEARANCE

Oil Rings	.0005" to .007"
Compression Rings	.001" to .004"

Ring Installation

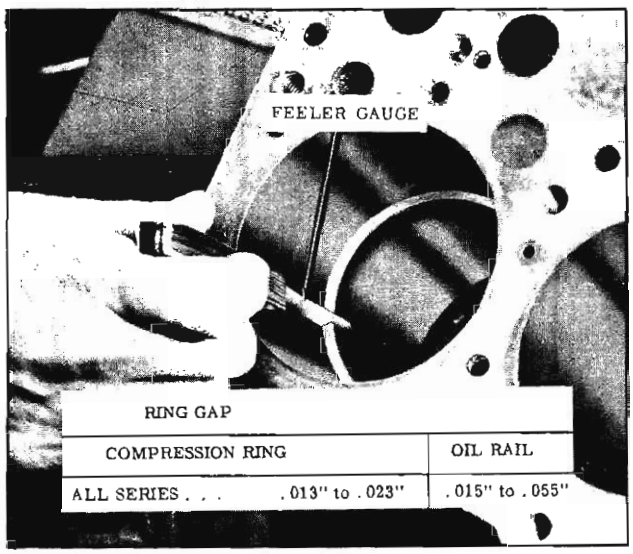
IMPORTANT: For service ring specifications and detailed installation instructions, refer to the instructions furnished with the parts package.

ROD AND PISTON ASSEMBLY

Install

When installing piston and connecting rod assemblies, Connecting Rod Bolt Guide Tool BT-22 should be placed over the connecting rod bolt threads to protect the crankshaft bearing surfaces.

Apply S.A.E. No. 20 oil to rings and piston, then install the rod and piston assemblies in their respective bores so the notch, cast in the top of each piston will be toward the front of the



RING GAP	
COMPRESSION RING	OIL RAIL
ALL SERIES . . . .013" to .023"	.015" to .055"

Fig. 3-28 Checking Ring Gap

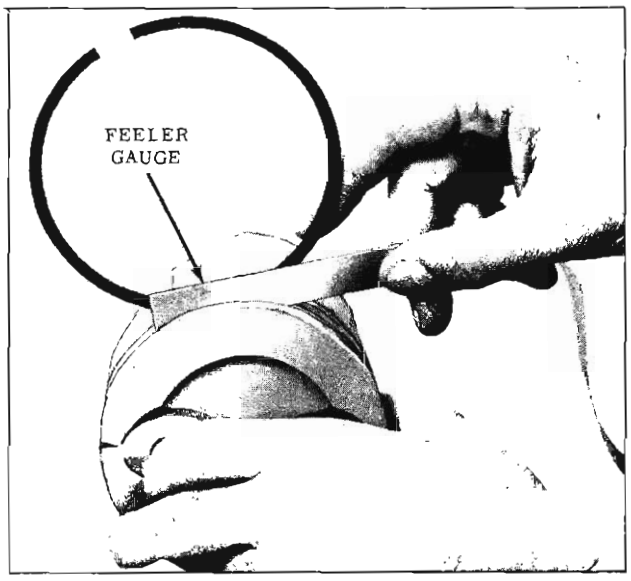


Fig. 3-29 Checking Ring Side Clearance

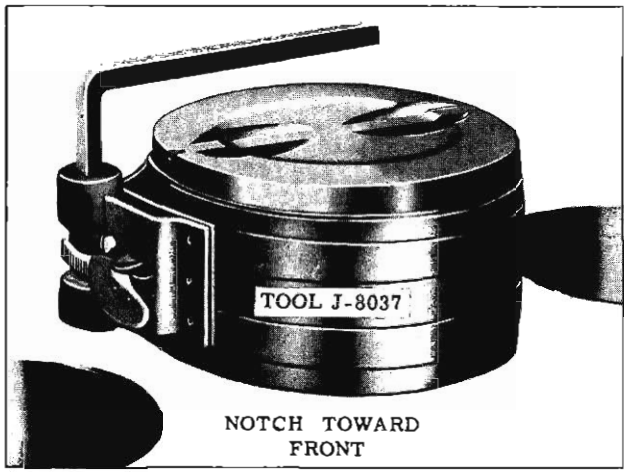


Fig. 3-30 Installing Piston Assembly

engine after installation.

NOTE: The piston can be installed in the piston bore without danger of breaking the piston rings if Tool J-8037 or a similar ring compressing tool is used. (Fig. 3-30)

Install connecting rod caps with bearing index notches in rod and cap on same side.

The connecting rod cap attaching nuts should only be tightened enough to keep each rod in position until all piston and rod assemblies have been installed. This will facilitate installation of the remaining piston assemblies.

The clearance between the adjacent rods on each crankpin should be from .002" to .011" when checked with a feeler gauge.

Torque rod bearing cap nuts 32 to 42 ft. lbs.

CONNECTING ROD BEARINGS

Replace

The removable steel backed aluminum insert type connecting rod bearing shells are assembled with a slight projection above the rod and cap faces to insure a positive contact. Adjustment for wear, such as installing shims behind the shells, should NEVER be practiced. WORN BEARINGS MUST BE REPLACED.

Connecting rod bearings can be replaced without removing the rod and piston assembly from the engine.

1. Remove oil pan.

2. With connecting rod journal at approximately bottom center, remove both bearing caps.

   NOTE: Before removing bearing caps, STAMP cylinder number on machined surfaces of connecting rod and cap for identification when reinstalling. Do not file notches on rod or cap.

3. Inspect journals for roughness and wear. Slight roughness may be removed with a fine grit polishing cloth saturated with engine oil. Burrs may be removed with a fine oil stone. If the journals are scored or ridged, the crankshaft must be replaced or reground.

4. The connecting rod journals can be checked for out-of-round with the use of a micrometer. Maximum out-of-round must not exceed .0015".

5. Clean oil from journal, bearing cap connecting rod, and outer and inner surface of bearing inserts.

6. Place a piece of "Plastigauge" in the center of lower bearing shell.

7. Reinstall bearing cap and torque 32 to 42 ft. lbs.

8. Remove bearing cap and determine bearing clearances by comparing the width of the flattened "Plastigauge" at its widest point with the graduation on the "Plastigauge" container. The number within the graduation on the envelope indicates the clearance in thousandths of an inch. (Fig. 3-31) If this clearance is greater than .0035", replace the bearing and recheck clearance with "Plastigauge".

   NOTE: Lubricate bearing with S.A.E. 20 oil before installation. Repeat Steps 2 thru 8 on remaining connecting rod bearings.

   All rods must be connected to their journals when rotating the crankshaft.

MAIN BEARINGS

Main bearing clearance must not exceed .0035" on No. 1, 2, 3, and 4 bearings and .0045" for No.

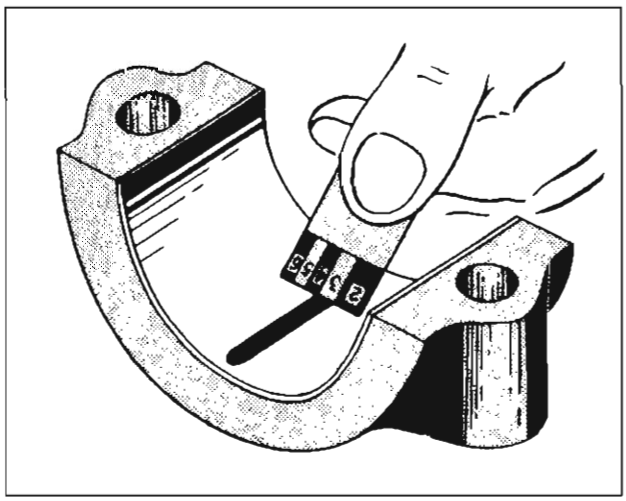


Fig. 3-31 Checking Bearing Clearance

5 bearing. The .0035" and .0045" clearances are permissable only if the engine is disassembled for other than a bearing noise condition. If bearings are noisy or if a visual inspection indicates defective bearings, new bearings must be installed within the specifications outlined under MAIN BEARINGS - REPLACE.

Bearings which fall within the .0035" and .0045" specifications should not be rejected if the bearings show a normal wear pattern or slight radial grooves.

Checking Bearing Clearances

1. Remove bearing cap and wipe oil from crankshaft journal and outer and inner surfaces of bearing shell.

   NOTE: To prevent the possibility of raising the metal around the dowel hole in the rear main bearing cap, insert Slide Hammer J-6125 in oil pump mounting screw hole to remove the cap.

2. Place a piece of "Plastigauge" in the center of bearing.

3. Use a floor jack or other means to hold crankshaft against upper bearing shell. This is necessary to obtain accurate clearance readings when using "Plastigauge".

4. Reinstall bearing cap and bearing. Torque 90 to 120 ft. lbs. (Rear bearing cap to be torqued 130 to 160 ft. lbs.)

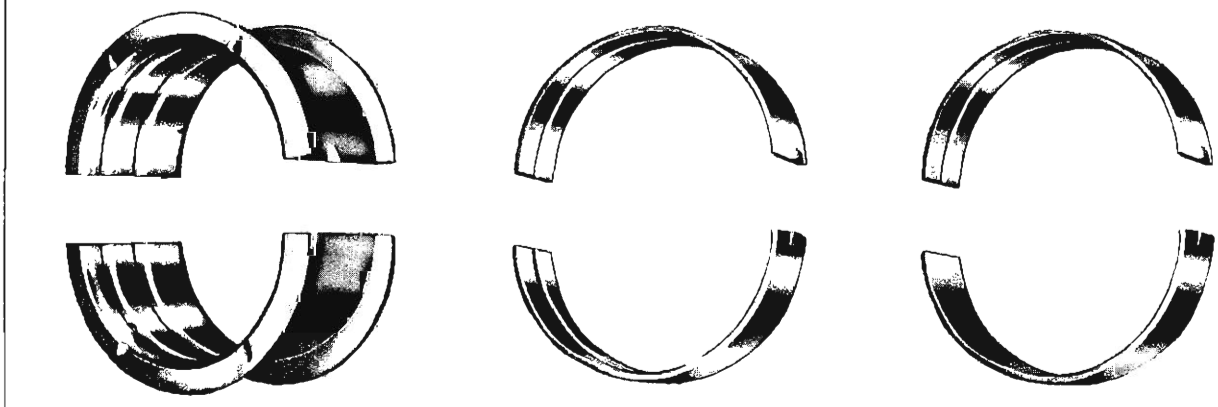
5. Remove bearing cap and determine bearing clearance by comparing the width of the flattened "Plastigauge" at its widest point with the graduation on the "Plastigauge" container. The number within the graduation on the envelope indicates the clearance in thousandths of an inch. (Fig. 3-31) If this clearance is greater than .0035" for No. 1, 2, 3 or 4 bearings and .0045" for No. 5 bearing, REPLACE BOTH BEARING SHELLS AS A SET. Recheck clearance after replacing shells. (Refer to MAIN BEARINGS - REPLACE).

MAIN BEARINGS
Replace

Main bearing clearances not within specifications (.0005" to .0021" for No. 1 and 2 bearings, .008" to .0024" for No. 3 and 4 bearings and .0020" to .0034" for No. 5 bearing), must be corrected by the use of selective upper and lower shells. (Refer to Fig. 3-32 for selective sizes.) UNDER NO CIRCUMSTANCES should the use of shims behind the shells, to compensate for wear, be attempted.

IMPORTANT: THE UPPER AND LOWER SHELLS MUST BE INSTALLED IN PAIRS.

To install main bearing shells, proceed as follows:



NO. 5 NO. 4, 3 OR 2 NO. 1

IDENTIFICATION (ON SHELL TANG)		THICKNESS
NO. 1 THRU 4	NO. 5	
NONE	NONE	STANDARD
B	A	.0005" UNDERSIZE
C	B	.0010" UNDERSIZE
E	C	.0015" UNDERSIZE

Fig. 3-32 Main Bearing Sizes

1. Remove bearing cap and remove lower shell.

2. Insert a flattened cotter pin in the oil passage hole in the crankshaft, then rotate the crankshaft in the direction opposite to cranking rotation. The cotter pin will contact the upper shell and force it out.

3. The main bearing journals should be checked for roughness and wear. Slight roughness may be removed with a fine grit polishing cloth saturated with engine oil. Burrs may be removed with a fine oil stone. If the journals are scored or ridged, the crankshaft must be replaced or reground.

   NOTE: The journals can be measured for out-of-round with the crankshaft installed by using a crankshaft caliper and inside micrometer. The upper bearing shell must be removed when measuring the crankshaft journals. Maximum out-of-round of the crankshaft journals must not exceed .0015".

4. Clean crankshaft journals and bearing caps thoroughly before installing new main bearings.

5. No. 5 bearing - apply Special Lubricant, Part No. 567196 to the thrust flanges of bearing shells. (Fig. 3-33)

6. Place new upper shell on crankshaft journal with locating tang in correct position and rotate shaft to turn it into place using cotter pin as during removal.

7. Place new lower shell in bearing cap.

8. No. 5 bearing - install new asbestos oil seal in the rear main bearing cap. (See REAR MAIN BEARING OIL SEAL - REPLACE)

9. Install bearing caps. Torque No. 1 thru 4 bearing caps 90 to 120 ft. lbs. and No. 5 bearing cap 130 to 160 ft. lbs.

REAR MAIN OIL SEALS—REPLACE

Rear Main Oil Seal

The rear main bearing is sealed against oil leaks by a special asbestos covered wiper seal. Special care must be exercised when installing this seal.

Whenever the crankshaft is removed, a new seal coated with graphite grease should be installed in the engine block. Whenever the No. 5 bearing cap is removed, a new seal should be installed in the bearing cap. The seal, to be properly installed, should be crowded into the groove in the bearing cap and block by hand, then driven tightly into the groove by tapping Tool 23-18 with a hammer. (Fig. 3-34)

NOTE: To check if seal is fully seated in the bearing cap, slide Tool 23-18 away from the seal. With Tool 23-18 fully seated in the bearing cap, slide tool against the seal. If under cut area of tool slides over the seal, the seal is fully seated. If tool butts against the seal, the seal must be driven further into the seal groove.

After the seal has been seated in the bearing cap and while the tool is still resting in the bearing cap, the seal should be cut flush with the parting line between upper and lower bearing. The ends of the seal must be cut clean so no frayed

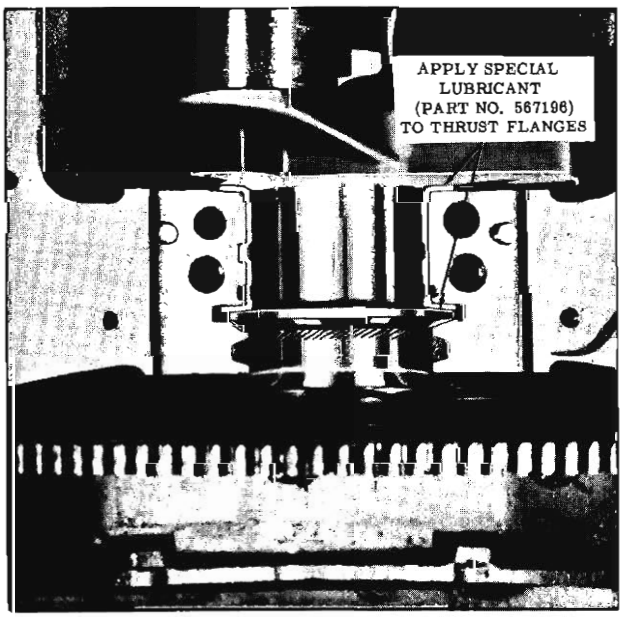


Fig. 3-33 Rear Main Bearing

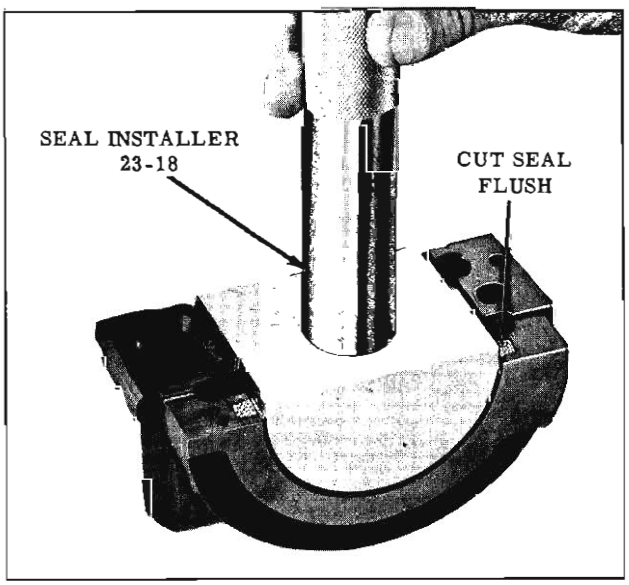


Fig. 3-34 Installing Oil Seal

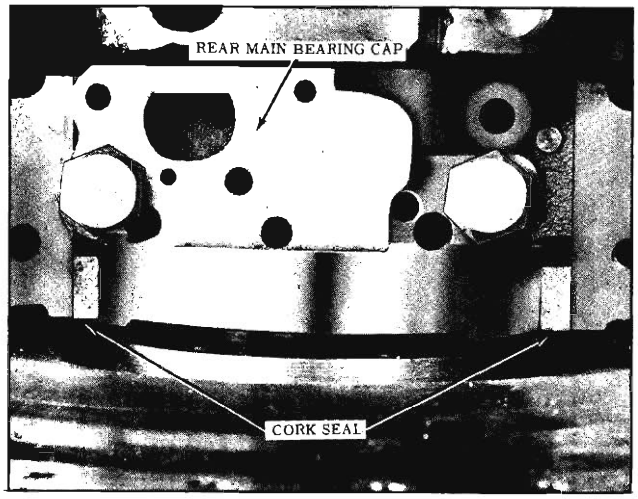


Fig. 3-35 Rear Main Bearing Cork Seals

ends will be clamped between the block and cap, and the seal must entirely fill the groove.

Cork Seals

After the rear main bearing cap has been installed, cement, Part No. 557621, should be wiped in grooves in block on both sides of bearing cap and the two cork seals pressed into place in the grooves. (Fig. 3-35)

CRANKSHAFT PULLEY

Remove

1. Remove belt(s) from crankshaft pulley.
2. Remove crankshaft pulley bolt and washer.
3. Pull pulley from crankshaft.

When installing crankshaft pulley, apply sealer Part No. 557622 to inside diameter of pulley and to crankshaft key to prevent possible oil leakage. Coat outside area of crankshaft pulley, which enters seal, with lubricant, Part No. 567196. Torque crankshaft pulley bolt 100 ft. lbs. (minimum).

CRANKSHAFT FRONT OIL SEAL

Remove (Fig. 3-36)

The crankshaft front oil seal can be removed without removing the radiator or crankshaft pulley key as follows:

1. Remove crankshaft pulley and thread Pilot Bolt J-7583-3 into end of crankshaft.
2. Thread Tool J-7583-1 into oil seal, then tighten forcing screw J-7583-2 until seal is removed from front cover.
3. Remove oil seal from Tool J-7581-1 and Pilot Bolt J-7583-3 from crankshaft.

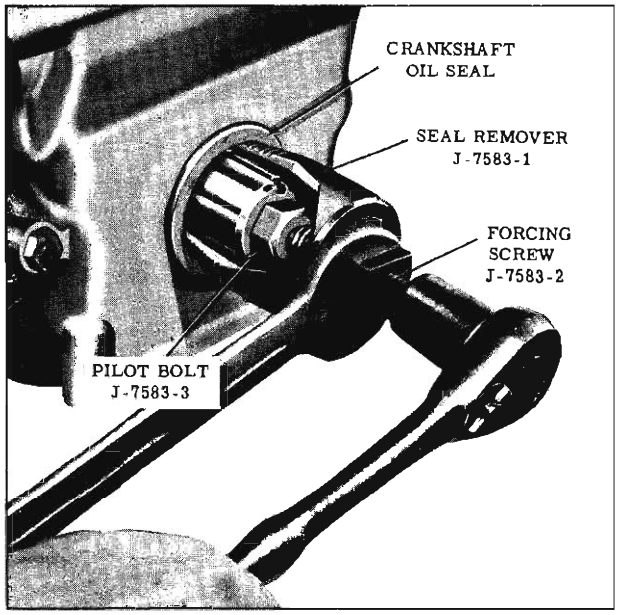


Fig. 3-36 Removing Crankshaft Front Oil Seal

Install (Fig. 3-37)

1. Coat outer diameter of a new seal with sealer, Part No. 557622. Lubricate lips of seal with lubricant, Part No. 567196
2. Position seal into engine front cover.
3. Position Seal Installer J-7584-1 over seal and thread Forcing Screw J-7584-3 into crankshaft until Seal Installer contacts engine cover.
4. Remove Seal Installer.
5. Install crankshaft pulley and belts. Torque pulley bolt 100 ft. lbs. minimum. Tighten belts using Tool 33-70.

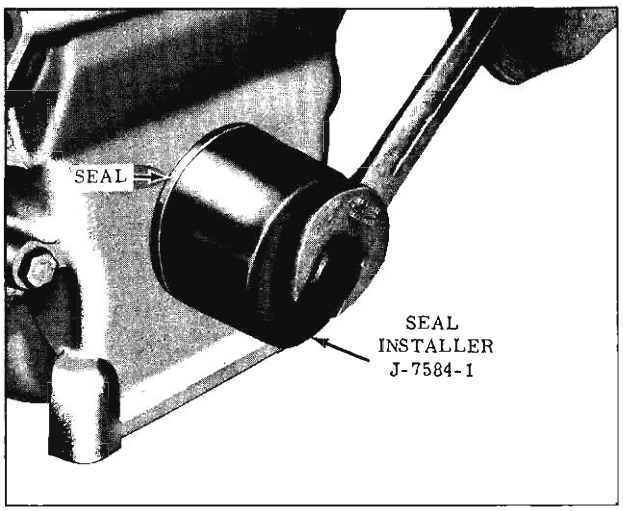


Fig. 3-37 Installing Crankshaft Front Oil Seal

FRONT COVER

Remove and Install

1. Drain cooling system.
2. Disconnect radiator lower hose and heater hose from front cover.
3. Disconnect Delcotron link at Delcotron.
4. Raise front of engine as outlined under RAISING FRONT OF ENGINE.
5. Remove oil pan.
6. Remove fan blades and pulley.
7. Remove crankshaft pulley.
8. Remove distributor cap. Install a jumper wire and crank engine until distributor rotor points toward the front of the engine, then remove fuel pump assembly.
9. Remove front cover attaching bolts and front cover assembly.

To install, reverse sequence of operations. Tighten belts using Tool 33-70.

NOTE: Always install a new front oil seal. Fuel pump rocker arm pad should be coated with lubricant, Part No. 567196. Install fuel pump with rocker arm of fuel pump resting on top of the fuel pump eccentric.

The front cover attaching bolts should be dipped in sealer, Part No. 557622. Torque 24 to 40 ft. lbs. One side of the fuel pump gasket should be coated with sealer, Part No. 557622.

TIMING CHAIN AND GEARS (WITH FRONT COVER REMOVED)

Whenever the timing gears or chain are to be removed, remove the fuel pump eccentric, then pull the camshaft gear from the shaft. The timing chain can now be removed. To remove the crankshaft gear, tap gear off shaft or if the gear is a tight fit, use a universal puller.

On reassembly, apply sealer, Part No. 557622 to crankshaft key, then install the gears and timing chain so the correct valve timing is obtained. Alignment marks on timing chain gears must index with pointers on Gauge BT-11. (Fig. 3-38) Install fuel pump eccentric with the cupped side out and torque attaching cap screws 14 to 22 ft. lbs.

CAMSHAFT AND CAMSHAFT BEARINGS

Three types of camshafts are used and can be identified by referring to Fig. 3-39.

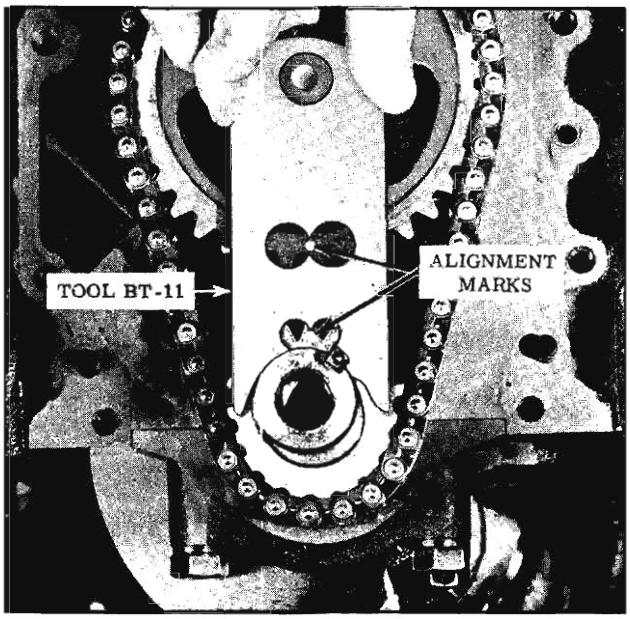


Fig. 3-38 Timing Camshaft

CAMSHAFT

Remove and Install

1. Drain cooling system.
2. Remove oil cooler lines and radiator hoses.

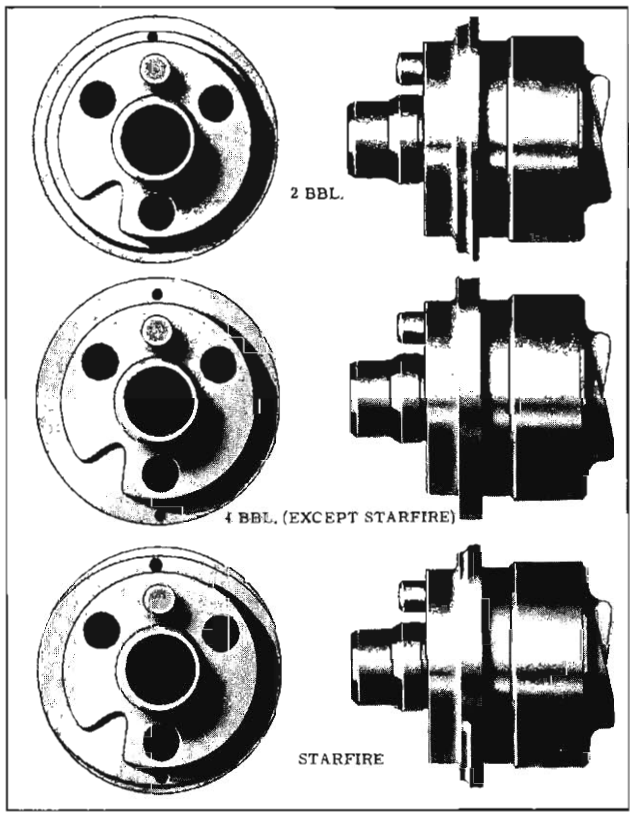


Fig. 3-39 Camshaft Identification

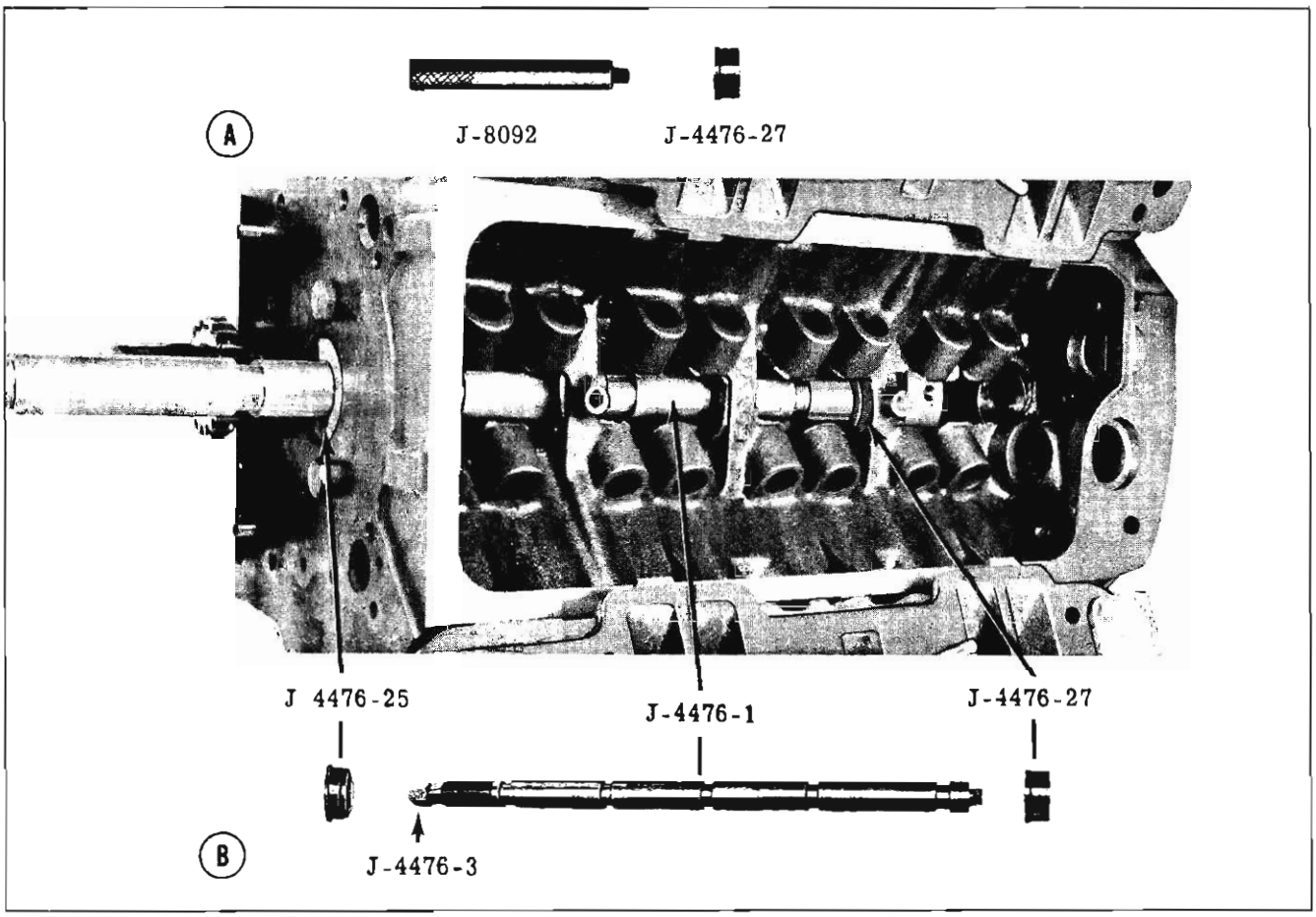


Fig. 3-40 Removing No. 4 Camshaft Bearing (Typical of 1, 2 & 3)

3. If equipped with air conditioning, remove condenser.
4. Remove radiator upper support and radiator.
5. Remove air cleaner.
6. Remove rocker arm covers, then remove the rocker arm shaft assemblies and push rods.
7. Disconnect fuel and vacuum lines, then remove intake manifold.
8. Remove distributor.
9. Remove engine top cover and valve lifters.
10. Raise engine, then remove oil pan.
11. Remove crankshaft pulley, fuel pump and engine front cover.
12. Remove fuel pump eccentric, camshaft sprocket and timing chain.
13. Remove camshaft by CAREFULLY sliding it out from the front of the engine.

Before installing the camshaft, it is important that the camshaft be lubricated liberally with engine oil mixed with Concentrate, Part No. 582099. To install the camshaft, reverse the removal procedure.

CAMSHAFT BEARINGS

Whenever it is necessary to replace a camshaft bearing, ALL THE BEARINGS must be replaced. Service replacement bearings do not require line reaming.

Remove—(Camshaft Removed)

1. Assemble tools as shown in Fig. 3-40 (Inset "A") and remove No. 1 camshaft bearing by driving it rearward. Remove old bearing from J-4476-27 and repeat procedure on No. 2 bearing.
2. Assemble tools as shown in Fig. 3-40 (Inset "B") and remove No. 3 bearing. Remove old bearing from J-4476-27 and repeat procedure on No. 4 bearing.
3. To remove No. 5 bearing proceed as follows:
   a. Assemble tools as shown in Fig. 3-41.
   b. Insert tool into block with the fingers of remover J-4476-9 behind No. 5 camshaft bearing. Spread fingers of remover by

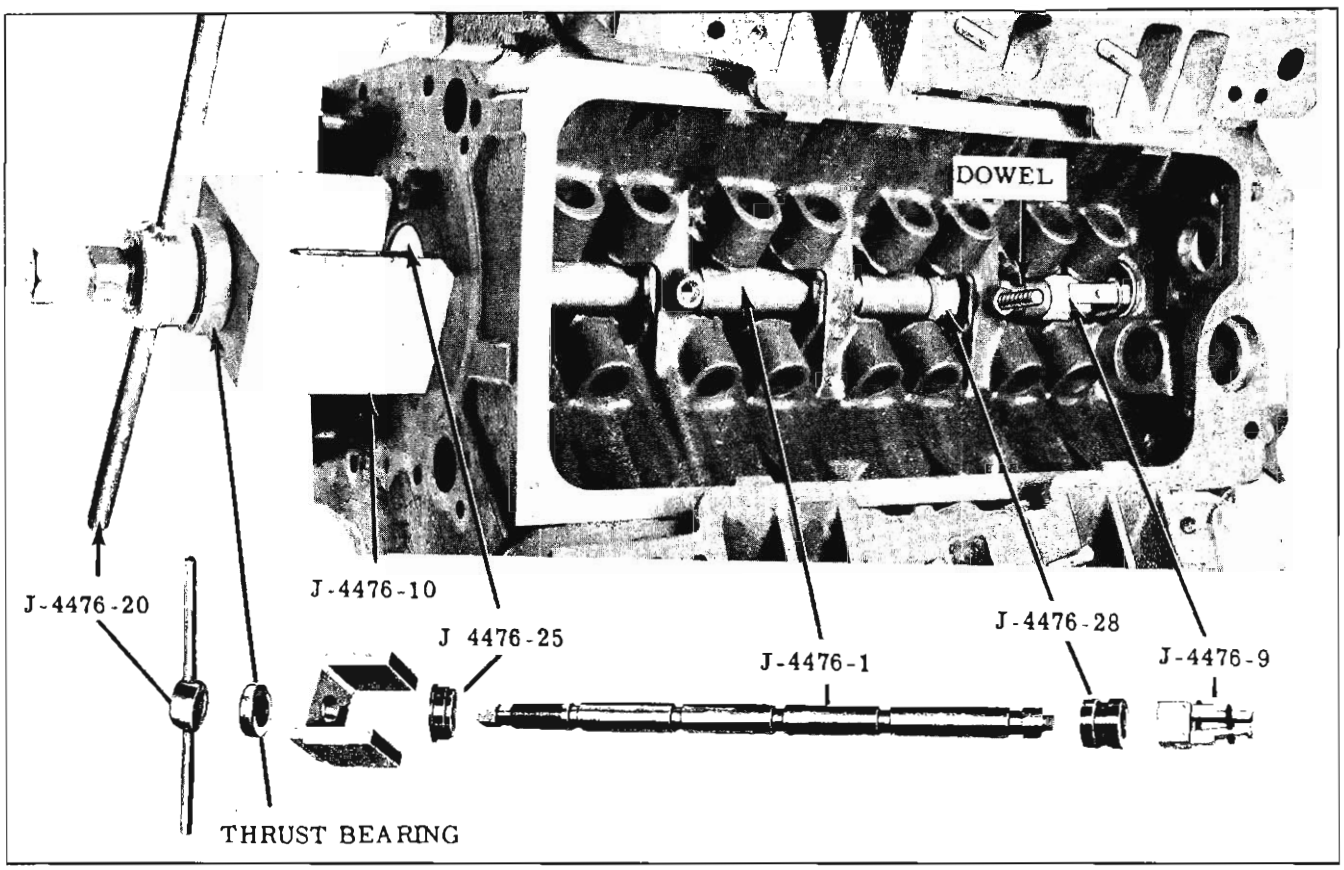


Fig. 3-41 Removing No. 5 Camshaft Bearing

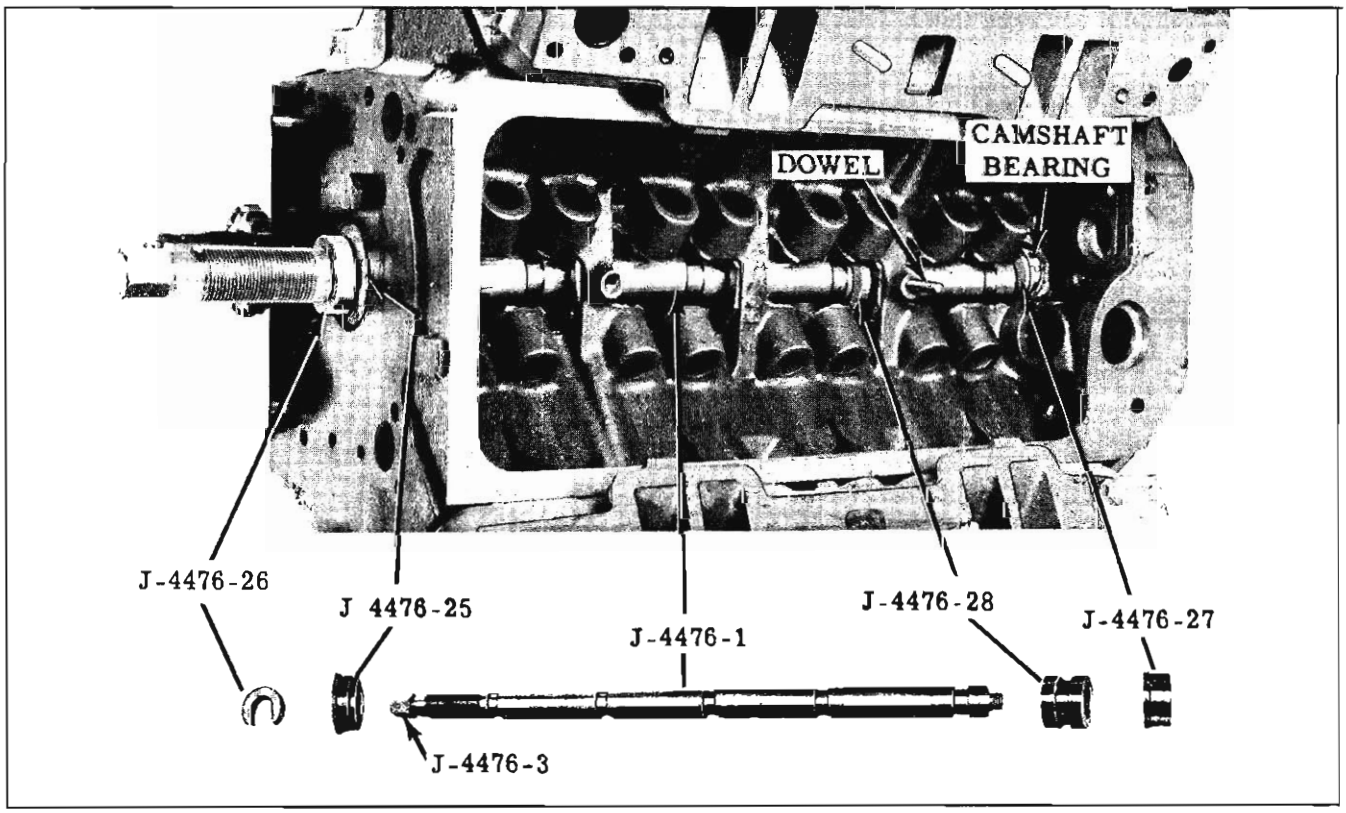


Fig. 3-42 Installing No. 5 Camshaft Bearing

tightening the set screw.

CAUTION: Use care to prevent dislodging the plug in the rear of the block.

c. Turn handle J-4476-20 clockwise until No. 5 bearing is removed.

d. Remove bearing from Remover J-4476-9 and remove Tool set-up from engine.

Install

Camshaft bearings must be installed with the outside chamfer toward the rear of the engine. Position bearing with parting line at top center to insure alignment of the bearing oil holes with the oil passages in the block.

CAUTION: Be sure the camshaft bearings are installed exactly as outlined in the installation procedure, as the bearings must be positioned in proper relationship to the camshaft bearing surfaces. If a bearing is installed too far forward or rearward in the web of the block, it is possible for the camshaft to wear a groove into the bearing and restrict the oil passage through the cam bearings.

After a bearing is installed, check alignment of the oil hole in the bearing and the oil hole in the block with a 1/8" rod.

1. To install No. 5 camshaft bearing proceed as follows:

   a. Assemble tools as shown in Fig. 3-42 and insert into engine block so that Installer J-4476-27 is past the No. 4 bearing opening.

   b. Position a new bearing on Installer J-4476-27, and insert tool and bearing in No. 5 bearing opening.

   c. Drive bearing into the bearing opening until Horseshoe Spacer J-4476-26 contacts Tool J-4476-25. This will correctly position the No. 5 bearing laterally.

      CAUTION: Be sure spacer J-4476-26 remains in place during bearing installation. If spacer should become mispositioned, it is possible to drive out the plug in the rear of the cylinder block. If the plug is loosened, the flywheel must be removed in order to install a new plug.

   d. Remove Installer from No. 5 bearing and check oil hole alignment.

2. After the No. 5 bearing is in place, install the No. 4 bearing as follows:

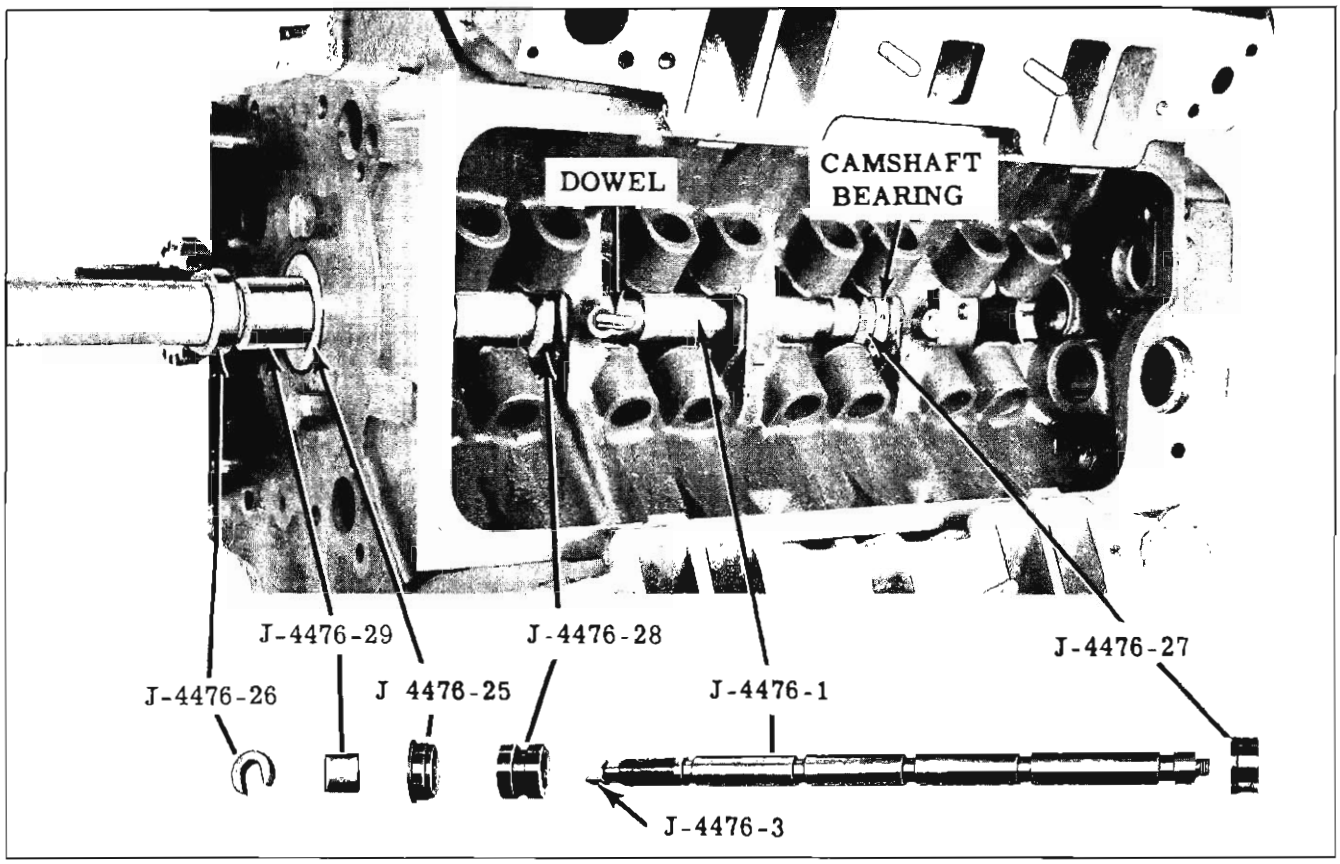


Fig. 3-43 Installing No. 4 Camshaft Bearing (Typical of 3 and 2)

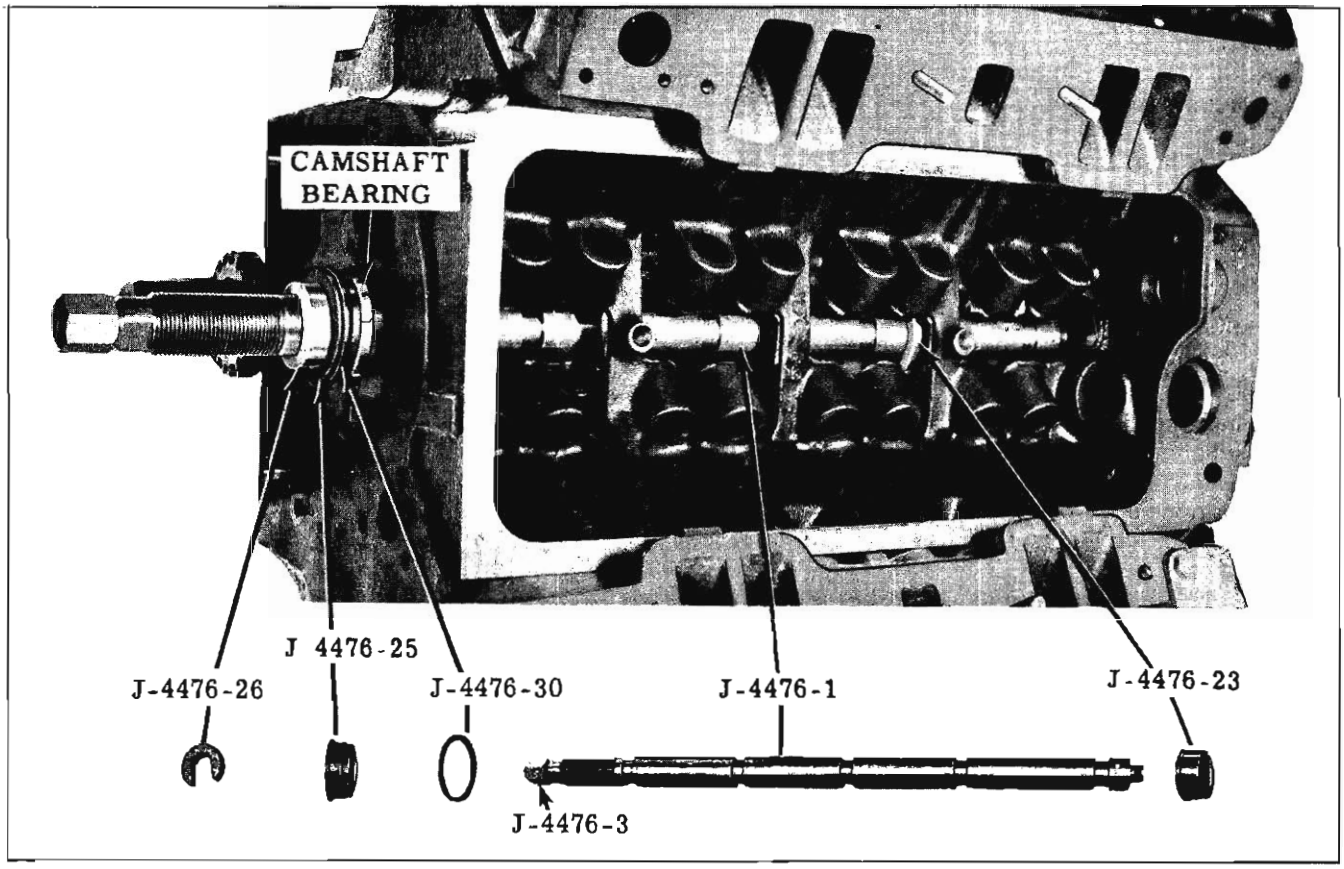


Fig. 3-44 Installing No. 1 Camshaft Bearing

a. Assemble tools as shown in Fig. 3-43.

b. Position a new bearing on Installer J-4476-27 and drive bearing until Tools J-4476-29 and J-4476-26 are driven tight against J-4476-25. This will correctly position the bearing laterally.

c. Remove Installer from bearing and check upper and lower oil hole alignment.

d. Repeat Steps b. and c. on No. 3, then No. 2 bearing.

NOTE: When installing No. 2 bearing, Pilot J-4476-28 is not used. After bearing is installed, check upper and lower oil hole alignment.

3. To install No. 1 bearing, proceed as follows:

a. Assemble tools as shown in Fig. 3-44.

b. Install Pilot J-4476-23 in No. 4 camshaft bearing.

c. Install a new bearing on Installer J-4476-25 and drive bearing until tool J-4476-30 and J-4476-26 are driven tight against Tool J-4476-25. This will correctly position No. 1 bearing laterally. Check oil hole alignment.

LOWER FLYWHEEL HOUSING ALIGNMENT

(Clutch Housing Removed)

Lower flywheel housing alignment is rarely required; however, if a new lower housing is used, alignment should be checked.

Misalignment is evident as a "step" between the engine block and the lower housing resulting from the location of the housing too far forward or rearward on the block. (Fig. 3-45) This condition can be corrected by elongating the dowel holes

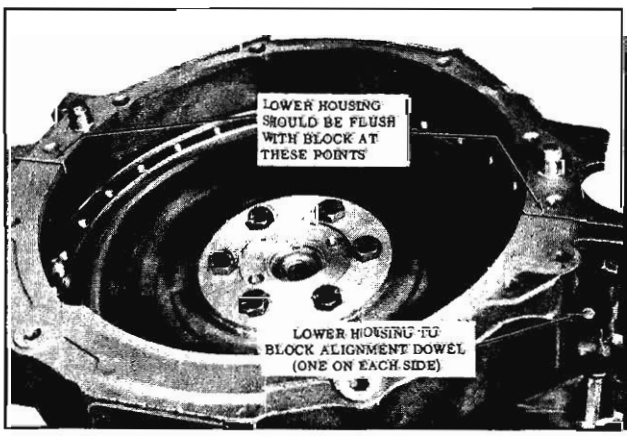


Fig. 3-45 Checking Lower Housing Alignment

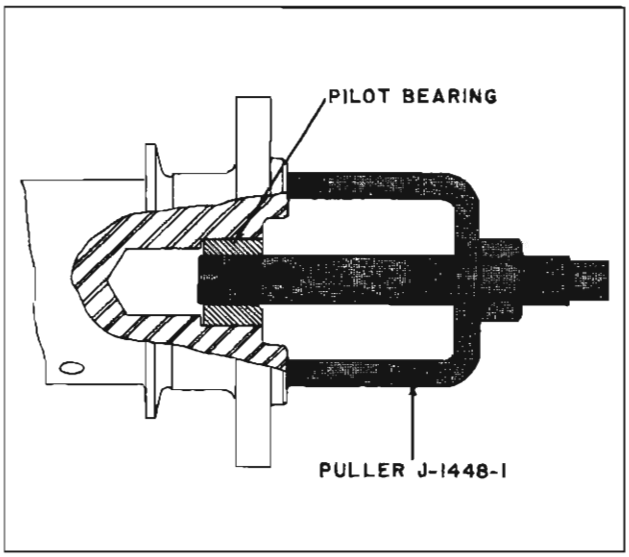


Fig. 3-46 Pilot Bearing Removal

so as to allow the lower housing to move to the rear or to the front as required.

NOTE: Do not remove dowel pins or enlarge dowel pin holes with an oversize drill, as correct sidewise location of lower housing must be maintained for proper engagement of starter pinion and ring gear.

CRANKSHAFT PILOT BEARING SYNCHROMESH

On Synchromesh transmission equipped cars, a pilot bearing is located in a bore in the rear end of the crankshaft and is held in place by a sheet metal retainer pressed in the crankshaft.

When removing the pilot bearing, pry out the bearing retainer with a screwdriver; then remove the bearing with Pilot Bearing Puller J-1448-1. (Fig. 3-46) All old lubricant in the reservoir behind the bearing should be removed.

Install the new bearing using Tool J-4530-1

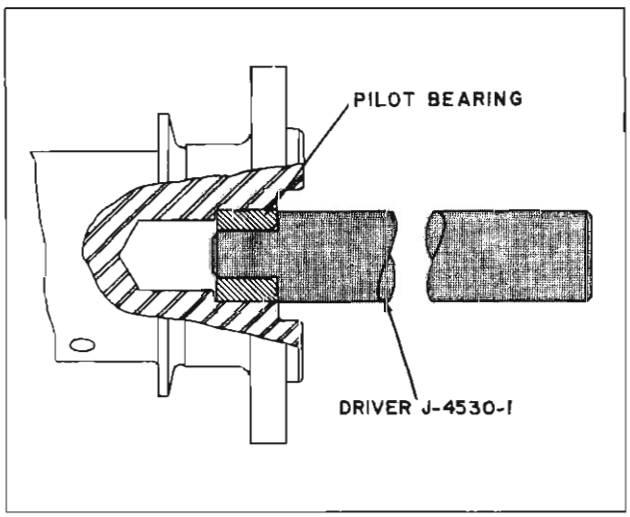


Fig. 3-47 Pilot Bearing Installation

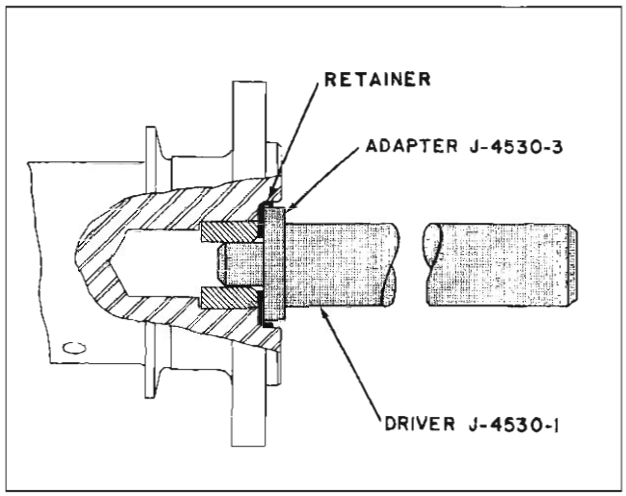


Fig. 3-48 Pilot Bearing Retainer Installation

(Fig. 3-47) Apply a light coat of sealer, Part No. 557622 to rim of retainer then install retainer as shown in Fig. 3-48, Add 1/4 ounce (level tablespoonful) of wheel bearing grease to the reservoir.

DAMPER PLATE

Remove and Install

1. Remove Hydra-Matic transmission.
2. Remove the six damper plate to flywheel attaching cap screws and remove damper. (Fig. 3-49)

To install, position damper with hub of damper toward the crankshaft and reverse the removal procedure. Torque the damper to crankshaft attaching cap screws 17 to 22 ft. lbs.

FLYWHEEL

Remove

1. Remove transmission, starting motor and

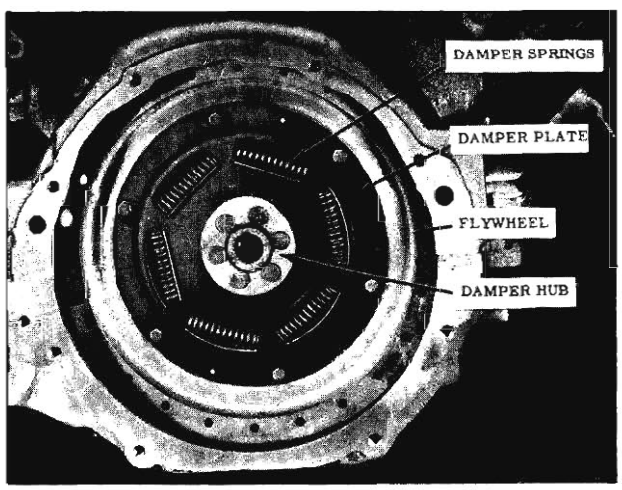


Fig. 3-49 Damper Assembly

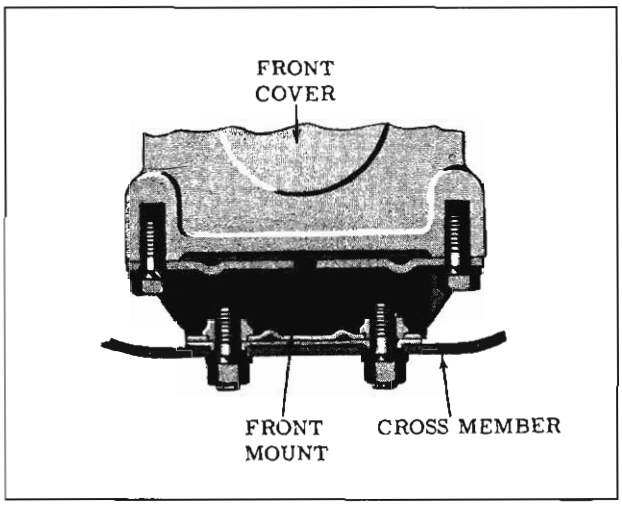


Fig. 3-50 Front Engine Mount

lower flywheel housing.

2. On Synchromesh transmission equipped cars, remove the clutch assembly.

3. On Hydra-Matic equipped cars, remove the damper plate assembly.

4. Remove the six flywheel to crankshaft attaching cap screws and remove the flywheel.

Balancing

All flywheels, original and service replacement, are balanced individually. This is accomplished by inserting and staking a balancing pin or pins, if necessary, into the holes provided along the outer circumference of the flywheel. THESE STAKED BALANCE PINS ARE NOT TO BE REMOVED. After the flywheel is attached to the crankshaft, the engine and flywheel are again balanced as an assembly and, if necessary, additional balancing pins are installed in the flywheel. These pins are not staked.

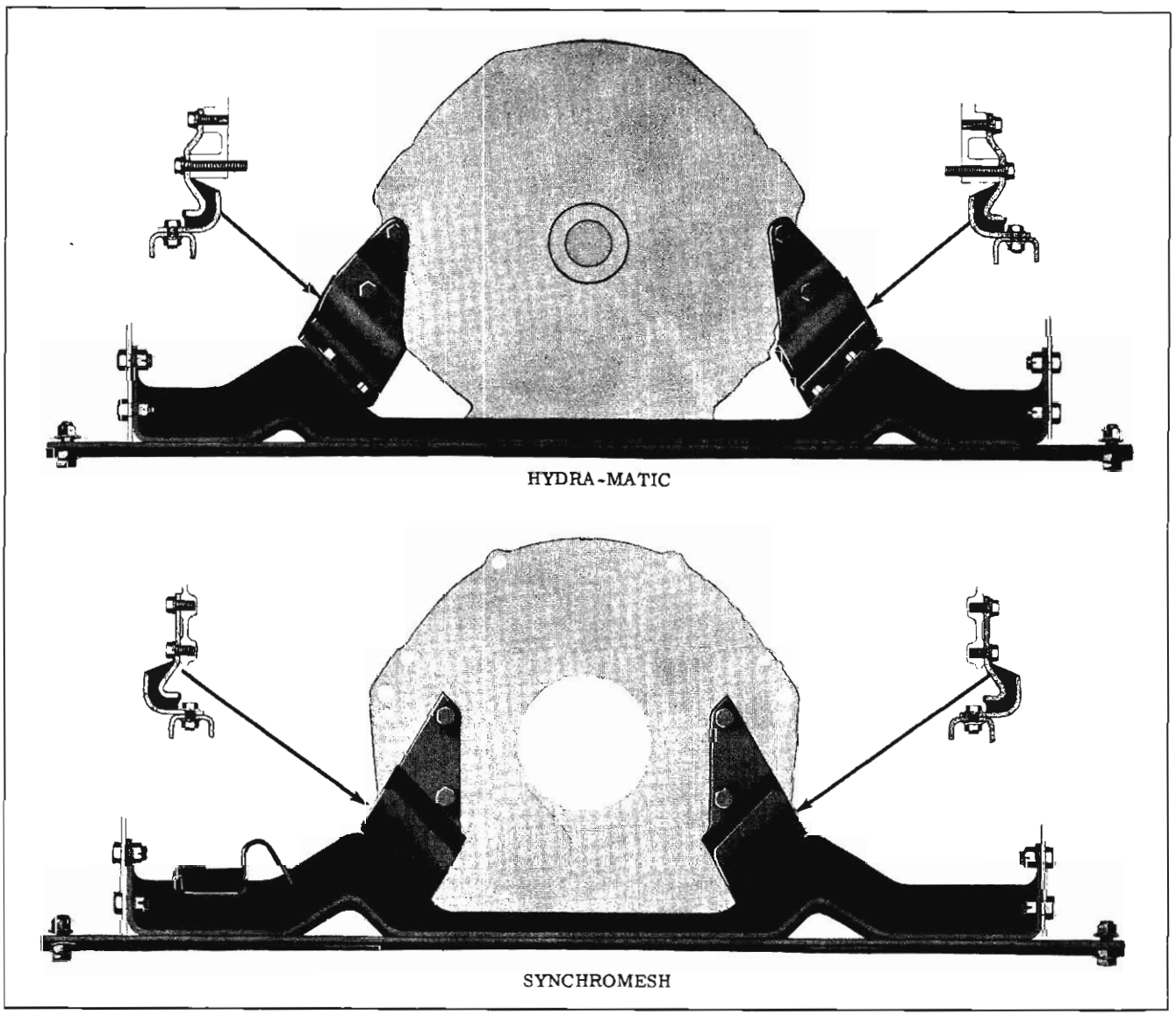


Fig. 3-51 Rear Engine Mounts

When installing a service replacement flywheel, it is essential that the flywheel be balanced with the engine. If there are no unstaked balance pins in the original flywheel, the new flywheel may be installed on the crankshaft as is. If UNSTAKED balance pins are found on the original flywheel, proceed as follows:

1. Position the original flywheel over the new flywheel and align the flywheel to crankshaft attaching bolt holes.
2. Mark the position of the unstaked balancing pins on new flywheel.
3. Transfer the balancing pins from the original flywheel to the new flywheel in the holes marked in Step 2.

   NOTE: If an unstaked pin cannot be installed in the exact position as the original due to the presence of a staked pin, insert the pin into an adjacent hole on either side of the staked pin.

Install

To install the flywheel, position the flywheel onto the crankshaft. Align the attaching bolt holes of the flywheel and crankshaft and install the attaching bolts. Torque the bolts 85 to 95 ft. lbs.

ENGINE MOUNTS

FRONT (Fig. 3-50)

To remove the front engine mount, proceed as follows:

1. Raise front of engine. (Refer to RAISING FRONT OF ENGINE.)
2. Loosen the mount to front cover bolts and remove mount.
3. To install engine front mount, reverse removal procedure.

   NOTE: The front mount must be properly positioned and tightened; otherwise, the mounting will bind and the engine will feel rough, particularly at idle. Tighten mount nuts 35 to 50 ft. lbs.

REAR (Fig. 3-51)
Remove

To remove a rear mount, proceed as follows:

1. Position the Engine Support BT-30-16 as shown in Fig. 3-52.
2. Remove the rear mount to cross member attaching bolts.

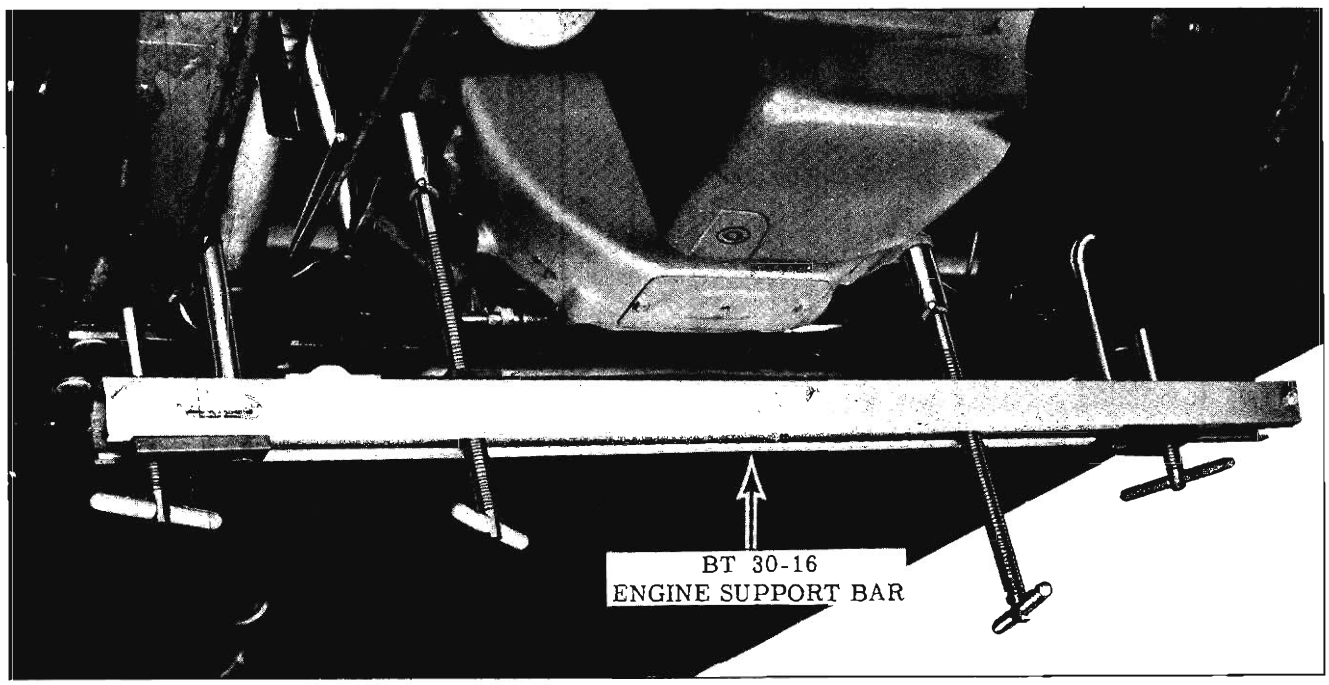


Fig. 3-52 Engine Support Bar

3. Raise engine slightly, until mount can be removed.

4. Remove the mount to flywheel housing attaching bolts and remove mount.

Install

1. Position the mount on the flywheel housing and install the attaching bolts. Torque mount to flywheel housing attaching bolts 50 to 60 ft. lbs.

2. Lower engine until full weight of engine is on the mounts and install the mount to cross member attaching bolts. Torque bolts 40 to 56 ft. lbs. Remove Tool BT-30-16.

COOLING SYSTEM (Fig. 3-53)

GENERAL DESCRIPTION

The engine cooling system is of the pressure type employing a 15 lb. pressure radiator cap. The water pump is a centrifugal type, and circulation is controlled by a thermostat located under the water outlet in the intake manifold. Full length water jackets allow the engine coolant to completely surround all cylinders.

OPERATION

The water pump discharges coolant through the front engine cover into both banks of the block. The water then flows through the full length water jackets in the block, up into the two cylinder heads, through the heads and then flows from the front of each cylinder head through the intake manifold water passage to the water outlet and finally to the radiator.

When the thermostat is closed, all the coolant flows through the two internal by-passes to the inlet side of the water pump and back to the engine block.

The 15 pound pressure radiator cap raises the boiling point of the coolant to approximately 247°F.

CAUTION: When removing the radiator cap, turn the cap counterclockwise to the point where pressure is released. After all the pressure has been released, the cap can then be SAFELY removed.

DRAIN AND REFILL

Before draining the cooling system, inspect the system and perform any necessary service to insure that it is clean, leak-tight and in proper working order.

1. Completely drain the system by opening drain valves at radiator lower tank and on each side of engine block.

   NOTE: If coolant drains out rusty, or if rust deposits are seen in the radiator, the cooling system should be flushed.

2. Determine the amount of anti-freeze to be use and mix with approximately two gallons of water.

3. Start engine and immediately pour the mixture of anti-freeze and water into the radiator with the engine idling and finish filling with water until level covers radiator core.

4. Run the engine until it reaches driving temperature, covering the radiator if necessary in order to open the thermostat and establish complete circulation through the system before driving the car or exposing it to freezing temperature. Finish filling with water to 1/4" below top of radiator filler neck after the engine has reached operating temperature.

FAN CLUTCH

A torque limited thermostatically controlled fan assembly is used on all air-conditioned cars. Through pulley ratio changes, the fan rotates faster than a conventional fan at low engine speeds. This improves low-speed cooling at idle.

The fan clutch engages when the radiator discharge air reaches 160°F. Engagement of the clutch allows the fan to rotate up to a maximum of 2000 rpm. When the radiator discharge air drops to 135°F. or below, the clutch disengages, which allows the fan to run a maximum of approximately 1500 rpm.

The thermostatically controlled fan clutch is serviced only as an assembly.

Remove and Install

1. Remove the four fan and clutch to pulley attaching bolts. (Fig. 3-54)

2. Remove fan and clutch assembly from car.

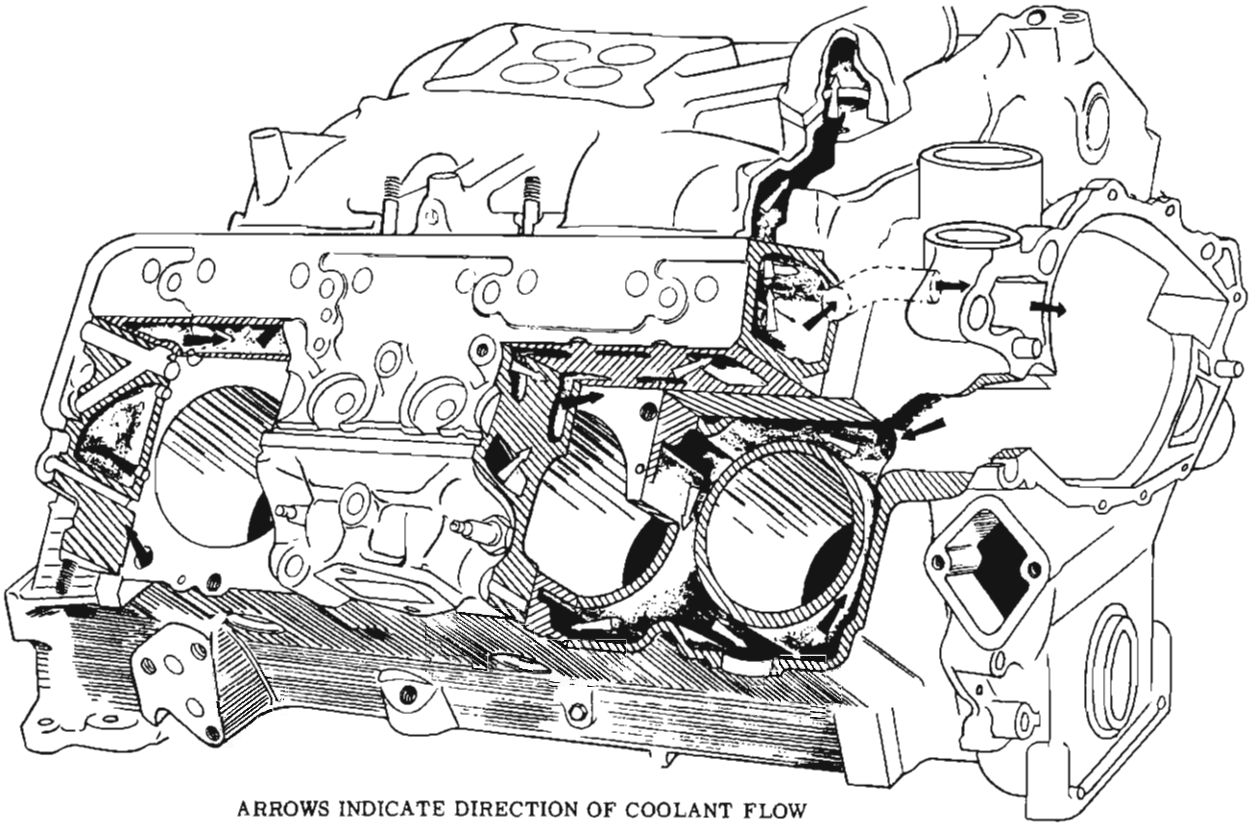
3. Remove the four fan to clutch attaching nuts, then separate fan and clutch.

4. To install, reverse the removal procedure. Torque attaching bolts and nuts 10 to 15 ft. lbs.

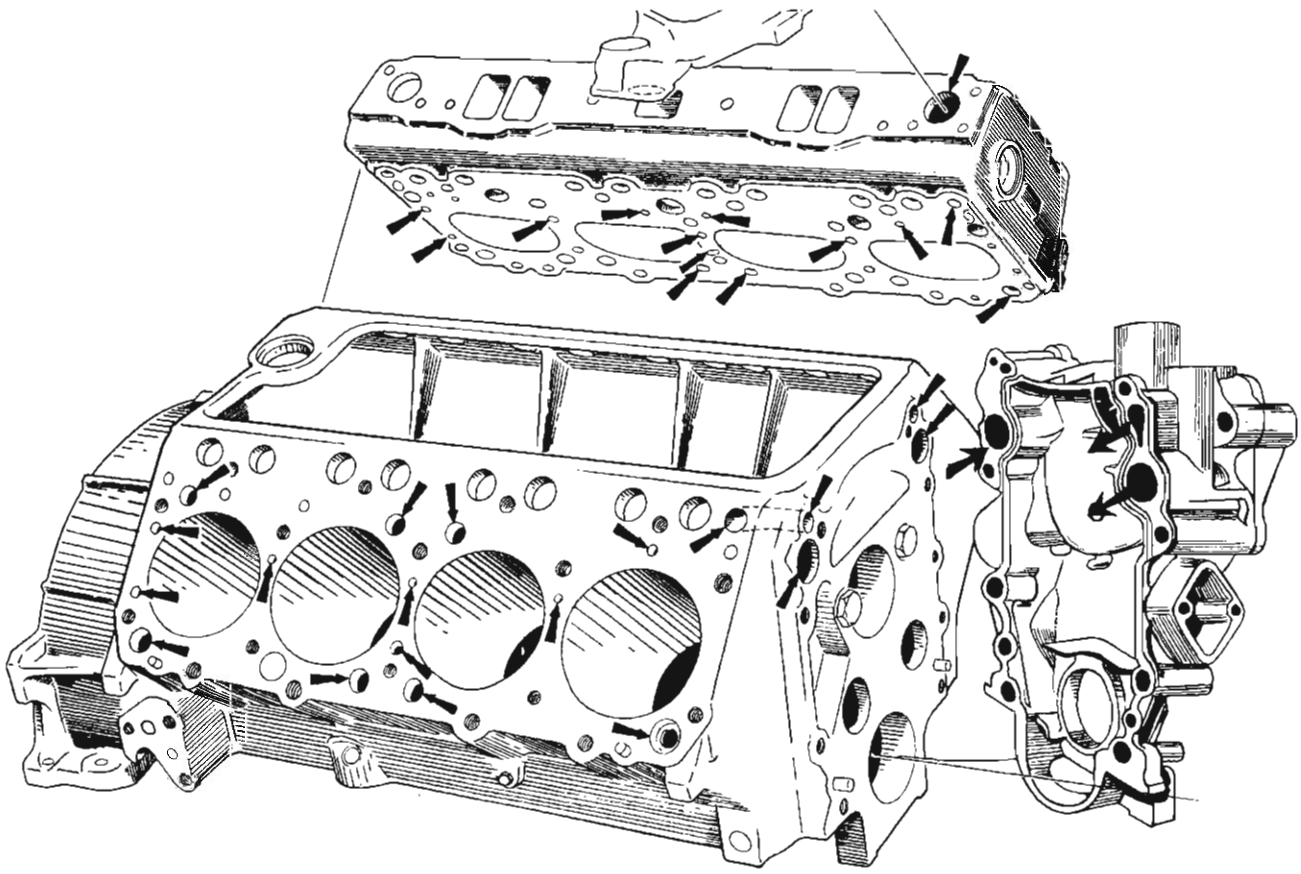
FAN AND PULLEY
Remove and Install

The fan blades and pulley can be removed without disturbing the water pump or radiator.

NOTE: If belt tension on pulley is not released, the fan can be removed without disturbing the



ARROWS INDICATE DIRECTION OF COOLANT FLOW



ARROWS INDICATE COOLANT PASSAGES

Fig. 3-53 Engine Cooling Flow and Passages

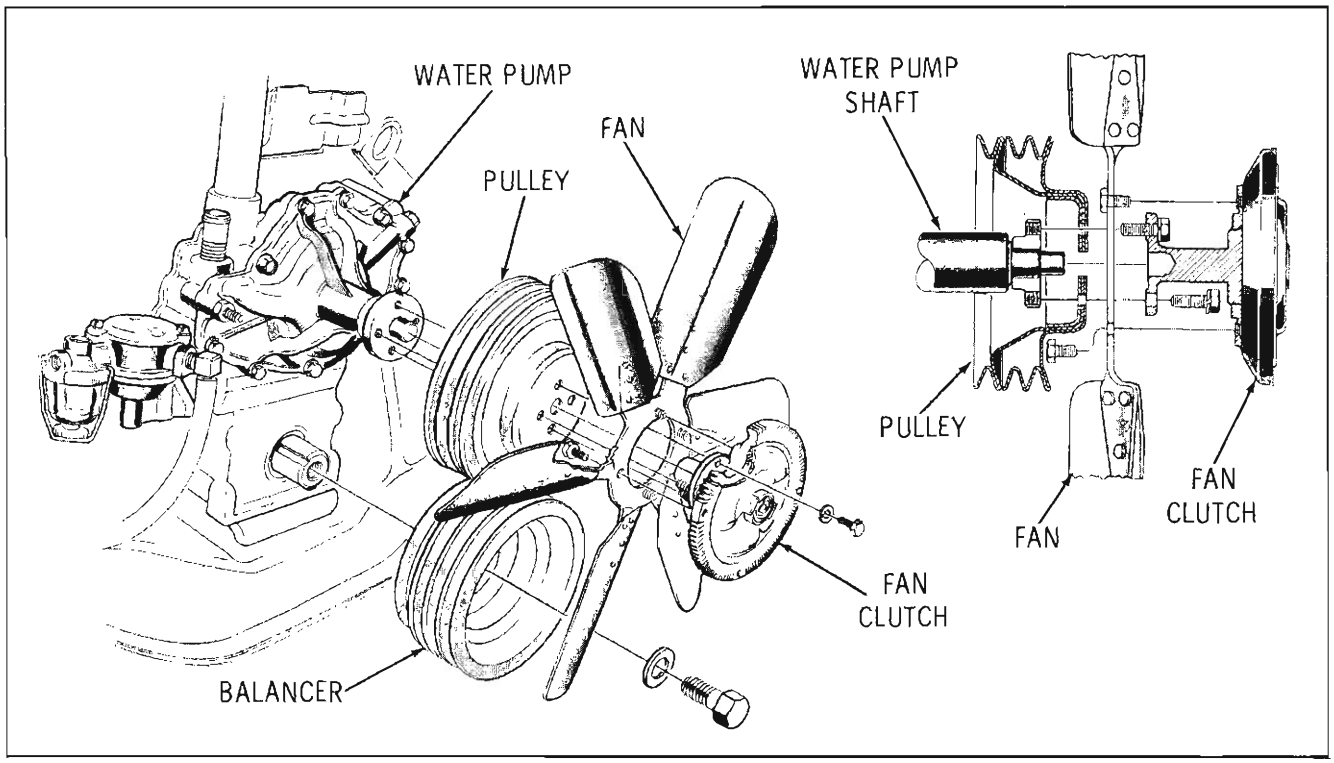


Fig. 3-54 Fan and Clutch Assembly

pulley by removing four attaching bolts. When the first two bolts are removed, replace with aligning studs. The tension of the belt will keep the pulley in position.

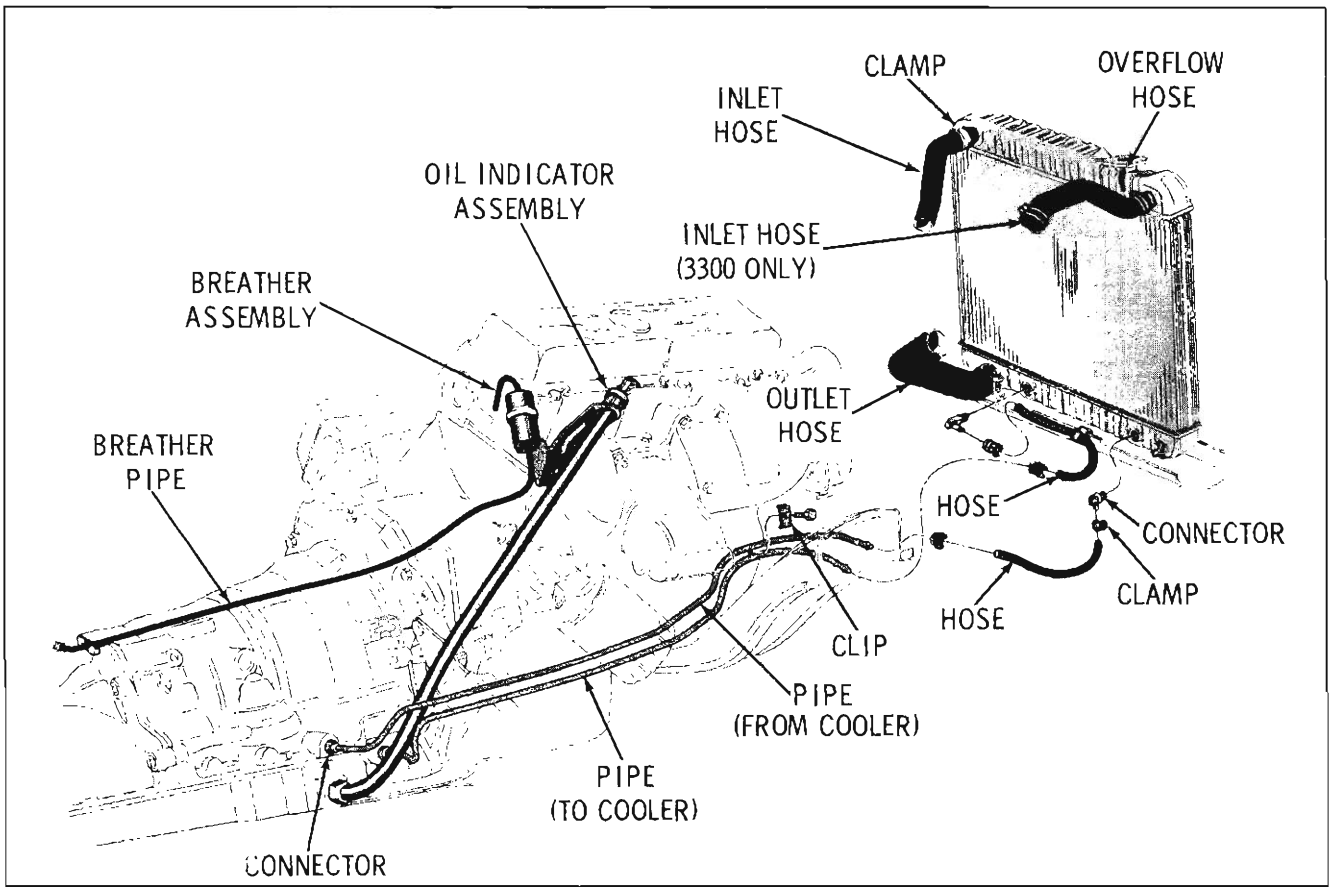


Fig. 3-55 Radiator and Attaching Parts

To remove the fan and pulley as an assembly, proceed as follows:

1. Loosen Delcotron and link adjusting bolt.
2. Remove four fan and pulley attaching bolts.
3. Remove fan and pulley.

Reverse the removal procedure for installing fan and pulley and adjust belt(s) to proper tension with BT 33-70.

RADIATOR
Remove and Install (Fig. 3-55)

1. Drain complete cooling system.
2. Disconnect radiator upper and lower hoses.

   NOTE: If car is equipped with Hydra-Matic transmission, disconnect and cap oil cooler lines. When installing oil cooler lines, use the following torque specifications. Oil cooler pipe connectors to radiator (brass) 22 to 28 ft. lbs., (steel) 30 to 40 ft. lbs. Adapter, oil cooler to transmission 15 to 20 ft. lbs. Fitting, oil cooler pipe to transmission adapter 20 to 25 ft. lbs.
3. Remove the radiator upper support.
4. Position fan blades to clear radiator lower outlet and remove radiator.

To install radiator, reverse sequence of operations and refill to 1/4" below top of radiator filler neck (At normal operating temperature). Check Hydra-Matic fluid level.

WATER PUMP (Fig. 3-56)
Remove

1. Drain cooling system below water pump level.
2. Loosen pulley belts, then remove fan, spacer and pulley from pump hub.
3. Remove the water pump attaching bolts (seven pump housing to front engine cover attaching bolts and four pump housing to block attaching bolts).

   NOTE: To remove the water pump lower center attaching bolt, rotate the crankshaft pulley until one of the notches machined in the pulley weight is aligned with the lower center bolt.
4. Remove water pump.

Install

1. Position a new water pump gasket on the engine front cover.
2. Install the water pump assembly on the front cover. Dip the 1/4" bolts in lubricant, Part No. 980131 before installing in front cover.

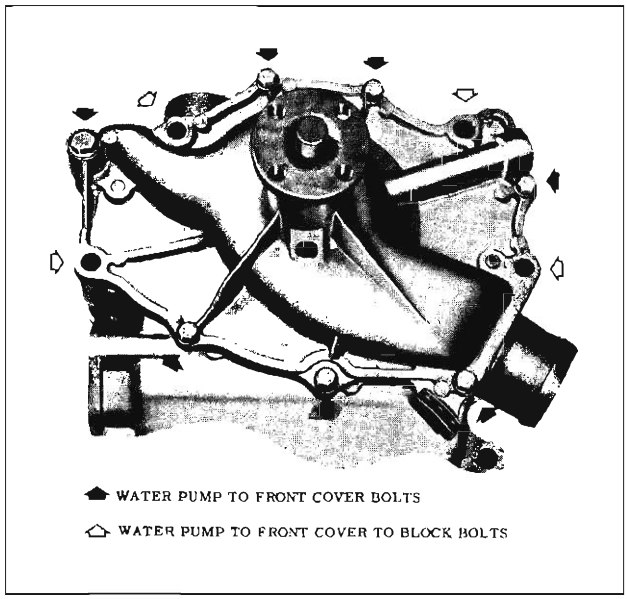


Fig. 3-56 Water Pump Attachment

Torque the 1/4" bolts 5 to 8 ft. lbs. and the 3/8" bolts 25 to 35 ft. lbs. The 3/8" cover to block bolts (four long ones) require sealer.

3. Install fan pulley, spacer and fan. Torque fan to hub bolts 10 to 15 ft. lbs.
4. Install pulley belt(s) and adjust belt tension with Tool 33-70.
5. Fill cooling system until coolant covers radiator core. After engine reaches operating temperature, fill radiator to 1/4" below filler neck.

FUEL SYSTEM

GAS TANK AND GAUGE (Fig. 3-57)

The gas tank has a capacity of 21 gallons. The gas tank filler is located in the left rear quarter panel. Venting of the fuel tank is provided for at the top of the tank and in the filler tube cap.

The tank gauge unit has a Saran fuel filter on the end of the suction pipe which prevents entry of dirt or water into the fuel line. The filter is a push fit on the end of the pipe and should be pressed on approximately 1-11/16" so that the pipe bottoms on the shoulder inside the filter. For repair and diagnosis of fuel gauge, refer to ELECTRICAL SECTION.

DRAINING GAS TANK

1. With the car on a hoist, gas tank cap removed, disconnect the neoprene hose from the fuel line at the frame side rail. This connection is located just ahead of the right rear torque box.

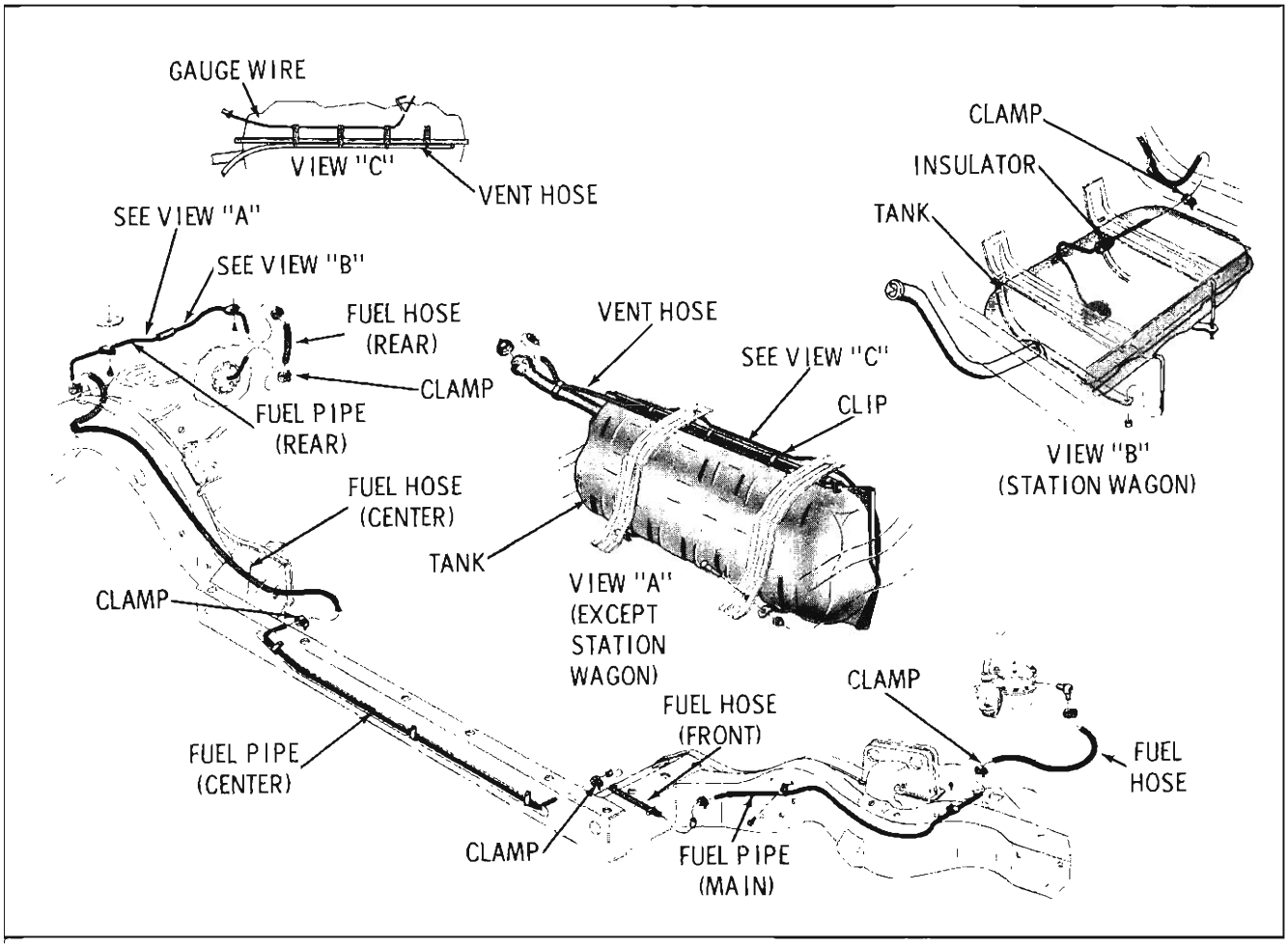


Fig. 3-57 Fuel Tank Installation

2. Insert approximately a three foot piece of tubing into the neoprene hose. Insert open end of tubing into a container.
3. The tank can now be drained through gravity flow.

Remove and Install

1. Drain tank.
2. Disconnect gas hose from fuel line at right side of tank. On cars equipped with a fuel return line, remove the fuel return hose from return line at right side of gas tank.
3. Disconnect the fuel gauge wire. Remove the two tank strap attaching bolts and lower tank.

To install, reverse the removal procedure. Torque the strap attaching nuts 10 ft. lbs. maximum.

NOTE: A fuel return from the fuel filter to the gas tank is incorporated on air conditioned equipped cars to prevent excessive fuel pressure build-up in the line between the fuel pump and the carburetor. (Fig. 3-58)

CAUTION: If a car is to be stored for any appreciable length of time, the gasoline should be drained from the complete fuel system - including carburetor, fuel pump, all fuel lines and fuel tank, in order to prevent gum formations and resultant improper engine performance.

FUEL FILTER

No attempt should be made to clean a dirty filter element. Whenever a dirty filter is encountered, the element should be replaced.

FUEL PUMP

GENERAL DESCRIPTION

Cars equipped with air conditioning use a fuel pump with integral fuel filter which incorporates a fuel return line. The fuel return line, from the filter to the gas tank, aids in maintaining a constant fuel pressure at the carburetor under varying conditions. (Fig. 3-58)

OPERATION

The fuel pump draws gasoline from the tank and supplies it to the carburetor in sufficient quantity to meet engine requirements at any speed or load.

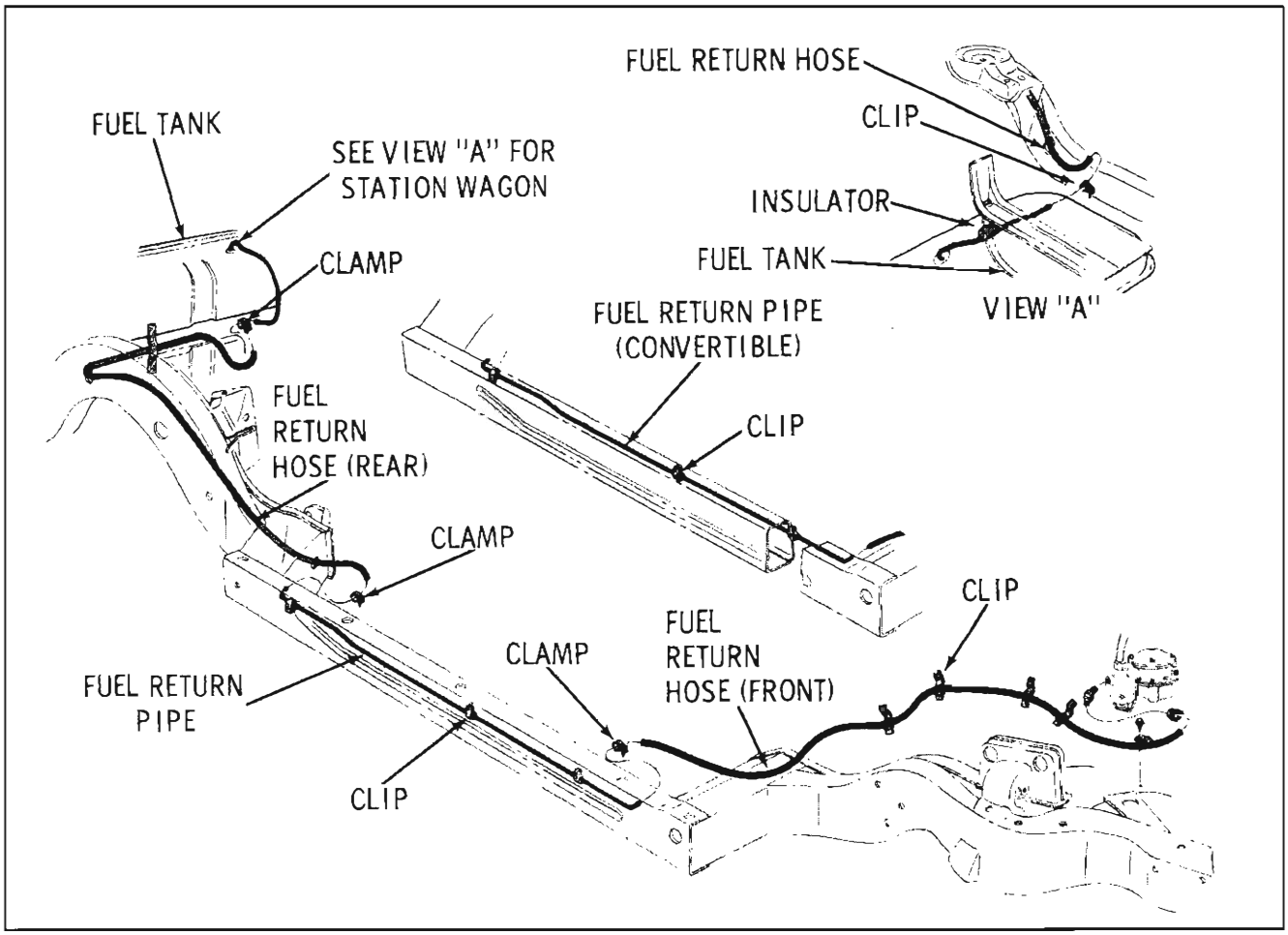


Fig. 3-58 Fuel Return System

The fuel pump rocker arm is held in constant engagement with the eccentric on the camshaft by the rocker arm spring. As the outer end of the rocker arm moves up, the fuel link pulls the fuel diaphragm down. The enlargement of the fuel chamber draws fuel from the tank through the inlet valve and into the fuel chamber.

The pump delivers fuel to the carburetor only when the pressure in the outlet line is less than the pressure maintained by the diaphragm spring. When the carburetor float needle valve opens, the spring expands and moves the diaphragm up to force fuel past the outlet valve to the carburetor. When the carburetor float needle valve closes (on cars without a fuel return line), the pump builds up pressure in the fuel chamber until the diaphragm spring is again compressed. The diaphragm then remains stationary until more fuel is required by the carburetor.

A pulsator is used to insure a solid charge of fuel to the carburetor.

FUEL PUMP INSPECTION AND TEST (ON CAR)

Before testing the fuel pump for volume flow, a new fuel filter should be installed.

As filtered foreign material builds up within the filter, fuel flow restriction increases, resulting in a decrease of volume flow at the filter outlet. When the restriction becomes excessively high, volume flow to the carburetor can drop below engine requirements although the fuel pump is still capable of meeting volume specifications.

1. Be sure there is gasoline in the tank.

2. Check for loose line connections. A leak at the pressure side of the system (line from pump to carburetor) will be indicated by dripping fuel. A leak in the suction side of the system (line from gas tank to pump) will not be apparent except in its effect of reducing volume of fuel on the pressure side of the system. Tighten loose line connections. Tighten fuel pump diaphragm flange screws.

3. Look for bends or kinks in lines which will reduce fuel flow.

4. Test fuel flow as follows:

   a. Disconnect fuel line at the carburetor.

   b. Ground primary terminal of distributor with jumper lead so that engine can be cranked without firing.

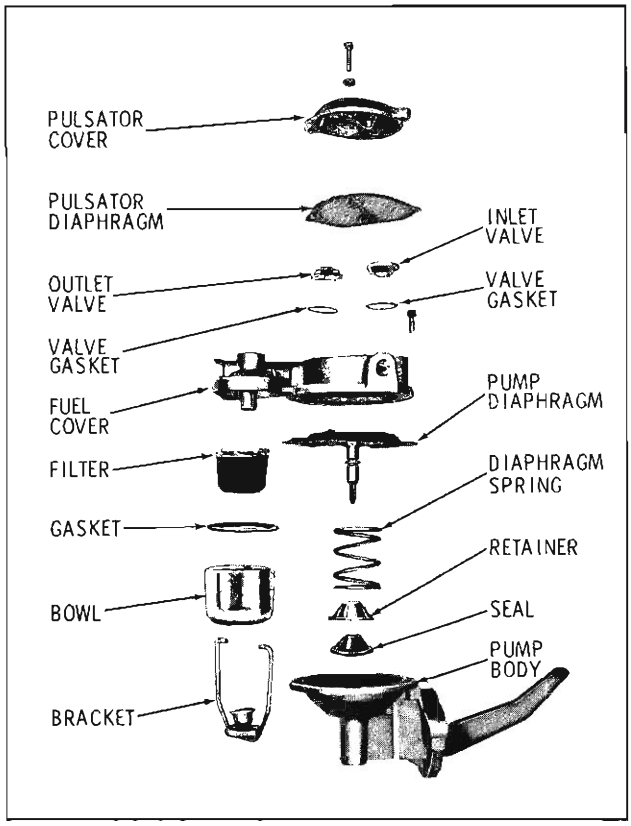


Fig. 3-59 Fuel Pump

c. Place suitable container at end of fuel line and crank engine a few revolutions.

NOTE: If little or no gasoline flows from open end of line, then the fuel line or tank filter is clogged or the pump is inoperative. Before removing pump, disconnect fuel lines at fuel pump and at gas tank and blow through them with an air hose to make sure they are clear. Reconnect fuel lines to pump and gas tank, then retest fuel flow while cranking engine.

5. Even if fuel flows in good volume from line at carburetor, it is advisable to make certain that pump is operating within limits.

a. Attach a low reading pressure gauge to upper end of pump to carburetor line.

b. Run engine at approximately 1000 rpm (using gasoline in carburetor bowl) and note reading on pressure gauge.

c. If pump is operating properly, the pressure will be 5 to 6 pounds and will remain constant. If pressure is too low or too high or varies materially at different speeds, the pump should be removed for repair or replacement.

NOTE: If pressure gauge is at pump height instead of at carburetor height, the pressure should be 1/2 pound higher.

PUMP ASSEMBLY
Remove and Install

1. Install a jumper wire and crank engine until the distributor rotor points forward.

2. Disconnect fuel lines from pump.

3. Remove the pump to front engine cover attaching bolts and remove pump.

When installing pump, the pump arm operating pad should be coated with lubricant, Part No. 567196. The gasket should be cemented in place to aid installation. Torque pump to cover bolts 34 to 40 ft. lbs.

Disassembly (Fig. 3-59)

NOTE: Before proceeding with the following operation, clean the outside of the unit. DO NOT SUBMERGE PUMP IN COMMERCIAL TYPE DEGREASER OR USE STEAM.

1. Clamp pump body in vise.

2. Remove screws attaching pulsator cover and diaphragm to pump body, then remove pulsator cover and diaphragm.

3. Mark edge of fuel cover and pump body flange so the parts can be reassembled in the same relative position.

4. Remove fuel cover screws. Tap cover lightly to separate it from body if cover sticks.

5. Remove pump from vise. Remove diaphragm and spring as shown in Fig. 3-60.

6. If valves are to be replaced, remove the staking, then remove the inlet and outlet valves and gaskets from the fuel cover. (Fig. 3-61)

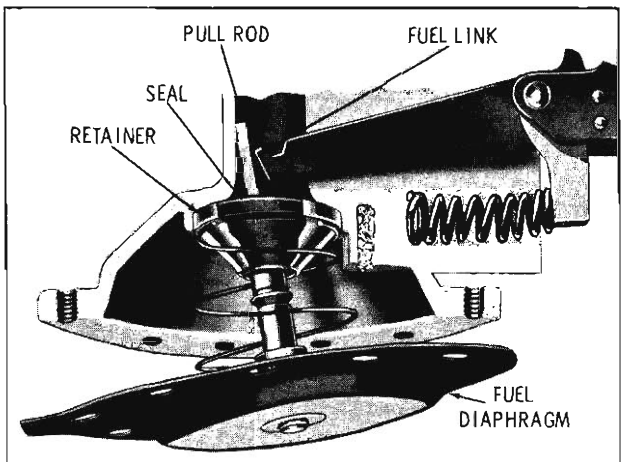


Fig. 3-60 Removing Fuel Diaphragm

7. Position pump body in vise. Remove pull rod retainer and seal as shown in Fig. 3-62.

NOTE: The pull rod seal should be replaced whenever the fuel pump is disassembled.

Cleaning and Inspection

1. Clean and rinse all metal parts in solvent. Blow out all passages with air hose.

2. Inspect pump body and fuel cover for cracks, breakage, and distorted flanges. Examine all screw holes for stripped or crossed threads. Replacement of pump assembly is advisable if any of the following conditions are found:

   a. Body or cover castings warped or damaged.

   b. Rocker arm worn at cam pad.

   c. Rocker arm bushing worn.

   d. Link worn excessively.

NOTE: If flange facings are warped .010" or less, they can be "trued up" on a piece of plate glass with No. 400 grit sandpaper.

Assembly

1. Install a new pull rod seal and retainer using Tool J-21421-3. (Fig. 3-63)

2. Position spring into the pump body, insert the diaphragm through the pull rod seal.

3. Install diaphragm as shown in Fig. 3-60.

4. Place valve gaskets in recesses provided in fuel cover. Install valves as shown in Fig. 3-61 and stake in place.

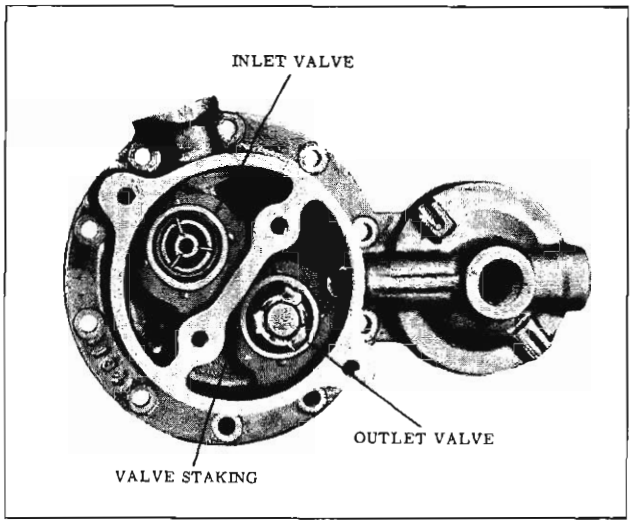


Fig. 3-61 Fuel Inlet and Outlet Valves

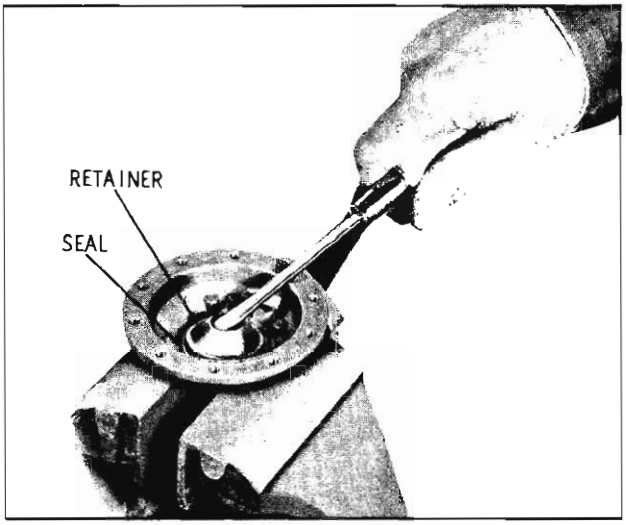


Fig. 3-62 Removing Fuel Pull Rod Seal

5. Lift rocker arm until the diaphragm is flat across the body flange and install fuel cover on body, making sure that alignment marks on cover and body are aligned. While holding diaphragm flat, install cover screws loosely.

NOTE: Diaphragm must be flexed by several full strokes of rocker arm before tightening cover screws or pump pressure will be incorrect and diaphragm may be damaged.

6. Tighten the cover screws alternately and securely.

7. Position pulsator diaphragm on fuel cover, then install pulsator cover and secure with attaching screws.

EXHAUST SYSTEM

The single exhaust system consists of a cross-over pipe, exhaust pipes, muffler and resonator.

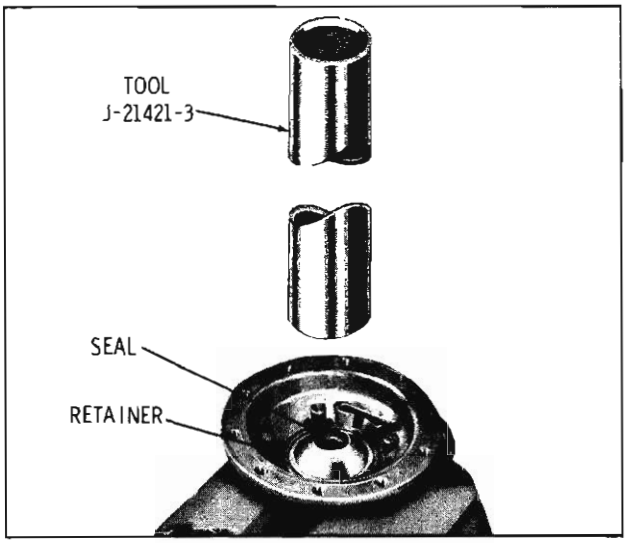


Fig. 3-63 Installing Fuel Pump Rod Seal

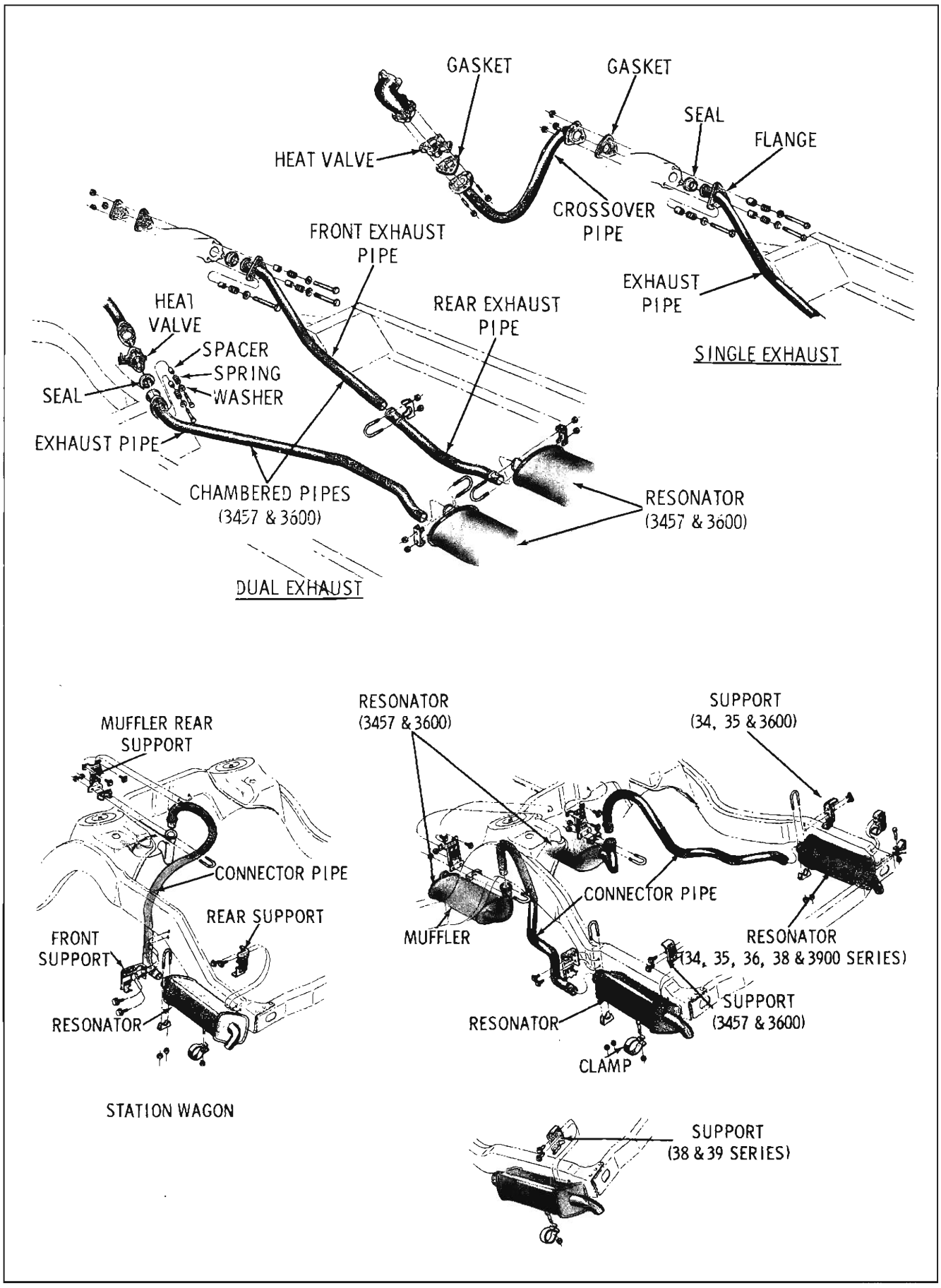
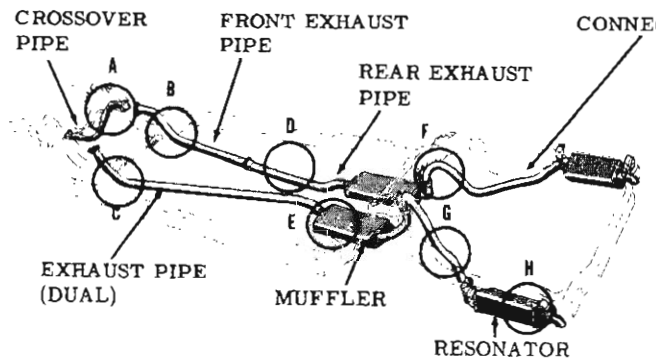
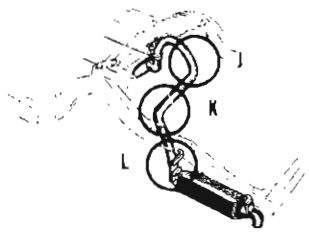


Fig. 3-64 Exhaust Systems





STATION WAGON

LOCATION	MINIMUM CLEARANCE
A. CROSSOVER PIPE TO FRAME	7/8"
B. FRONT EXHAUST PIPE TO FRAME	1"
C. EXHAUST PIPE TO FRAME	1"
D. REAR EXHAUST PIPE TO UNDERBODY	13/16"
E. MUFFLER TO UNDERBODY	1-3/8"
F. CONNECTOR PIPE TO UNDERBODY	13/16" Ex. S.W. - 1" S.W.
G. CONNECTOR PIPE TO SHOCK	2-1/4"
G. CONNECTOR PIPE TO GAS TANK	1-1/16"
H. RESONATOR TO FRAME	1"
H. RESONATOR TO UNDERBODY	15/16"
J. CONNECTOR PIPE TO UNDERBODY	1-1/2"
K. CONNECTOR PIPE TO GAS TANK	1-13/16"
L. CONNECTOR PIPE TO SHOCK	1-5/8"

Fig. 3-65 Clearance Specifications for Exhaust System Parts

The dual exhaust system is standard on all cars equipped with Starfire engines. On all series except 3457 and 3600, the dual exhaust system consists of two exhaust pipes, two mufflers and two resonators. On 3457 and 3600 series, the system consists of two chambered exhaust pipes and two front and two rear resonators. (Fig. 3-64)

MUFFLER AND RESONATOR

The muffler is a reverse flow type having an asbestos and steel outer shell.

Resonators are used to aid the mufflers in silencing exhaust pulsations.

Mufflers and resonators have drain holes to expel condensation. These drain holes should be periodically checked and opened if necessary.

When installing components of the exhaust system, observe the following:

1. To insure gas tight connections:
   a. Always use new gaskets.
   b. Apply Vibradamp No. 253 or equivalent to the outside diameter of the pipes where they join the muffler or resonator, and at exhaust pipe joints.
   c. When tightening exhaust pipe flange, tap the flanges with a hammer to insure the proper seating of the flanges and gaskets.
2. Before tightening any part of the exhaust system, align the exhaust system pipes to provide adequate clearance between the body and frame. (Fig. 3-65)

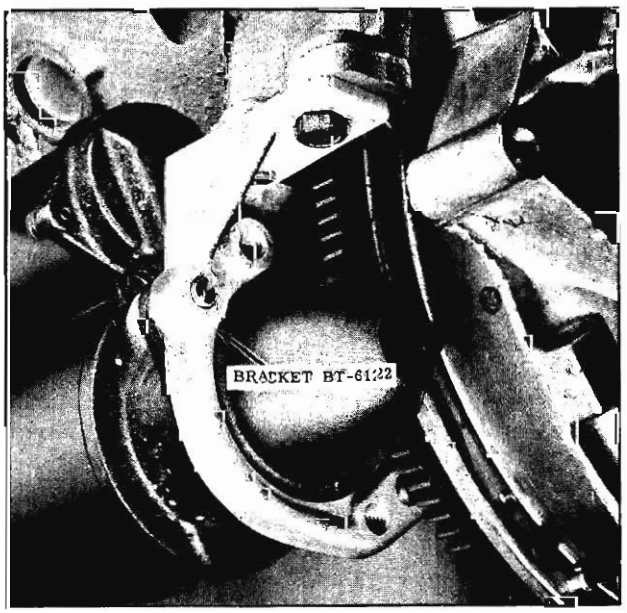


Fig. 3-66 Starter Bracket Installation

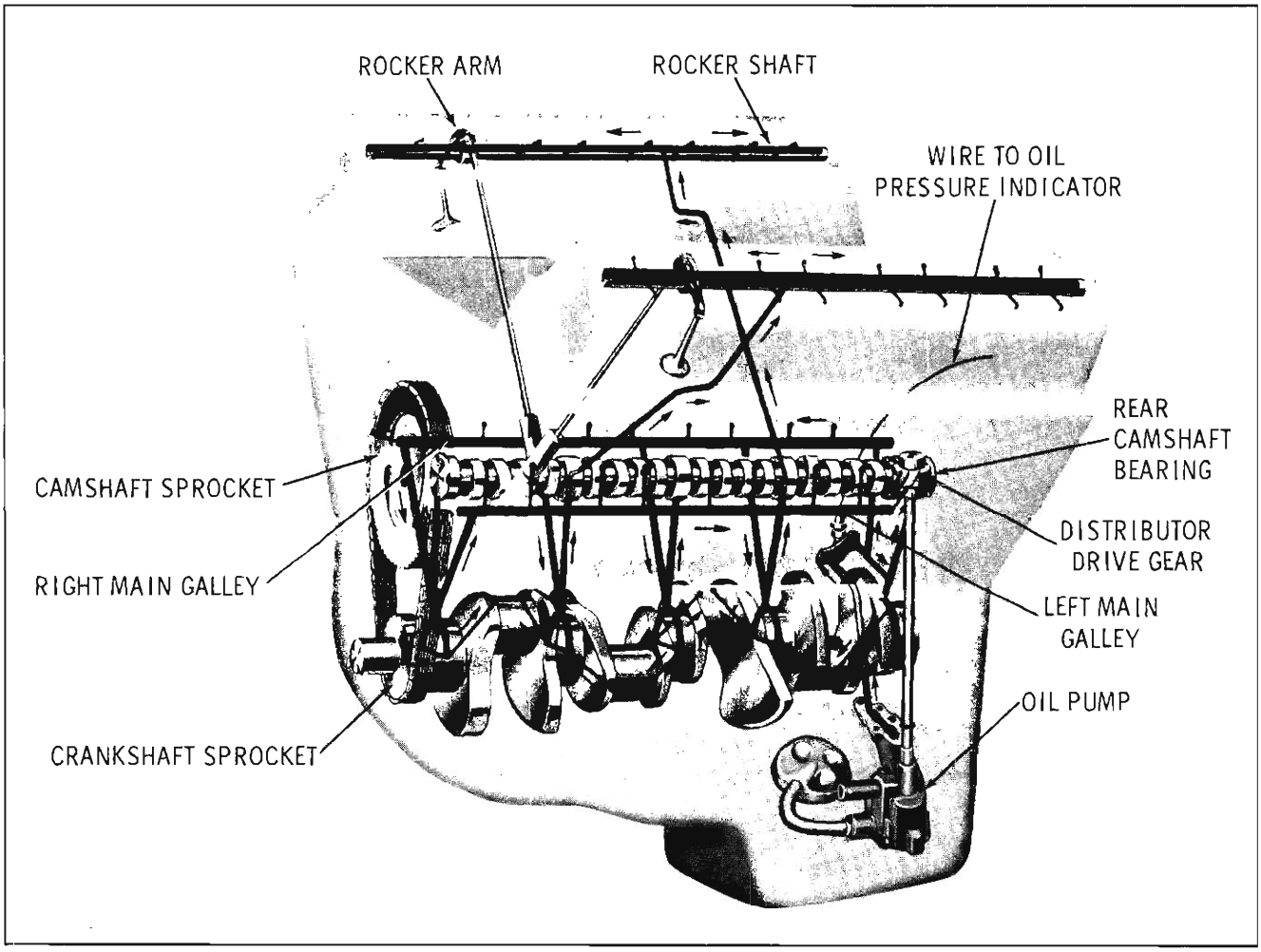


Fig. 3-67 Engine Lubrication Circuit

NOTE: ALLOW ENGINE TO REACH OPERATING TEMPERATURE BEFORE TORQUING ATTACHING NUTS.

Torque exhaust system flex-joint nuts 7 to 10 ft. lbs.

LOCATING ENGINE OIL LEAKS

In cases where the engine oil leaks cannot be located visually, the use of Oil Red or "Blacklight" should be used.

To use Oil Red, drain one quart (minimum) of oil from the engine, then mix 1 tablespoon of the Oil Red and the oil that was drained. Pour this mixture into the crankcase. Start engine and inspect for trace of colored oil. Oil Red is harmless to the engine.

Blacklight should be used when it cannot be determined whether the oil leak originated from the engine or the transmission. To use the Blacklight method, remove engine and transmission dipsticks to compare with a sample of oil from the location of the leak. By viewing the oil on the dipsticks with a sample under Blacklight, it can be determined which unit is leaking.

NOTE: When an oil leak is suspected in the immediate flywheel area, remove the lower flywheel housing and install starter bracket BT-6122 as shown in Fig. 3-66. This will allow the engine to be started with lower housing removed.

The Blacklight method can also be used to pin point leaks after the suspected area has been wiped clean of oil and the engine runs long enough to show up a leak. The oil will glow when viewed with Blacklight.

GENERAL SPECIFICATIONS

Subject and Remarks	
1. CYLINDER BLOCK	
a. Engine Type	90° V-Type
b. Number of Cylinders	8
c. Bore and Stroke	4.125" x 3.6875"
d. Piston Displacement	394.1 cu. in.
e. Compression Ratio	
Regular Fuel	8.75:1
Premium Fuel	10.25:1
Premium Fuel, Starfire	10.50:1
f. Firing Order	1-8-7-3-6-5-4-2
g. Cylinder Identification	
Left Bank (Front to Rear)	1-3-5-7
Right Bank (Front to Rear)	2-4-6-8
2. CRANKSHAFT	
a. Diameter - Main Bearing Journal	
All	2.9993" to 3.0003"
b. Width - Main Bearing Journal, Including Fillets	
No. 1	1.340"
Nos. 2, 3 and 4	1.156" to 1.166"
No. 5	1.879" to 1.881"
c. Diameter - Connecting Rod Bearing Journal	2.4988" to 2.4998"
d. Diameter - Connecting Rod Bearing Journal (Engines with "X" on Left Front Face of Block)	2.4893" to 2.4988"
e. Width - Connecting Rod Bearing, Including Fillets	1.877" to 1.880"
f. Length - Overall Crankshaft	26.066"
g. Diameter - Of Oil Holes in Crankshaft	.201" to .209"
h. Number of counterweights	6
j. Clearance - Crankshaft End Thrust	.004" to .008"
3. CRANKSHAFT SPROCKETS	
a. Width	.520" to .530"
b. Pitch	.500"
c. Number of Teeth	18
4. FLYWHEEL	
a. No. of Teeth on Starter Gear	166
b. No. of Teeth on Starter Pinion	9
5. MAIN BEARINGS	
a. Clearance - Crankshaft Vertical	
Nos. 1, 2, 3, 4	.0005" to .0021"
b. No. 5	.0020" to .0034"
c. Width - Bearing Shell	
Nos. 2, 3 and 4	.970" to .980"
No. 5	1.873" to 1.875"
No. 1	1.063" to 1.073"
6. PISTONS	
a. Length Overall	4.050"
b. Length from Top of Piston to Pin Center	1.770" to 1.773"
c. Clearance (At Thrust Surface) Selective	.00075" to .00125"
d. Diameter - Nominal Outside	4.125"
e. Weight - Less Pins and Rings	26.349 oz.

GENERAL SPECIFICATIONS—Continued

Subject and Remarks	
7. PISTON PINS	
a. Diameter (Selective)	.9807" to .9803"
b. Length Overall	3.126"
c. Diametrical Clearance (Selective) Plain Boss	.0003" to .0005" Loose
8. PISTON RINGS	
a. Number Compression Rings	2
b. Width, Compression Ring Upper	.0775" to .0780"
c. Width, Compression Ring Lower	.0925" to .0935"
d. Gap Clearance Compression Rings	.013" to .023"
e. Clearance in Groove, Compression Rings	
Upper	.0018" to .0038"
Lower	.0018" to .0038"
f. Number, Oil Rings	1
g. Width, Oil Ring Assembly	
Sealed Power	.1840" to .1880"
Muskegon	.1810" to .1860"
h. Gap Clearance, Oil Ring	.015" to .055"
i. Clearance - Oil Ring to Piston Groove	.0005" to .007"
9. CONNECTING RODS	
a. Length - Center to Center	6.996" to 7.000"
b. Diameter - Connecting Rod Bore	2.6243" to 2.6250"
c. Diameter - Pin Bore	.9807" to .9811"
d. Clearance - Crankshaft (Vertical)	.0005" to .0026"
e. Clearance - Pin to Rod	.0003" to .0005" Loose
f. Clearance - End to Crankshaft	.002" to .011"
10. CAMSHAFT	
a. Bearing Journal Diameters	
All	1.9972" to 1.9980"
b. Width (Including Chamfers)	
Nos. 1 and 5	.781"
Nos. 2, 3 and 4	.699"
c. Journal Clearance in Bearing	.0015" to .0038"
d. Diameter - Reamed Bearing	
All	1.9995" to 2.0010"
e. Length - Bearing	
All	.688"
11. CAMSHAFT SPROCKET	
a. Width	.520" to .530"
b. Pitch	.500"
c. Number of Teeth	36
12. TIMING CHAIN	
a. Width	27/32"
b. Length	24"
c. Number of Links	48
d. Pitch	.500"
13. VALVES - INTAKE	
a. Diameter - Head	1.870" to 1.880"
b. Diameter - Stem	.3427" to .3432"

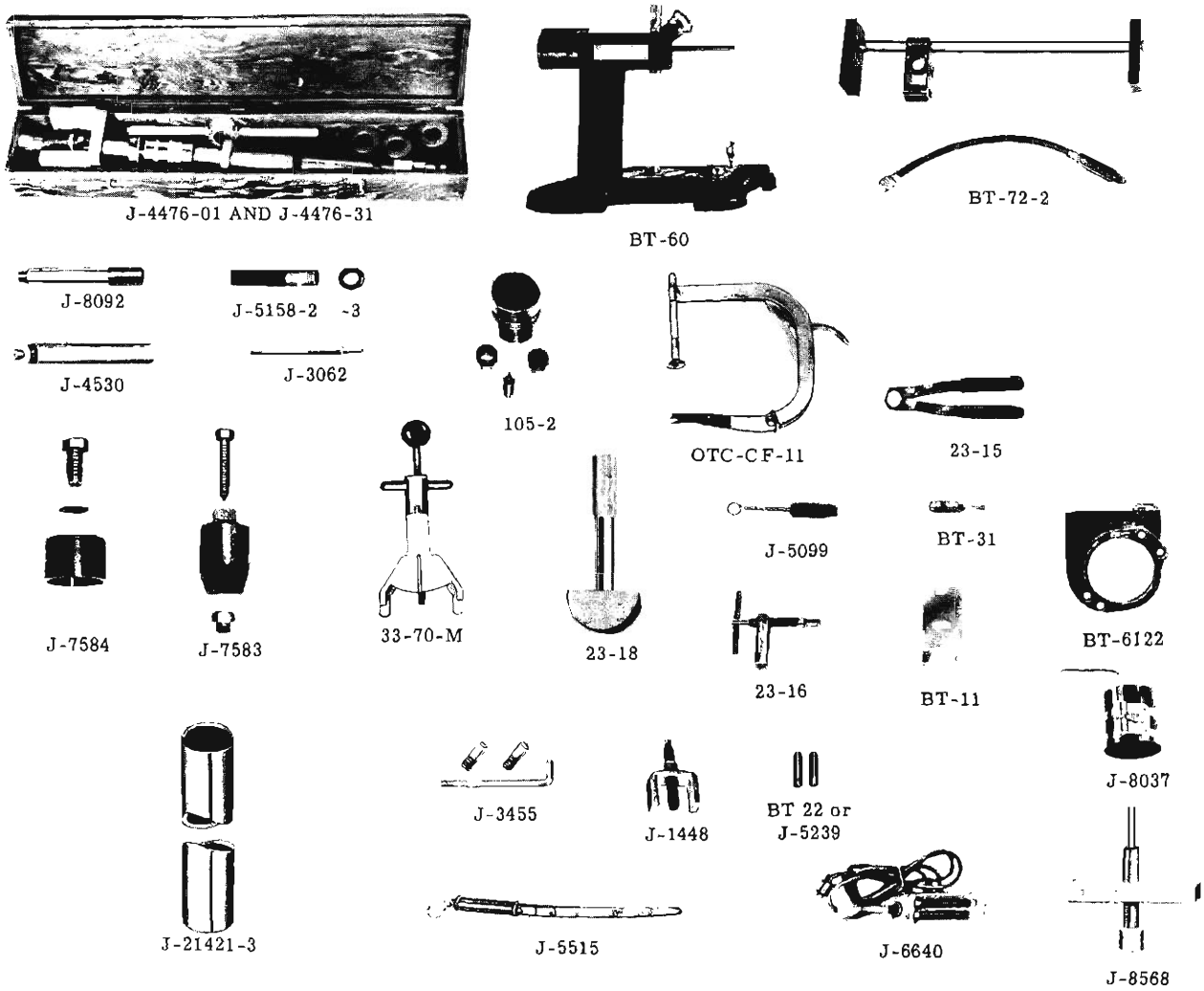
GENERAL SPECIFICATIONS—Continued

Subject and Remarks		
13. VALVES - INTAKE - (Continued)		
c. Angle - Valve Seat		45°
d. Width - Valve Seat		.037" to .075"
e. Lift - 2 Bbl. Engine		.4276"
- 4 Bbl. Engine		.4352"
- Starfire		.4433"
f. Clearance in Guide		.0010" to .0025"
g. Lash		Hydraulic
14. VALVES - EXHAUST		
a. Diameter - Head		1.557" to 1.567"
b. Diameter - Stem		.3422" to .3427"
c. Angle - Valve Seat		45°
d. Width - Valve Seat		.037" to .075"
e. Lift - 2 Bbl. Engine		.4352"
- 4 Bbl. Engine		.4364"
- Starfire		.4364"
f. Clearance in Guide		.0015" to .0030"
g. Lash		Hydraulic
15. VALVE SPRINGS		
a. Number of coils		6.40 to 6.60
b. Length - Free		2.25"
c. Diameter - Wire		.190" to .194"
d. Diameter - Inside Top		.760"
e. Diameter - Outside Bottom		1.472" to 1.496"
f. Pressure and Length		
Valve Open	175 to 189 lbs.	1.437"
g. Valve Closed	85 to 95 lbs.	1.837"
16. VALVE LIFTERS		
a. Diameter - Body		
Standard		.9210" to .9215"
.010" Oversize		.9310" to .9315"
b. Length - Overall		2.122" to 2.132"
c. Clearance in Boss Selective		.0005" to .0020"
17. VALVE GUIDES		
a. Height from top of Head		.787"
b. Diameter - Inside Intake		.3442" to .3452"
c. Diameter - Inside Exhaust		.3442" to .3452"
d. Length - Overall		2.390"
18. LUBRICATION SYSTEM		
a. Capacity - Engine		
Crankcase Only, Drain and Refill		4 Qts.
Drain and Refill with Filter Change		5 Qts.
b. Oil Pump		
Clearance - Pressure Relief Valve in Bore		.0025" to .005"
Clearance - End Gears		.0025" to .0065"
Width - Pump Gears		1.5075" to 1.5095"
19. COOLING SYSTEM		
a. Radiator - Make		Harrison
b. Capacity		19-1/4 Qts.
For Heater, Add		1 Qt.
For Air Conditioning, Add		1-3/4 Qts.
c. Pressure Cap		15 Lb.
d. Thermostat		180°

TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below the specified minimum.

Application	Ft. Lbs.
CRANKSHAFT AND CONNECTING RODS	
Connecting Rod Bearing Cap Bolts	32 to 42
Crankshaft Bearing Cap Bolts (Nos. 1, 2, 3 & 4)	90 to 120
Crankshaft Bearing Cap Bolts (Rear)	130 to 160
Crankshaft Pulley Bolt	100 Min.
ENGINE MOUNTS	
Front Mount to Front Cover Bolts	40 to 50
Front Mount to Frame Nuts	35 to 50
Rear Mount to Flywheel Housing Bolts	45 to 60
Rear Mount to Cross Member	40 to 56
HEAD AND VALVE MECHANISM	
Rocker Arm Cover Bolts	4 to 7
Cylinder Head to Block Bolts	60 to 80
Rocker Shaft Bracket to Head	14 to 22
Spark Plugs	18 to 34
FLYWHEEL AND DAMPER PLATE	
Flywheel to Crankshaft Bolts	85 to 95
Clutch Pressure Plate to Flywheel Bolts	14 to 17
Damper Plate to Flywheel Bolts	17 to 22
FLYWHEEL AND CLUTCH HOUSING	
Flywheel Lower Housing Cover Bolts	4 to 7
Flywheel Lower Housing to Block Bolts	50 to 55
Flywheel Cover Housing to Block and Flywheel Housing	50 to 55
Clutch Housing to Block and Flywheel Housing Bolts	50 to 55
FRONT COVER AND WATER PUMP	
Cover to Block Bolts (3/8")	24 to 40
Water Pump to Front Cover (3/8")	25 to 35
Water Pump to Front Cover (1/4")	5 to 8
Water Outlet to Manifold	22 to 26
FUEL PUMP	
Pump to Front Cover Bolts	34 to 44
Fuel Pump Eccentric	14 to 22
MANIFOLD	
Intake Manifold to Head Bolts	22 to 34
Exhaust Manifold to Head Bolts and Nuts	19 to 25
OIL PAN, PUMP AND FILTER	
Oil Pan Bolts	10 to 15
Oil Pan Drain Plug	30 to 50
Pump to Bearing Cap	24 to 34
Pump Cover Bolts	5 to 8
Pump Screen Bolts	4 to 7
Filter Assembly to Cylinder Block Bolts	28 to 38
Filter Housing	10 to 20
Oil Pressure Switch	10 to 15
OIL COOLER LINES	
Oil Cooler Pipe Connector to Radiator	Brass - 22 to 28 Steel - 30 to 40
Adapter, Oil Cooler to Transmission	15 to 20
Fitting, Oil Cooler Pipe to Transmission Adapter	20 to 25



BT-11	Timing Gauge
BT-22	Connecting Rod Bolt Guide
BT-31	Valve Lifter Lock Spring Tool
BT-60	Hydraulic Valve Lifter Tester
BT-72-2	Valve Spring Compressor Set
23-15	Valve Lifter Remover
23-16	Valve Lifter Plunger Remover
23-17	Water Pump Seal Installer
23-18	Rear Main Bearing Seal Installer
BT-6122	Starting Motor Bracket
33-70-M	Belt Tension Gauge
105-2	Adapter (Used with Hydraulic Valve Lifter Tester)
J-1448	Crankshaft Pilot Bearing Remover
J-21421-3	Use to Install Pull Rod Seal and Retainer
J-3062	Valve Guide Remover
J-3455	Cylinder Head Guide Studs
J-4476-01 & J-4476-31	Camshaft Bearing Remover and Installer
J-4530	Crankshaft Pilot Bearing Installer
J-5099	Valve Lifter Cleaning Brush
J-5158-2 & 3	Valve Guide Remover and Installer
J-5239	Connecting Rod Bolt Guide
J-5515	Spring Scale (Used for Fitting Piston)
J-6640	Black Light (Used for Checking Oil Leaks)
J-7583	Front Cover Crankshaft Oil Seal Remover
J-7584	Front Cover Crankshaft Oil Seal Installer
J-8037	Piston Ring Compressor
J-8092	Driver Handle - Used with J-4476-01 and J-4476-31
J-8568	Engine Jack
OTC-CF-11	Valve Spring Compressor

Fig. 3-68 Engine Tools

ENGINE

(30-31-32-33 SERIES)

CONTENTS OF SECTION 3

V-6 ENGINE

V-8 ENGINE

V-6 ENGINE

DESCRIPTION (Fig. 3-101)

A V-6 engine of 225 cubic inches displacement is standard equipment on 30-31 series cars.

The same basic engine is used for both Synchromesh and automatic transmissions. Both engines have a bore of 3.750 inches and a stroke of 3.400 inches. Synchromesh transmission engines are equipped with a cast iron flywheel and flywheel housing, while automatic transmission engines are equipped with a stamped steel flywheel which is bolted to the transmission. All V-6 engines have 9.0:1 compression ratio pistons.

ENGINE CONSTRUCTION

Cylinder Crankcase

The V-6 cylinder crankcase is cast iron. It has two banks of cylinders which form a 90° angle. The crankcase section extends below the centerline of the crankshaft to form a continuous flat surface with the rear bearing cap and timing chain cover, permitting installation of the oil pan with a one-piece gasket.

The left bank of cylinders (as viewed from the driver's seat) is set forward of the right bank so connecting rods of opposite pairs of pistons and rods may be connected to the same crankpin.

The cylinders in the left bank are numbered (from front to rear) 1-3-5. Cylinders in the right bank are numbered (from front to rear) 2-4-6.

Crankshaft and Bearings

The crankshaft is supported in the crankcase by steel-backed full precision bearings, all having the same nominal diameter. Except for the thrust bearing, all bearings are identical. The thrust bearing takes end thrust and has flanges for that purpose. Number 2 bearing is the thrust bearing.

Connecting Rods and Pistons

The lower end of each rod is fitted with a steel-backed full precision-type bearing. The piston pin is a press fit into the upper end. The outer ends of the piston pin are a slide fit in the piston.

Two compression rings and one oil control ring are located above the piston pin. The cast iron compression rings in the two upper grooves of the piston have a groove or bevel cut around the inner edge on one side.

Cylinder Heads

Cylinder heads are cast iron with valve stem guides cast in place. Right and left cylinder heads are identical and interchangeable. Although, in service, it is good practice to install the cylinder heads on the side from which they were removed.

Camshaft and Valve Mechanism (Figs. 3-102 & 3-103)

The camshaft is located above the crankshaft between the two banks of cylinders, where it is supported in five steel backed babbit bearings. It is driven at 1/2 crankshaft speed by sprockets and a single outside guide type chain.

The V-6 engine is equipped with timing chain dampers as shown in Fig. 3-102.

Hydraulic valve lifters and one piece push rods are used to operate overhead rocker arms and valves of both banks of cylinders from a single camshaft. This system requires no lash adjustment at time of assembly or in service. Construction and operation of hydraulic valve lifters are described later.

The rocker arms for each bank of cylinders are mounted on a tubular steel shaft supported on the cylinder head by die cast brackets.

The rocker arms are die cast aluminum with inserts at the push rod socket and the valve stem contact face. The rocker arms are offset slightly to accommodate the different planes of movement of the valves and the push rods. (Fig. 3-104)

Hydraulic Valve Lifters

In addition to its normal function of a cam follower, each hydraulic valve lifter also serves as an automatic adjuster which maintains zero lash in the valve operating linkage under all operating conditions.

As shown in Fig. 3-105, all parts of a hydraulic lifter are housed in the body, which is the cam follower. The body and the plunger are ground to very close limits, then a plunger is selectively fitted to each body to assure free movement with very little clearance. The push rod seat is free to move with the plunger in the body.

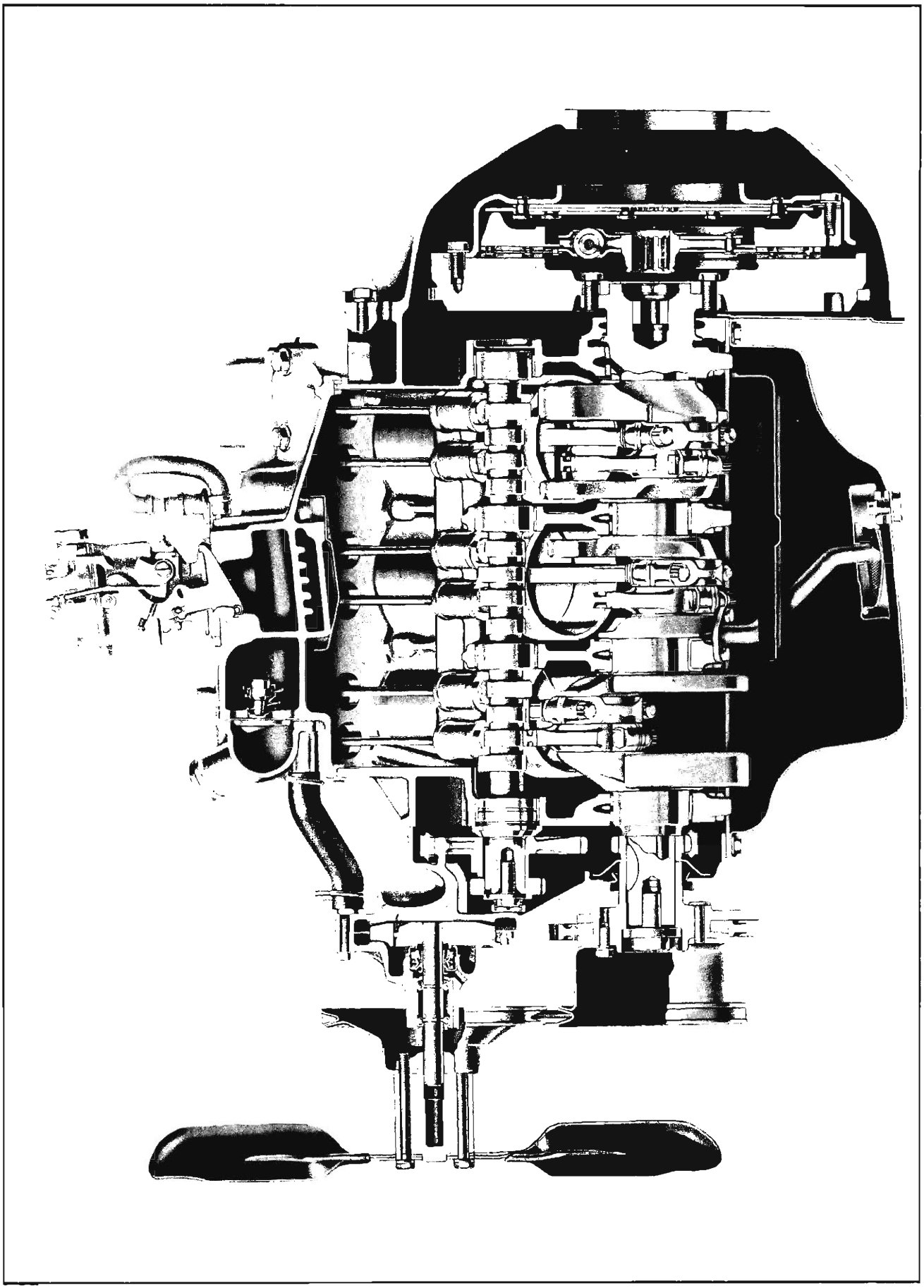


Fig. 3-101 Engine Side Sectional View

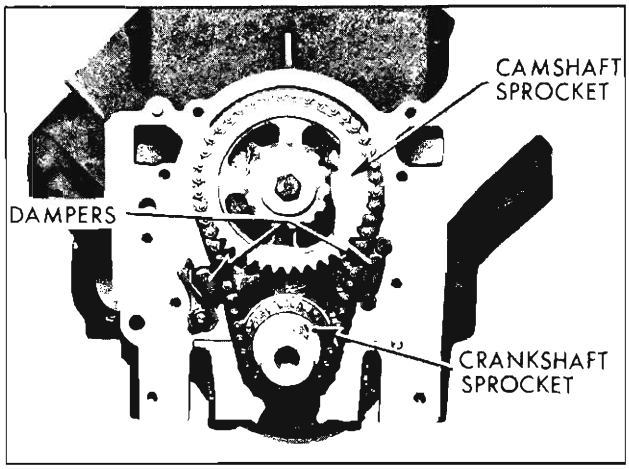


Fig. 3-102 Timing Chain and Sprockets

The plunger and seat are pressed toward the upper end of the lifter body by a coil spring which also holds a check ball retainer against the lower end of the plunger. When lifter is out of engine, a spring wire retainer holds all parts in the body. The ball retainer holds a spring loaded check ball in position over the lower end of a feed hole in the plunger. (Fig. 3-105)

When the valve lifter is installed in the engine, the push rod holds the seat and plunger downward and clear of the plunger retainer at all times. The plunger spring then presses the lifter body down against the camshaft and presses the plunger and seat up against the push rod with an eight

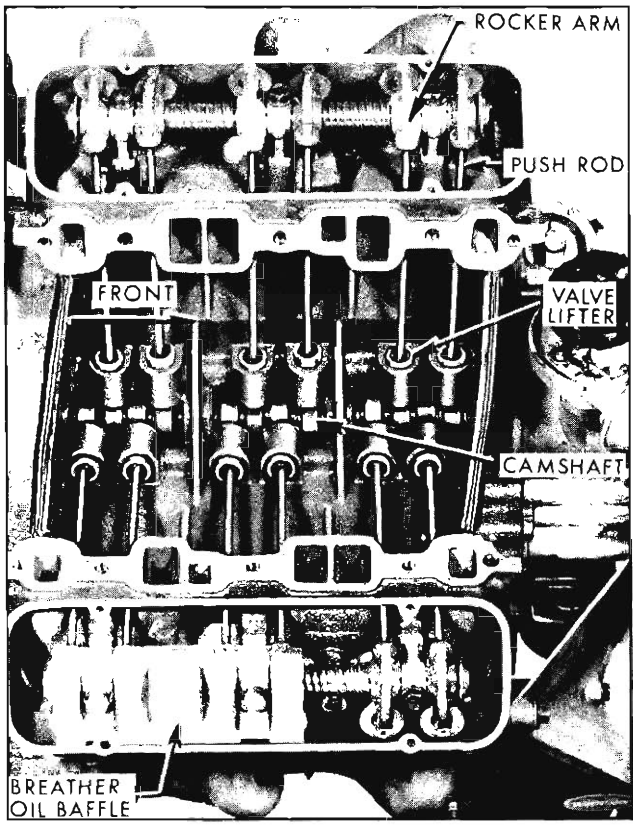


Fig. 3-103 Valve Mechanism

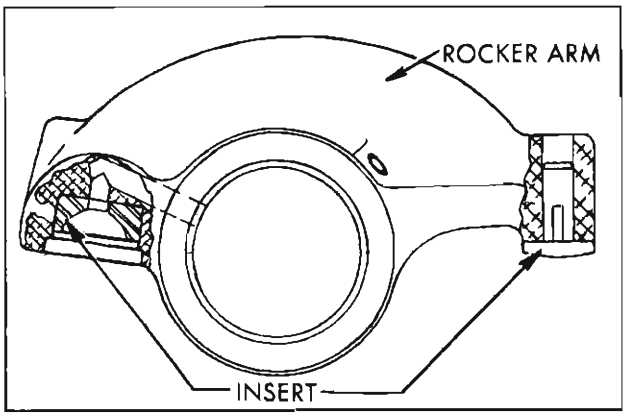


Fig. 3-104 Valve Rocker Arm

pound load, this is enough to take up all lash clearances between parts in the valve linkage without affecting positive seating of the valve.

Oil is fed to all lifters through galleys in the crankcase. Oil enters each lifter through grooves and oil holes in the lifter body and plunger, flows down into the chamber below the plunger through the feed hole and around the check ball. The first few cycles of operation after the engine is started forces out all air and completely fills the plunger and lower chamber of each lifter with oil.

At the start of a cycle of valve operation, the lifter body rests on the camshaft base circle.

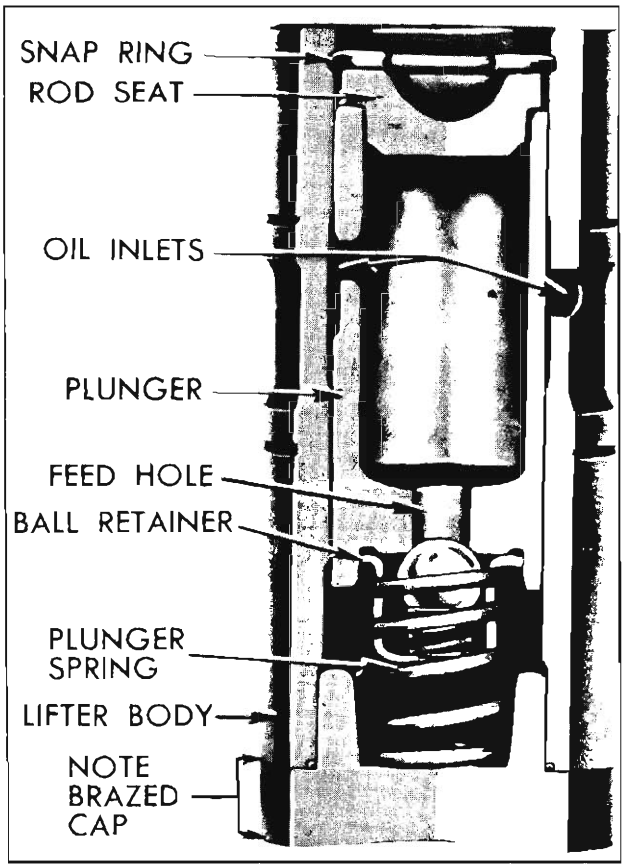


Fig. 3-105 Hydraulic Valve Lifter Sectional View

The plunger spring holds all lash clearances out of the valve linkage.

As the rotating camshaft starts raising the valve lifter body, the check ball spring and oil in the lower chamber, firmly seat the check ball against the plunger to prevent appreciable loss of oil from the lower chamber. The lifting force against the body is then transmitted through the entrapped oil to the check ball and plunger so that the plunger and push rod seat move upward with the body to operate the linkage which opens the engine valve.

As the camshaft rotates further to close the engine valve, the valve spring forces the linkage and lifter to follow the cam down. When the engine valve seats, the linkage parts and lifter plunger stop but the plunger spring forces the body to follow the cam downward .002" to .003" until it again rests on the camshaft base circle. Oil pressure against the check ball from the lower chamber ceases when the plunger stops and allows passage of oil past the check ball into the lower chamber to replace the slight amount of oil lost by "leak-down".

During the valve opening and closing operation a very slight amount of oil escapes through the clearance between plunger and body and returns to the crankcase. This slight loss of oil (called "leak-down") is beneficial in providing a gradual change of oil in the lifter, since fresh oil enters the lower chamber when pressure is relieved on the check ball at the end of each cycle of operation.

When engine temperature increases and the valve linkage parts expand, the plunger must move to a slightly lower position in the lifter body to assure full closing of the engine valve. When engine temperature decreases and the linkage parts contract, the plunger must move to a slightly higher position in body to prevent lash clearances in the valve linkage. In either case, the capacity of the lower chamber changes and the volume of oil present is automatically controlled by passage of oil through the plunger feed hole.

ENGINE LUBRICATION SYSTEM

The engine lubrication system is the force feed type in which oil is supplied under pressure to the crankshaft, connecting rods, camshaft bearings and valve lifters. Oil is supplied under controlled volume to the rocker arm bearings and push rods. All other moving parts are lubricated by gravity flow or splash.

Oil Supply

The supply of oil is carried in the oil pan which is filled through a filler opening in the left valve cover. The filler opening is covered by a combination filter and ventilating cap which contains a metal gauze to exclude dust. An oil dip stick on the left side of the crankcase is provided to check oil level.

Oil Pump

The oil pump is located in the timing chain cover where it is connected by a drilled passage in the cylinder crankcase to an oil screen housing and pipe assembly. The screen is submerged in the oil supply and has ample area for all operating conditions. If the screen should become clogged for any reason, oil may be drawn into the system over the top edge of the screen which is held clear of the sheet metal screen housing.

Oil is drawn into the pump through the screen and pipe assembly and a drilled passage in the crankcase which connects to drilled passages in the timing chain cover. All oil is discharged from the pump to the oil pump cover assembly. The cover assembly consists of an oil pressure relief valve, an oil filter by-pass valve and a nipple for installation of an oil filter. The spring loaded oil pressure relief valve limits the oil pressure to a maximum of 33 pounds per square inch. The oil filter by-pass valve opens when the filter has become clogged to the extent that 4-1/2 to 5 pounds pressure difference exists between the filter inlet and exhaust to by-pass the oil filter and channel unfiltered oil directly to the main oil galleys of the engine.

Oil Filter

A full flow oil filter is externally mounted to the oil filter cover nipple on the right side of the engine just below the Delcotron. Normally, all engine oil passes through the filter element, however, if the element becomes restricted, a spring loaded bypass valve opens as mentioned previously.

Main Oil Galleys

The main oil galleys run the full length of the crankcase and cut into the valve lifter guide holes to supply oil at full pressure to the lifters. Connecting passages drilled in the crankcase permit delivery of oil at full pressure to all crankshaft and camshaft bearings.

Crankshaft, Connecting Rods and Pistons

Holes drilled in the crankshaft carry oil from the crankshaft bearings to the connecting rod bearings. Pistons and cylinder walls are lubricated by oil forced through a small notch in the

bearing parting surface on the connecting rod, which registers with the hole in the crankpin once in every revolution. Piston pins are lubricated by splash.

Timing Chain and Sprockets

Drilled holes in the camshaft connect the front camshaft bearing journal to the keyslot in the front of the camshaft. Oil flows from the journal into the keyslot over the woodruff key in the space between the key and the camshaft sprocket and fuel pump eccentric.

The forward end of the fuel pump eccentric incorporates a relief which allows the oil to escape between the fuel pump eccentric and the camshaft distributor gear. The oil stream strikes the distributor shaft gear once each camshaft revolution and provides ample lubrication of the timing chain and sprockets by splash.

Rocker Arms, Valves, and Push Rods

The rocker arms and valves on each cylinder head are supplied with oil from the oil galleys through holes drilled in the front of the cylinder block and cylinder head. The hole drilled in the cylinder head ends beneath the front rocker arm shaft bracket. A notch cast in the base of the rocker arm shaft bracket allows the oil to flow up inside the bracket in the space between the bracket and bolt to the hollow rocker arm shaft which is plugged at both ends. Each rocker arm receives oil through a hole in the under side of the shaft. Grooves in the rocker arm provide lubrication of the bearing surface. Oil is metered to the push rod seat and valve stem through holes drilled in the rocker arm. Excess oil drains off and returns to the oil pan through passages in the cylinder head and block.

ENGINE COOLING SYSTEM

The engine cooling system is the pressure type with thermostatic control of coolant circulation.

The cooling system is sealed by a pressure type radiator filler cap which causes the system to operate at higher than atmospheric pressure. The higher pressure raises the boiling point of the coolant and increases the cooling efficiency of the radiator. The 15 pound pressure cap used raises the coolant boiling point approximately 46°.

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 predetermined strength which protects the radiator by relieving the pressure if the pressure should exceed that for which the radiator is designed.

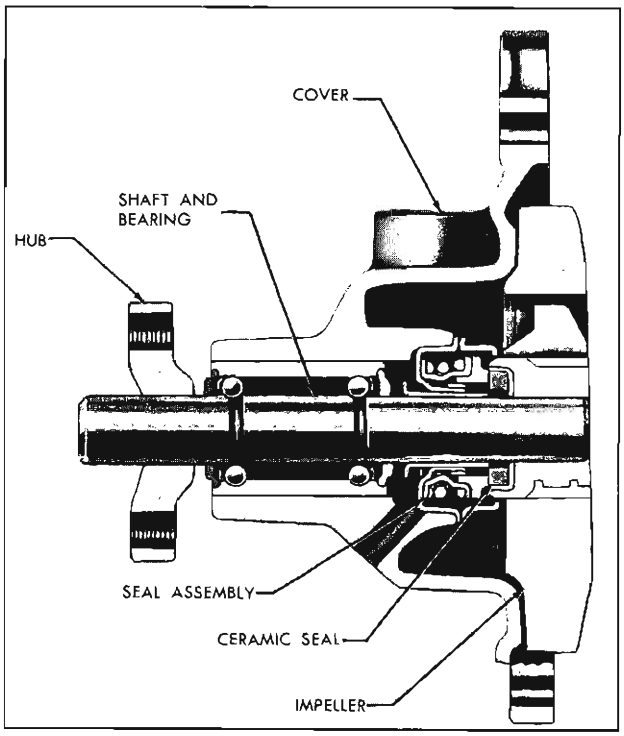


Fig. 3-106 Water Pump Cover

The vacuum valve is held against its seat by a light spring which permits opening of the valve to relieve vacuum created when the system cools off.

The coolant is circulated by a centrifugal pump mounted on the front cover which forms the outlet side of the pump. The engine fan and pulley(s) are bolted to the pump shaft hub at its forward end. Thus both the fan and pump are belt driven by a crankshaft pulley bolted to the harmonic balancer. The pump shaft and bearing assembly is pressed in the aluminum water pump cover. The bearings are permanently lubricated during manufacture and sealed to prevent loss of lubricant and entry of dirt. The pump is sealed against coolant leakage by a packless non-adjustable seal assembly mounted on the pump cover in position to bear against the impeller hub. The inlet pipe cast in the pump cover feeds into the passage formed by the cover and the front face of the impeller, which is mounted on the bearing shaft with the vanes facing rearward. Coolant flows through the inlet passage to the low pressure area at the center where it then flows rearward through three openings in the impeller. Vanes on the rotating impeller cause the coolant to flow radially outward through two discharge passages cast in the timing chain cover. These passages deliver an equal quantity of coolant to each cylinder bank water jacket. See Figs. 3-106 and 3-107.

The coolant then flows rearward through the water jacket which surrounds each cylinder barrel and extends below the lower limit of piston ring travel. After flowing the full length of the cylinder

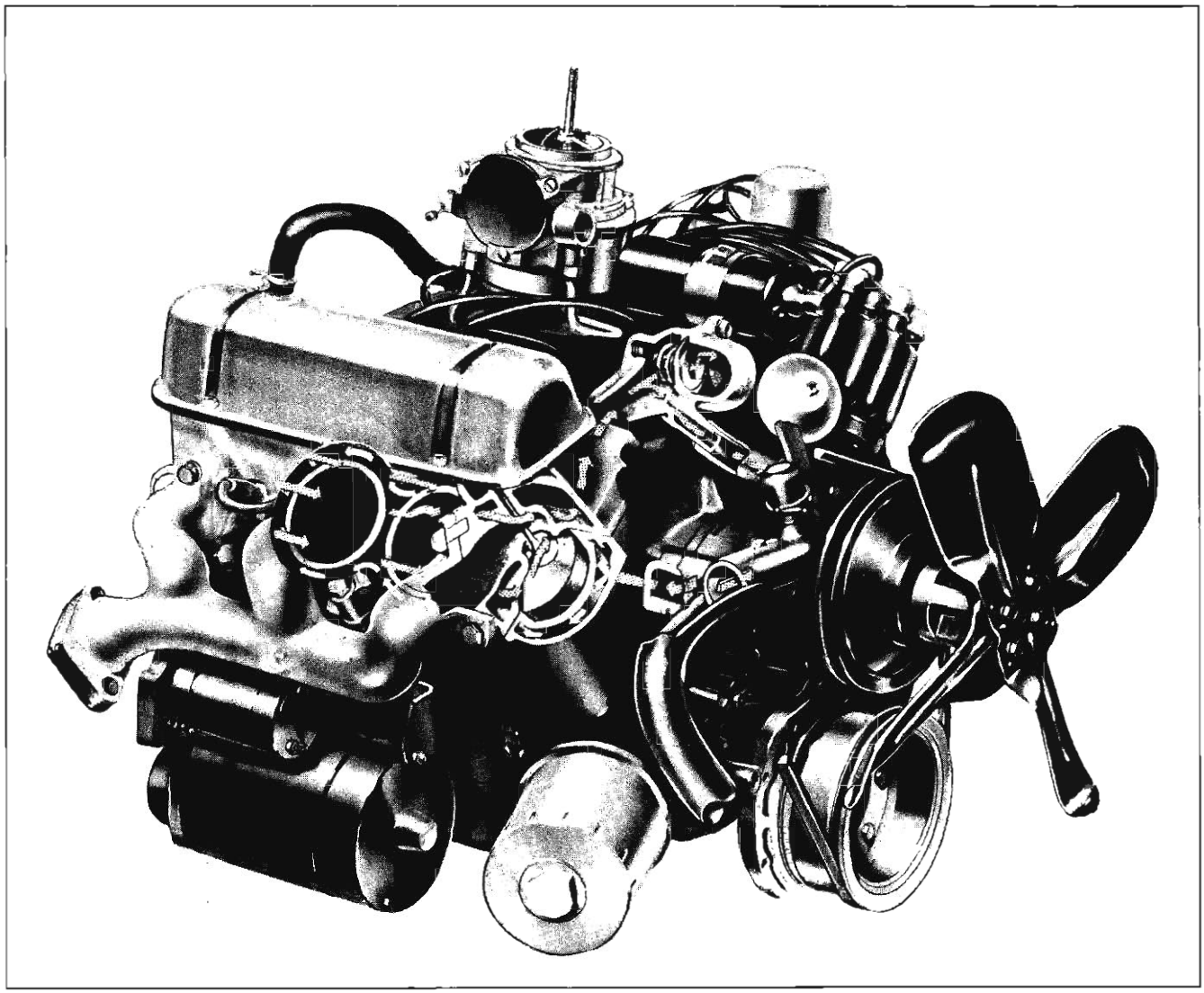


Fig. 3-107 Engine Coolant Flow

banks, the coolant flows up through openings to the rear of the cylinder bank into the cylinder heads. The coolant flows forward in the cylinder heads to cool the combustion chamber areas. At the forward end of the cylinder heads the coolant flows into the intake manifold.

Next, the coolant flows into the intake manifold water passage from the forward port of the cylinder heads to the thermostat housing and thermostat by-pass. A nipple in the mainfold allows connection of the heater hose. See Fig. 3-107.

A pellet type thermostat housed in the forward (outlet) end of the intake mainfold controls the circulation of water through the engine radiator. During cold engine operation when the thermostat is closed, a thermostat by-pass, open at all times, allows recirculation of coolant through the engine to provide rapid warm-up. When the thermostat opens, (177° - 182°F) coolant is directed to the upper tank of the radiator, through the radiator core and lower tank to the water pump inlet where the cycle is repeated.

Excessive Oil Consumption

If an engine is reported to be using an excessive amount of oil, a thorough inspection should be made for external leaks and the conditions of operation should be carefully considered before assuming that the engine is using too much oil as a result of an internal condition.

Place clean paper on the floor under engine and run the engine at medium speed until the oil is thoroughly warmed up, then stop the engine and check for oil leaks and dripping on the paper. Inspect both sides, front and rear ends of engine for wet spots. Pay particular attention to rocker arm cover, timing chain cover, and lower crankcase gaskets. All external leaks should be corrected and the results noted before attempting any internal correction.

The conditions of operation have an important bearing on oil consumption. The following points should be checked:

1. Improper reading of oil gauge rod. An erroneous reading will be obtained if car is not level, gauge rod is not pushed down against stop, or insufficient drain-back time (1 minute) is not allowed after stopping engine. An oversupply of oil may be added if gauge rod markings are not understood. The space between the "FULL" and "ADD" marks represent 1 quart.

2. Oil too light. The use of oil of lower viscosity than specified for prevailing temperatures will contribute to excessive oil consumption.

3. Continuous high speed driving. In any automobile engine, increased oil consumption per mile may be expected at speeds above 60 MPH.

4. High speed driving following slow speed town driving. When a car is used principally for slow speed town driving under conditions where considerable crankcase dilution occurs, a rapid lowering of oil level may occur when the car is driven for some distance at high speed. This is because the dilution from town driving is removed by the heat of the high speed driving. This condition is normal and should not be mistaken for excessive consumption.

5. Valve Guides worn. Excessive clearance between the valve stem and valve guide can result in high oil consumption.

6. Piston rings not worn in. A new engine, or an engine in which new rings have been installed, will require sufficient running time to wear in the rings against the cylinder walls. During the wear-in period a higher than average oil consumption rate is to be expected, and no attempt should be made to improve oil economy by replacing rings before the engine has been in service for at least 5000 miles.

EXCESSIVE VALVE NOISE

Checking Noise Level of Valve Mechanism

The noise level of the valve mechanism cannot be properly judged where the engine is below operating temperature when the hood is raised or when the valve rocker arm covers are removed.

Before attempting to judge valve noise level, the engine must be thoroughly warmed up (at least 20 minutes of operation at 1200 to 1500 RPM) to stabilize oil and coolant temperatures and bring all engine parts to a normal state of expansion. When the engine is warmed up, listen for engine noise while sitting in the drivers' seat with the hood closed. Run the engine at idle and at various higher speeds. It is advisable to observe the noise level in several engines that have been properly broken in, in order to develop good judgment for checking the noise level in any given engine.

Cause of Noise In Valve Mechanism

If the preceding check indicates the valve mechanism is abnormally noisy, remove the rocker arm covers so that the various conditions that cause noise may be checked. A piece of heater hose of convenient length may be used to pick out the particular valves or valve linkages that are causing abnormal noise. With the engine running at a speed where the noise is pronounced, hold one end of hose to an ear and hold other end about 1/2" from point of contact between rocker arm and valve stem. Mark or record the noisy valves for investigation of following causes.

1. Excessive Oil In Crankcase. Crankcase oil level high enough to allow the crankshaft to churn the oil will cause air bubbles in the lubricating system. Air bubbles entering the hydraulic lifters will cause erratic operation resulting in excessive lash in the valve linkage. Locate and correct cause of high oil level, then run engine long enough to expel air from system.

2. Sticking, Warped or Eccentric Valves, Worn Guides. Sticking valves will cause irregular engine operation or missing on a low speed pull and will usually cause intermittent noise.

   Pour penetrating oil over the valve spring cap and allow it to drain down the valve stem. Apply pressure to the one side of the valve spring and then the other, and then rotate the valve spring about 1/2 turn. If these operations affect the valve noise, it may be assumed that valves should be reconditioned.

3. Worn or scored parts in the valve train. Inspect rocker arms, push rod ends for scoring. Check push-rods for bends, valve lifters and camshaft surfaces for scoring. Replace faulty parts.

4. Valves and seats cut down excessively. Noisy and improper valve action will result if a valve and its seat have been refinished enough to raise the end of the valve stem approximately .050" above normal position. In this case it will be necessary to grind off the end of the valve stem or replace parts. The normal height of the valve stem above the

valve spring seat is 1.825".

5. Faulty Hydraulic Valve Lifters. If the preceding suggestions do not reveal the cause of noisy valve action, check operation of valve lifters.

Checking Hydraulic Valve Lifters

When checking hydraulic valve lifters, remember that grit, sludge, varnish or other foreign matter will seriously affect operation of these lifters. If any foreign substance is found in the lifters or engine where it may be circulated by the lubrication system, a thorough cleaning job must be done to avoid a repetition of lifter trouble.

To help prevent lifter trouble, the engine oil and oil filter must be changed as recommended.

When the car is delivered, faulty valve lifter operation usually appears under one of the following conditions:

1. Rapping noise only when engine is started. When engine is stopped, any lifter on a camshaft lobe is under pressure of the valve spring; therefore, leak down or escape of oil from the lower chamber can occur. When the engine is started a few seconds may be required to fill the lifter, particularly in cold weather. If noise occurs only occasionally, it may be considered normal requiring no correction. If noise occurs daily, however, check for (a) oil too heavy for prevailing temperatures (b) excessive varnish in lifter.

2. Intermittent Rapping Noise. An intermittent rapping noise that appears and disappears every few seconds indicates leakage at check ball seat due to foreign particles, varnish, or defective surface of check ball or seat. Recondition, clean, and/or replace lifters as necessary.

3. Noise on idle and low speed. If one or more valve lifters are noisy on idle and up to approximately 25 mph but quiet at higher speeds, it indicates excessive leakdown rate or faulty check ball seat on plunger. With engine idling, lifters with excessive leak-down rate may be spotted by pressing down on each rocker arm above the push-rod with equal pressure. Clean or replace noisy lifters.

4. Generally noisy at all speeds. Check for high oil level in crankcase. With engine idling, strike each rocker arm above push rod several sharp blows with a mallet; if noise disappears, it indicates that foreign material was keeping check ball from seating. Stop engine and place lifters on camshaft base circle. If there is lash clearance in any valve linkage, it indicates a stuck lifter plunger, worn lifter body lower end, or worn camshaft lobe.

5. Loud noise at normal operating temperature only. If a lifter develops a loud noise when engine is at normal operating temperature, but is quiet when engine is below normal temperature, it indicates an excessively fast leak-down rate or scored lifter plunger. Clean or replace lifter.

ENGINE VIBRATION OR NOISE

If unusual vibration or noise develops in the car, test first to determine whether the condition originates in the engine or in other operating units. Time will often be saved by checking the recent history of the car to determine whether the vibration became noticeable gradually or followed an accident or installation of repair parts.

Vibration or noise is usually more pronounced at a certain car speed. If the engine is run at the equivalent speed with car standing and transmission in neutral, the condition will still exist if the engine or clutch is at fault. If the trouble does not exist with engine running and car standing still, the engine is not at fault.

Engine Tune-Up

An engine which is not properly tuned will run rough and vibrate, particularly at idling and low speeds. A thorough engine tune-up operation is the proper correction.

Fan, Delcotron Belt(s) or Water Pump

Bent fan blades will cause vibration and noise. Remove fan belt and run engine. If vibration or noise is eliminated or reduced it indicates that the condition is caused by the fan, Delcotron, belt, or possibly the water pump. Check water pump for rough or noisy bearings and replace parts as necessary.

Inspect fan belt, all pulleys, balancer, fan blades and Delcotron for undercoating or other material that would cause an unbalanced condition.

Check fan blades for excessive runout and correct if necessary. Check all pulleys for abnormal runout or wobble and replace if necessary. Reinstall fan belt and adjust to proper tension.

With engine running, place one hand on Delcotron and slowly open throttle from idle to approximately 60 MPH. If Delcotron vibrates to create a noise in the car, it will vibrate enough to be felt by the hand. As the engine is slowly

speeded up the Delcotron may be felt to go into periods of vibration at different engine speeds. Noise caused by the Delcotron should occur at the same time that Delcotron vibration occurs.

Repair or replace a noisy Delcotron.

Engine Mountings

Vibration may be caused by loose, broken, or deteriorated engine mountings. Tighten loose mountings or replace faulty mountings.

Crankshaft Balancer

Loose or broken rivets in the crankshaft balancer may cause vibration in the engine. If the balancer is damaged in such a manner that the parts cannot function freely, extreme roughness will result which may eventually break the crankshaft. A balancer which shows evidence of damage or which is suspected of being inoperative should be replaced and the result noted, since it is not possible to test the balancer any other way.

Unbalanced Connecting Rods or Pistons

Vibration will result if connecting rods or pistons are installed which are not of equal weight with all other rods or pistons in engine. If new parts have recently been installed, these should be checked to determine whether they are standard parts or if they have been altered in weight by filing, machining or other repairs.

Unbalanced Clutch Assembly or Flywheel

Engine roughness may be caused by an unbalanced combination of clutch, flywheel and crankshaft even though these units are balanced individually during manufacture. Unbalance may occur if clutch or flywheel is removed without marking to allow reinstallation in original position.

Unbalanced Flywheel or Converter Pump

Vibration existing with Jetaway transmission may be due to unbalanced flywheel or converter pump.

COOLING SYSTEM TROUBLE DIAGNOSIS

Excessive Water Loss

If the radiator is filled too full when cold, expansion when hot will overfill the radiator and coolant will be lost through the overflow pipe. Adding unnecessary water will weaken the anti-freeze solution and raise the temperature at which freezing may occur.

The use of alcohol anti-freeze with a high temperature radiator thermostat will cause boiling and loss of coolant through the overflow pipe.

If the cooling system requires frequent addition of water in order to maintain the proper level in the radiator, check all units and connections in the cooling system for evidence of leakage. Inspection should be made with cooling system cold. Small leaks which may show dampness or dripping can easily escape detection when the engine is hot, due to the rapid evaporation of coolant. Tell-tale stains of grayish white or rusty color, or dye stains from anti-freeze, at joints in cooling system are almost always sure signs of small leaks even though there appears to be no dampness.

Air or gas entrained in the cooling system may raise the level in radiator and cause loss of coolant through the overflow pipe. Air may be drawn into the cooling system through leakage at the water pump seal. Gas may be forced into the cooling system through leakage at the cylinder head gasket even though the leakage is not sufficient to allow water to enter the combustion chamber. The following quick check for air leaks on suction side of pump or gas leakage from engine may be made with a piece of rubber tubing and a glass bottle containing water.

1. With cooling system cold, add water to bring coolant to proper level.
2. Block open the radiator cap pressure valve, or use a plain cap, and be sure radiator cap is on tight. Attach a suitable length of rubber hose to overflow pipe.
3. Run engine in neutral at a safe high speed until the engine reaches a constant operating temperature.
4. Without changing engine speed, put the free end of rubber hose into a bottle of water, avoiding kinks or low bends that might block the flow of air.
5. Watch for air bubbles in water bottle. A continuous flow of bubbles indicates that air is being sucked into the cooling system, or exhaust gas is leaking into the cooling system past the cylinder head gasket.

Overheating of Cooling System

It must be remembered that the Oldsmobile pressure system operates at higher temperatures than systems operating at atmospheric pressure. Depending on the pressure in cooling system, the

temperature of water or permanent type anti-freeze will go considerably above 212°F without danger of boiling.

In cases of actual overheating the following conditions should be checked:

1. Excessive water loss.
2. Slipping or broken fan belt.
3. Radiator thermostat stuck, radiator air passages clogged, restriction in radiator core, hoses, or water jacket passages.
4. Improper ignition timing.
5. Shortage of engine oil or improper lubrication due to internal conditions.
6. Dragging brakes.

CYLINDER HEAD AND VALVE SERVICE

Cylinder Head Removal

1. Drain radiator and cylinder block. Disconnect battery cable.
2. Remove air cleaner assembly. Disconnect all pipes and hoses from carburetor. Remove coil. Disconnect water temperature indicator wire from switch.
3. Disconnect accelerator linkage. Disconnect throttle return spring. Disconnect positive crankcase ventilator hose.
4. Slide front thermostat bypass hose clamp back on hose. Disconnect bypass hose at timing chain cover to allow coolant to drain from manifold. Disconnect upper radiator hose at outlet.
5. Disconnect heater hose at intake manifold.
6. Remove bolts attaching intake manifold to cylinder heads.
7. Remove intake manifold and carburetor as an assembly. Remove intake manifold gasket and seals.
8. Pull spark plug wire retainers from brackets on rocker arm cover. Disconnect spark plug wires at plugs and swing wires and retainer out of the way.

   Remove screws attaching rocker arm cover to cylinder head. On right side remove positive crankcase ventilator valve. Remove rocker arm cover and gasket. Remove rocker arm shaft bracket to cylinder head attaching bolts. Remove rocker arm and shaft assembly. Oil baffle is mounted under rear bolts on right rocker arm and shaft assembly.
10. Remove push-rods.

    NOTE: If lifters are to be serviced, remove them. Otherwise protect the lifters and camshaft from the entrance of dirt by covering the area with clean cloths.
11. Remove Delcotron mounting bracket and brace attaching bolts. Position Delcotron out of the way.
12. Remove power steering pump rear bracket to cylinder head attaching bolts.
13. If equipped with Jetaway transmission, remove filler tube support to exhaust manifold bolt.
14. Remove exhaust manifold to exhaust pipe bolts.
15. Remove cylinder head bolts.
16. Remove cylinder head with exhaust manifold attached.
17. If work is to be done on head, remove exhaust manifold on bench.

Reconditioning Valves and Guides

1. Place cylinder head on clean smooth surface.
2. Using suitable spring compressor, compress valve spring and remove cap retainers. Release tool and remove spring and cap.
3. Remove valves. Valves should be set aside so they may be re-installed in original location.
4. Remove carbon from combustion chamber of heads, using care to avoid scratching the head or the valve seats.
5. Clean carbon and gum deposits from valve guide bores.
6. Clean valves. Inspect valve faces and seats for pits, burned spots or other evidence of poor seating.
7. Grind or replace valves as necessary. If a valve head must be ground to a knife edge to obtain a true face, the valve should be replaced; as a sharp edge will run too hot. 45° is the correct angle for valve faces.
8. Valve stem guides are non-replaceable, due to being cast in place. If a valve stem has excessive clearance in its guide, the guide must be reamed .003" oversize, using Reamer

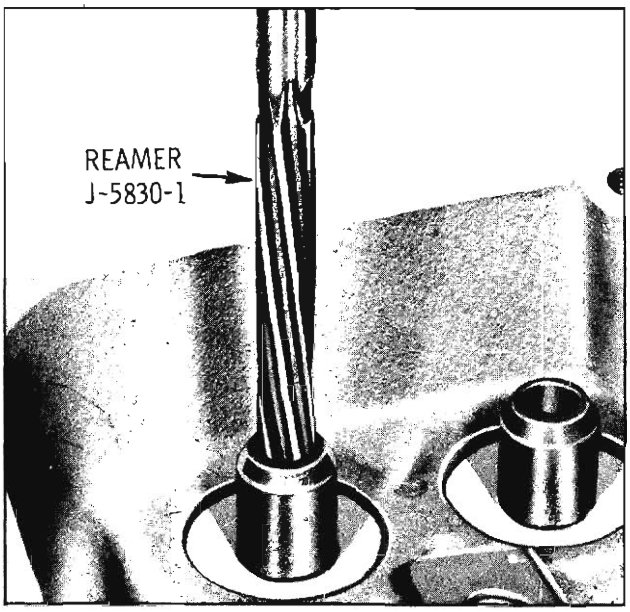


Fig. 3-108 Reaming Valve Guide

J-5830-1. (Fig. 3-108) Oversize valves (.003") are available.

9. True up valve seats to 45°. Cutting a valve seat results in lowering the valve spring pressure and increases the width of the seat. The nominal width of the valve seat is 1/16". If a valve seat is over 5/64" wide after truing up it should be narrowed to specified width by the use of 20° and 70° stones.

   Improper hydraulic valve lifter operation may result if valve and seat are refinished to the extent that the valve stem is raised more than .050" above normal height. In this case it will be necessary to replace parts.

   The normal height of the valve stem above the valve spring seat surface of the head is 1.825".

10. Lightly lap the valves into seats with fine grinding compound. The refacing and reseating operations should leave the refinished surfaces smooth and true so that a minimum of lapping is required. Excessive lapping will groove the valve face preventing a good seat when hot.

11. Test valves for concentricity with seats and for tight seating. The usual test is to coat the valve face lightly with Prussian blue and turn the valve against seat. If the valve seat is concentric with the valve guide a mark will be made all around the seat, while if the seat is not concentric with the guide, a mark will be made on only one side of the seat. Next, coat the valve seat lightly with Prussian blue. Rotate the valve against the seat to determine if the valve face is concentric with the valve stem, and if the valve is seating all the way around. Both of these tests are necessary to prove that a proper seat is being obtained.

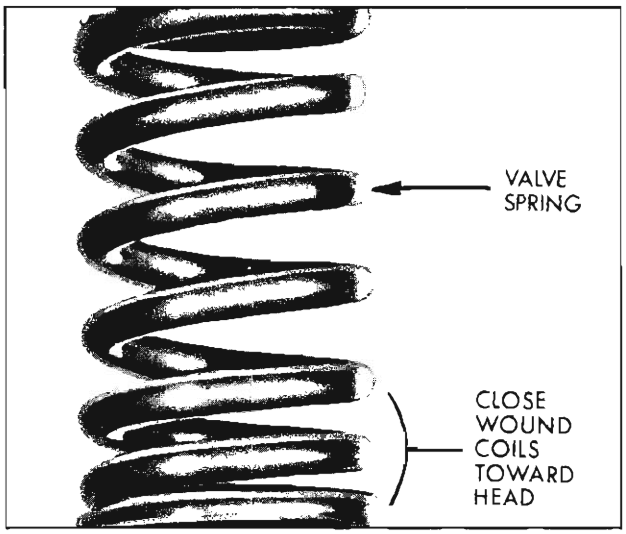


Fig. 3-109 Valve Spring

12. Lube stems and tips with engine oil and reinstall valves, valve springs, caps and cap retainers, using same equipment used for removal. Install valve spring with closely wound coils toward the cylinder head. (Fig. 3-109)

Replacement of Rocker Arms

1. Remove rocker arm and shaft assembly.

2. Remove cotter pin, plain washer and spring washer from each end of the rocker arm shaft.

3. Remove bracket bolts. Slide rocker arms and brackets off shaft.

4. Clean and inspect all parts, taking particular care to clean out all oil holes. Replace parts that are excessively worn.

5. Assemble springs, rocker arms and brackets on shaft. Take care that the assembly for the right side has the notch in the shaft forward and the left side has the notch to the rear.

6. Install spring washer, flat washer and cotter pin on each end of shaft in order named.

7. Install bolts with plain washers through the brackets and shaft so the notch in the right assembly is up and to the front and the notch in the left assembly is up and to the rear.

Installation of Cylinder Head

1. Wipe off engine block gasket surface and be certain no foreign material has fallen in the cylinder bores, bolt holes, or in the valve lifter area. It is good practice to clean out bolt holes with air.

2. Install new head gasket on cylinder block. Dowels in the block will hold the gasket in position. Always handle gaskets carefully to avoid kinking or damage to the surface treatment of the gasket. Do not use any type of sealing material on head gaskets. The gaskets are coated with a special lacquer to provide a good seal, once the parts have warmed up.

3. Assemble exhaust manifold to cylinder head. Torque bolts to 10-15 ft. lbs.

   NOTE: Jetaway transmission filler tube bracket fastens to rear bolt, right side.

4. Clean gasket surface of cylinder head and carefully set in place on the engine block dowel pins.

5. Clean and coat the head bolts with sealer. Install bolts as shown in Fig. 3-110.

6. Tighten the head bolts a little at a time about three times around in the sequence shown in Fig. 3-111, then torque the bolts in the same sequence to 65-70 ft. lbs.

Use an accurate torque wrench when installing head bolts and do not overtighten. Uneven tightening of the cylinder head bolts can distort the cylinder bores, causing compression loss and excessive oil consumption.

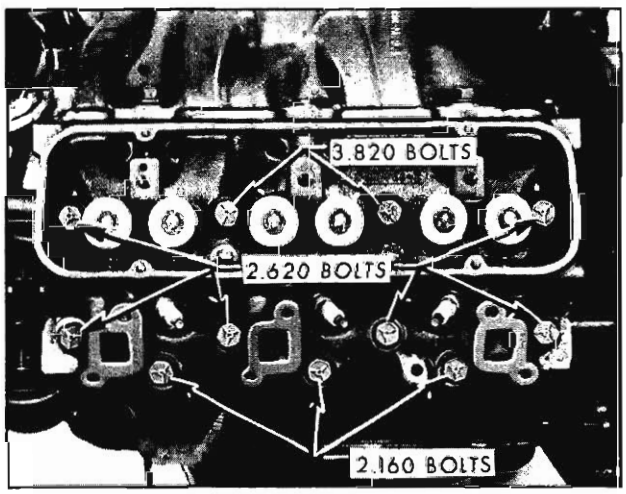


Fig. 3-110 Cylinder Head Bolt Installation

Installation of Rocker Arm and Shaft Assemblies

1. Install push-rods through cylinder head openings so rods are correctly positioned on lifter plungers.

2. Clean bases of rocker arm shaft brackets and bracket bosses on cylinder head.

3. Check notch on one end of rocker arm shaft. Be sure it is positioned correctly.

4. Tilt the rocker arms toward the push rods and locate the top of each push rod in its rocker arm seat.

5. Draw down the rocker arm and shaft assembly by tightening the bracket bolts a little at a time. Use a reliable torque wrench to torque the bracket bolts to 25-35 ft. lbs. Do not overtighten.

6. Install rocker arm cover and gasket. On right side connect positive crankcase ventilation.

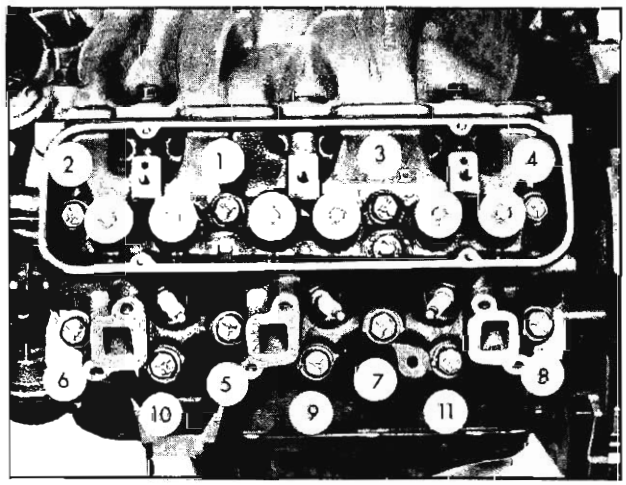


Fig. 3-111 Cylinder Head Bolt Tightening Sequence

7. Connect spark plug wires and set retainers in position on brackets.

VALVE SPRING REMOVAL AND INSTALLATION—HEAD INSTALLED

1. Remove valve cover and rocker arm assembly.

2. Install Tool BT-72-1-B into spark plug hole and use air to hold valves against their seat.

3. Using Tool BT-6413 compress valve spring as shown in Fig. 3-112 and remove valve cap retainers, valve cap and valve spring.

4. To install - reverse removal procedure.

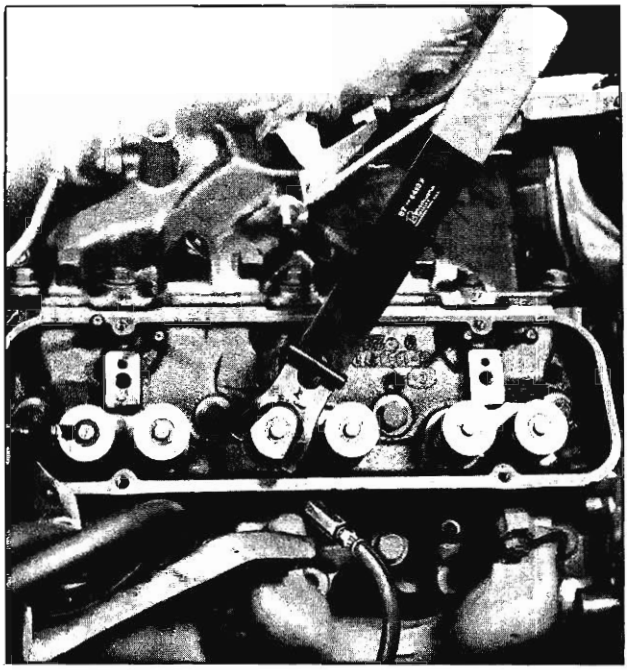


Fig. 3-112 Valve Spring Removal

Installation of Intake Manifold

1. Place new rubber manifold seal in position at front and rear rails of cylinder block. Be sure pointed ends of seal fit snugly against block and head. (Fig. 3-113)

2. Set intake manifold in place carefully and start two guide bolts on each side.

3. Lift the manifold slightly and slip the gaskets into position as shown in Fig. 3-114. Take care to see that the gasket is installed with the three intake manifold ports aligned with the head and manifold. The gasket should be installed as shown in Fig. 3-114 on the left side and reversed for right side installation.

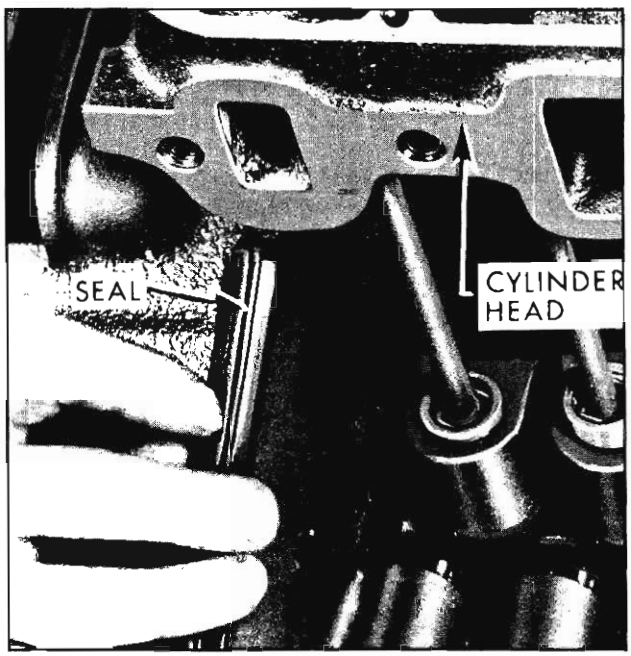


Fig. 3-113 Intake Manifold Seals

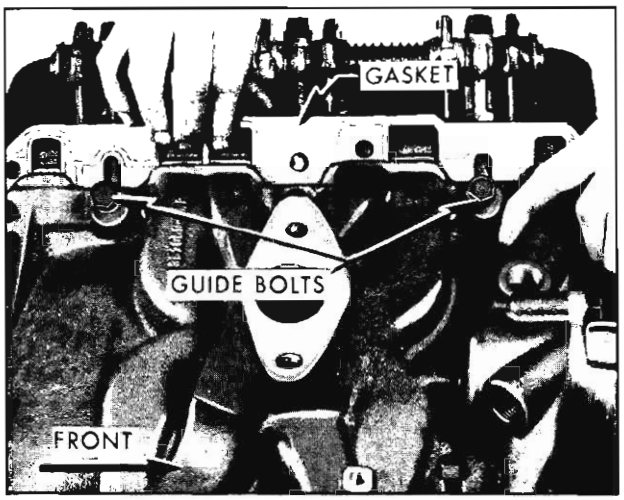


Fig. 3-114 Intake Manifold Gasket

4. Install manifold attaching bolt in open bolt hole as shown in Fig. 3-115. Open bolt hole is held to close tolerances and the bolt in this location serves to locate the manifold fore-and-aft.

5. Install remaining manifold to cylinder head bolts. Longer bolts at forward location. Torque bolts alternately and evenly to 25-35 ft. lbs.

HYDRAULIC VALVE LIFTER SERVICE

Removal of Valve Lifters

1. Clean dirt from cylinder heads and adjacent parts to avoid getting dirt into engine. It is extremely important to avoid getting dirt into the valve lifters.
2. Remove Intake Manifold.

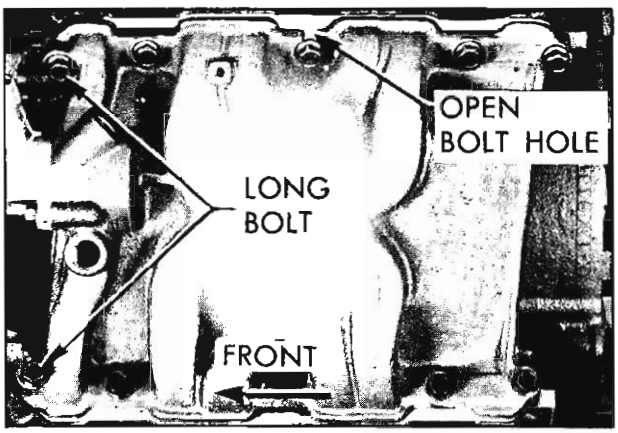


Fig. 3-115 Intake Manifold Installation

3. Remove Rocker Arm Covers and Rocker Arm and Shaft Assemblies.

4. Remove push-rods and remove valve lifters that require service. Place lifters in a wooden block having numbered holes or use other suitable means of identifying them according to original position in the engine.

5. If less than a complete set of lifters is being removed, immediately disassemble one or two for presence of dirt or varnish. If lifters contain dirt or varnish, it is advisable to remove all lifters for cleaning and inspection. Otherwise, it will be satisfactory to service only those lifters that are not operating properly.

6. Examine the cam contact surface at lower end of lifter body. If this surface is excessively worn, galled, or otherwise damaged, discard the lifter assembly. In this case also examine the mating camshaft lobe for excessive wear or damage.

Disassembly and Cleaning of Lifters

1. Disassemble each valve lifter by using a push-rod to hold down the push-rod seat while removing the plunger retainer from the lifter body. Remove push-rod seat and plunger from lifter body.

   NOTE: If a plunger sticks in lifter body place lifter in large end of Plunger Remover BT-6416, with plunger inward. While holding lifter with thumb, rap the open end of remover against a block of wood with just enough force to jar the plunger from body.

2. Drain oil out of body into waste can and remove the ball retainer, ball, ball spring, and plunger spring. A strainer placed over waste can will prevent dropping these parts into can.

3. Wash parts in a suitable cleaning solution and air dry.

Inspection of Hydraulic Lifter Parts

1. Lifter Body. Inspect inner and outer surfaces of body for blow holes and scoring. Replace lifter assembly if body is roughly scored or grooved, or has a blow hole extending through the wall in position to permit oil leakage from lower chamber. The prominent wear pattern just above lower end of body should not be considered a defect unless it is definitely grooved or scored; it is caused by side thrust of cam against body while the lifter is moving vertically in its guide.

   Inspect the cam contact surface on lower end of lifter body. Replace the lifter assembly if this surface is excessively worn, galled, or otherwise damaged. A lifter body that has been rotating will have a round wear pattern and a non-rotating lifter body will have a square wear pattern with a very slight depression near the center.

   Either condition is normal and such bodies may be continued in use if the surface is free of defects.

2. Lifter Plunger. Using a magnifying glass, inspect the 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 lifter 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 the body. This edge is not detrimental unless it is sharp or burred.

   A blackened appearance is not a defective condition. Sometimes the 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.

3. Push Rod and Seat. Replace the push rod seat if the area where the push rod contacts is rough or otherwise damaged. Replace any push rod having a rough or damaged ball end.

4. Check Ball. Using a magnifying glass, carefully examine the check ball for nicks, imbedded material or other defects which would prevent proper seating. Such defects would indicate the cause of intermittently noisy lifter

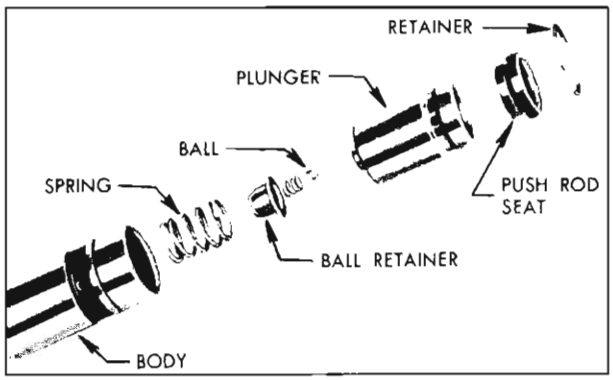


Fig. 3-116 Hydraulic Valve Lifter Parts

operation. Even though no defects are found it is always advisable to discard the old ball and use a new one when reassembling the lifter.

5. Check ball spring. Examine check ball spring for wear or damage. Replace any spring that is distorted or shows evidence of wear.

6. Ball Retainer. Replace a retainer which is cracked or which has a heavily pounded area between the two holes. A small bright spot where the ball contacts the retainer is the normal condition.

7. Plunger Spring. Replace the plunger spring only if it is distorted or damaged. Exhaustive tests have shown that plunger springs seldom break down in service.

Assembly and Valve Lifter Leak-Down Test (Fig. 3-116)

IMPORTANT: Lifters must be assembled while submerged in Hydraulic Lifter Test Fluid BT-59 and leak-down tested before placing into service.

1. Install Adapter 105-2 in reservoir of Tester BT-60, then fill reservoir with Hydraulic Lifter Test Fluid BT-59, 1/2" below top of reservoir.

2. Assemble ball check and retainer into plunger. Make sure retainer flange is pressed tight against bottom of recess in plunger.

3. Install plunger spring over ball check retainer.

4. Hold plunger with spring up and insert into lifter body. Hold plunger vertical to prevent cocking spring.

5. Place assembly into the tester cup then position push rod seat onto plunger.

6. Position the 1/4" steel test ball on the push rod seat. Lower tester ram until it contacts the steel ball.

7. Allow ram to move downward by its own weight until air bubbles disappear.

8. Raise ram, then allow to lower as in Step 7.

   Repeat this procedure several times or until all air is expelled from lifter.

   CAUTION: Do not attempt to expel air from lifter by pumping on ram.

9. After all air is expelled, allow ram to bleed down lifter until retaining groove is exposed.

10. Install retaining ring.

11. Adjust ram screw so that it contacts the steel ball in the push rod seat when the pointer is at the start line.

12. Raise arm, then start test by resting ram on steel ball. Rotate reservoir one revolution every 2 seconds and time the indicator from the start to the stop line. (Fig. 3-117) Allowable tolerance for leak-down rate is 12 to 60 seconds.

13. If leak-down tolerance is within specifications, the lifter can be placed in service without removing test fluid.

Installation of Valve Lifters

Make certain that valve lifter guide holes and adjacent area of cylinder block are clean, then liberally lubricate the camshaft and lifter bores with engine oil and install valve lifters. Each lifter must slide freely in its guide hole.

Complete the installation of all parts by reversing the procedure for removal.

TIMING CHAIN, COVER AND CAMSHAFT SERVICE

Timing Chain Cover Removal

1. Drain radiator and block.
2. Disconnect upper radiator hose and heater return hose at water pump, disconnect lower radiator hose. Remove attaching bolts and brackets and remove radiator core.
3. Remove fan, fan pulleys and belt(s).

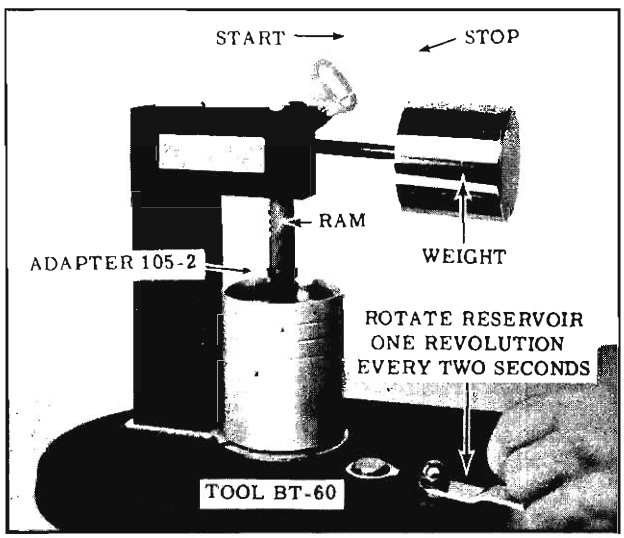


Fig. 3-117 Valve Lifter Bleed Down Test

4. Remove crankshaft pulley and pulley reinforcement.
5. Remove harmonic balancer to crankshaft bolt and washer. Remove harmonic balancer. It may be necessary to tap the balancer with a plastic mallet to start it off the crankshaft.
6. If car is equipped with power steering, remove steering pump bracket bolts attached to timing chain cover and loosen or remove other bolts to allow the brackets and pump to be moved out of the way.
7. Disconnect fuel lines and remove fuel pump.
8. Remove Delcotron and brackets.
9. Remove distributor cap and pull spark plug wire retainers off brackets on rocker arm cover. Swing distributor cap, with wires attached, out of the way. Disconnect distributor primary lead.
10. Remove distributor. If timing chain and sprockets are not going to be disturbed, note position of distributor rotor for reinstallation in same position.
11. Loosen and slide front clamp on thermostat bypass hose rearward.
12. Remove bolts attaching timing chain cover to cylinder block. Remove two oil pan to timing chain cover bolts. Remove timing chain cover assembly and gasket. Thoroughly clean the cover, taking care to avoid damage to the gasket surfaces.

Crankshaft Oil Seal Replacement

1. Remove front cover.
2. Lay front cover flat on bench.
3. Remove seal retainer with drift. (Fig. 3-118)

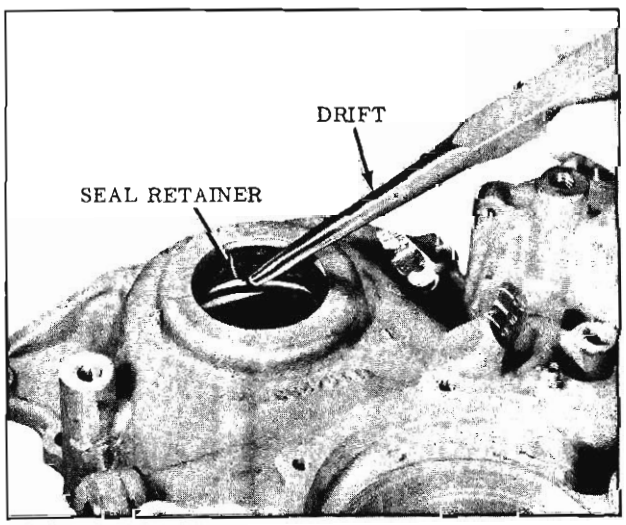


Fig. 3-118 Removing Front Oil Seal

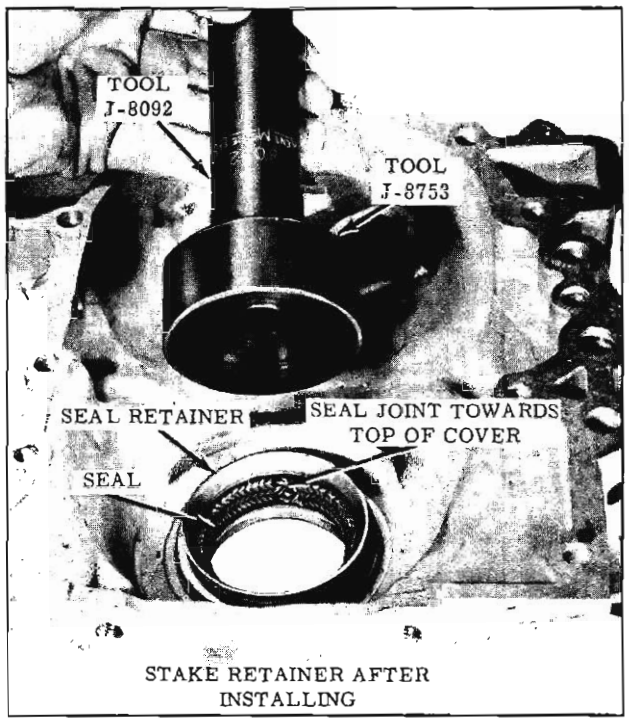


Fig. 3-119 Installing Front Seal

4. Assemble seal in retainer.
5. Support front cover on block of wood. Apply P.O.B. No. 4 sealer to outside of seal retainer.
6. Place seal and retainer in cover with seal joint towards top of cover, and install with Tool J-8753 until seated. Stake retainer securely. (Fig. 3-119)
7. Place Tool J-8753-2 in seal and push tool a little at a time from both sides of the seal until tool goes through seal. (Fig. 3-120)

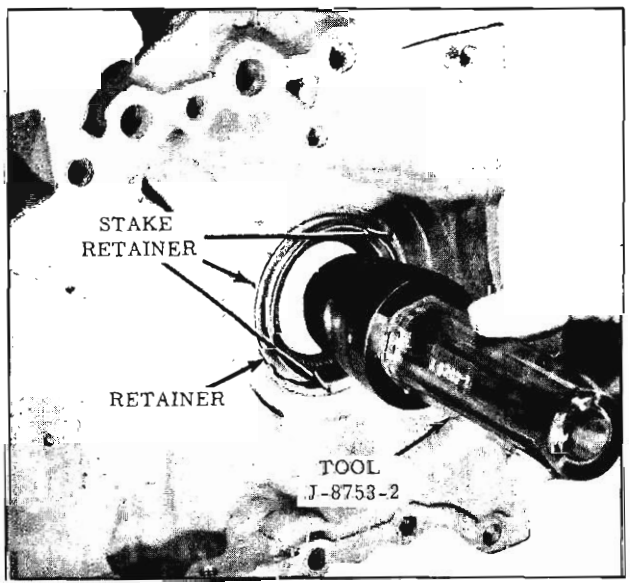


Fig. 3-120 Sizing Front Oil Seal

Timing Chain Cover Replacement

Reinstall timing chain cover by reversing removal procedure, paying particular attention to the following points.

1. Remove oil pump cover and pack the space around the oil pump gears completely full of petroleum jelly. There must be no air space left inside the pump. Reinstall cover using new gasket. This step is very important as the oil pump may "lose its prime" whenever the pump, pump cover or timing chain cover is disturbed. If the pump is not packed, it may not begin to pump oil as soon as the engine is started.

2. The gasket surface of the block and timing chain cover must be smooth and clean. Use a new gasket and be certain it is positioned correctly.

3. Position timing chain cover against block and be certain dowel pins engage dowel pin holes before starting bolts.

4. Lube the bolt threads before installation.

   NOTE: If the car is equipped with power steering the front steering pump bracket should be installed at this time.

5. Lube the OD of the harmonic balancer before installation to prevent damage to the seal during installation and when the engine is first started.

Timing Chain and Sprocket Removal

1. With timing chain cover removed, temporarily install harmonic balancer bolt and washer in end of crankshaft. Turn crankshaft so sprockets are positioned as shown in Fig. 3-121. Doing so will make it easier to reinstall parts. Remove harmonic balancer bolt and washer using a sharp rap on the wrench handle to start the bolt out without changing position of sprockets.

   NOTE: It is not necessary to remove timing chain dampers unless they are worn or damaged and require replacement.

2. Remove front crankshaft oil slinger.

3. Remove bolt and special washer retaining camshaft distributor drive gear and fuel pump eccentric to camshaft forward end. Slide gear and eccentric off camshaft.

4. Use two large screwdrivers to alternately pry the camshaft sprocket then the crankshaft sprocket forward, until the camshaft sprocket is free, then remove the camshaft sprocket and chain and finish working crankshaft sprocket off crankshaft.

5. Thoroughly clean the timing chain, sprockets, distributor drive gear, fuel pump eccentric and crankshaft oil slinger.

Timing Chain and Sprocket Installation

1. Turn crankshaft so number one piston is at top dead center.

2. Turn camshaft so with sprocket temporarily installed, timing mark is straight down. See Fig. 3-121. Remove sprocket.

3. Assemble timing chain on sprockets and slide the sprocket and chain assembly on the shafts with the timing marks in their closest together position and in line with the sprocket hubs. (Fig. 3-121)

   NOTE: It will be necessary to hold spring loaded timing chain damper out of the way while sliding chain and sprockets into position.

4. Assemble slinger on crankshaft with ID against sprocket. (Concave side toward front of engine.)

5. Slide fuel pump eccentric on camshaft and key with oil groove forward. See Fig. 3-122.

6. Install distributor drive gear. See Fig. 3-122.

7. Install drive gear and eccentric bolt and retaining washer. Torque to 40-45 ft. lbs.

8. Reinstall timing chain cover.

Camshaft Replacement

1. Remove rocker arm and shaft assemblies, push rods and valve lifters.

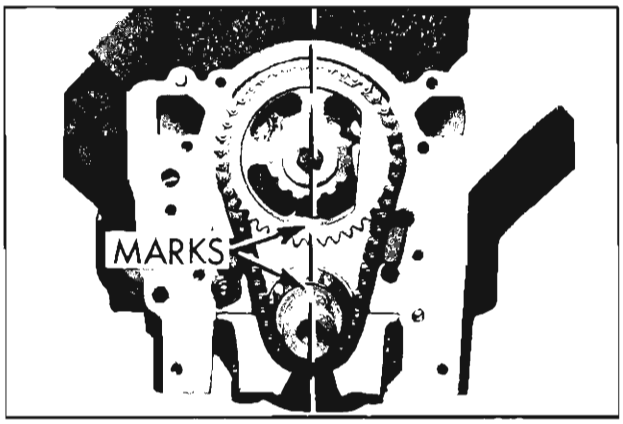


Fig. 3-121 Timing Chain and Sprockets

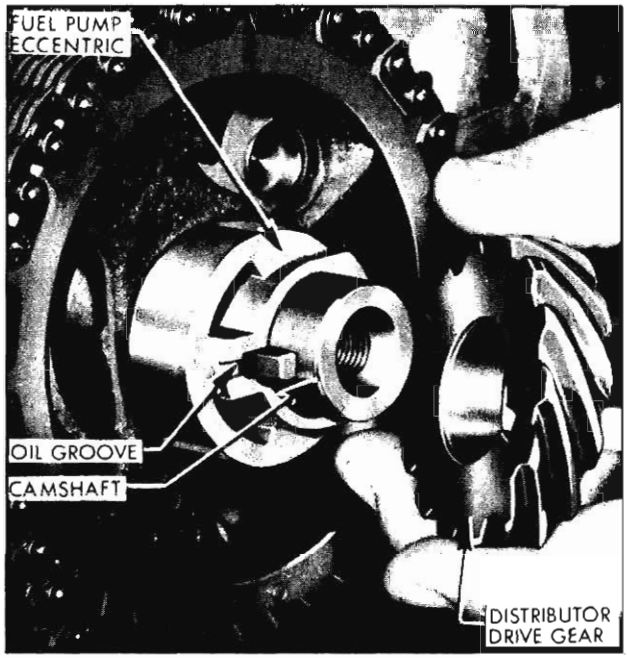


Fig. 3-122 Fuel Pump Eccentric

2. Remove timing chain cover, timing chain and sprocket.
3. Slide camshaft forward out of bearing bores carefully to avoid marring the bearing surfaces.
4. Replace camshaft by reversing removal procedure, taking particular care to avoid damage to the camshaft bearings.

Camshaft Bearings

The steel-backed babbit-lined camshaft bearings are pressed into the crankcase. Going from front to rear, each bearing is bored .030" smaller than the preceding bearing, and each camshaft journal is correspondingly reduced in diameter.

Slightly scored camshaft bearings will be satisfactory if the surfaces of camshaft journals are polished and bearings are cleaned up to remove burrs, and the fit of the shaft in bearings is free and within the clearance limits of .0015" to .004".

REMOVAL AND INSPECTION OF OIL PAN, OIL PUMP PIPE AND SCREEN ASSEMBLY

1. Raise car and support on stands.
2. Drain oil.
3. Remove lower flywheel housing bolts. Remove housing.
4. Remove oil pan bolts and lower oil pan enough to remove oil pump pipe and screen to cylinder block bolts. (Fig. 3-122A)

   NOTE: On Synchromesh it will be necessary to raise engine.

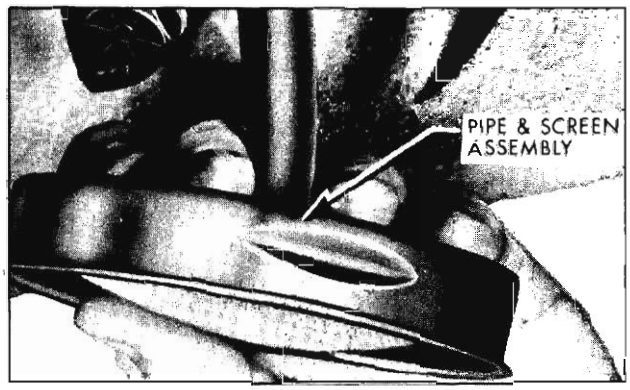


Fig. 3-122A Oil Pump Pipe and Screen Assembly

5. Rotate crankshaft to provide maximum clearance at forward end of oil pan. Move front of pan to the right and lower pan.
6. Clean oil pan. Pry screen out of housing and examine for evidence of clogging due to deposit of sludge or other foreign material.
7. Clean the screen and housing thoroughly in solvent and blow dry with air stream.
8. Snap screen into housing.

Install by reversing removal procedure, paying particular attention to the following points.

1. Make sure oil pump pipe flange gasket surface of block is smooth and free of dirt.
2. Use a new gasket and tighten bolts to 10-15 ft. lbs. torque.
3. Tighten pan bolts evenly. Do not over tighten.

OIL PUMP SERVICE

Removal of Oil Pump Cover and Gears

1. Remove oil filter.
2. Disconnect wire from oil pressure indicator switch in filter bypass valve cap.
3. Remove screws attaching oil pump cover assembly to timing chain cover. Remove cover assembly and slide out oil pump gears.

Inspection

1. Wash off gears and inspect for wear, scoring, etc. Replace any unsatisfactory gears.
2. Remove the oil pressure relief valve cap, spring and valve. (Fig. 3-123). Oil filter bypass valve and spring are staked in place and should not be removed.
3. Wash the parts thoroughly and inspect the relief valve for wear or scoring. Check the

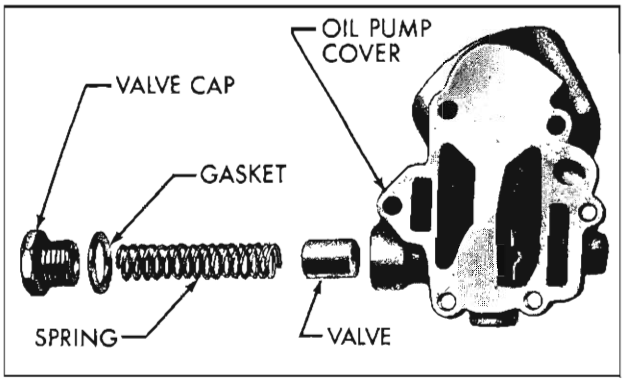


Fig. 3-123 Oil Pump Cover

relief valve spring to see that it is not worn on its side or collapsed. Replace any relief valve spring that is questionable. Thoroughly clean the screen staked in the cover.

4. Check the relief valve in its bore in the cover. The valve should have no more clearance than an easy slip fit. If any perceptible side shake can be felt, the valve and/or the cover should be replaced.

5. Check filter bypass valve for cracks, nicks, or warping. The valve should be flat and free of nicks or scratches.

Assembly and Installation

1. Lubricate and install pressure relief valve and spring in bore of oil pump cover. (Fig. 3-123) Install cap and gasket. Torque cap to 25-35 ft. lbs. with a reliable torque wrench. Do not over-tighten.

   NOTE: PRESSURE RELIEF VALVE CAP HAS NO HOLE TAPPED FOR INSTALLATION OF OIL PRESSURE SWITCH.

2. Install oil pump gears and shaft in oil pump body section of timing chain cover to check gear end clearance.

3. Place a straight edge over the gears and measure the clearance between the straight edge and the gasket surface. Clearance should be between .0023" and .0058". If clearance is less than .0023" check timing chain cover gear pocket for evidence of wear. (Fig. 3-124)

4. If gear end clearance is satisfactory, remove gears and pack gear pocket full of petroleum jelly. Do not use chassis lube!!!

5. Reinstall gears so petroleum jelly is forced into every cavity of the gear pocket and between the teeth of the gears. Place new gasket in position. (Fig. 3-125)

   NOTE: THIS STEP IS VERY IMPORTANT. UNLESS THE PUMP IS PACKED WITH PETROLEUM JELLY, IT MAY NOT PRIME ITSELF WHEN THE ENGINE IS STARTED.

6. Install cover assembly screws. Tighten alternately and evenly. The torque specification is 8-12 ft. lbs.

7. Install filter on nipple.

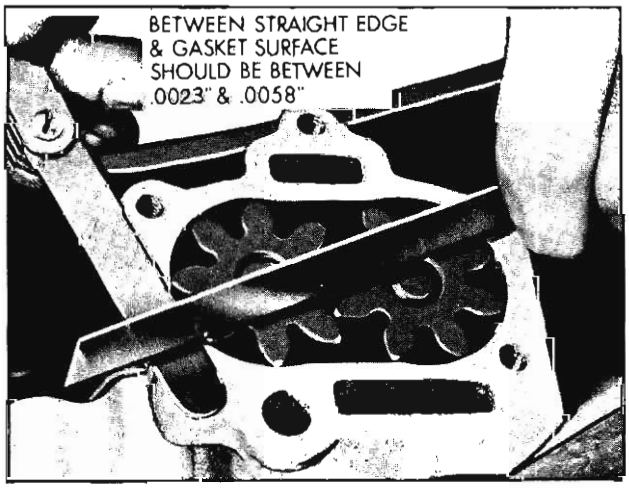


Fig. 3-124 Checking End Clearance

REPLACEMENT OF CONNECTING ROD BEARINGS

A connecting rod bearing consists of two halves or shells which are alike and interchangeable in rod and cap. When the shells are placed in rod and cap the ends extend slightly beyond the parting

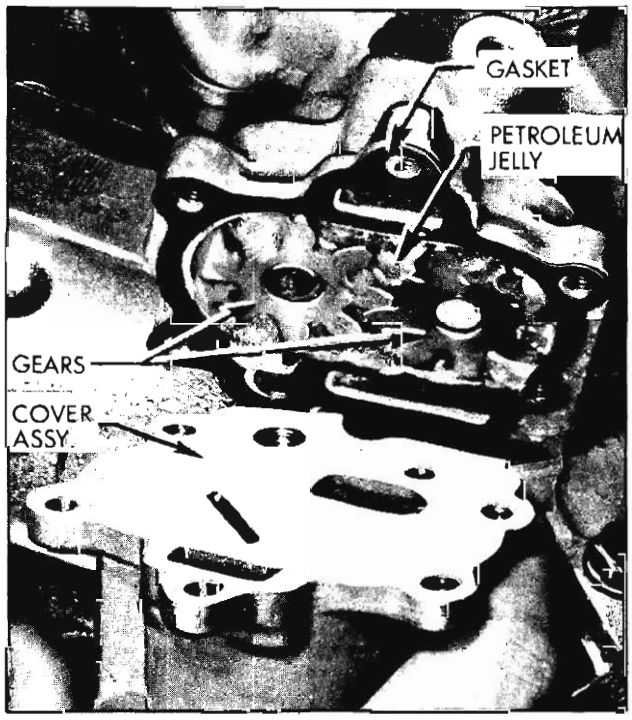


Fig. 3-125 Packing Oil Pump

surfaces so that when rod bolts are tightened the shells will be clamped tightly in place to insure positive seating and to prevent turning. The ends of shells must never be filed flush with parting surface of rod or car.

If a connecting rod bearing becomes noisy or is worn so that clearance on crankpin is excessive, a new bearing of proper size must be selected and installed since no provision is made for adjustment.

Inspection of Connecting Rod Bearings and Crankpin Journals

After removal of oil pan, disconnect two connecting rods at a time from crankshaft and inspect the bearings and crankpin journals. While turning crankshaft it is necessary to temporarily reconnect the rods to crankshaft to avoid possibility of damaging the journals through contact with loose rods.

If connecting rod bearings are chipped or scored they should be replaced. If bearings are in good physical condition check for proper clearance on crankpin as described below.

If crankpin journals are scored or ridged the crankshaft must be replaced, to insure satisfactory life of connecting rod bearings. Slight roughness may be polished out with fine grit polishing cloth thoroughly wetted with engine oil. Burrs may be honed off with a fine oil stone.

Use an outside micrometer to check crankpins for out-of-round. If crankpins are more than .0015" out-of-round, satisfactory life of new bearings cannot be expected.

Checking Clearance and Selecting Replacement Bearings

Service bearings are furnished in standard size and several undersizes.

The clearance of connecting rod (and crankshaft) bearings may be checked by use of Plastigage.

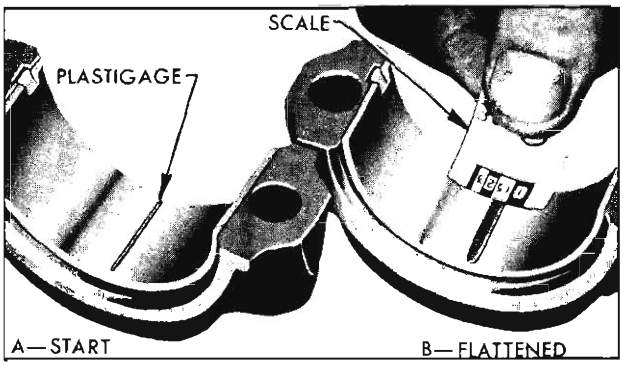


Fig. 3-126 Checking Bearing Clearance

1. Remove connecting rod cap with bearing shell. Wipe oil from bearing and crankpin journal.

2. Place a piece of Plastigage lengthwise along the bottom center of the lower bearing shell (Fig. 3-126, View A), then install cap with shell and tighten bolt nuts to 30-35 ft. lbs. torque.

   NOTE: The rib on edge of cap and the conical boss on web of rod must be toward rear of engine on all rods in left bank and toward front of engine in right bank.

3. DO NOT TURN CRANKSHAFT with Plastigage in bearing.

4. Remove bearing cap with bearing shell, the flattened Plastigage will be found adhering to either the bearing shell or the crankpin. Do not remove it.

5. Using the scale printed on the Plastigage envelope, measure the flattened Plastigage at its widest point. The number within the graduation which most closely corresponds to the width of Plastigage indicates the bearing clearance in thousandths of an inch. See Fig. 3-126, View B.

6. The desired clearance with a new bearing is .0002" to .0023". If bearing has been in service it is advisable to install a new bearing if the clearance exceeds .003"; however, if bearing is in good condition and is not being checked because of bearing noise, it is not necessary to replace the bearing.

7. If a new bearing is being selected, try a standard size, then each undersize bearing in turn until one is found that is within the specified limits when checked for clearance with Plastigage.

   NOTE: Each undersize bearing shell has a number stamped on outer surface on or near the tang to indicate amount of undersize.

8. After the proper size bearing has been selected, clean off the Plastigage, oil the bearing thoroughly, reinstall cap with bearing shell and tighten bolt nuts to 30-35 ft. lbs. torque.

9. With selected bearing installed and bolts tightened, it should be possible to move connecting rod freely back and forth on crankpin as allowed by end clearance. If rod cannot be moved, either the bearing is too much undersize or a misaligned rod is indicated.

REPLACEMENT OF CRANKSHAFT BEARINGS

A crankshaft bearing consists of two halves or shells which are not alike and not interchangeable in cap and crankcase. The upper (crankcase) half of the bearing is grooved to supply oil to the connecting rod bearings while the lower (bearing cap) half of the shell is not grooved. The two bearing halves must not be interchanged. All crankshaft bearings except the thrust bearing are identical. The thrust bearing is longer and flanged to take end thrust. When the shells are placed in crankcase and bearing cap, the ends extend slightly beyond the parting surfaces so that when cap bolts are tightened the shells will be clamped tightly in place to insure positive seating and to prevent turning. The ends of shells must never be filed flush with parting surface of crankcase or bearing cap.

If the thrust bearing shell is disturbed or replaced it is necessary to line up the thrust surfaces of the bearing shell before the cap bolts are tightened. To do this, move the crankshaft fore and aft the limit of its travel several times with the bearing cap bolts finger tight.

Crankshaft bearings are the precision type which do not require reaming to size or other fitting. Shims are not provided for adjustment since worn bearings are readily replaced with new bearings of proper size. Bearings for service replacement are furnished in standard size and undersizes. Under no circumstances should crankshaft bearing caps be filed to adjust for wear in old bearings.

Inspection of Crankshaft Bearings and Crankshaft

After removal of oil pan, oil pump pipe and screen, perform the following removal, inspection and installation operations on each crankshaft bearing in turn so that the crankshaft will be well supported by the other bearings.

NOTE: If crankshaft has been removed to check straightness the following procedure is suggested.

Rest crankshaft on "veeblocks" at number one and number five main bearing journals. Check indicator runout at No. 2, 3 and 4 main bearing journals. Total indicator readings at each journal should not exceed .003".

While checking runout at each journal note relation of "high" spot (or maximum eccentricity) on each journal to the others. "High" spot on all journals should come at the same angular location. If "high" spots do not come at nearly the same angular location, crankshaft has a "crook" or "dogleg" in it and is unsatisfactory for service.

1. Since any service conditions which affects the crankshaft bearings may also affect the connecting rod bearings, it is advisable to inspect connecting rod bearings first. If crankpins are worn to the extent that crankshaft should be replaced, replacement of crankshaft bearings only will not be satisfactory.
2. Remove one bearing cap, then clean and inspect lower bearing shell and the crankshaft journal. If journal surface is scored or ridged, the crankshaft must be replaced to insure satisfactory operation with new bearings. Slight roughness may be polished out with fine grit polishing cloth thoroughly wetted with engine oil, and burrs may be honed off with a fine stone.
3. If condition of lower bearing shell and crankshaft journal is satisfactory, check the bearing clearance with Plastigage as described for connecting rod bearings.
4. When checking a crankshaft bearing with Plastigage, turn crankshaft so that oil hole is up to avoid dripping of oil on Plastigage. Place paper shims in lower halves of adjacent bearings and tighten cap bolts to take the weight of crankshaft off the lower shell of bearing being checked.
5. If bearing clearance exceeds .003", it is advisable to install a new bearing; however, if bearing is in good condition and is not being checked because of bearing noise, it is not necessary to replace the bearing.

Selection and Installation of a New Crankshaft Bearing

1. Loosen all crankshaft bearing cap bolts 1/2 turn, and remove cap of bearing to be replaced.
2. Remove upper bearing shell.
3. The crankshaft journal cannot be measured with an outside micrometer when shaft is in place; however, when upper bearing shell is removed the journal may be checked for out-of-round by using a special crankshaft caliper and inside micrometer. The caliper should not be applied to journal in line with oil hole.

   If crankshaft journal is more than .0015" out-of-round, the crankshaft should be replaced since the full mileage cannot be expected from bearings used with an excessively out-of-round crankshaft.
4. Before installation of bearing shells make sure that crankshaft journal and the bearing seats in crankcase and cap are thoroughly cleaned.
5. Coat inside surface of upper bearing shell

with engine oil and place shell against crankshaft journal so that tang on shell will engage notch in crankcase when shell is rotated into place.

IMPORTANT: Upper bearing shells have an oil groove in their center, while lower shells are plain. They must not be interchanged.

6. Rotate bearing shell into place.

7. Place lower bearing shell in bearing cap, then check clearance with Plastigage as previously described.

8. The desired clearance with a new bearing is .0005" to .0025". If this clearance cannot be obtained with a standard size bearing, insert an undersize bearing and check again with Plastigage.

NOTE: Each undersize shell has a number stamped on outer surface on or near the tang to indicate amount of undersize.

9. When the proper size bearing has been selected, clean out all Plastigage, oil the lower shell and reinstall bearing cap. Clean the bolt holes and lube bolts, then torque cap bolts to 65-70 ft. lbs. The crankshaft should turn freely at flywheel rim; however, a very slight drag is permissible if an undersize bearing is used.

10. If the thrust bearing shell is disturbed or replaced it is necessary to line up the thrust surfaces of the bearing shell before the cap bolts are tightened. To do this, move the crankshaft fore and aft the limit of its travel several times with the thrust bearing cap bolts finger tight.

11. After bearing is installed and tested, loosen all bearing cap bolts 1/2 turn and continue with other bearings. When bearings have been installed and tested, tighten all bearing cap bolts to specification given in paragraph 2-1.

Installation of Rear Bearing Oil Seals

Braided fabric seals are pressed into grooves formed in crankcase and rear bearing cap to rear of the oil collecting groove, to seal against leakage of oil around the crankshaft.

Neoprene composition seals are placed in grooves in the sides of bearing cap to seal against leakage in the joints between cap and crankcase. The neoprene composition swells in the presence of oil and heat. The seals are undersize when newly installed and may even leak for a short time until the seals have had time to swell and seal the opening.

The braided fabric seal can be installed in crankcase only when crankshaft is removed; however, the seal can be replaced in cap whenever cap is removed. Remove old seal and place new seal in groove with both ends projecting above parting surface of cap. Force seal into groove, using Tool J-8753-1, until seal projects above the groove not more than 1/16". Cut ends off flush with surface of cap, using sharp knife or razor blade. Lube the seal with heavy engine oil just before installation.

CAUTION: The engine must be operated at slow speed when first started after new braided seal is installed.

The neoprene composition seals are slightly longer than the grooves in the bearing cap. The seals must not be cut to length. Just before installation of bearing cap in crankcase, lightly lubricate the seals and install in bearing cap with upper end protruding approximately 1/16".

After cap is installed, force seals up into the cap with a blunt instrument to be sure of a seal at the upper parting line between the cap and case.

REPLACEMENT OF PISTONS, RINGS, AND CONNECTING RODS

Removal and Disassembly of Piston and Rod Assemblies

1. Remove cylinder heads.

2. Examine the cylinder bores above the ring travel. If bores are worn so a shoulder or ridge exists at this point, remove the ridges with a ridge reamer to avoid damaging rings or cracking ring lands in pistons during removal.

3. Use a silver pencil or quick drying paint to mark the cylinder number on all pistons, connecting rods and caps. Starting at the front end of the crankcase, the cylinders in the right bank are numbered 2-4-6 and in the left bank, are numbered 1-3-5.

4. Remove cap and bearing shell from number one connecting rod. Install connecting rod bolt guide hose on the bolts to hold the upper half of the bearing shell in place.

NOTE: Use a short piece of hose slipped over connecting rod bolt as a guide.

5. Push the piston and rod assembly up out of the cylinder. Then remove guides and reinstall cap and bearing shell on rod.

6. Remove other rod and piston assemblies in same manner.

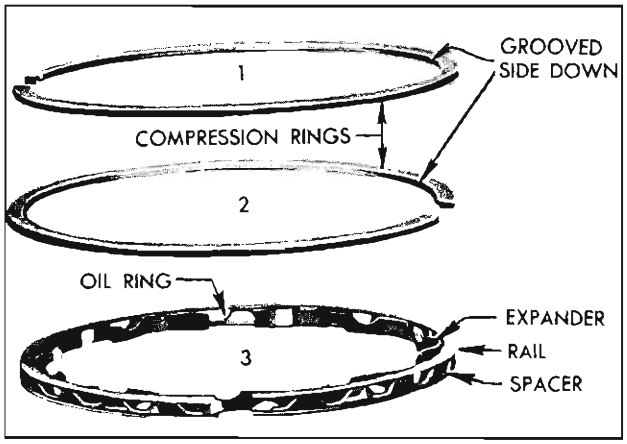


Fig. 3-127 Piston Rings

7. Remove compression rings with expander and remove oil ring by removing the two rails and spacer-expander which are separate pieces in each piston third groove. (Fig. 3-127)

8. To remove piston pin - set up Tool BT-6408 and Adapter BT-6408-5 as shown in Figs. 3-434 and 3-435.

INSPECTION OF CYLINDER BORES

Inspect cylinder walls for scoring, roughness or ridges which indicate excessive wear. Check cylinder bores for taper and out-of-round with an accurate cylinder gauge at top, middle and bottom of bore, both parallel and at right angles to the centerline of the engine.

A cylinder bore which is tapered .005" or more or is out-of-round .003" or more, is unacceptable.

Inspection of Pistons, Rings and Pins

Clean carbon from piston surfaces and under side of piston heads. Clean carbon from ring grooves with suitable tool and remove any gum or varnish from piston skirts with suitable solvent.

Carefully examine pistons for rough or scored bearing surfaces, cracks in skirt or head, cracked or broken ring lands, chipping or uneven wear which would cause rings to seat improperly or have excessive clearance in ring grooves. Damaged or faulty pistons should be replaced.

The pistons are cam ground, which means that the diameter at a right angle to the piston pin is greater than the diameter parallel to the piston pin. When a piston is checked for size, it must be measured with micrometers applied to the skirt at points 90° to the piston pin. (Fig. 3-128) The piston should be measured (for fitting purposes) 1/4" below the bottom of the oil ring groove.

Inspect bearing surfaces of piston pins and check for wear by measuring worn and unworn surfaces with micrometers. Rough or worn pins should be replaced. Test fit of piston pins in piston bosses. Occasionally pins will be found tight due to gum or varnish deposits. This may be corrected by removing the deposit with a suitable solvent. If piston bosses are worn out-of-round or oversize, the piston and pin assembly must be replaced. Oversize pins are not practical due to the pin being a press fit in the connecting rod. Piston pins must fit the piston with an easy finger push at 70°F (.0003" to .0005" clearance).

Examine all piston rings for scores, chips or cracks. Check compression rings for tension by comparing with new rings. Check gap of compression rings by placing rings in bore at bottom of ring travel. Measure gap with feeler gauge. Gap should be between .010" and .020". If gaps are excessive (over .020") it indicates the rings have worn considerably and should be replaced.

Pistons

Standard size service pistons are high limit or maximum diameter; therefore, they can usually be used with a slight amount of honing to correct slight scoring or excessive clearances in engines having relatively low mileage. Service pistons are also furnished in .010" oversize. All service pistons are diamond bored and selectively fitted with piston pins; pistons are not furnished without pins.

Honing Cylinders

To hone cylinders, use clean sharp stones of proper grade for the amount of metal to be removed, in accordance with instructions of the hone manufacturer. Dull or dirty stones cut unevenly and generate excessive heat. When using coarse or medium grade stones use care to leave sufficient metal so that all stone marks may be removed with the fine stones used for finishing to provide proper clearance.

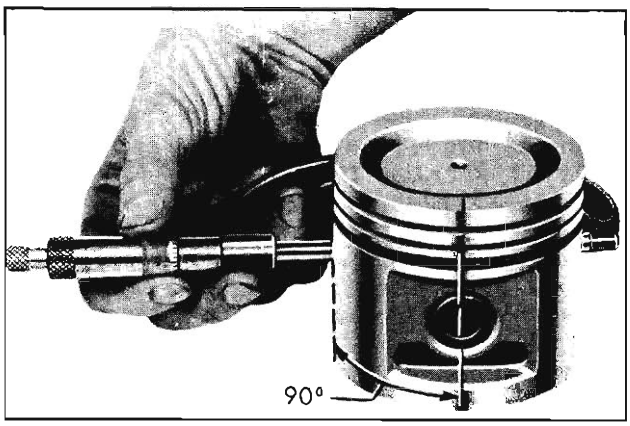


Fig. 3-128 Measuring Piston

When finish honing, pass the hone through the entire length of cylinder at the rate of approximately 60 cycles per minute. This should produce the desired 45° cross hatch pattern on cylinder walls which will insure maximum ring life and minimum oil consumption.

It is of the greatest importance that refinished cylinder bores are trued up to have not over .0005" out-of round or taper. Each bore must be final honed to remove all stone or cutter marks and provide a smooth surface. During final honing, each piston must be fitted individually to the bore in which it will be installed and should be marked to insure correct installation.

After final honing and before the piston is checked for fit, each cylinder bore must be thoroughly washed to remove all traces of abrasive and then dried thoroughly. The dry bore should then be brushed clean with a power-driven fiber brush. If all traces of abrasive are not removed, rapid wear of new pistons and rings will result. A satisfactory method of fitting pistons is as follows:

1. Place a strip of .0015" feeler gauge against the upper side of the bore, at 90° to the normal piston pin location. Attach scale J-5515 to feeler gauge. (Fig. 3-129)

2. Insert piston with pin and rings removed, into bore with head downward.

3. While holding the piston in the center of its normal travel, slowly pull the scale in a straight line and note the reading on the scale. the reading should be between 3 to 8 pounds while pulling the feeler gauge out of the bore.

Each piston should be fitted to its individual cylinder and marked for that cylinder.

NOTE: Both block and piston must be at very nearly the same temperature when measurements are made or errors due to expansion will occur. A difference of 10°F. between parts is sufficient to produce a variation of .0005".

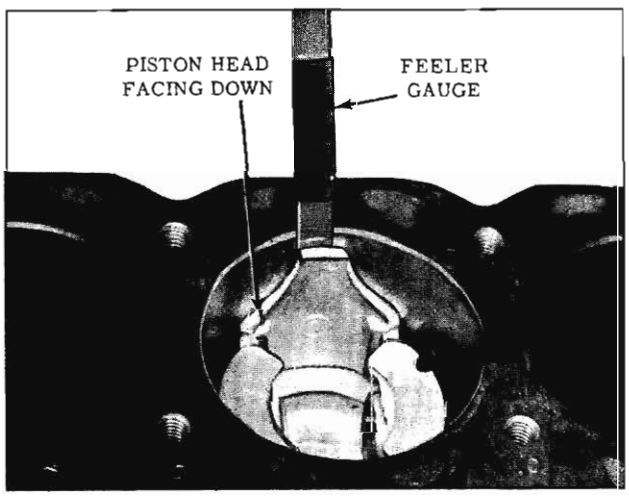


Fig. 3-129 Checking Piston Clearance

Fitting New Piston Rings

When new piston rings are installed the glazed cylinder walls should be slightly dulled, but without increasing the bore diameter, by means of the finest grade of stones in a cylinder hone. New piston rings must be checked for clearance in piston grooves and for gap in cylinder bores; however, the flexible oil rings are not checked for gap. The cylinder bores and piston grooves must be clean, dry and free of carbon and burrs.

With rings installed, check clearance in grooves by inserting feeler gauges between each ring and its lower land because any wear that occurs forms a step at inner portion of the lower land. If the piston grooves have worn to the extent that relatively high steps exist on the lower lands, the piston should be replaced because the steps will interfere with the operation of new rings and the ring clearance will be excessive.

When fitting new rings to new pistons, the side clearance of the compression rings should be .003" to .005" and side clearance of the oil ring should be .0035" to .0095".

To check the end gap of compression rings, place the ring in the cylinder in which it will be used, square it in the bore using the upper end of a piston, then measure the gap with feeler gauges. Piston rings should not have less than .010" gap when placed in cylinder bores. If gap is less than .010", file the ends of rings carefully with a smooth file to obtain proper gap.

ASSEMBLY AND INSTALLATION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. To assemble piston and pin to connecting rod, set up Tool BT-6408 and Adapter BT-6408-4 as shown in Figs. 3-436 and 3-437.

2. If the piston and rod assembly is to be installed in the left bank, the assembly must be made as shown in Fig. 3-130.

3. If the piston and rod is to be installed in the right bank, the assembly must be made as shown in Fig. 3-131.

4. Assemble piston and rod on spring-loaded guide pin.

5. Lubricate piston pin to avoid damage when pressing through the connecting rod.

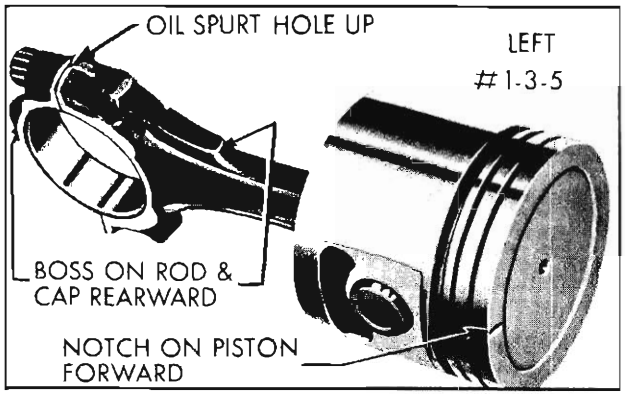


Fig. 3-130 Left Bank Piston and Rod Assembly

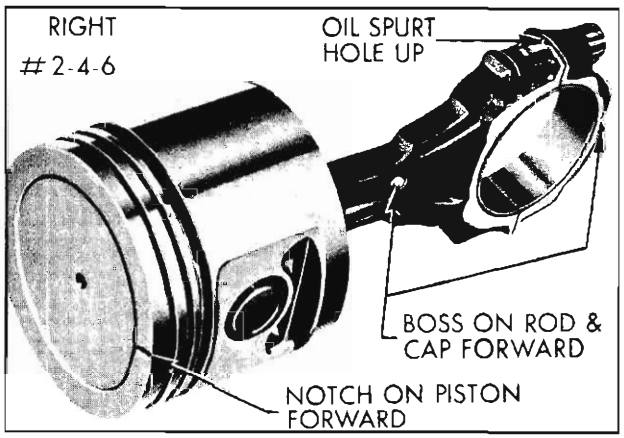


Fig. 3-131 Right Bank Piston and Rod Assembly

6. Install drive pin in upper end of piston pin. Press on drive pin until piston pin bottoms.

7. Remove piston and rod assembly from press. Rotate piston on pin to be sure pin was not damaged during the pressing operation.

8. Install piston rings as shown in Fig. 3-132. Position expander ends over piston pin. Install oil ring rail spacer, and oil ring rails. Position gaps in rails up on same side of piston as oil spit-hole in connecting rod. Install compression rings in upper two grooves. If a single chrome plated compression ring is used, the chrome ring must be installed in the top groove.

9. Install compression rings in top and center groove. See Fig. 3-132.

   NOTE: All compression rings are marked with a dimple, a letter "T", a letter "O" or word "TOP" to identify the side of the ring which must be assembled toward the top of the piston. If a single chrome plated compression ring is used, the chrome ring must be installed in the top groove.

10. Make sure cylinder bores, pistons, connecting rod bearings and crankshaft journals are absolutely clean, then coat all bearing surfaces with engine oil.

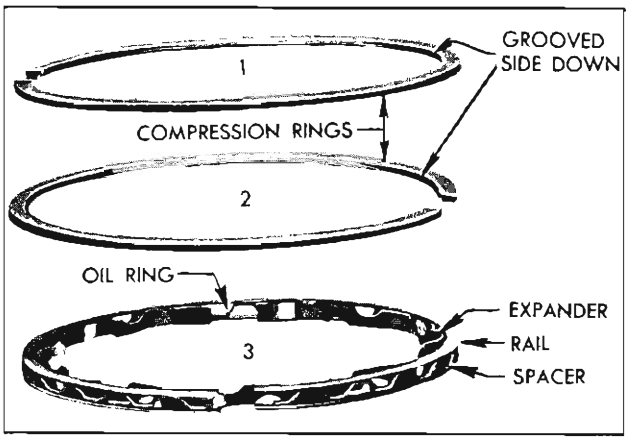


Fig. 3-132 Piston Rings

11. Before installation of a piston and rod assembly in its bore, position the crankpin straight down.

12. Remove connecting rod cap and, with bearing upper shell seated in rod, install connecting rod guides. These guides hold the upper bearing shell in place and prevent damage to the crankpin during installation of the connecting rod and piston assembly.

13. Make sure the gap in the oil ring rails is up, toward center of engine and the gaps of the compression rings are not in line with each other or the oil ring rails. Be certain the ends of the oil ring spacer-expander are butted together, not lapped over.

14. Lubricate the piston and rings and install in bore by compressing the rings either with a "wrap around" compressor or a split ring type such as shown in Fig. 3-133.

15. Select new connecting rod bearing, if necessary. Otherwise, install cap with bearing lower shell on rod and tighten bolt nuts to 30-35 ft. lbs. torque.

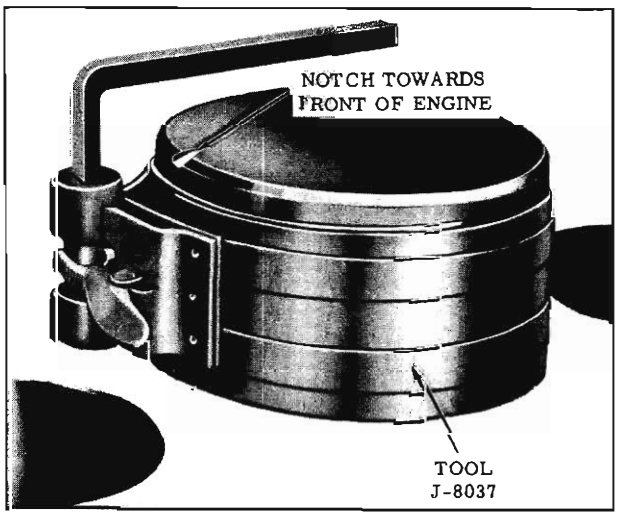


Fig. 3-133 Piston Ring Compressor

16. Install all other piston and rod assemblies in same manner. When piston and rod assemblies are properly installed, the oil spit holes in the connecting rods will be up, toward the camshaft, the rib on the edge of the rod cap will be on the same side as the conical boss on the connecting rod web and these marks, (rib and boss) will be toward the other connecting rod on the same crankpin. (Figs. 3-130 and 3-131)

17. Check end clearance between connecting rods on each crankpin using feeler gauges. Clearance should be between .005" and .012".

18. Install cylinder heads. Install oil screen and oil pan.

    IMPORTANT: After installation of new pistons and rings, care should be used in starting the engine and running it for the first hour. Avoid high speeds until the parts have had a reasonable amount of break in to avoid scuffing.

ENGINE MOUNTING REPLACEMENT

Removal of Front Mounts

1. Raise car and provide frame support at front of car.
2. Install engine support bar Tool BT-6424 and Adapter 6424-2.
3. Remove mount to engine block bolts. Raise engine slightly and remove mount to mount bracket bolt and nut. Remove mount.

Installation of Front Mount

1. Install mount to engine block bolts and torque to 50-55 ft. lbs.
2. Lower engine so mounts rest on brackets in normal manner. Install mount to bracket bolt and torque to 50-60 ft. lbs.
3. Remove engine support bar and lower car.

Removal of Rear (Transmission) Mount

To remove mount, remove attaching bolts, raise transmission and remove mount.

FLYWHEEL REPLACEMENT

Removal and Replacement of Automatic Transmission Flywheel

1. Remove transmission.
2. Remove six bolts attaching flywheel to crankshaft flange.
3. Inspect flywheel. If cracked at flywheel bolt holes, replace flywheel.
4. Inspect crankshaft and flywheel to be installed for burrs. Remove any burrs with a mill file.
5. Install flywheel. Bolt holes are unevenly spaced so all flywheel bolts may be installed with flywheel in only one position. Install bolts and torque evenly to 50-60 ft. lbs.
6. Mount dial indicator to engine block and check flywheel run-out at three flywheel attaching bosses. Run-out should not exceed .015".

   NOTE: The crankshaft end play must be held in one direction during this check.

7. If run-out exceeds .015", attempt to correct by tapping high side with mallet. If this does not correct, remove flywheel and check for burrs between flywheel and crankshaft mounting flange.

COOLING SYSTEM

COOLING SYSTEM SERVICES

Refer to Periodic Maintenance Lubrication, Section 2.

FAN BELT ADJUSTMENT OR REPLACEMENT

A tight fan belt will cause rapid wear of the Delcotron and water pump bearings. A loose belt will slip and wear excessively and cause noise, engine overheating and unsteady Delcotron output. A fan belt, which is cracked, frayed or worn so that it bottoms in the pulleys, should be replaced.

The fan belt may be replaced by loosening the the Delcotron brace at both ends, slightly loosening the Delcotron mounting bolts and moving Delcotron inward to provide maximum slack in the belt.

All belts are adjusted using Tool BT-33-70-M.

WATER PUMP

The water pump is serviced only as an assembly.

Removal

1. Drain cooling system being sure to drain into a clean container, if anti-freeze solution is to be saved.
2. Loosen belt or belts, then remove fan blade, and pulley or pulleys from hub on water pump shaft. Remove belt or belts.
3. Disconnect hose from water pump inlet and heater hose from nipple. Remove bolts, then remove pump assembly and gasket from timing chain cover.
4. Check pump shaft bearings for end play or roughness in operation. If bearings are not in serviceable condition, the assembly must be replaced.

Installation

1. Make sure the gasket surfaces on pump and timing chain covers are clean. Install pump assembly with new gasket. Bolts with lockwashers must be tightened uniformly.
2. Connect radiator hose to pump inlet and heater hose to nipple, then fill cooling system and check for leaks at pump and hose joints.
3. Install fan pulley or pulleys and fan blade, tighten attaching bolts securely. Install belt or belts and adjust for proper tension.

FUEL AND EXHAUST SYSTEM

FUEL SYSTEM

Refer to Figs. 3-134 and 3-135.

FUEL PUMP (Fig. 3-136)

GENERAL DESCRIPTION

The fuel pump on all models with or without heater or air conditioning, is a single action pump.

OPERATION

The fuel pump draws gasoline from the tank and supplies it to the carburetor in sufficient quantity to meet engine requirements at any speed or load.

The fuel pump rocker arm is held in constant

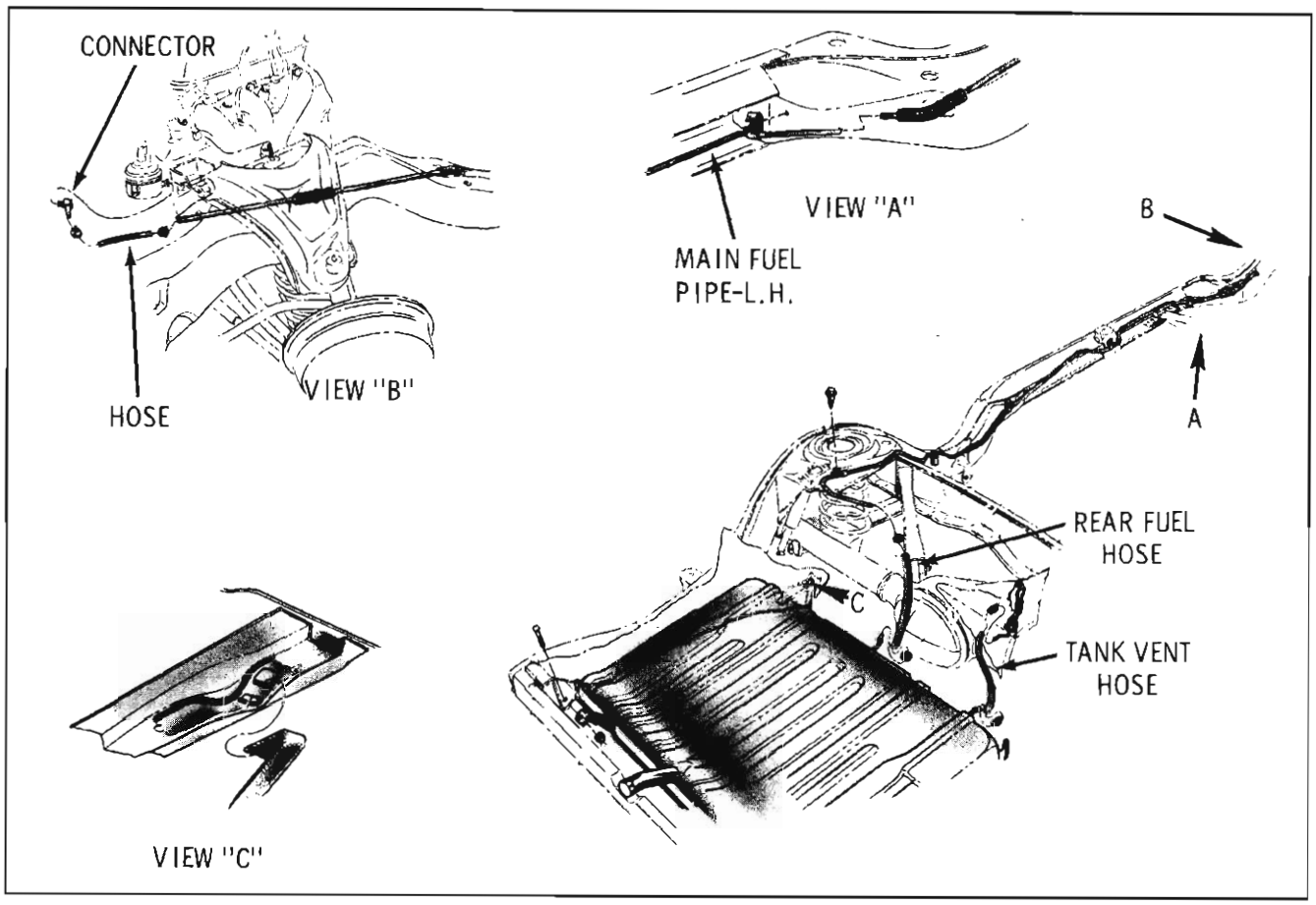


Fig. 3-134 V-6 Fuel System (All Except Air Conditioning)

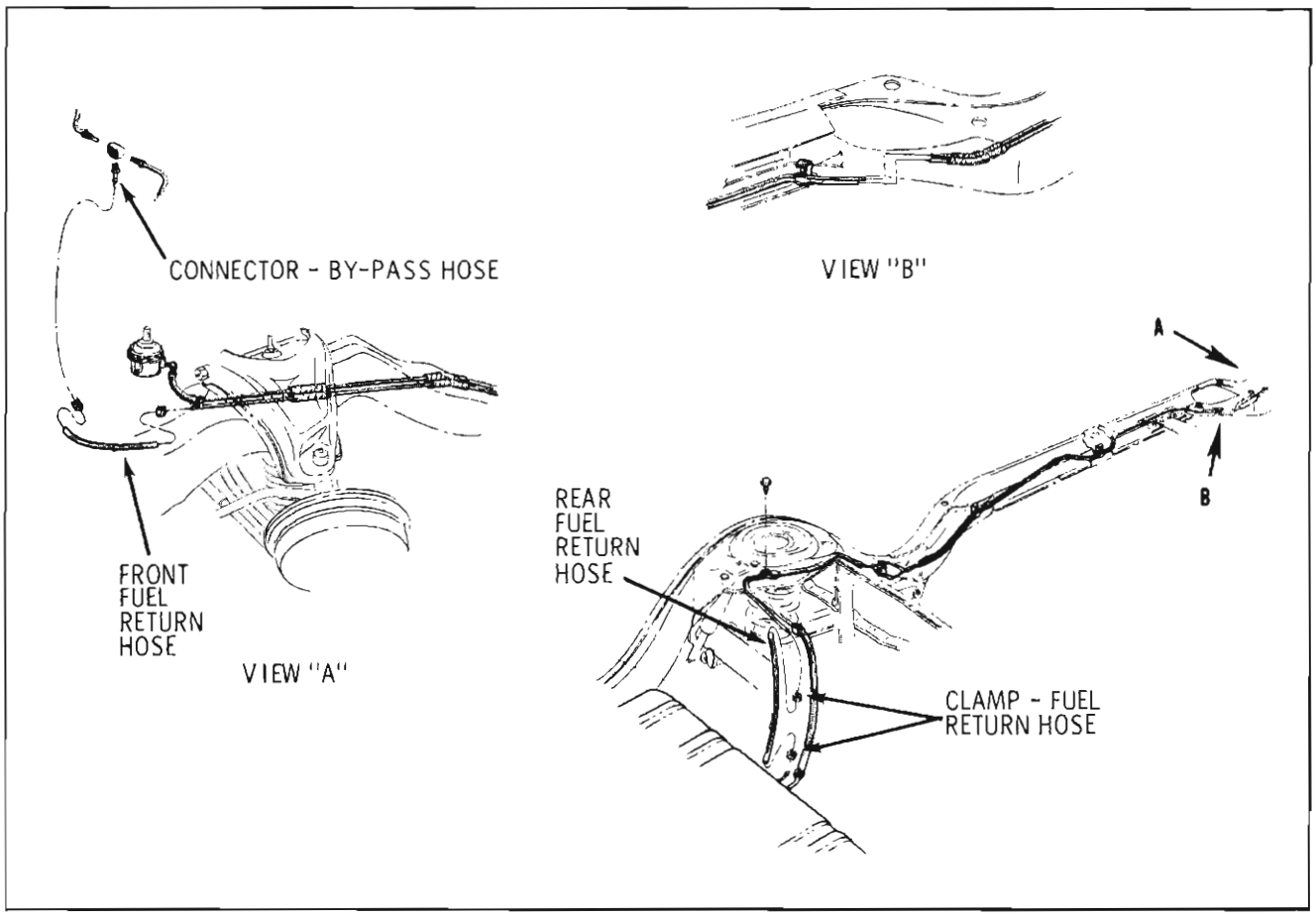


Fig. 3-135 V-6 Fuel System (Air Conditioning Equipped)

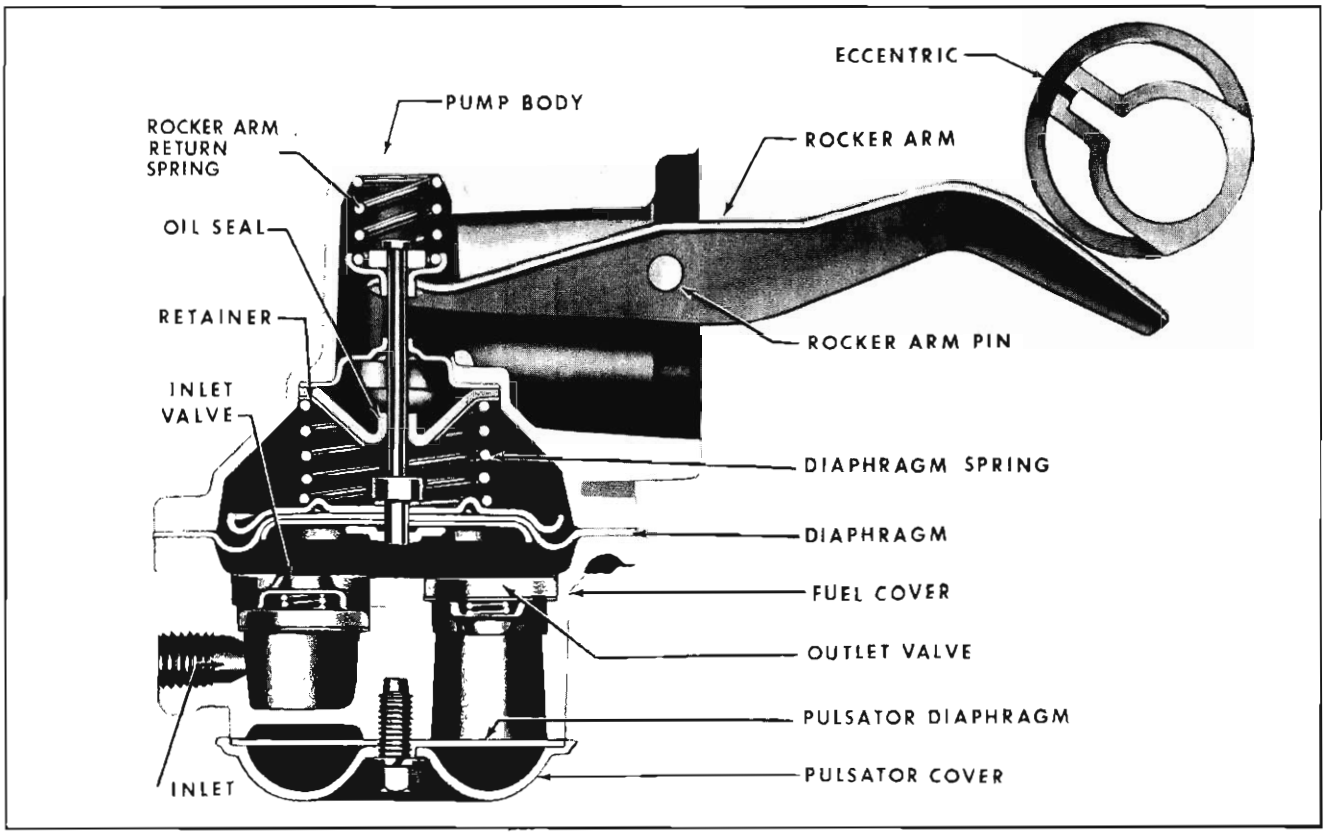


Fig. 3-136 Fuel Pump (Cross Sectional View)

engagement with the eccentric on the camshaft by the rocker arm spring. As the outer end of the rocker arm moves up, the fuel link pulls the fuel diaphragm down. The enlargement of the fuel chamber draws fuel from the tank through the inlet valve and into the fuel chamber.

The pump delivers fuel to the carburetor only when the pressure in the outlet line is less than the pressure maintained by the diaphragm spring. When the carburetor float needle valve opens, the spring expands and moves the diaphragm up to force fuel past the outlet valve to carburetor. When the carburetor float needle valve closes (on cars without a fuel return line), the pump builds up pressure in the fuel chamber until the diaphragm spring is again compressed. The diaphragm then remains stationary until more fuel is required by the carburetor.

A pulsator is used to insure a solid charge of fuel to the carburetor.

FUEL PUMP INSPECTION AND TEST (ON CAR)

Before testing the fuel pump for volume flow, a new fuel filter should be installed.

As filtered foreign material builds up within the filter, fuel flow restriction increases, resulting in a decrease of volume flow at the filter outlet. When the restriction becomes excessively high, volume flow to the carburetor can drop below engine requirements although the fuel pump is still capable of meeting volume specifications.

1. Be sure there is gasoline in the tank.
2. Check for loose line connections. A leak at the pressure side of the system (line from pump to carburetor) will be indicated by dripping fuel. A leak in the suction side of the system (line from gas tank to pump) will not be apparent except in its effect of reducing volume of fuel on the pressure side of the system. Tighten loose line connections. Tighten fuel pump diaphragm flange screws.
3. Look for bends or kinks in lines which will reduce fuel flow.
4. Test fuel flow as follows:
   a. Disconnect fuel line at the carburetor.
   b. Ground primary terminal of distributor with jumper lead so that engine can be cranked without firing.
   c. Place suitable container at end of fuel line and crank engine a few revolutions.

   NOTE: If little or no gasoline flows from open end of line, then the fuel line or tank filter is clogged or the pump is inoperative. Before removing pump, disconnect fuel lines at fuel pump and at gas tank and blow through them with an air hose to make sure they are clear. Reconnect fuel lines to pump and gas tank, then re-test fuel flow while cranking engine.
5. Even if fuel flows in good volume from line at carburetor, it is advisable to make certain that pump is operating within limits.
   a. Attach a low reading pressure gauge to upper end of pump to carburetor line.
   b. Run engine at approximately 1000 rpm (using gasoline in carburetor bowl) and note reading on pressure gauge.
   c. If pump is operating properly, the pressure will be 5 to 6 pounds and will remain constant. If pressure is too low or too high or varies materially at different speeds, the pump should be removed for repair or replacement.

DISASSEMBLY

1. Clamp pump carefully in vise by one ear of mounting flange Clear dirt from outside of pump.
2. Refer to Fig. 3-137.
3. Remove pulsator diaphragm cover attaching bolt and remove diaphragm cover and diaphragm.
4. Remove fuel cover attaching screws and remove cover.
5. Remove pull rod and diaphragm assembly and rocker arm return spring. (Fig. 3-138)
6. To remove valves, remove burrs produced by staking and pry inlet valve assembly from

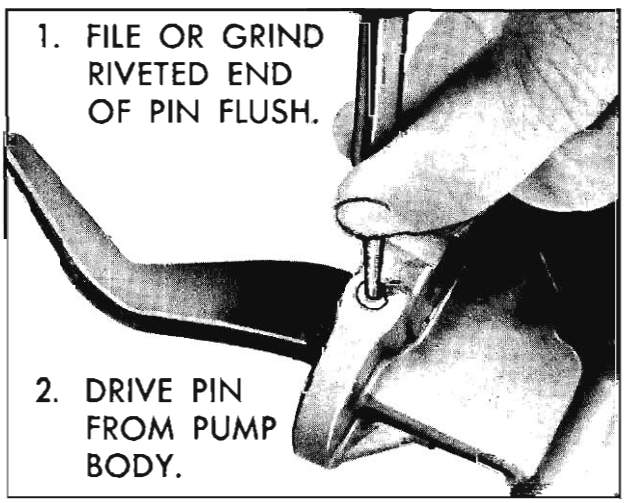


Fig. 3-137 Removing Rocker Arm Pin

fuel cover and push outlet valve assembly through cover from pulsator side of cover.

Cleaning and Inspection

1. Clean and rinse all metal parts in solvent. Blow out all passages with air hose.
2. Inspect pump body and cover for cracks, breakage and distorted flanges. Examine all screw holes for stripped or crossed threads. Replacement of pump assembly is advisable, if either condition is encountered.

Assembly

1. Place valve gaskets in recesses provided in fuel cover Place valve assemblies on top of gaskets. Inlet valve must have spring cage facing out of cover and the outlet valve must have the spring cage facing into cover. Stake valves in place.
2. Install rocker arm return spring in pump body. Be sure rocker arm return spring is properly seated to pull rod and diaphragm assembly.
3. Position fuel cover, aligning outlet opening

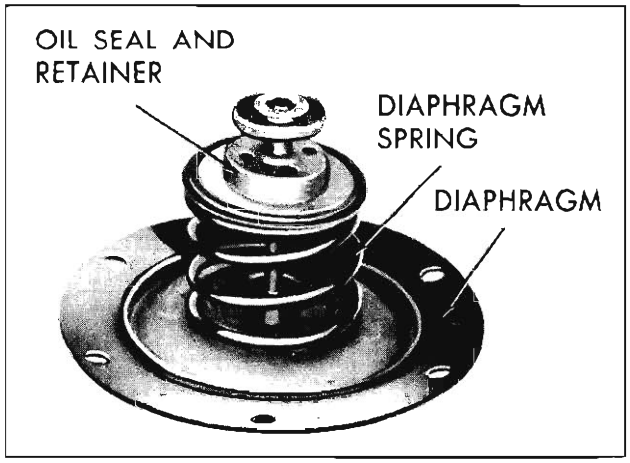


Fig. 3-138 Diaphragm Assembly

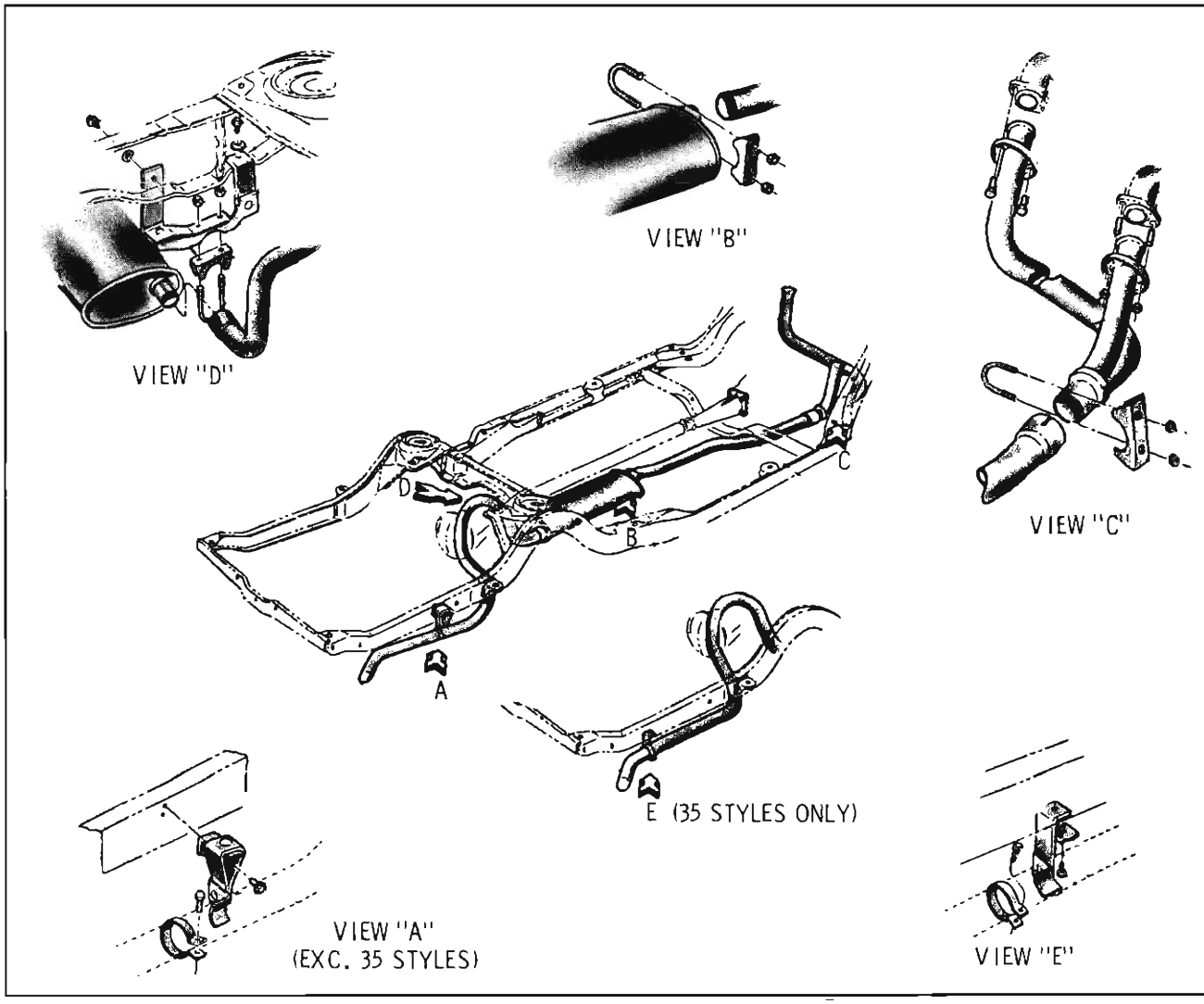


Fig. 3-139 Exhaust System

with ear of mounting flange. Install attaching screws and tighten evenly and securely.

4. Install new pulsator diaphragm, position diaphragm cover and install attaching bolt.
5. Position rocker arm in pump body and connect to pull rod.
6. Install rocker arm pin through pump body and rocker arm.

ENGINE TIGHTENING SPECIFICATIONS

Use a reliable torque wrench to tighten the parts listed to prevent straining or distorting the parts or possibly damaging the threads. It is important that the torque specifications be strictly observed. Over tightening to any extent may damage threads, thus preventing proper torque from being attained, requiring replacement or repair of the damaged part.

Cylinder head attaching bolts must be dipped in a non-hardening lubricant and sealer that prevents seizure of head bolts in the cylinder block due to coolant seepage.

TORQUE SPECIFICATIONS

Part	Application	Thread	Torque Ft. Lbs.
Plug	Spark	14mm	25-35
Plug	Crankcase drain	1/2 -20	25-35
Bolt	Water pump and timing chain cover to block	5/16-18	20-25
Bolt	Water pump cover to timing chain cover	1/4 -20	6-9
Bolt	Water outlet to intake manifold	5/16-18	20-25
Bolt	Intake manifold gasket clamp to block	5/16-18	10-15
Bolt	Intake manifold to cylinder head	3/8 -16	25-35
Bolt	Exhaust manifold to cylinder head	3/8 -16	25-35
Bolt	Carburetor to intake manifold	5/16-18	12-15
Bolt	Fuel pump to timing chain cover	5/16-18	20-25
Bolt	Camshaft Sprocket to camshaft	7/16-20	40-45
Bolt	Rocker arm shaft bracket to cylinder head	3/8 -16	25-35
Screw	Rocker arm cover to cylinder head	1/4 -20	3-5
Bolt	Cranking motor to cylinder block	3/8 -16	30-35
Bolt	Distributor clamp to timing chain cover	3/8 -16	14-17
Bolt	Crankshaft bearing cap to crankcase	1/2 -13	65-70
Plug	Cylinder block water drain	1/4 -18 pt	15-20
Bolt	Cylinder head to block	7/16-14	65-70
Bolt	Upper flywheel housing to cylinder block	3/18-16	30-40
Bolt	Lower flywheel housing to block and upper flywheel housing	5/16-18	8-12
Bolt	Flywheel to crankshaft	7/16-20	50-60
Bolt	Harmonic balancer to crankshaft	5/8 -18	140-160
Nut	Connecting rod bolt	11/32-24	30-35
Bolt	Oil pan to block	5/16-18	6-15
Bolt	Oil screen housing pipe and flange assembly to block	1/4 -20	6-9
Bolt	Timing chain cover to block	5/16-18	20-25
Cap	Oil pressure relief valve		25-35
Screw	Oil pump cover assembly to timing chain cover	1/4 -20	8-12
Switch	Oil pressure		8-10
Bolt	Fan and pulley to water pump hub	5/16-24	15-25
Bolt	Pulley and reinforcement to harmonic balancer	5/16-18	15-25
Bolt	Engine mount to cylinder block	7/16-14	50-55
Bolt	Engine mount to frame bracket	7/16-20	55-65

ENGINE GENERAL SPECIFICATIONS

Item	225 Cubic Inch V-6 Engine
Type - No. of cylinders	90° V-6
Valve arrangement	In Head
Bore and stroke	3.750" x 3.400"
Piston displacement	225 cubic inches
Compression ratio	
Standard	9.0 to 1
Export	7.6 to 1
Brake Horsepower at RPM	155 @ 4600
Foot Pounds Torque at RPM	225 @ 2400
Taxable Horsepower	33.748
Cylinder Numbers Front to Rear	
Right Bank	2-4-6
Left Bank	1-3-5
Firing Order	1-6-5-4-3-2
Cylinder Block Material	Cast Iron
Cylinder Liners	None
Crankshaft Bearings Number and Type	4 replaceable liners
Material	Durex 100A
Bearing Which Takes End Thrust	No. 2
Connecting Rod Bearings - Type	Replaceable Liner
Material	Durex 100A
Piston Material and Surface Treatment	Aluminum Alloy
Piston Pin Offset	.040"
Compression Rings Material and Surface Treatment	
#1	Iron - Chrome Plated
#2	Lubrited
Oil Ring - Type	Dual Steel Rail With Spacer
Oil Ring Expander	Steel Hump Type
Location of all Piston Rings	Above Piston Pin
Camshaft Type and Material	Cast Alloy Iron
Camshaft Drive	Chain
Number and Type of Camshaft Bearings	4 Steel Backed Babbit
Valve Lifter Type	Hydraulic
Valve Spring Type	Single Helical
Oiling System Type	Forced Feed
Oil Supplied to Bearing Surfaces	
Crankshaft, Camshaft and Connecting Rods	Full Pressure
Pistons, Pins	Splash
Cylinder Walls	Splash and Nozzle
Valve Lifters	Full Pressure
Rocker Arms	Low Pressure
Normal Oil Pressure	33# at 2400 RPM
Oil Reservoir Capacity - Quarts	4 (5 with Dry Filter)
Oil Filter, Make and Type	(AC Type PF - 7)
Cooling System Type	Pressure (15# Radiator Cap)
Water Temperature Control	Thermostat
Thermostat	180°
Cooling System Capacity (Quarts)	
Less Heater	11.5
With Heater	13
Fan Diameter, Number of Blades	
Regular	20.00" - 4 (Shrouded)
With Air Conditioning	18" - 7 (Shrouded)
Fan Drive	
Regular	Water Pump Shaft
With Air Conditioning	Torque and Temperature Sensitive Clutch

ENGINE DIMENSIONS, FITS AND ADJUSTMENTS

NOTE: These dimensions and limits for fit of parts apply to new parts only.

Item	225 Cubic Inch V-6
Crankshaft journal diameter	2.2992"
Crankshaft journal to bearing clearance	.0005" - .0021"
Crankshaft end play at thrust bearing	.004" - .008"
Crankshaft bearing effective length	
#1	.864"
#2	1.057"
#3	.864"
#4	.864"
Crankpin journal diameter	2.000"
Crankpin journal to bearing clearance	.002"
Connecting rod end play on crankpin	.005" - .012" (Total both rods)
Connecting rod bearing length	.820"
Piston clearance in bore	.0002" - .0023"
Piston pin diameter	.8747"
Piston pin length	2.960"
Piston pin fit at 70° F in piston	.0001"
Piston pin fit in connecting rod	.0007" - .0015" Press
Piston ring side clearance in groove	
Compression ring	.003" - .005"
Oil ring	.0035" - .0095"
Piston ring gap, compression ring in bore	.010" - .020"
Oil ring in bore	.015" - .035"
Camshaft bearing journal diameter	
#1	1.755" - 1.756"
#2	1.725" - 1.726"
#3	1.695" - 1.696"
#4	1.665" - 1.666"
Camshaft journal clearance in bearings	.0005" - .0035"
Valve lifter diameter	.8422" - .8427"
Valve lifter clearance in block	.0005" - .003"
Valve lifter leakdown rate, in test fixture	12 to 60 sec.
Rocker arm ratio	1.6 to 1
Rocker arm clearance on shaft	.0017" - .0032"
Valve head diameter inlet	1.625"
Valve head diameter exhaust	1.3125"
Valve seat angle inlet and exhaust	45°
Valve stem diameter inlet	.3412" top .3407" bottom
Valve stem diameter exhaust	.3407" top .3402" bottom
Valve stem clearance in guide	
Inlet	top .001" - .003"
	bottom .0015" - .0035"
Exhaust	top .0015" - .0035"
	bottom .002" - .004"
Valve Spring	
Valve closed pounds @ length	64 @ 1.640"
Valve open pounds @ length	168 @ 1.260"

V-8 ENGINE

DESCRIPTION

The same basic V-8 engine is available in the 30 and 31 series with the exception of the 3127. It is standard in 32 and 33 series.

Different flywheels and housings are used to accommodate either the Synchromesh or Jetaway transmission. The engine has a bore of 3-15/16" and a stroke of 3.385" providing a displacement of 330 cubic inches.

The cylinder block is cast iron. The intake manifold also serves as the engine top cover.

The left bank of cylinders (as viewed from the driver's seat) are numbered (from front to rear) 1-3-5-7. Cylinders in the right bank are numbered (from front to rear) 2-4-6-8. (Fig. 8-101)

The oil pump is mounted to the rear main bearing inside the crankcase and is driven by a shaft from the distributor.

INTAKE MANIFOLD

Removal

1. Remove air cleaner assembly.
2. Drain radiator, then disconnect upper radiator hose from water outlet. Also, disconnect heater hose at rear of manifold, if car is so equipped.

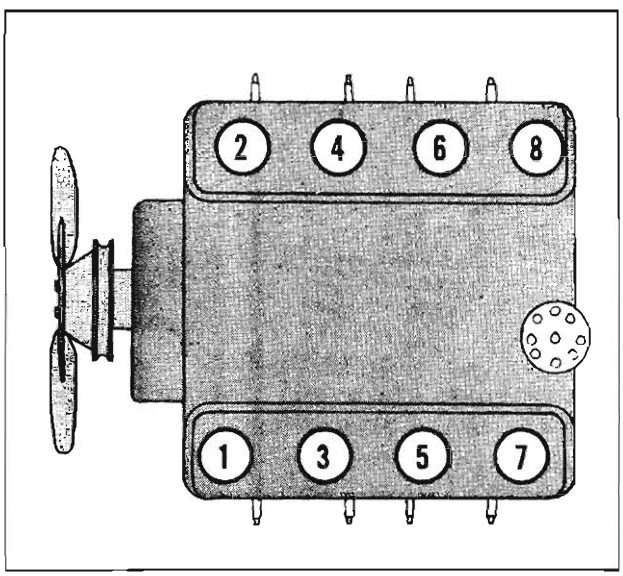


Fig. 3-401 Cylinder Numbers

3. Disconnect throttle linkage from accelerator bellcrank.
4. Disconnect wiring at throttle control switch.
5. Disconnect throttle control switch from manifold and leave wires to transmission attached.
6. Remove fuel and vacuum lines from carburetor.
7. Disconnect primary and secondary wiring from coil. Disconnect spark plug wires as necessary.
8. Disconnect and/or remove Delcotron, power steering pump and air conditioning compressor brackets as necessary.
9. Disconnect temperature gauge wire.
10. Disconnect thermostat bypass hose.
11. Remove intake manifold bolts; then remove manifold with coil and carburetor attached.
12. Clean machined surfaces of cylinder head and intake manifold with a putty knife. Use extreme care not to gouge or scratch machined surface.

Installation

1. Coat both sides of gasket sealing surface that seal the intake manifold to the head with POB #3 and install new intake manifold gasket.
2. Install end seals, being sure that ends are positioned under cylinder heads as shown in Fig. 3-403.
3. Position intake manifold on engine and connect thermostat bypass hose to water pump.
4. Install intake manifold bolts. Torque alternately 25 to 35 ft. lbs. (Fig. 3-404)
5. Connect temperature gauge wire, primary wire and secondary lead to coil.
6. Connect wiring at stator and downshift control switch.
7. Install fuel and vacuum lines.
8. Connect upper radiator hose, spark plug wires, heater hose, carburetor linkage and install air cleaner assembly.
9. Fill cooling system.

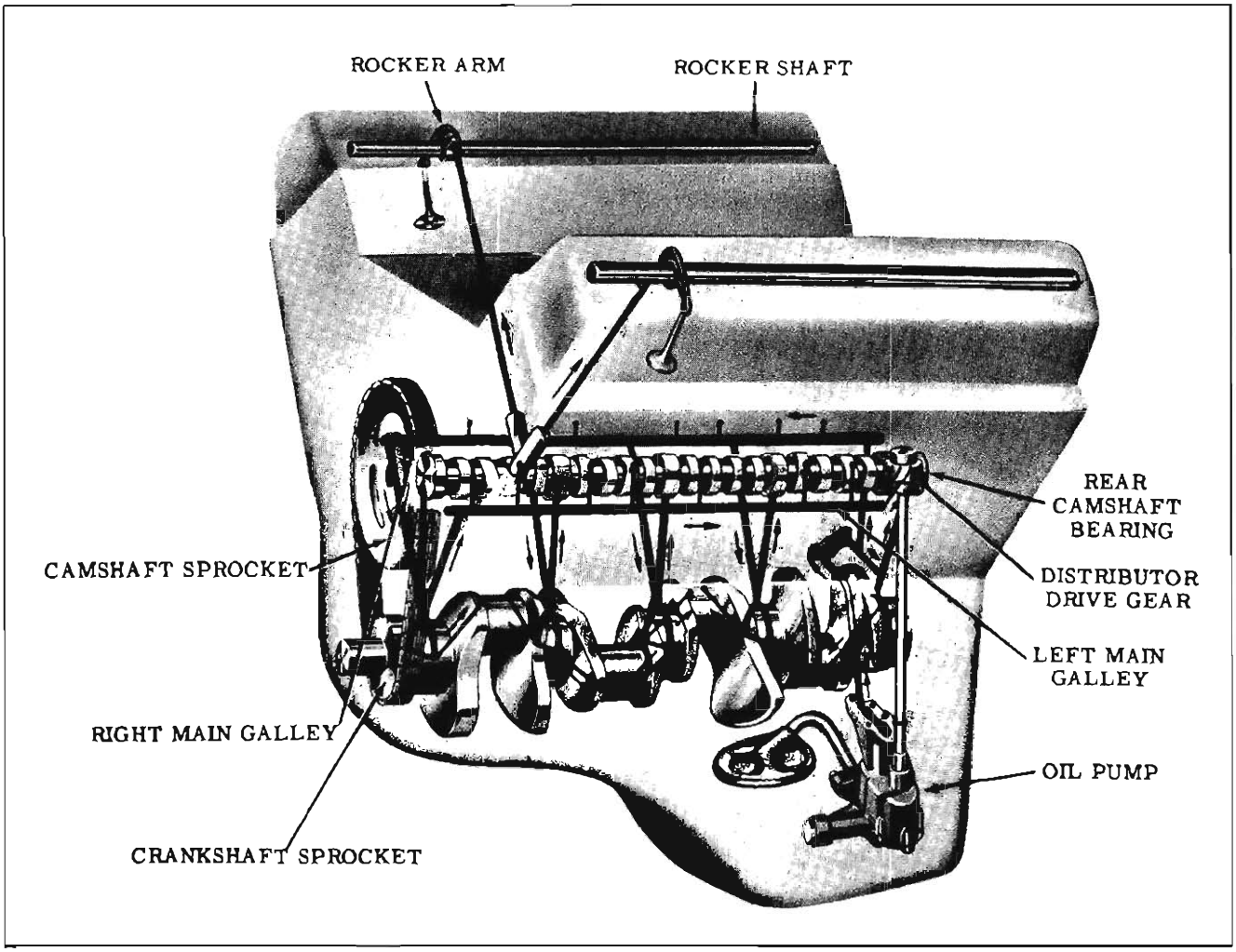


Fig. 3-402 Engine Oil Flow

NOTE: Refer to Section 2, Periodic Maintenance for cooling system recommendations.

Choke Heat Stove

Figure 3-405 shows an exploded view of the choke heat stove.

EXHAUST MANIFOLD

Removal

1. Remove the crossover pipe.
2. For the right manifold, disconnect the exhaust pipe.
3. Straighten lock tabs and remove the manifold to head attaching bolts, washers and locks and remove the manifold.

NOTE: The left manifold can be removed by sliding rearward before lowering out of car.

4. Clean manifold and cylinder head machined surfaces with a putty knife. Use care not to gouge or scratch machined surfaces.

Installation

1. Install manifold to head bolts and torque 20-25 ft. lbs.
2. Reconnect disconnected parts.

VALVE COVER

Removal

1. Disconnect positive crankcase ventilation from right valve cover.
2. Disconnect spark plug wires and move away from valve cover.
3. Remove valve cover to cylinder head attaching screws. Remove accessory mounting

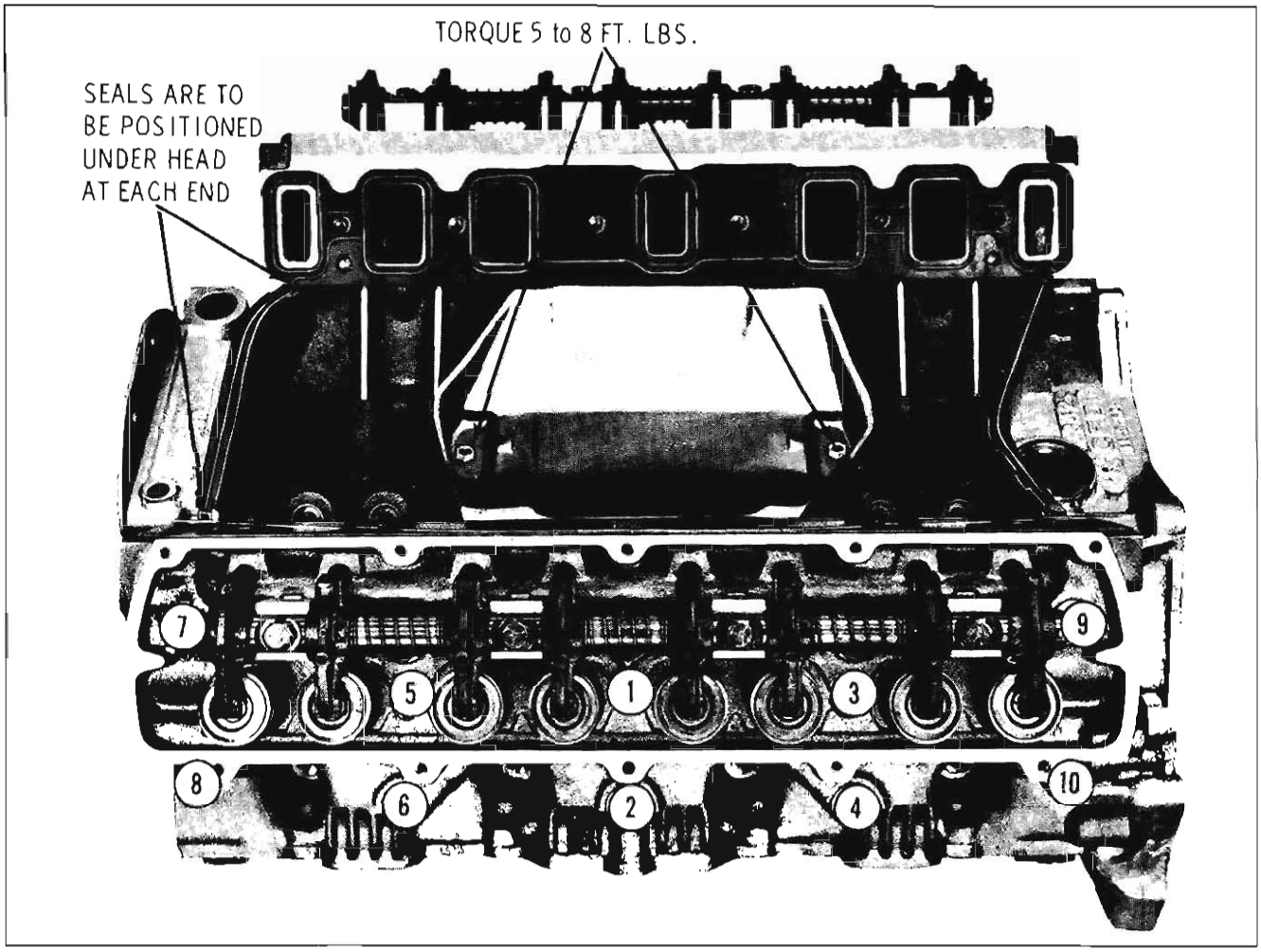


Fig. 3-403 Intake Manifold Installation

brackets as necessary and remove valve cover.

Installation

Reverse removal procedure. Torque valve cover attaching screws 4-7 ft. lbs. For mounting brackets, torque attaching bolts as follows:

5/16" thread	20-25 ft. lbs.
3/8 " thread	25-35 ft. lbs.
7/16" threads	40-50 ft. lbs.

ROCKER ARMS AND SHAFTS

Removal

1. Remove valve cover.
2. Remove four rocker arm shaft bracket to head bolts. (Fig. 3-406)

Disassembly

1. Remove cotter pins from ends of shaft.

   NOTE: Disassemble one shaft at a time and place on bench so parts may be reassembled in their original place.

2. Remove springs, arms and brackets from shaft.

Assembly

1. Lubricate frictional surfaces of rocker arms and shaft with SAE 10W30 oil, and assemble. (Fig. 3-407)

Installation

1. Position rocker arm shaft assembly on

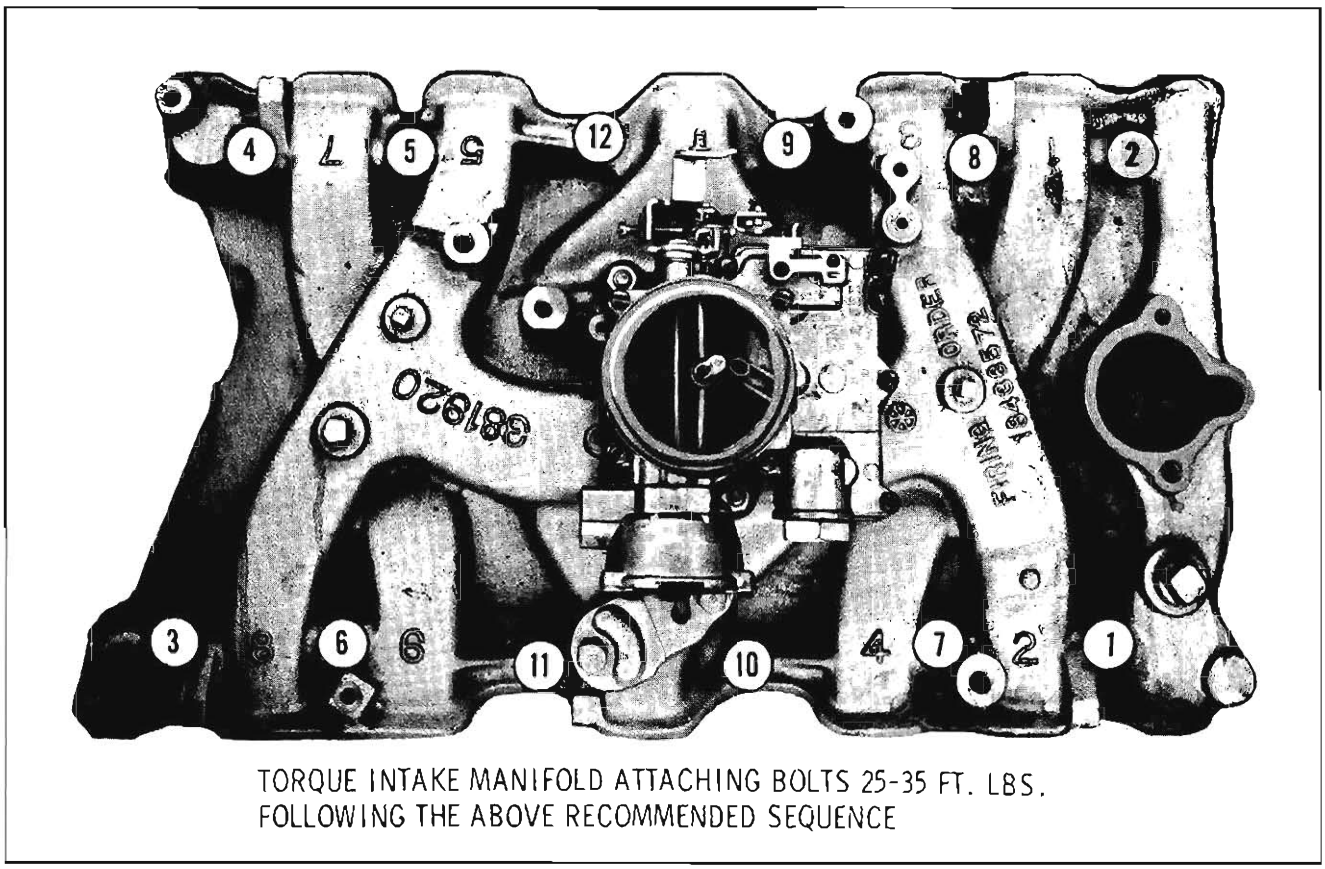


Fig. 3-404 Intake Manifold Torque Sequence

cylinder head and align brackets with mounting bolts. (Fig. 3-406)

2. Coat bolt threads and heads with engine oil and torque 25-35 ft. lbs. Check rocker arm to valve stem contact for proper alignment.

3. Install valve cover with a new gasket, connect spark plug wires and install air cleaner.

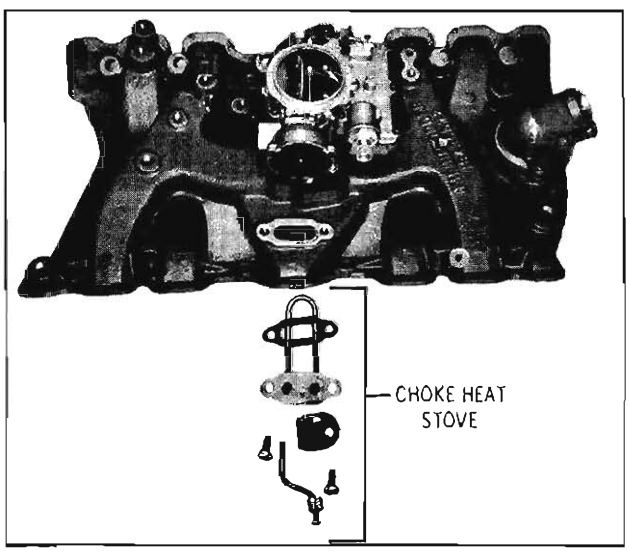


Fig. 3-405 Intake Manifold Choke Heat Stove

VALVE LIFTERS

Operation

Oil is supplied to the lifter through a hole in the side of the lifter body which indexes with a groove and hole in the lifter plunger. Oil is then fed through the push rods to the rocker arms. (Fig. 3-408)

When the lifter begins to ride up the cam lobe, the ball check is held against its seat in the plunger by the ball check spring which traps the oil in the base of the lifter body below the plunger. The plunger and lifter body then raise as a unit, pushing up the push rod to open the valve. The force of the valve spring which is exerted on the plunger through the rocker arm and push rod causes a slight amount of leakage between the plunger and lifter body. This "leak down" allows a slow escape of trapped oil in the base of the lifter body. As the lifter rides down the other side of the cam lobe and reaches the base circle or "valve closed" position, the plunger spring quickly moves the plunger back (up) to its original position. This movement causes the ball check to open against the ball spring, and oil from within the plunger is drawn into the base of the lifter. This restores the lifter to zero lash.

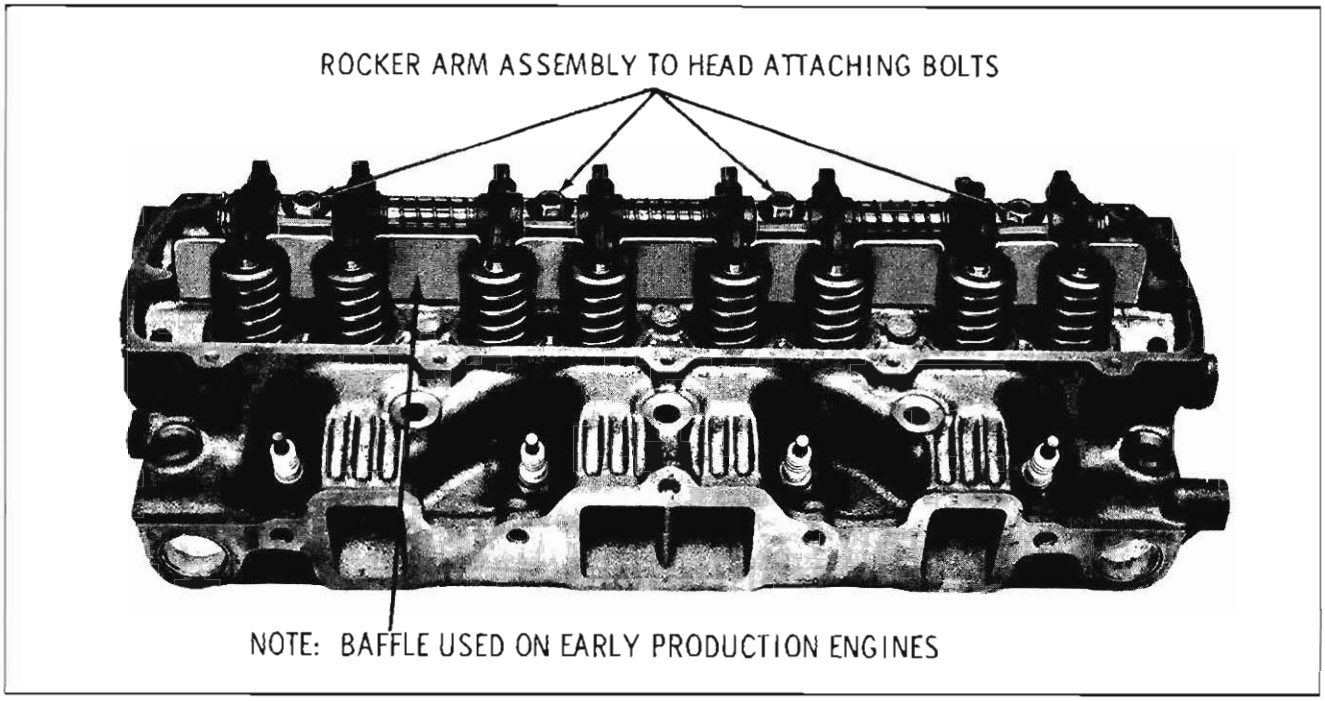


Fig. 3-406 Rocker Arm Assembly Attachment

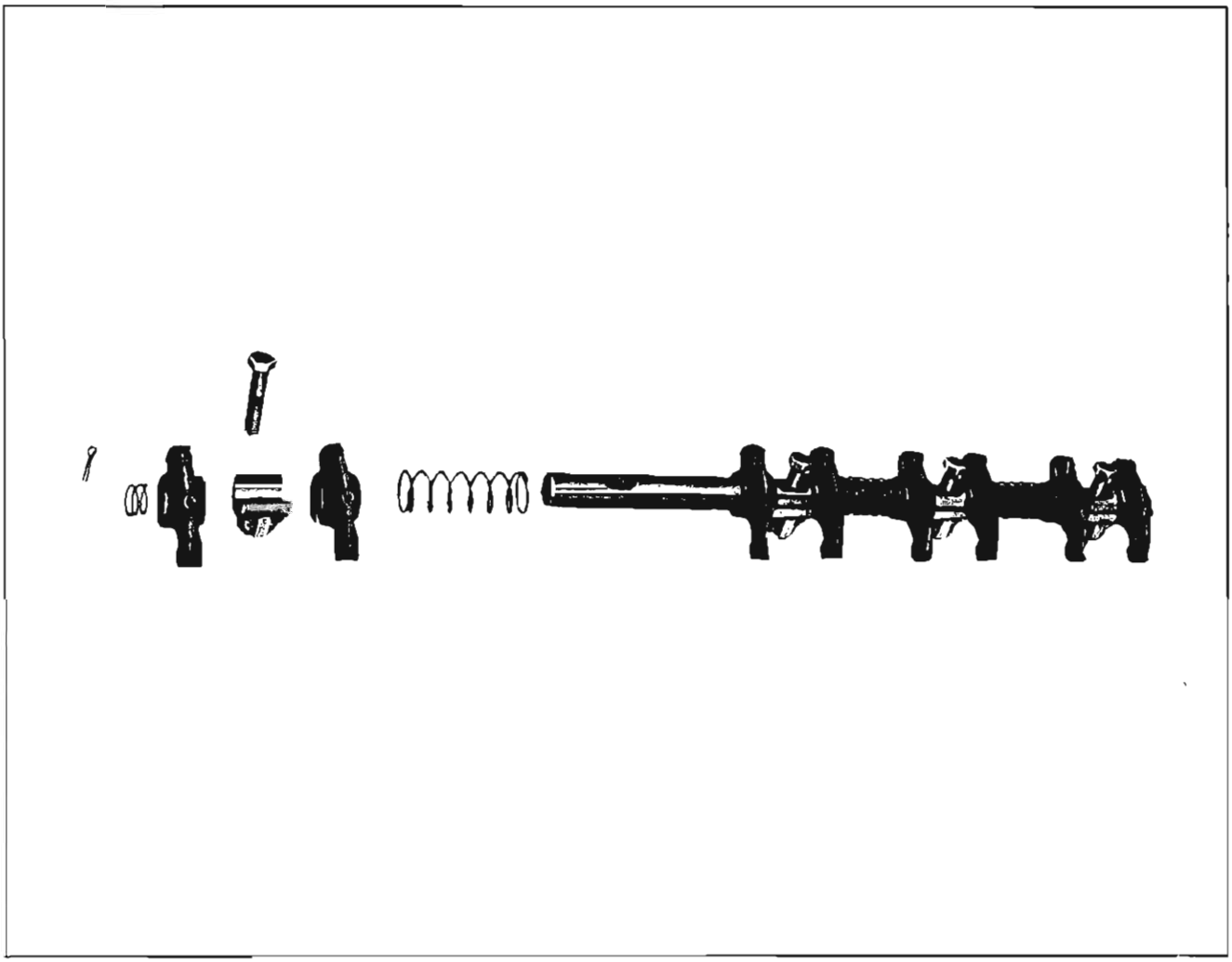


Fig. 3-407 Rocker Arm Shaft Assembly

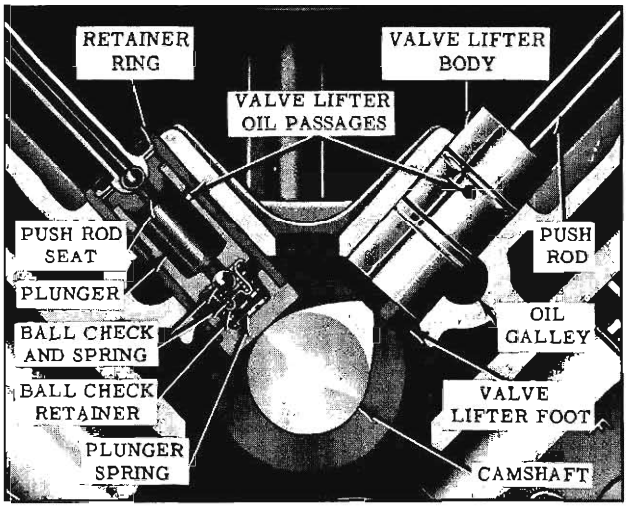


Fig. 3-408 Valve Lifter Operation

Removal

IMPORTANT: Valve lifters and push rods should be kept in order so they can be reinstalled in their original position in the cylinder block.

1. Remove intake manifold and gasket.

2. Remove valve covers, rocker arm assemblies and push rods.

3. On varnished lifters, apply carburetor cleaning solution to lifter body. Allow five minutes for solution to remove varnish.

4. Remove lifters. Use of Tool BT-39 will aid in removal of varnished lifters. (Fig. 3-409)

Disassembly

1. Remove retainer spring with Tool BT-31 or small screwdriver.

2. Remove push rod seat.

3. Remove plunger and plunger spring. If plunger is stuck tight, allow lifter to soak in carburetor cleaning solvent for approximately five minutes, then remove.

   NOTE: Available Tool BT-6416 can be used to remove plunger.

   CAUTION: Carburetor cleaning solvent should be used in a well ventilated room. Avoid contact with skin and prolonged breathing of fumes.

4. Remove ball check retainer from plunger, then remove ball and spring.

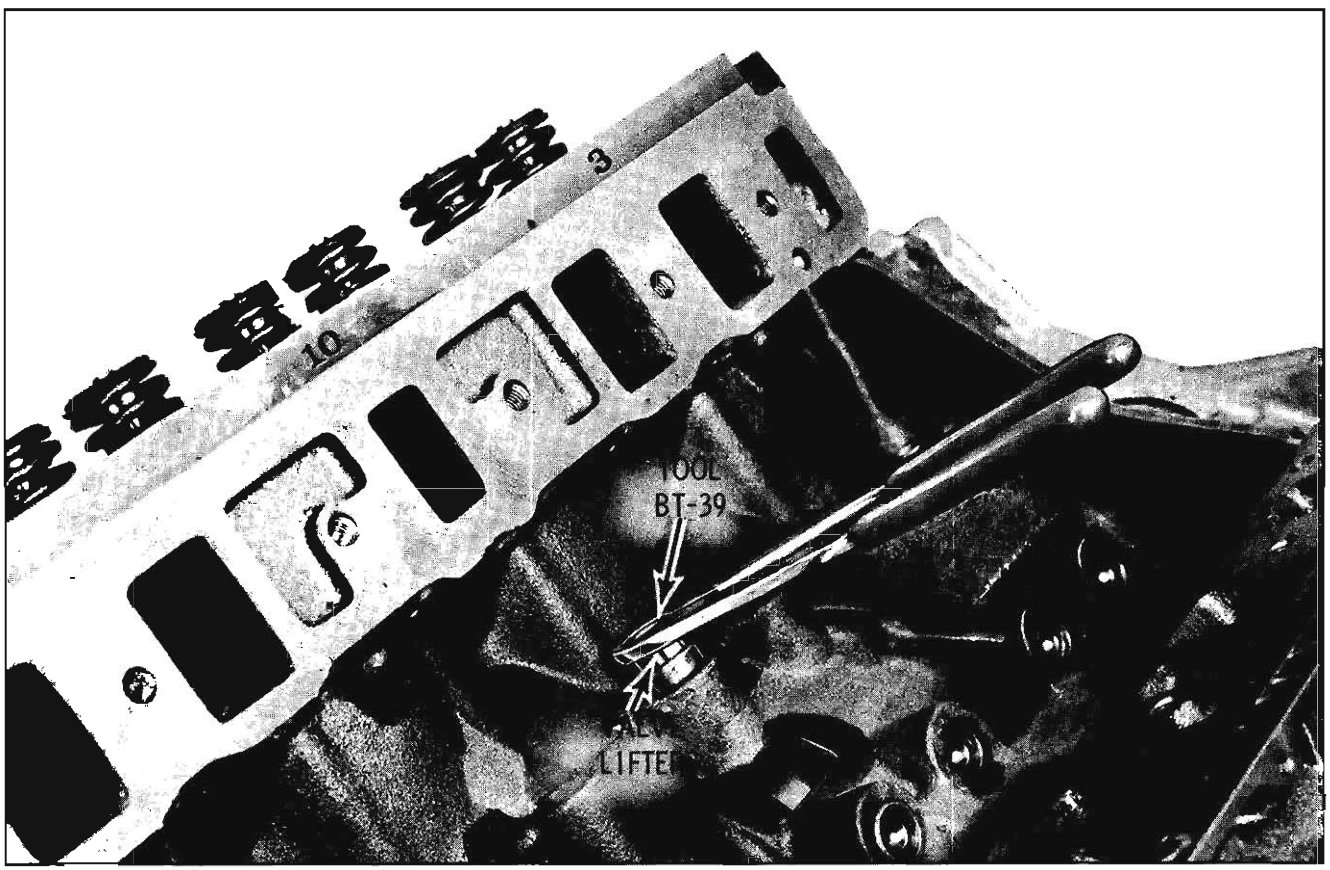


Fig. 3-409 Removing Valve Lifter

Cleaning and Inspection

After lifters are disassembled, all parts should be cleaned in clean solvent. A small particle of foreign material under the ball check valve will cause malfunctioning of the lifter. Close inspection should be made for nicks, burrs, or scoring of parts. If either the body or plunger is defective, replace with a new lifter assembly.

IMPORTANT: Do not condemn valve lifters that have a slight gap or show evidence of leakage where the lifter foot is welded to the lifter body, unless the leak-down rate is not within specifications. (See VALVE LIFTER LEAK-DOWN)

NOTE: Wherever lifters are removed, check the lifter foot for abnormal wear as follows:

1. Place a straight edge across the lifter foot.

   NOTE: Lifter foot must be clean and dry.

2. While holding the lifter at eye level, check for light between the straight edge and lifter foot.

3. If light indicates a flat or concave surface of the lifter foot, the lifter should be replaced and the camshaft inspected for wear. Wear at the CENTER of the cam base circle is NORMAL. The camshaft should be replaced ONLY when wear is present across FULL WIDTH of cam base circle.

Installation

NOTE: Install lifters and push rods into original position in cylinder block.

1. Install lifters and push rods.

2. Position rocker arm assembly on cylinder head and align brackets with mounting bolts.

3. Coat bolt threads and heads with engine oil and install bolts. Torque 25-35 ft. lbs. Check rocker arm to valve stem contact.

4. Install valve cover, connect spark plug wires and install air cleaner.

Assembly and Valve Lifter Leak-Down Test

IMPORTANT: Lifters must be assembled while submerged in Hydraulic Lifter Test Fluid BT-59 and leak-down tested before placing into service.

1. Install Adapter 105-2 in reservoir of Tester BT-60, then fill reservoir with Hydraulic Lifter Test Fluid BT-59, 1/2" below top of reservoir.

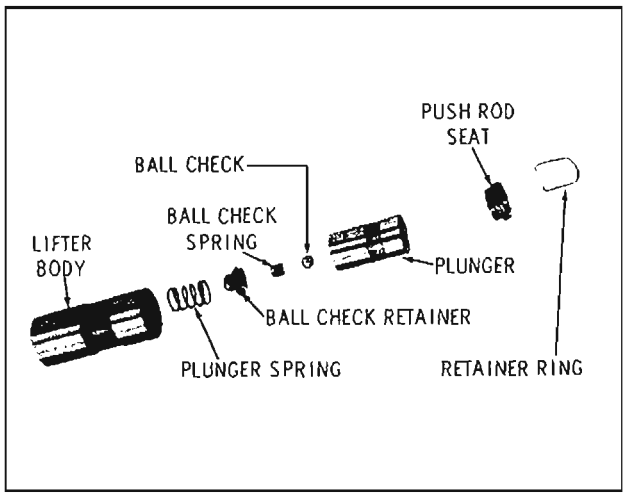


Fig. 3-410 Valve Lifter Exploded View

2. Assemble ball check and retainer into plunger. (Fig. 3-410) Make sure retainer flange is pressed tight against bottom of recess in plunger.

3. Install plunger spring over ball check retainer.

4. Hold plunger with spring up and insert into lifter body. Hold plunger vertical to prevent cocking spring.

5. Place assembly into the tester cup then position push rod seat onto plunger.

6. Position the 1/4" steel ball on the push rod seat. Lower tester ram until it contacts the steel ball.

7. Allow ram to move downward by its own weight until air bubbles disappear.

8. Raise ram, then allow to lower as in Step 7. Repeat this procedure several times or until all air is expelled from lifter.

   CAUTION: Do not attempt to expell air from lifter by pumping on ram.

9. After all air is expelled, allow ram to bleed down lifter until retaining groove is exposed.

10. Install retaining ring.

11. Adjust ram screw so that it contacts the steel ball in the push rod seat when the pointer is at the start line.

12. Raise arm, then start test by resting ram on steel ball. Rotate reservoir one revolution every 2 seconds and time the indicator from the start to the stop line. (Fig. 3-411) Allowable leak-down rate is 8 seconds minimum for used lifters, and 12 to 60 seconds for new lifters.

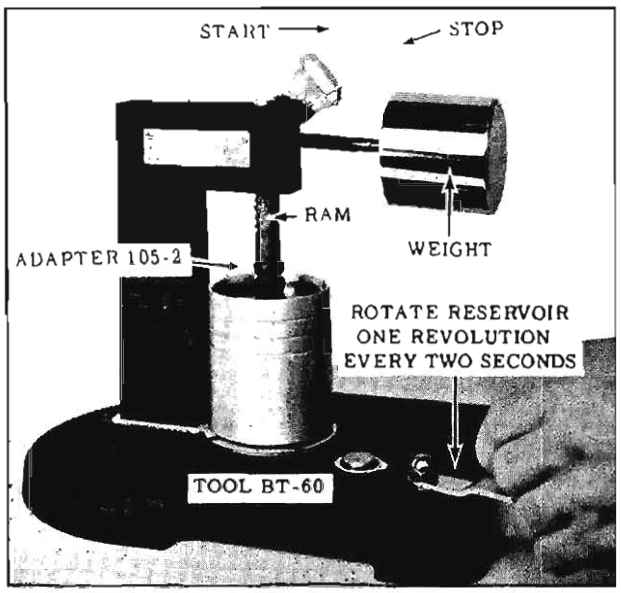


Fig. 3-411 Valve Lifter Bleed Down Test

13. If leak-down tolerance is within specifications, the lifter can be placed in service without removing test fluid.

Valve Lifter Diagnosis

1. Momentarily Noisy When Car is Started:

   This condition is normal. Oil drains from the lifters which are holding the valves open when the engine is not running. It will take a few seconds for the lifter to fill after the engine is started.

2. Intermittently Noisy on Idle Only, Disappearing When Engine Speed is Increased:

   Intermittent clicking may be an indication of a flat or pitted ball, or it may be caused by dirt.

   Correction: Clean the lifter and inspect. If ball is defective, replace lifter.

3. Noisy At Slow Idle or With Hot Oil, Quiet With Cold or As Engine Speed is Increased:

   Insert a .015" feeler gauge between the rocker arm and valve stem. If noise momentarily disappears and then re-appears after a few seconds with the feeler still inserted, it is an indication that the lifter "leak-down" rate is too fast.

   Correction: The lifter must be replaced.

4. Noisy at High Car Speeds and Quiet at Low Speeds.

   a. High oil level - Oil level above the "Full" mark allows crankshaft counter-weights to churn the oil into foam. When foam is pumped into the lifters, they will become noisy since a solid column of oil is required for proper operation.

   Correction: Drain oil until proper level is obtained. See PERIODIC MAINTENANCE SECTION.

   b. Low oil level - Oil level below the "Add 2" mark allows the pump to pump air at high speeds which results in noisy lifters.

   Correction: Fill until proper oil level is obtained. See PERIODIC MAINTENANCE SECTION.

5. Noisy at Idle Becoming Louder as Engine Speed is Increased to 1500 rpm.

   a. This noise is not connected with lifter malfunction. It becomes most noticeable in the car at 10-15 mph "L" range, or 30-35 mph "D" range, and is best described as a hashy sound. At slow idle, it may be entirely gone or appear as a light ticking noise in one or more valves. It is caused by one or more of the following:

      (1) Badly worn or scuffed valve tip and rocker arm pad.

      (2) Excessive valve stem to guide clearance.

      (3) Excessive valve seat runout.

      (4) Off square valve spring.

      (5) Off square rocker arm pad.

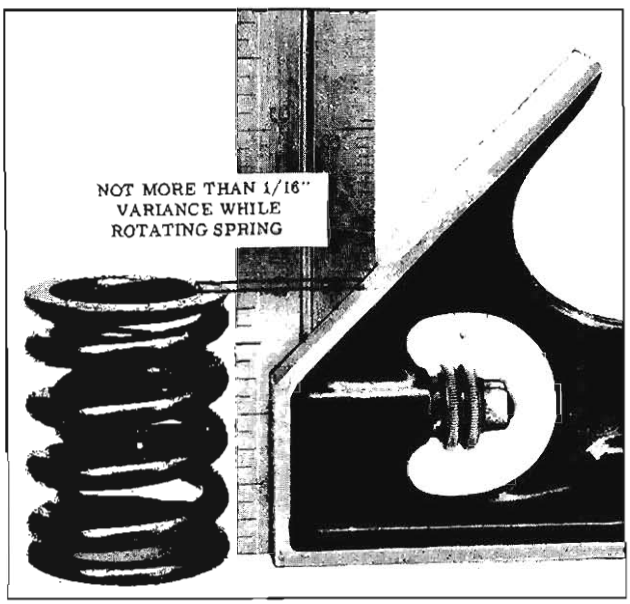


Fig. 3-412 Valve Spring Checking

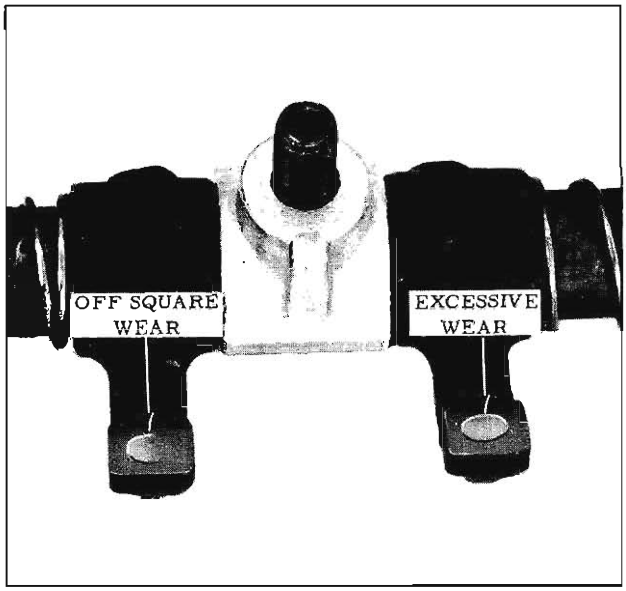


Fig. 3-413 Rocker Arm Wear

(6) Excessive valve face runout.

Diagnosis

Remove valve covers and while listening with a stethoscope, locate noisy valves by increasing engine speed slightly above idle, about 1500 rpm. With glooved hand, push sideways on valve spring. Noise will change, either becoming louder or disappearing completely. Some noise will be present in all valve locations. It is necessary to determine which are actually responsible for the noise.

Correction:

a. Occasionally this noise can be eliminated by rotating the valve spring and valve. Crank engine until noisy valve is off its seat. Rotate spring. This will also rotate valve. Repeat until valve becomes quiet. If correction is obtained, check for an off square valve spring. If spring is off square more than 1/16" in free position, replace spring. (Fig. 3-412)

b. Observe rocker arm pad for excessive wear or excessive off square. Replace as required. (Fig. 3-413)

c. If correction is not obtained, check for excessive valve stem to guide clearance. If necessary, correct as required.

6. Valves Noisy Regardless of Engine Speed.

This condition can be caused by foreign particles or excessive valve lash.

Correction:

a. If a foreign particle in the lifter is restricting proper operation, this method sometimes proves successful in dislodging the particle.

With transmission in neutral and parking brake on, run the engine at a high speed.

If this method does not quiet the lifter, strike the rocker arm above the push rod with a mallet while the engine is idling. This method of correction has proven successful for dislodging a foreign particle which is preventing the ball from seating properly.

b. Check for valve lash by turning engine so the piston in that cylinder is on top dead center of firing stroke. If valve lash is present, the push rod can be freely moved up and down a certain amount with rocker arm held against valve.

Valve lash indicates one of the following:

(1) Worn push rod.

(2) Worn rocker arm.

(3) Lifter plunger stuck in down position due to dirt or varnish.

(4) Defective lifter.

Checking of the above four items:

Remove the rocker arm shaft assembly then proceed as follows:

1. Observe upper end of push rod. Excessive wear of the spherical surface indicates one of the following conditions.

a. Improper hardness of the push rod ball. The rod and arm must be replaced.

b. Improper lubrication to the push rod. The push rod and rocker arm must be replaced. The oiling system to the push rod should be checked.

2. If push rod appears in good condition and has been properly lubricated, replace rocker arm and recheck valve lash.

3. If valve lash exists and push rod and rocker arm are O.K., trouble is in the lifter. Lifter should be replaced.

CYLINDER HEAD AND GASKET

Removal

1. Drain radiator and cylinder block.
2. Disconnect spark plug wires and remove intake manifold.
3. Disconnect exhaust crossover pipe for left side and/or crossover pipe and exhaust pipe for right side.
4. Remove valve cover.

   NOTE: Loosen or remove any accessory brackets which interfere.

5. Remove ground strap from right cylinder head.
6. Remove rocker arm shaft assembly and remove push rods.
7. Remove cylinder head bolts and remove cylinder head with exhaust manifold attached.

   CAUTION: DO NOT BEND OIL DIPSTICK TUBE WHEN REMOVING OR INSTALLING LEFT CYLINDER HEAD.

Installation

Torque head bolts 60 to 80 ft. lbs. (Fig. 3-414) and torque exhaust manifold to head bolts 20 to 25 ft. lbs.

Head gasket should be coated on both sides with P.O.B. No. 4 Sealer or equivalent before installation.

VALVES AND SPRINGS (HEAD REMOVED)

NOTE: The valve order in each cylinder head has been changed to accommodate the new exhaust manifold. This is shown in Fig. 3-416.

Removal

1. Remove spark plugs and exhaust manifold.
2. Remove valve keys by compressing valve spring with a tool such as J-7541 or OTC-CF-11.
3. Remove valve spring retainers and springs. (Fig. 3-415)
4. Remove oil deflectors from valve stems.
5. Remove valves. Keep valves separated so they can be installed in their original locations. (Fig. 3-416)

Installation

1. Install valves in their respective guides.
2. Install new oil deflectors over valve stem. Position deflectors down as far as possible on valve stem. The deflectors will correctly position themselves when the engine is started.
3. Position valve springs over valve stems.
4. Install valve spring retainers then compress springs with a tool such as J-7541 or OTC-CF-11 and install valve stem keys.

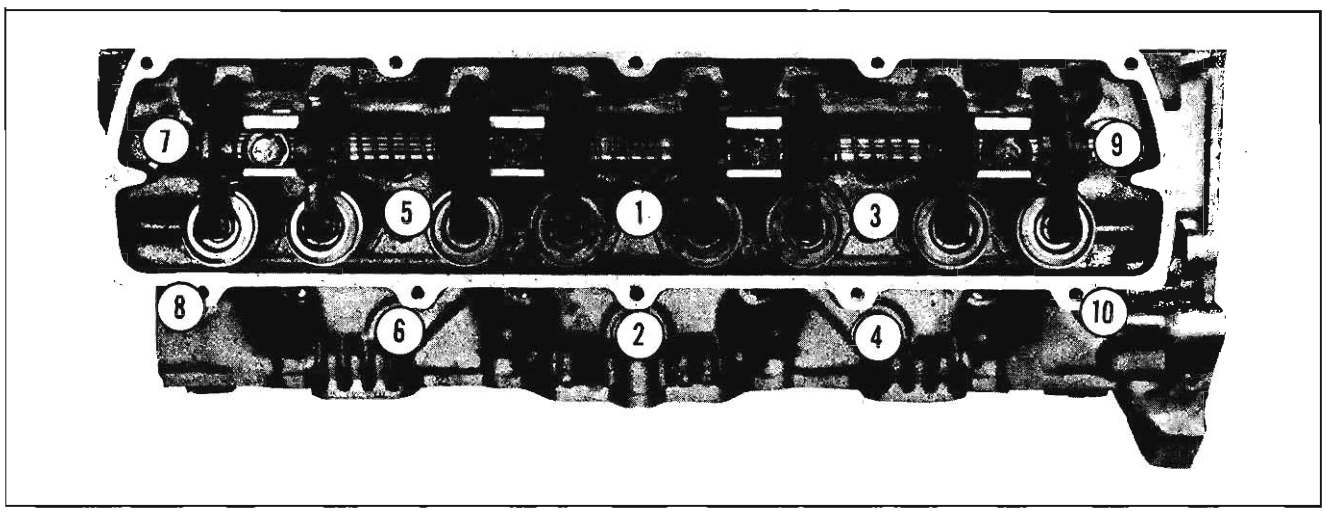


Fig. 3-414 Cylinder Head Torque Sequence

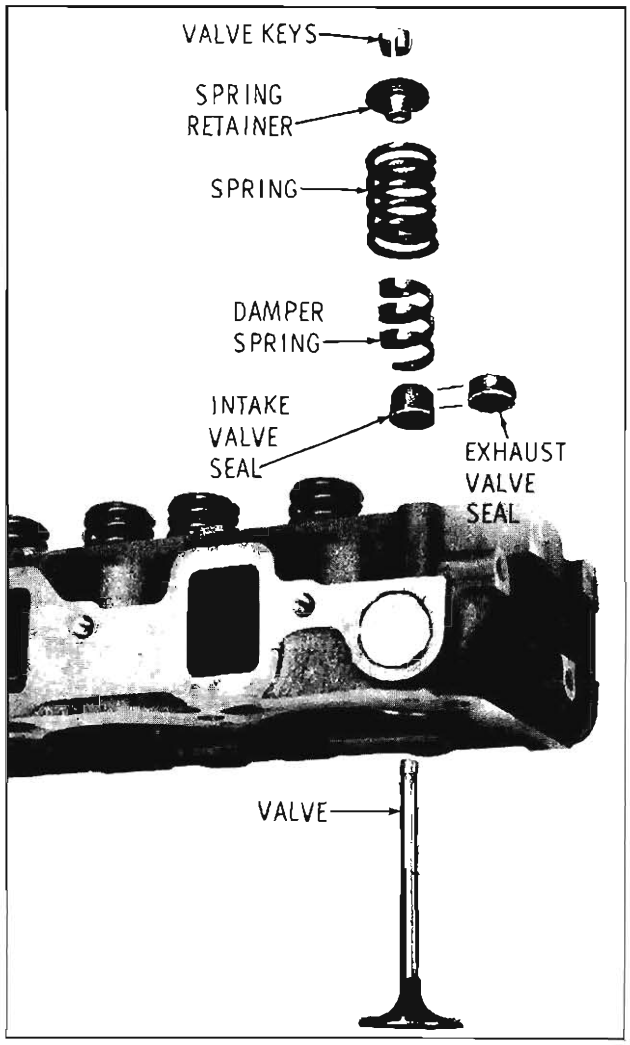


Fig. 3-415 Valve Assembly - Exploded View

5. Check valve springs and keys to be sure they are properly seated.

6. Install exhaust manifold. Torque bolts and nuts 20-25 ft. lbs.

7. Set spark plug gap (.030"). Lubricate plug threads with 1 drop of SAE 10W30 oil and re-install plugs. Torque 25-35 ft. lbs.

Reconditioning Valves

When reconditioning valves and valve seats, clean carbon from cylinder heads and valves using extreme care not to gouge or scratch machined surfaces. A soft wire brush is suitable for the purpose. Whenever valves are replaced or new valves installed, the valve seats must be reconditioned. If valve guides are worn excessively, they can be reamed oversize. This will require replacement of the valves. The guides should be reamed before grinding the valve seats. Valve clearance in guide should be .001" to .003".

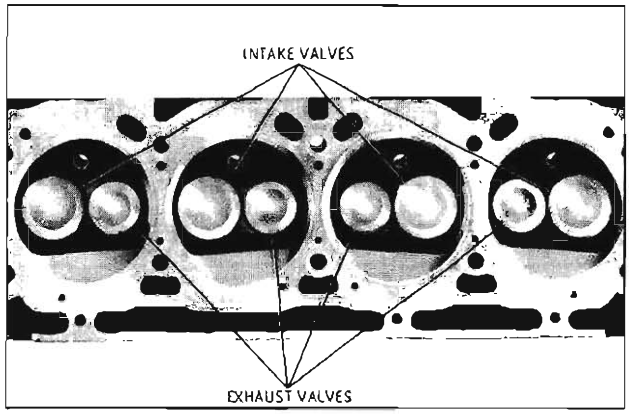


Fig. 3-416 Valve Location

VALVE GUIDES

As previously stated, if the valve guides are worn excessively, they can be reamed oversize. The following reamers are available:

BT-6414-1 .003" Oversize Valve Guide Reamer

BT-6414-2 .006" Oversize Valve Guide Reamer

BT-6414-3 .013" Oversize Valve Guide Reamer

If a standard valve guide is being reamed, use the .003" oversize reamer. If a .003" oversize valve guide is being reamed, use the .006" oversize reamer. For the .010" oversize valve guide, use the .013" oversize reamer. Note that in each case, the reamer used was .003" larger than the valve guide. If too large a reamer is used and the spiraling is removed, it is possible that the valve will not receive the proper lubrication.

Three sizes of valve guides are used in production engines: Standard, .003" oversize and .010" oversize. Oversize valve guides are marked on the inboard side of the cylinder heads on the machined surface just above the intake manifold surface, Fig. 3-417. These markings are visible without removing any parts other than the air cleaner assembly. Before removing the cylinder heads to perform service to either the valves or valve guides, the cylinder heads should be inspected to determine if these markings are present. If no markings are present, the guides are standard. If oversize markings are present, any valve replacement will require an oversize valve. Service valves are available in 5 different stem diameters: Standard, .003" oversize, .006" oversize, .010" oversize, and .013" oversize.

REAMING PROCEDURE

Before attempting to ream the valve guides, they should be cleaned using Tool BT-6415 as shown in Fig. 3-418.

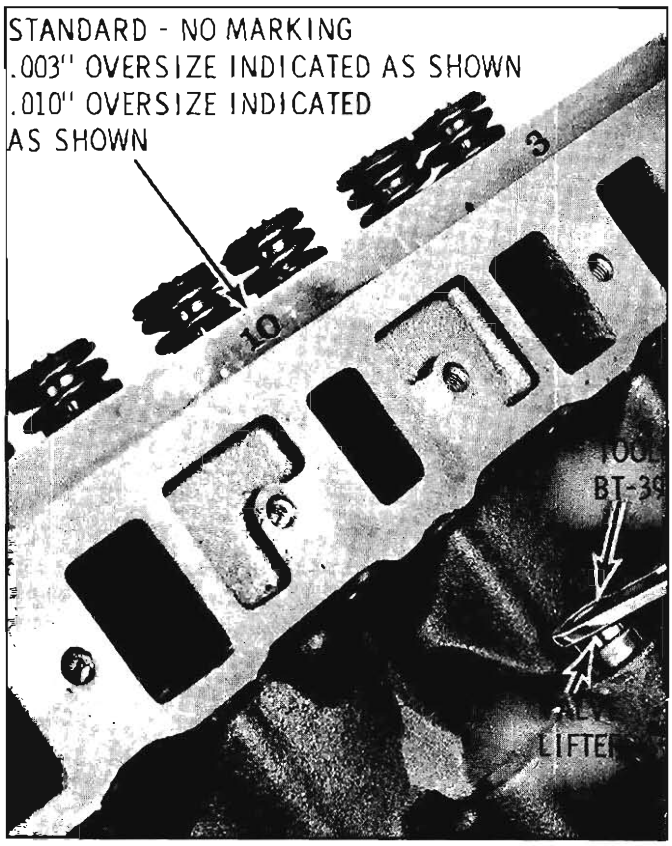


Fig. 3-417 Valve Guide Marking

This procedure to ream valve guides using Tool BT-6414 is shown in Fig. 3-419. Use care to hold reamer straight in valve guide.

REPLACING VALVE SPRING (HEAD ON ENGINE)

To replace a worn or broken valve spring without removing the cylinder head:

Removal

1. Remove rocker arm assembly.

2. Remove spark plug and install Tool BT-72-1-B into spark plug hole and attach to an air hose to hold the valve against its seat.

3. Install Tool BT-6413, (Fig. 3-420) compress the valve spring until valve keys are accessible, then remove keys, spring retainer cups, and springs.

   NOTE: If valve spring does not compress, tap retainer with a plastic hammer to break bind at retainer and keys.

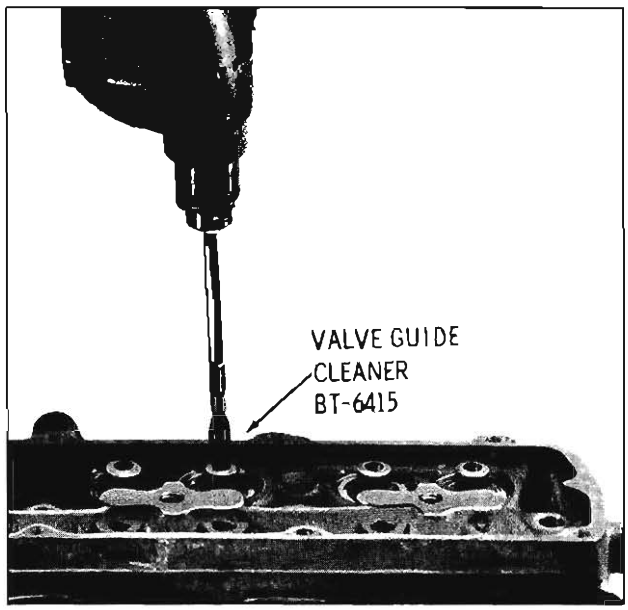


Fig. 3-418 Cleaning Valve Guides

Installation

1. Install valve spring and spring retainer. Using Tool BT-6413 compress the valve spring until the valve keys can be installed.

2. Install spark plugs. Torque 25-35 ft. lbs.

3. Install rocker arm assembly.

OIL PAN (All V-8 Except 33 Series)

Removal

1. Remove the dipstick.

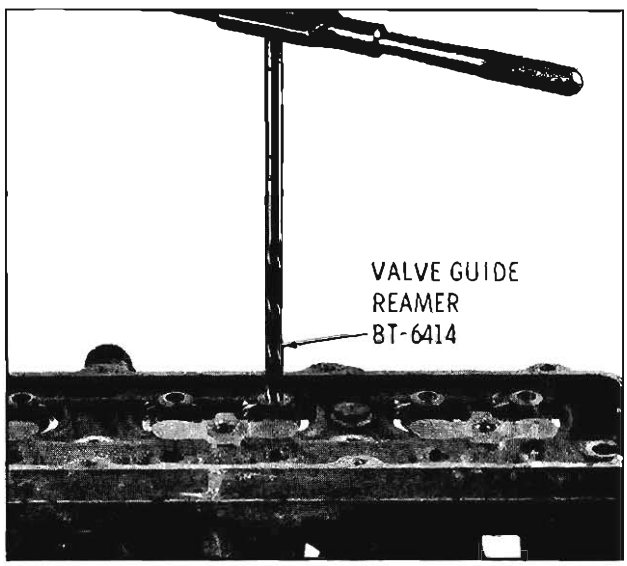


Fig. 3-419 Reaming Valve Guide

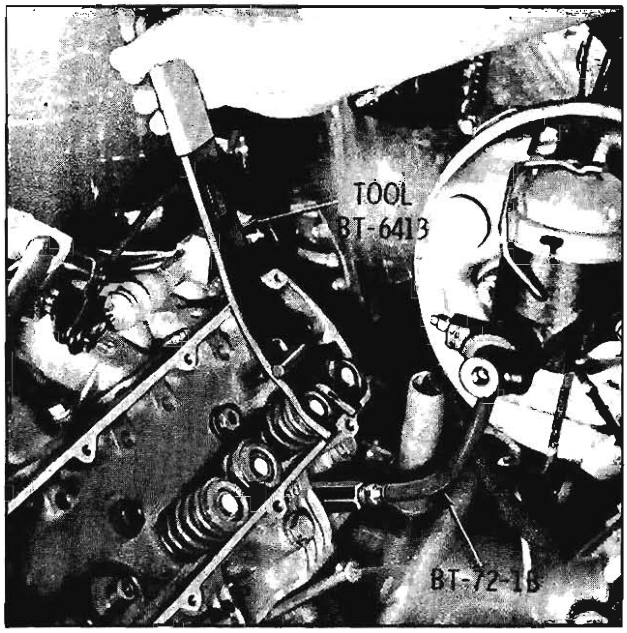


Fig. 3-420 Removing Valve Spring

2. Hoist the car and drain oil.

3. Disconnect exhaust pipe from right exhaust manifold.

4. Disconnect front engine mounts and jack front of engine up as far as possible using a wooden block under front of crankshaft hub and wooden blocks between halves of front engine mounts.

CAUTION: Be sure distributor does not contact cowl and fan blades do not contact fan ring. Position No. 1 crankshaft throw up.

5. Remove crossover pipe and starter.

6. Remove oil pan attaching bolts and remove oil pan.

Installation (Fig. 3-421)

Reverse removal procedure. Torque 5/16" pan bolts 12-15 ft. lbs. and 1/4" pan bolts 4-8 ft. lbs. Fill crankcase as explained in the PERIODIC MAINTENANCE section.

OIL PAN (33 Series)

Removal

1. Remove the dipstick.

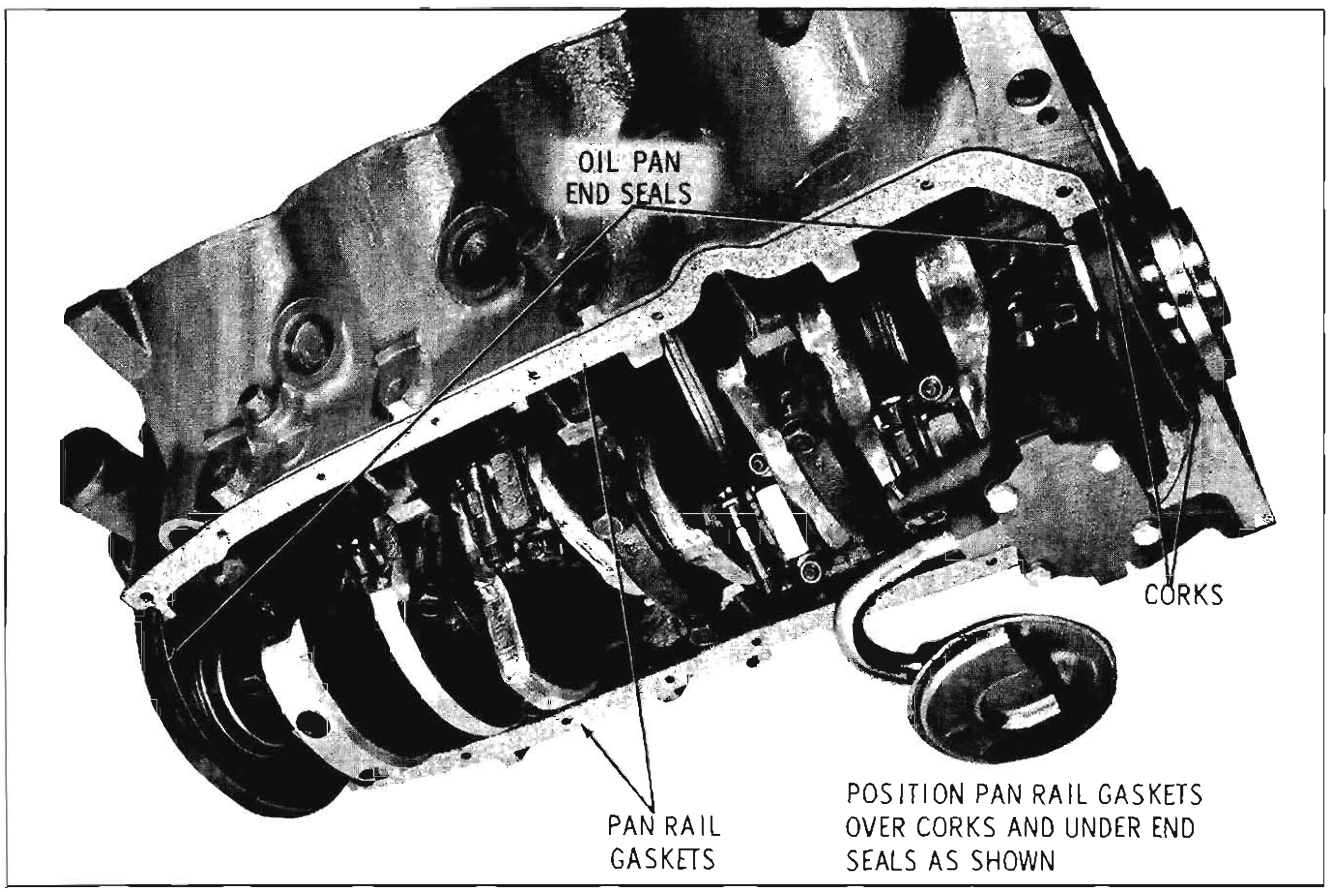


Fig. 3-421 Oil Pan Installation

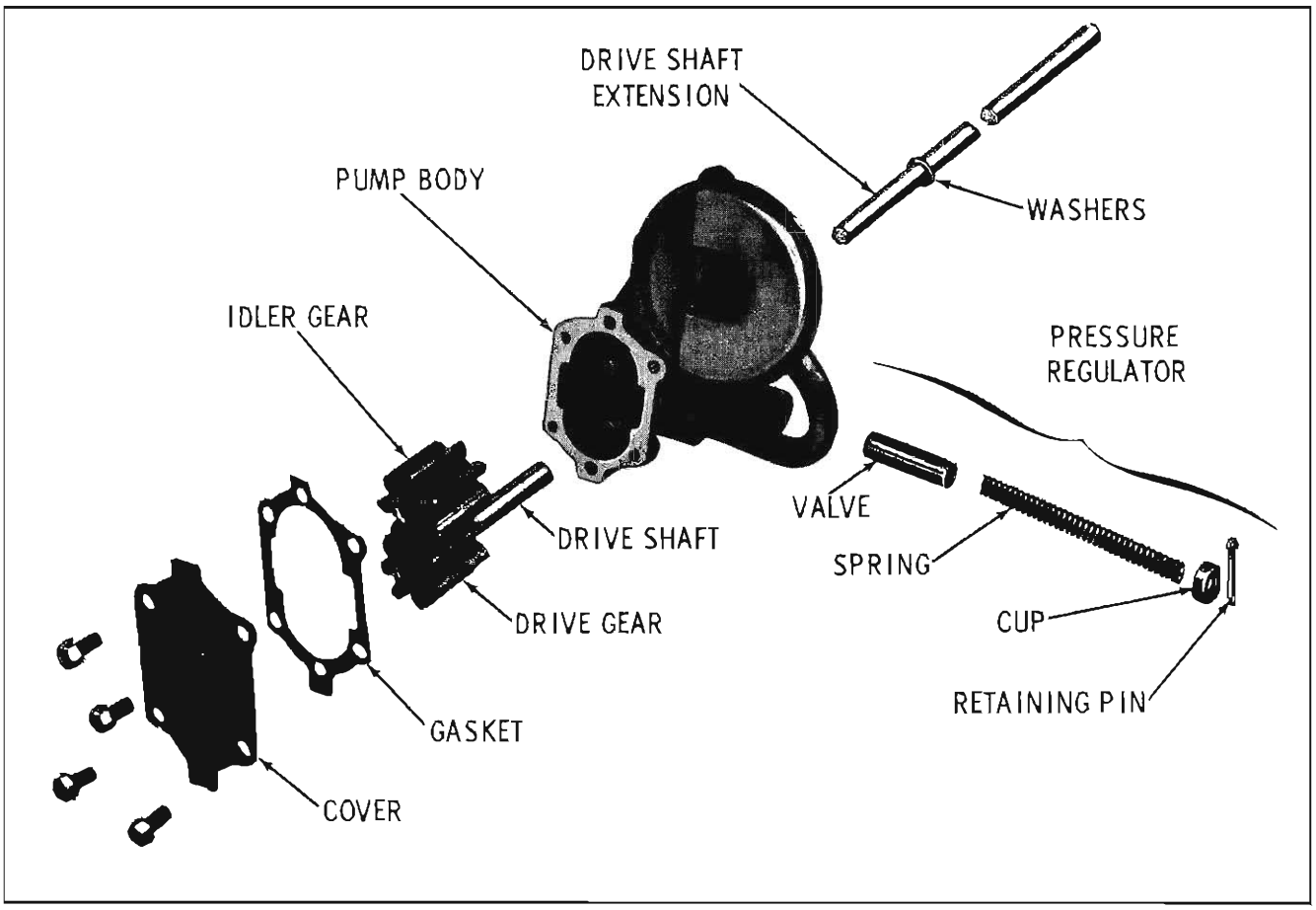


Fig. 3-422 Oil Pump - Exploded View

2. Hoist the car and drain oil.

3. Disconnect pitman arm from pitman shaft and lower relay rod.

4. Remove starter, flywheel cover, and cross-over pipe.

5. Remove oil pan attaching bolts and remove oil pan.

Installation (Fig. 3-421)

Reverse removal procedure. Torque 5/16" pan bolts 12-15 ft. lbs. and 1/4" pan bolts 5-8 ft. lbs. Fill crankcase as explained in the PERIODIC MAINTENANCE section.

OIL PUMP

Removal

1. Remove oil pan. Refer to OIL PAN - Removal.

2. Remove oil pump baffle.

3. Remove the oil pump to rear main bearing cap attaching screws, then remove pump and drive shaft extension.

Disassembly (Fig. 3-422)

1. Remove the oil pump drive shaft extension.

NOTE: Do not attempt to remove the washers from the drive shaft extension. The drive shaft extension and washers must be serviced as an assembly. (Fig. 3-423)

2. Remove the retaining pin spring and the pressure regulator valve.

CAUTION: Position thumb over pressure regulator bore before removing retaining pin as the spring is under tension.

3. Remove the oil pump cover attaching screws and remove the oil pump cover and gasket.

4. Remove the drive gear and idler gear from the pump body.

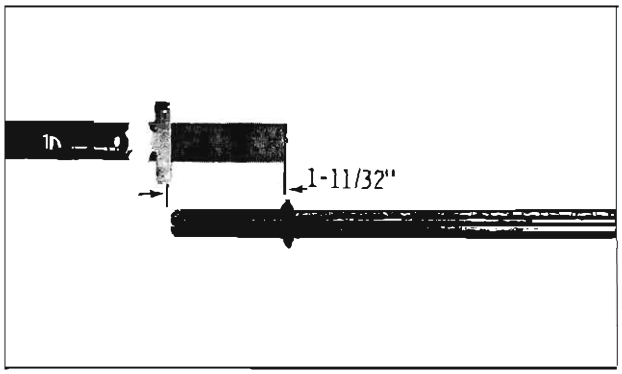


Fig. 3-423 Oil Pump Drive Shaft Extension

Assembly

1. Install the drive gear into the pump with the hex ID of the drive shaft toward the oil pump mounting pad, then install the idler gear.

2. Position a new gasket on the pump body and install the oil pump cover. Tighten the cover screws 5-8 ft. lbs.

3. Position the pressure regulator valve into the pump cover, closed end first, then install the spring and retaining pin.

IMPORTANT: When assembling the drive shaft extension to the drive shaft, the END OF THE EXTENSION NEAREST THE WASHERS MUST BE INSERTED INTO THE THE DRIVE SHAFT.

Installation

1. Insert the drive shaft extension through the opening in the block until the shaft mates into the distributor drive gear.

2. Position pump onto the rear main bearing cap and install attaching bolts. Torque bolts 25-35 ft. lbs. (Fig. 3-424)

3. Install the oil pan. Refer to OIL PAN - Installation.

CONNECTING ROD AND PISTON ASSEMBLY

Removal

1. Remove intake manifold, head or heads.

2. Remove oil pan.

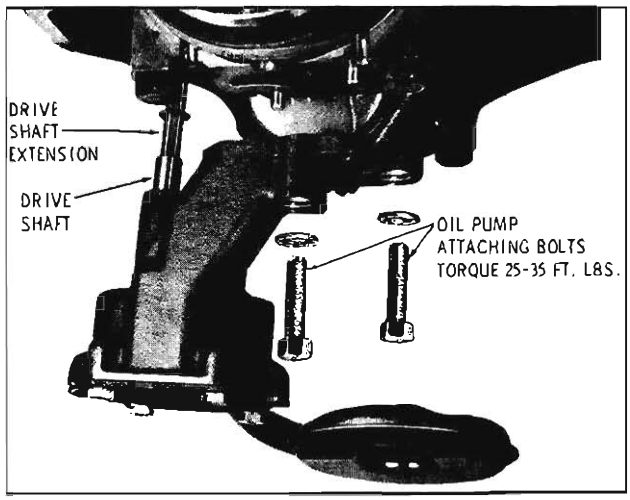


Fig. 3-424 Oil Pump Installation

3. Remove oil pump assembly.

IMPORTANT: Stamp cylinder number on the machined surfaces of the bolt bosses of the connecting rod and cap for identification when reinstalling. If the pistons are to be removed from the connecting rod, mark cylinder number on piston with a silver pencil or quick drying paint. The right bank is numbered 2-4-6-8, left bank 1-3-5-7.

3. Examine the cylinder bore above ring travel. If ridge exists, remove ridge with ridge reamer before attempting to remove the piston and rod assembly.

4. Remove rod bearing cap and bearing.

5. Install guide hose over threads of rod bolts. This is to prevent damage to bearing journal and rod bolt threads. (Fig. 3-425)

6. Remove rod and piston assembly through the top of the cylinder bore.

7. Remove other rod and piston assemblies in the same manner.

ROD BEARINGS

The connecting rod bearings are assembled with a slight projection above the rod and cap faces to insure a positive contact. Adjustment for wear is compensated by replacing the bearing.

Connecting rod bearings can be replaced without removing the rod and piston assembly from the engine.

1. Remove oil pan.

NOTE: It may be necessary to remove oil pump to provide access to rear connecting rod bearings.

Fig. 3-425 Connecting Rod Bolt Guides

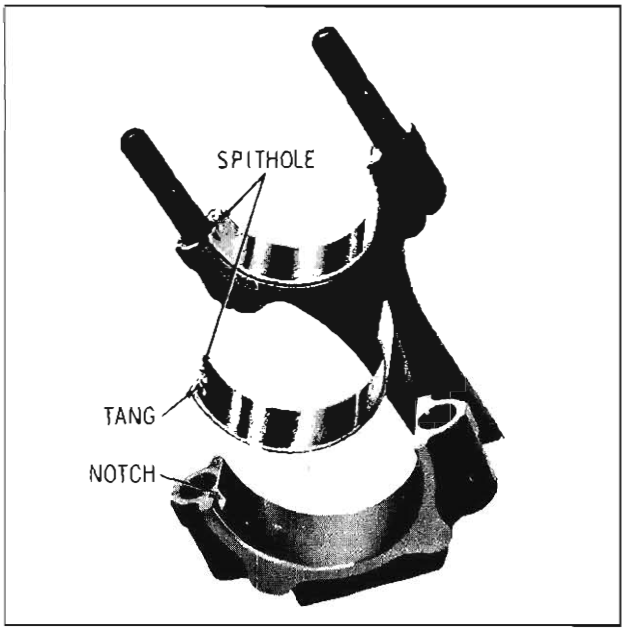


Fig. 3-426 Bearing Tang and Notch

2. With connecting rod journal at the bottom, stamp cylinder number on machined surfaces of connecting rod and cap for identification when reinstalling, then remove caps.

3. Inspect journals for roughness and wear. Slight roughness may be removed with a fine grit polishing cloth saturated with engine oil. Burrs may be removed with a fine oil stone. If the journals are scored or ridged, the crankshaft must be replaced.

4. The connecting rod journals can be checked for out-of-round with the use of a micrometer. Maximum out-of-round must not exceed .0015".

If plastigauge is to be used:

5. Clean oil from journal bearing cap, connecting rod, and outer and inner surface of bearing inserts. Position insert so that tang is properly aligned with notch in rod and cap. (Fig. 3-426)

6. Place a piece of plastigauge in the center of lower bearing shell

7. Reinstall bearing cap and torque 30-42 ft. lbs.

8. Remove bearing cap and determine bearing clearances by comparing the width of the flattened plastigauge at its widest point with the graduation on the plastigauge container. The number within the graduation on the envelope indicates the clearance in thousandths of an inch. (Fig. 3-427) If this clearance is greater than .0035", replace the bearing and recheck clearance with plastigauge.

NOTE: Lubricate bearing with SAE 10W30 oil before installation. Repeat Steps 2 thru 7 on remaining connecting rod bearings.

All rods must be connected to their journals when rotating the crankshaft.

9. Measure the rod size clearance as shown in Fig. 3-428.

ROD ASSEMBLY

If a rod is twisted or bent, a new rod must be installed. NO ATTEMPT SHOULD BE MADE TO STRAIGHTEN CONNECTING RODS.

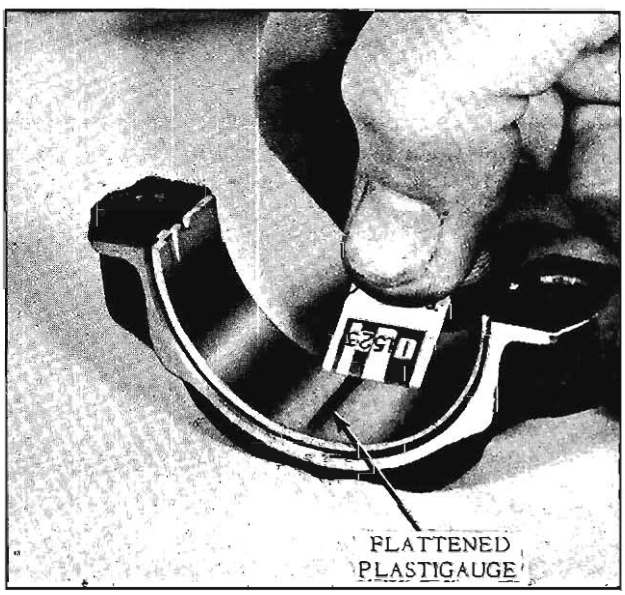


Fig. 3-427 Checking Oil Clearance

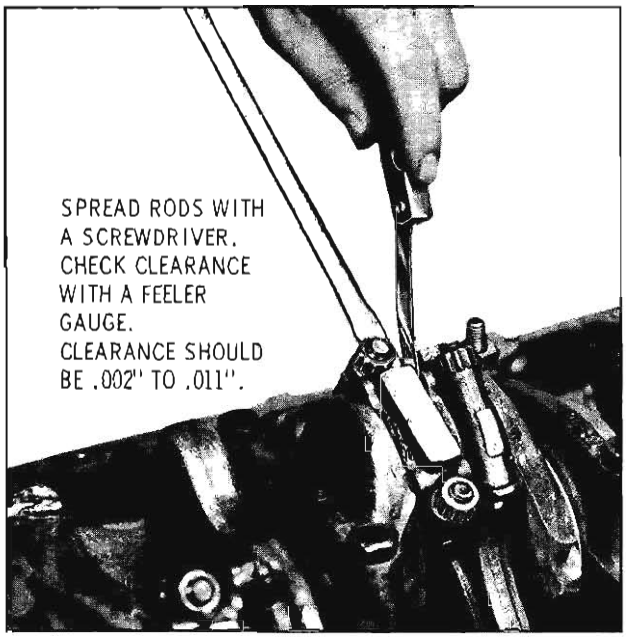


Fig. 3-428 Connecting Rod Side Clearance

PISTON

MEASURING PISTON

When replacing pistons, the original cylinder size is stamped with a code letter on the block near each cylinder on the cylinder head surface.

When measuring piston for size or taper, measurement must be made on skirt 90° from piston pin hole (with the piston pin removed).

When measuring taper, the largest reading must be at the bottom of the skirt. Allowable taper is .000" to .001".

NOTE: On some cars, oversize pistons may be found. These pistons will be either .005" or .010" oversize.

NOTE: The piston and cylinder bore must be free of oil and at the same temperature.

1. Place a strip of .0015" feeler gauge against the upper side of the bore, at 90° to the normal piston pin location. Attach scale J-5515 to feeler gauge. (Fig. 3-429)

2. Insert piston with pin and rings removed, into bore with head downward.

3. While holding the piston in the center of its normal travel, slowly pull the scale in a straight line and note the reading on the scale. The reading should be between 3 to 12 pounds while pulling the feeler gauge out of the bore.

Each piston should be fitted to its individual cylinder and marked for that cylinder.

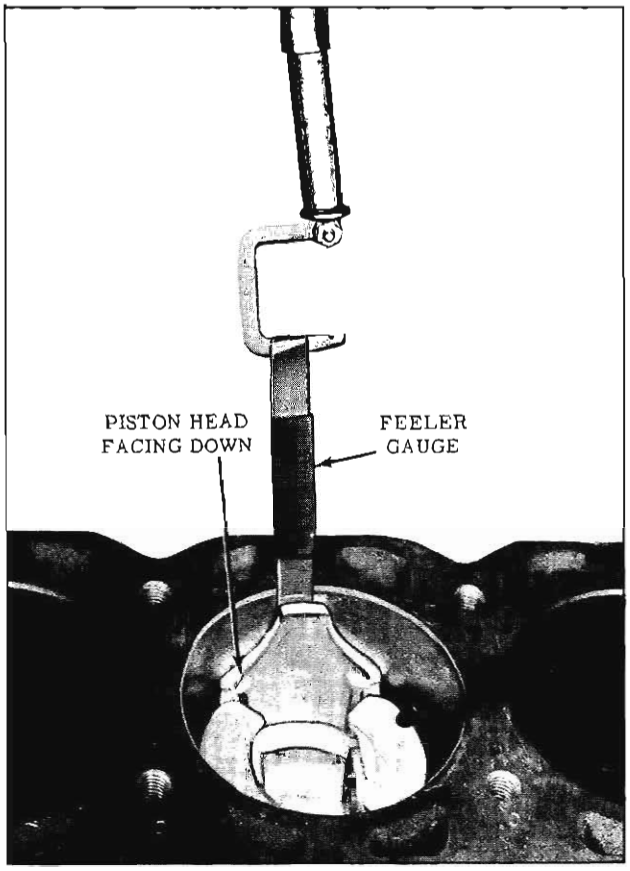


Fig. 3-429 Checking Piston Clearance

CHECKING CYLINDER BORE

Cylinder bore size can be measured with inside micrometers or a cylinder gauge. Maximum allowable taper of the cylinder bore is .010". The most wear will occur at the top of the ring travel.

Reconditioned cylinder bores should be held to not more than .001" out-of-round and .001" taper. They should not be bored over .010".

It is important that reconditioned cylinder bores be thoroughly washed with a soap and water solution to remove all traces of abrasive material to eliminate premature wear.

CLEANING PISTON

Clean the pistons by scraping carbon off the top of the piston. Deposits in the ring grooves should be removed with a suitable ring groove cleaning tool. It is important that the ring grooves be completely free of deposits.

RINGS (Fig. 3-430)

The pistons have three rings (two compression rings and one oil ring). The oil rings consist of two rails and an expander.

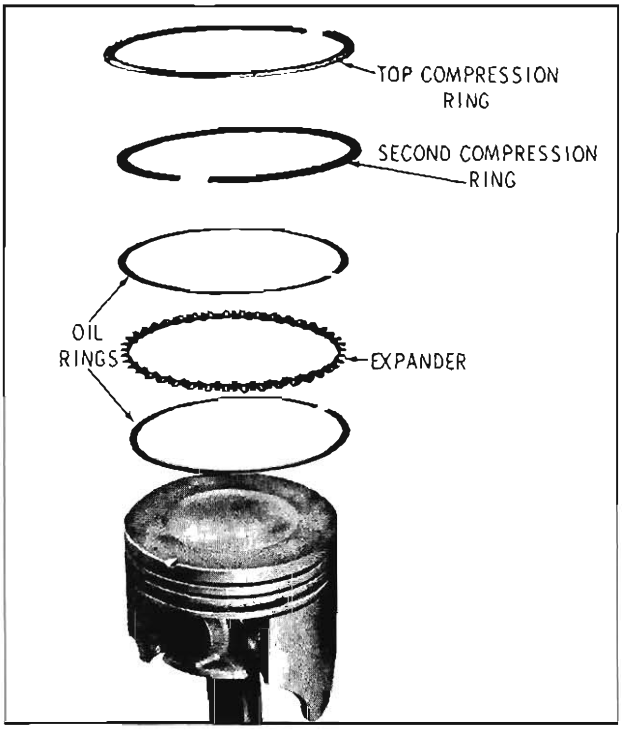


Fig. 3-430 Piston Rings

Ring Tolerances

When installing new rings, ring gap and side clearance should be checked as follows:

Piston Ring and Rail Gap

Each ring and rail gap must be measured with the ring or rail positioned squarely and at the bottom of the ring-travel area of the bore. (Fig. 3-431)

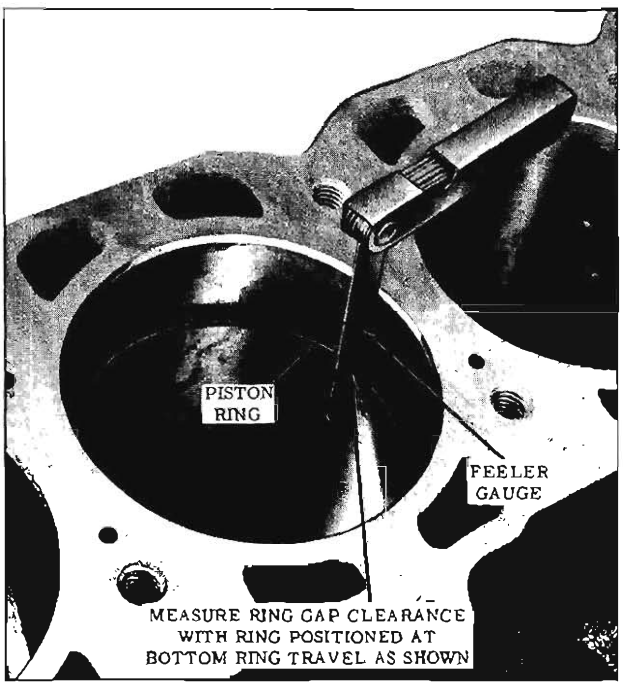


Fig. 3-431 Measuring Piston Ring Gap

If the gap measurement is less than .010" to .020" for compression rings and .015" to .055" for oil rings, minimum, file the ends of rings and rails until the minimum gap is obtained. Ends of rings and rails must be filed square.

Side Clearance

Each ring must be checked for side clearance (see chart) in its respective piston groove by inserting a feeler gauge between the ring and its upper land. (Fig. 3-432) The piston grooves must be cleaned before checking ring for side clearance.

NOTE: To check oil ring side clearance, the oil rings must be installed on the piston.

ALLOWABLE SIDE CLEARANCE

Oil Rings . . . . . .0001" to .0051"

Compression Ring . . . . . .0018" to .0038"

Ring Installation (Fig. 3-430)

IMPORTANT: For service ring specification and detailed installation instructions, refer to the instructions furnished with the parts package.

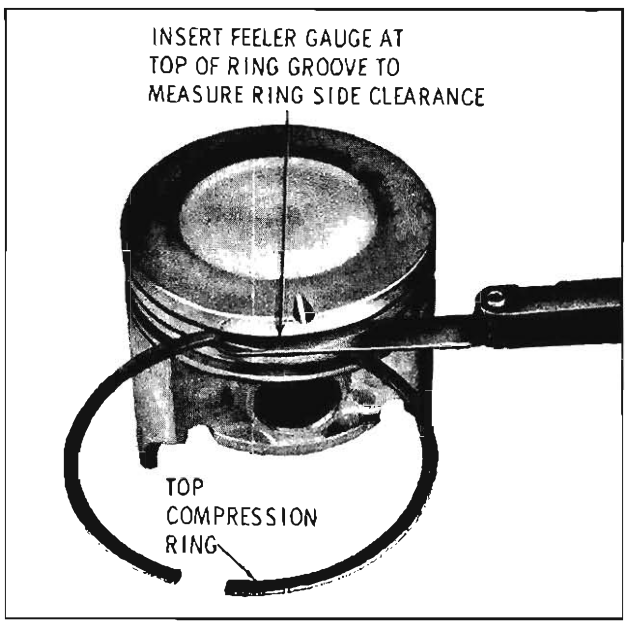


Fig. 3-432 Piston Ring Side Clearance

ROD AND PISTON ASSEMBLY

Installation

1. Install connecting rod bolt guide hose over rod bolt threads. (Fig. 3-425)

2. Apply SAE 10W30 oil to rings and piston, then install piston ring compressing tool on piston. (Fig. 3-433)

3. Install assembly in its respective cylinder bore so notch cast in top of piston is towards the front of engine.

4. Lubricate the crankshaft journal with new SAE 10W30 oil and install connecting rod bearing and cap, with bearing index tang in rod and cap on same side.

   NOTE: When more than one rod and piston assembly is being installed, the connecting rod cap attaching nuts should only be tightened enough to keep each rod in position until all have been installed. This will facilitate installation of remaining piston assemblies.

   The clearance between the adjacent rods when checked with a feeler gauge on each crankpin should be from .002" to .011". (Fig. 3-428)

5. Torque rod bolt nuts 32-42 ft. lbs.

PISTON PINS

The correct piston pin fit in the piston is .0003" to .0005" loose. If the pin to piston clearance is to the high limit (.0005"), the pin can be inserted in the piston with very little hand pressure, and will fall through the piston by its own weight. If the clearance is .0003", the pin will not fall through. It is important that the piston pin hole be clean and free of oil when checking pin fit. The pin is a press fit in the connecting rod.

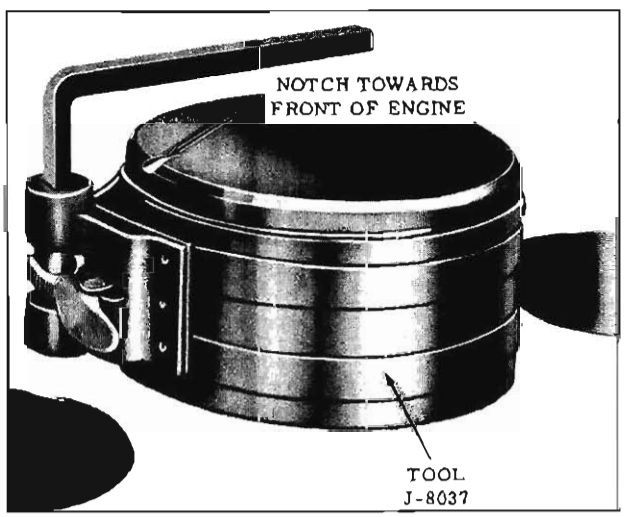


Fig. 3-433 Piston Ring Compressor

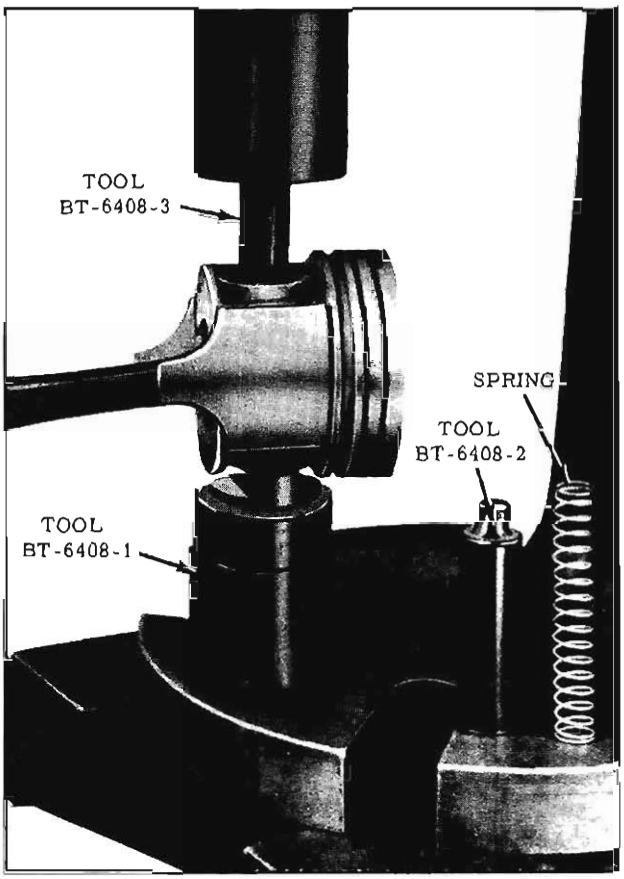


Fig. 3-434 Removing Piston Pin

Whenever the replacement of a piston pin is necessary, use the following procedure.

Removal

1. Place piston on piston pin remover Tool BT-6408-1, with the letter "F" on piston facing up.

2. Place Remover Tool BT-6408-3 in piston pin as shown in Fig. 3-434, and press pin out.

Installation

1. Place spring, Tool BT-6408-5, and guide stop Tool BT-6408-2 in main body Tool BT-6408-1. (Fig. 3-435)

2. Place piston on Tool BT-6408-1 with letter "F" facing up. Refer to Fig. 3-436 for correct rod and piston assembly.

3. Coat piston pin with SAE 10W30 oil. Place pin in piston as shown in Fig. 3-437. Press in piston pin with Tool BT-6408-3 until it makes contact with guide stop Tool BT-3408-2

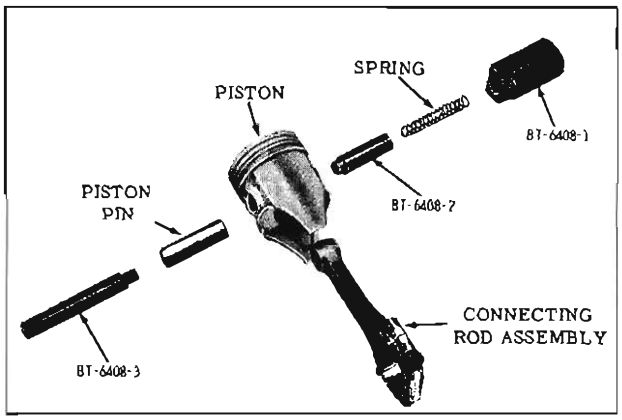


Fig. 3-435 Tool BT - 6408

in main body Tool BT-6408-1. This will automatically center the pin in the piston. Pin to connecting rod fit is .0008" to .0016" tight.

CRANKSHAFT PULLEY

Removal

1. Remove belt(s). Remove fan.

2. Hoist car.

3. Remove four (4) pulley bolts, reinforcement

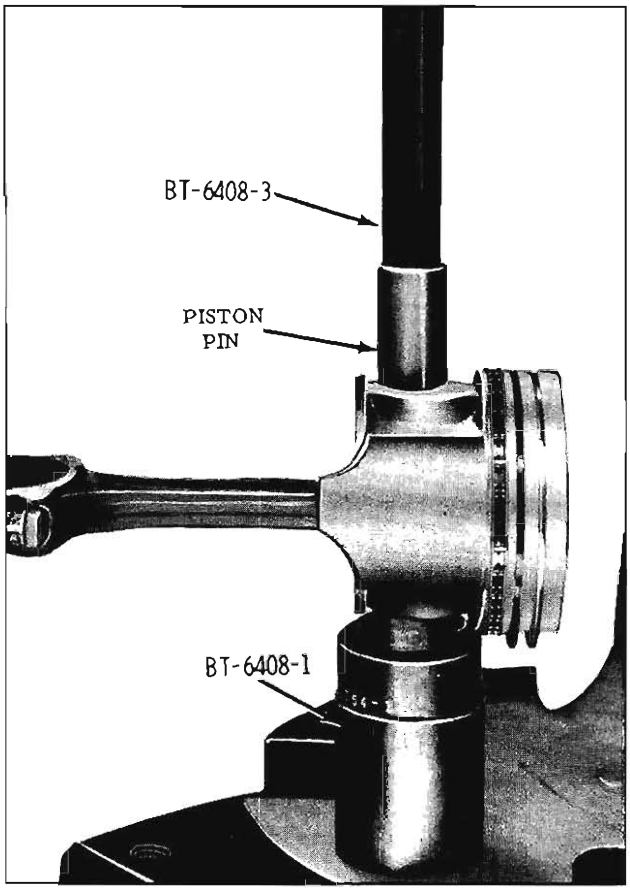


Fig. 3-437 Installing Piston Pin

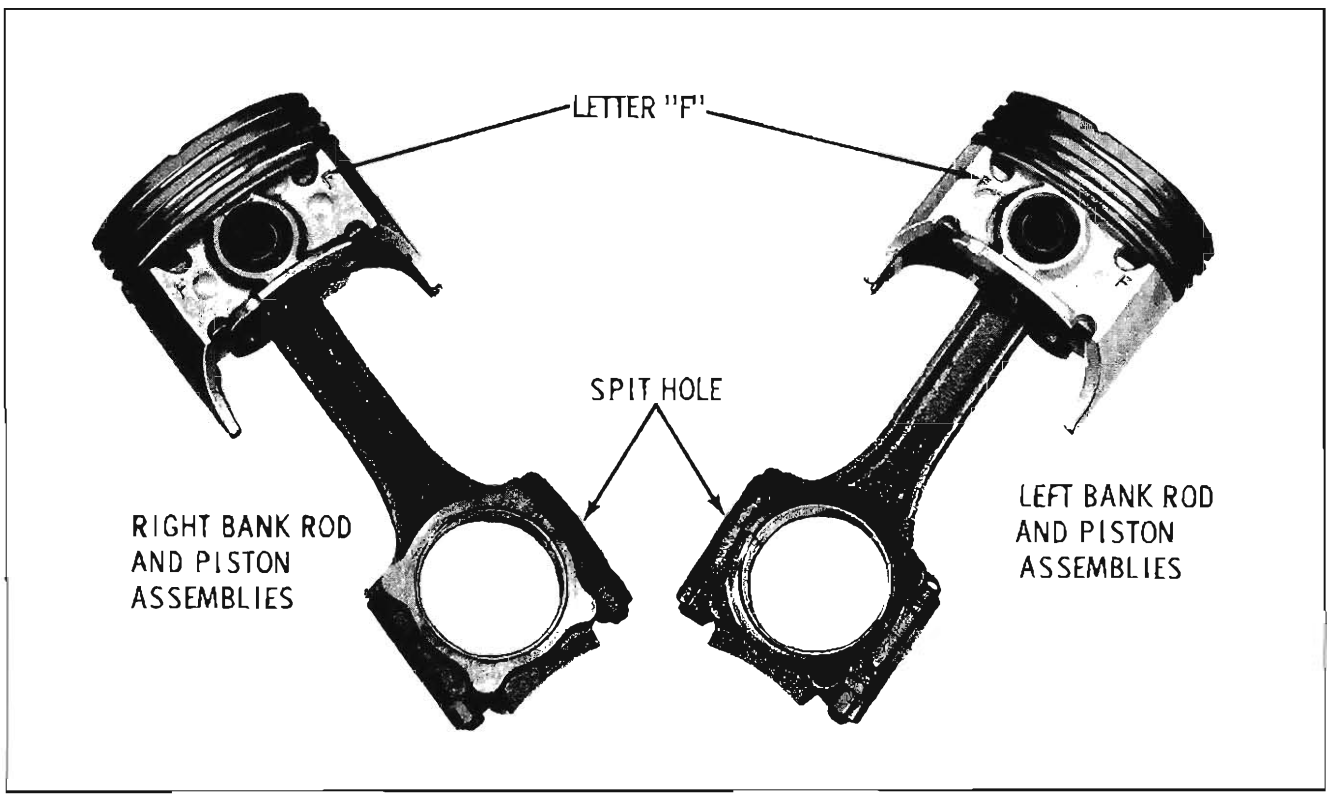


Fig. 3-436 Piston and Connecting Rod Assembly

plate and pulley. Air conditioning equipped cars do not have a reinforcement plate.

Installation

1. Install pulley, reinforcement plate and four (4) bolts. Torque 15-20 ft. lbs.
2. Install fan pulley and fan.
3. Install belt(s). Adjust belts using Tool BT-33-70.

CRANKSHAFT PULLEY HUB

NOTE: A harmonic balancer is used on all cars equipped with a 4 bbl. carburetor.

Removal

1. Remove belts. Remove fan, fan pulley, and crankshaft pulley hub.
2. Remove crankshaft pulley hub bolt and washer.
3. Remove pulley hub.
4. Install pulley and reinforcement plate on hub of balancer, then align small holes in plate and pulley with the bolt holes in balancer.
5. Install four (4) pulley bolts and torque 15-20 ft. lbs.

Installation

1. Apply P.O.B. No. 3 Sealer to inside diameter of pulley hub and to crankshaft key to prevent possible oil leakage. Coat outside area of crankshaft pulley hub which enters seal with special seal lubricant.
2. Install pulley hub on crankshaft.
3. Install pulley hub washer and bolt. Torque 100 ft. lbs. minimum.
4. Install belt(s). Use Tool BT-33-70M and adjust.

FRONT COVER

Removal

1. Drain cooling system.
2. Disconnect heater hose, bypass hose, and both radiator hoses.

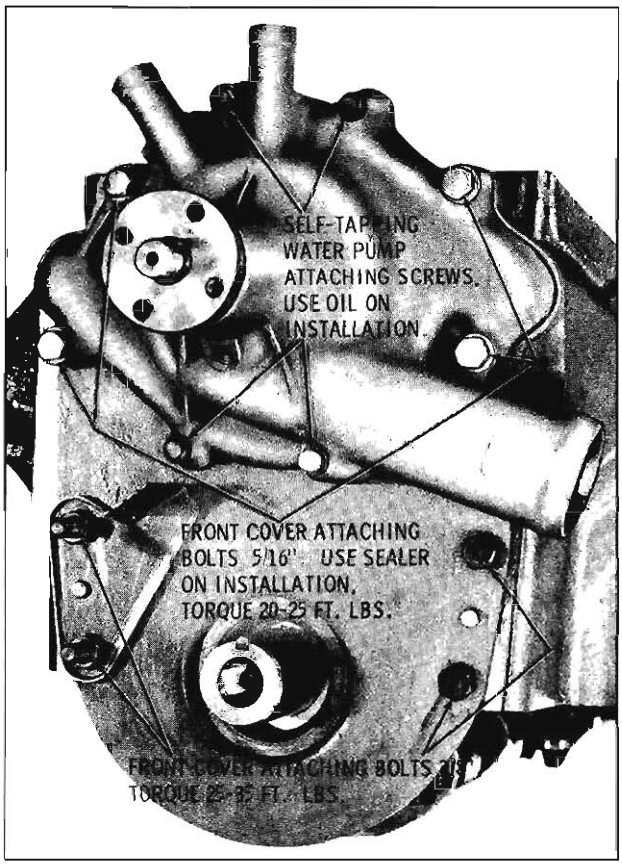


Fig. 3-439 Engine Front Cover Bolts

3. Remove all belts, fan and fan pulley, crankshaft pulley, and pulley hub.
4. Remove oil pan.
5. Remove cover to block attaching bolts and remove cover, timing pointer and water pump assembly. (Fig. 3-439)

Installation

1. Install new cover gasket. Apply P.O.B. No. 2 to gasket around water hose and place on block.
2. Install front cover, timing pointer and water pump assembly.
3. Apply SAE 10W30 oil to bolts (threads and heads) and install. Torque bolts evenly as indicated.
4. Apply seal lubricant on pulley hub seal surface.
5. Install pulley hub and pulley hub bolt. Torque 100 ft. lbs. minimum.
6. Connect heater hose, bypass hose and radiator hoses.

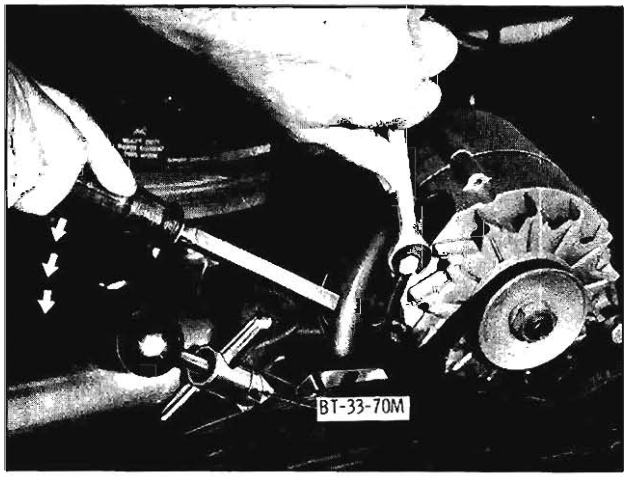


Fig. 3-440 Belt Adjustment

7. Install crankshaft pulley and four (4) attaching bolts. Torque 15-20 ft. lbs.

8. Install fan pulley, fan and four (4) attaching bolts. Torque bolts 15-20 ft. lbs.

9. Install belts and adjust using Tool BT-33-70M. Refer to Fig. 3-440 or Fig. 8-21.

10. Install oil pan.

11. Fill radiator and crankcase.

OIL SEAL

Removal—Front Cover Installation

1. Remove the belts.

2. Remove the crankshaft pulley and pulley hub.

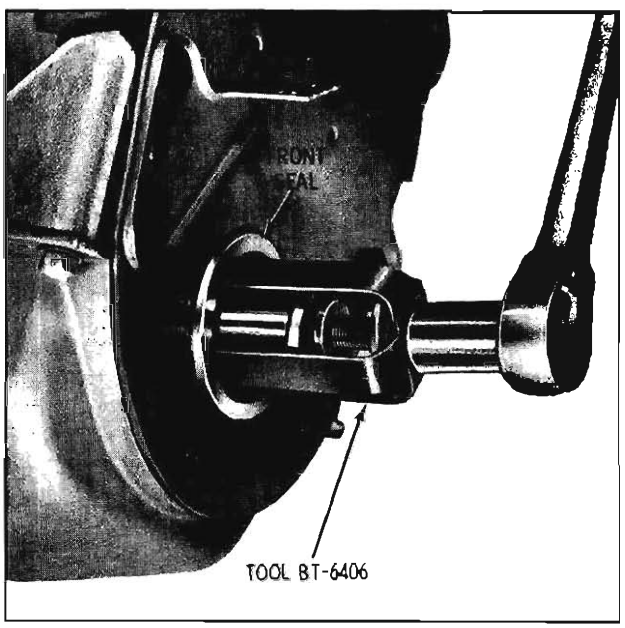


Fig. 3-441 Front Oil Seal Removal

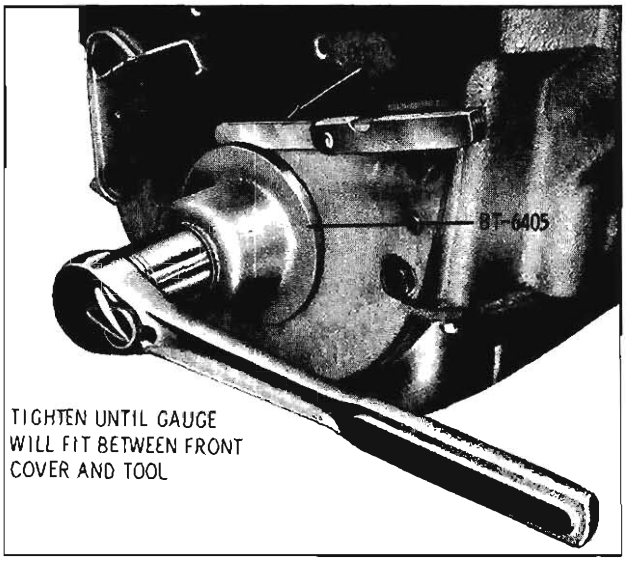


Fig. 3-442 Front Oil Seal Installation

3. Using Tool BT-6406, remove oil seal as shown in Fig. 3-441.

Installation

1. Apply P.O.B. No. 4 Sealer to outside of seal.

2. Using Tool BT-6405, install oil seal as shown in Fig. 3-442.

3. Install the pulley hub and crankshaft pulley.

4. Install and adjust belts. (Fig. 3-440 or Fig. 8-21)

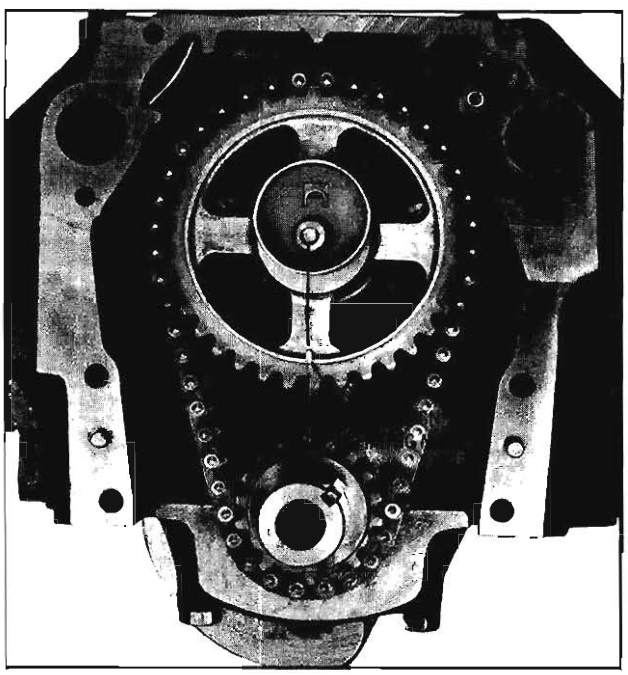


Fig. 3-443 Timing Gear Position

TIMING CHAIN AND GEARS (With Front Cover Removed)

Removal

1. Remove fuel pump eccentric.
2. Remove oil slinger, crankshaft gear, chain, and cam gear.

Installation

1. Install camshaft gear, crankshaft gear, and timing chain together to align timing marks. (Fig. 3-443)
2. Install fuel pump eccentric with flat side rearward. (Fig. 3-444)
3. Install oil slinger. (Fig. 3-444)

CAMSHAFT

Removal

1. Remove grille.
2. Remove radiator. If equipped with air conditioning, it will be necessary to remove the condenser.
3. Remove fuel pump.

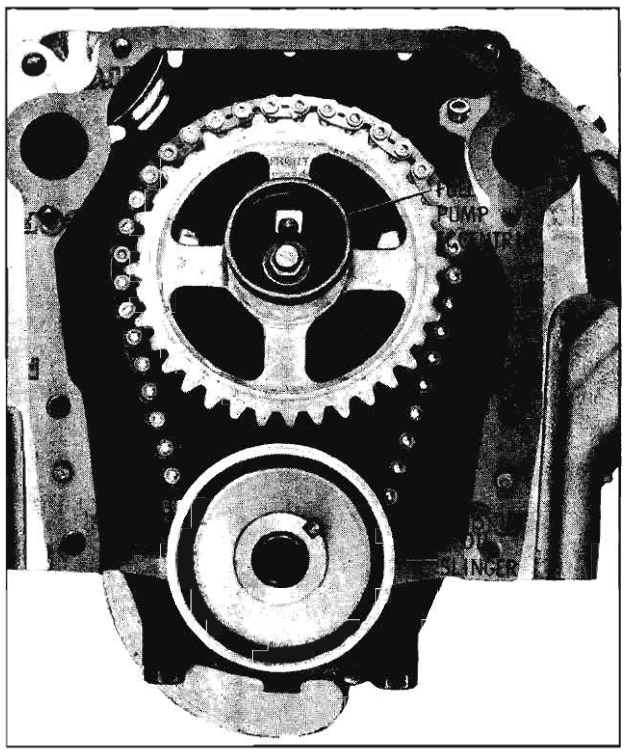


Fig. 3-444 Fuel Pump Eccentric

4. Remove front cover.
5. Remove oil slinger, timing chain and gears.
6. Remove distributor.
7. Remove intake manifold.
8. Remove rocker arm assembly, push rods and valve lifters.
9. Remove camshaft by carefully sliding it out the front of the engine.

Installation

NOTE: To insure proper camshaft installation and to provide initial lubrication, it is extremely important that whenever a camshaft is installed it must first be coated liberally with SAE 10W30 mixed with GM Concentrate, Part No. 582099.

1. Install camshaft CAREFULLY.
2. Install valve lifters, push rods, and rocker arm assemblies.
3. Install intake manifold.
4. Install timing chain and gear, and front cover.
5. Install fuel pump.
6. Install radiator (condenser, if so equipped) and grille.
7. Install distributor. Refer to Electrical Section 13.

CAMSHAFT BEARINGS

The camshaft bearings must be replaced in complete sets. All bearings must be removed before any can be installed. Number 1 bearing must be removed first, then number 2, then 3, 4 and 5. When installing the bearings, number 5 must be installed first, then number 4, 3, 2 and 1.

Included with the available tools is Camshaft Bearing Remover and Installer Set BT-6409 shown in Fig. 3-459.

This set can be used to remove cam bearings with the engine either in or out of the car. To replace bearings with engine in car, proceed as follows:

Removal

(Camshaft Removed)

1. Install #1 Cam Bearing Remover and Installer

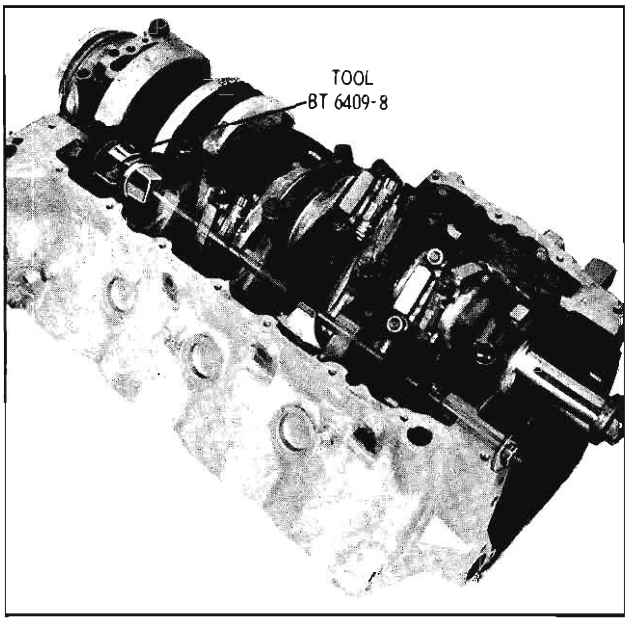


Fig. 3-445 Removing Rear Cam Bearing

BT-6409-5 on Handle J-8092 (existing tool) and drive out front cam bearing.

2. Place Pilot BT-6409-6 on Installer BT-6409-7 and install #2 Cam Bearing Tool BT-6409-4 on installer and drive out #2 bearing.

3. Remove #3 and #4 bearings in the same manner, using BT-6409-3 and BT-6409-2 removers.

   NOTE: Each cam bearing is a different diameter and the correct sequence must be used both for removal and installation.

4. To remove #5 bearing with engine in chassis, use puller BT-6409-8 as shown in Fig. 3-445.

Installation

NOTE: To aid in aligning bearings with oil passages, place each bearing in the front bore

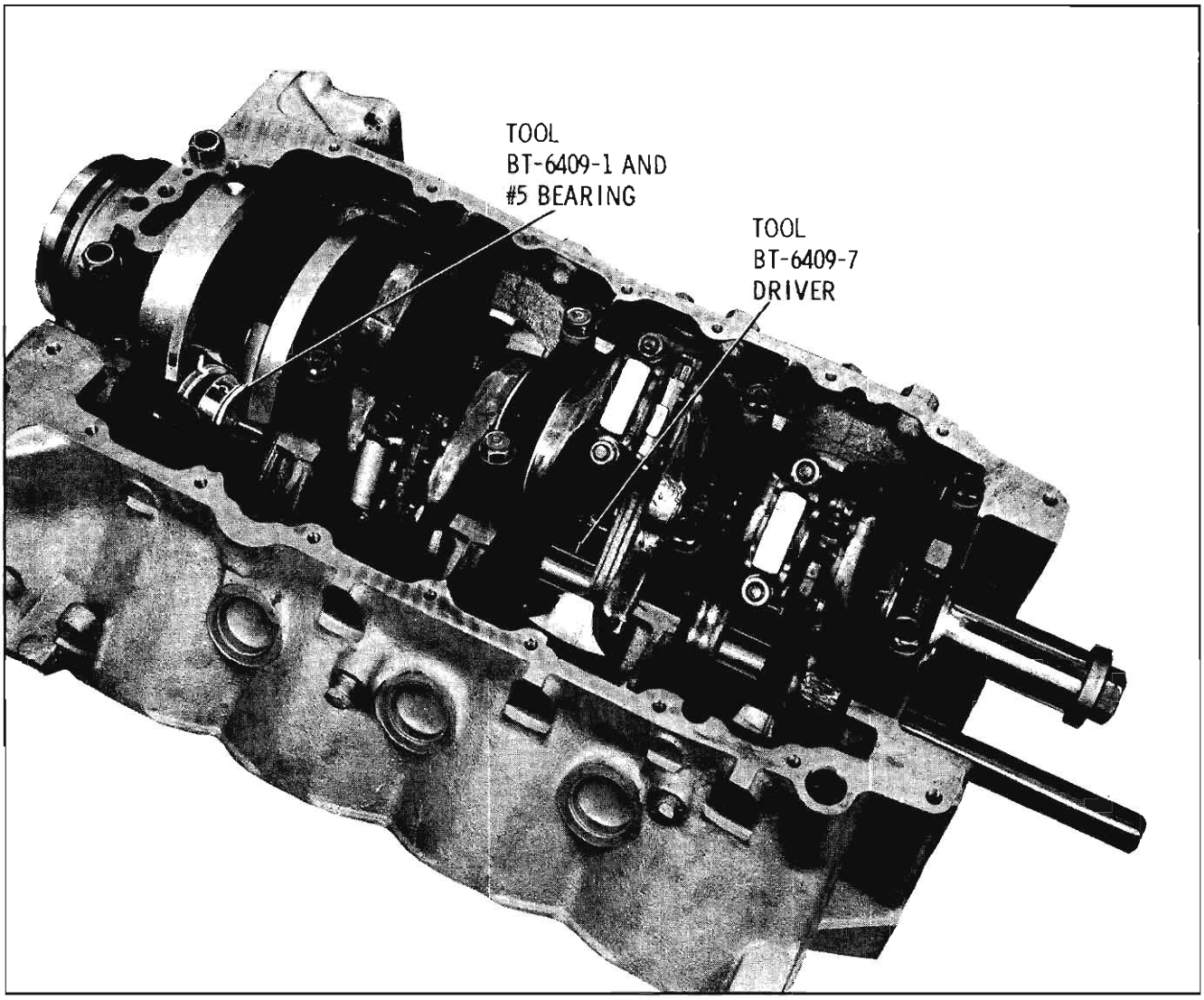


Fig. 3-445A Installing Rear Cam Bearing

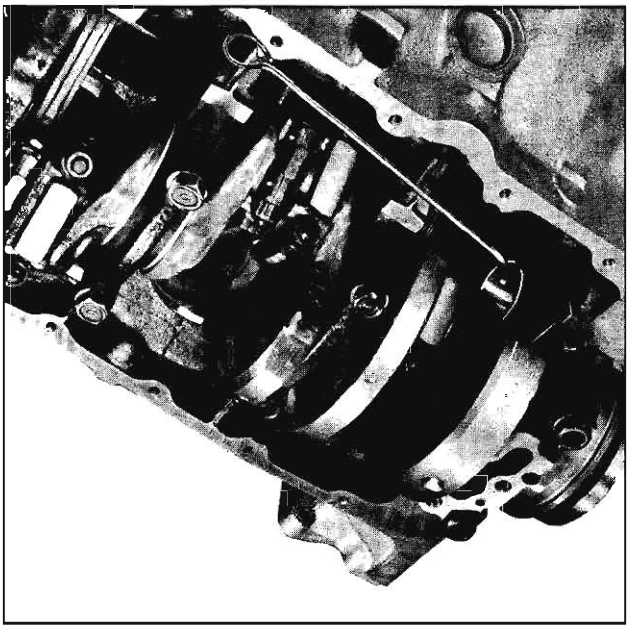


Fig. 3-446 Checking No. 5 Oil Hole

with tapered edge toward block and align the oil hole in the bearing with the center of the oil slot in the bore. Mark top of bearing. When installing the bearings the mark will act as a guide.

1. Place new #5 bearing on BT-6409-1 and drive bearing in until the last white line on the installer is flush with the front face of the pilot. (Fig. 3-445A)

2. Use BT-6409-9 to check oil hole opening as shown in Fig. 3-446.

3. Remove BT-6409-1 Installer and install BT-6409-2. Place #4 bearing on installer and drive in until second to last white line on installer is flush with pilot.

4. Follow the same procedure to install #3 and #2.

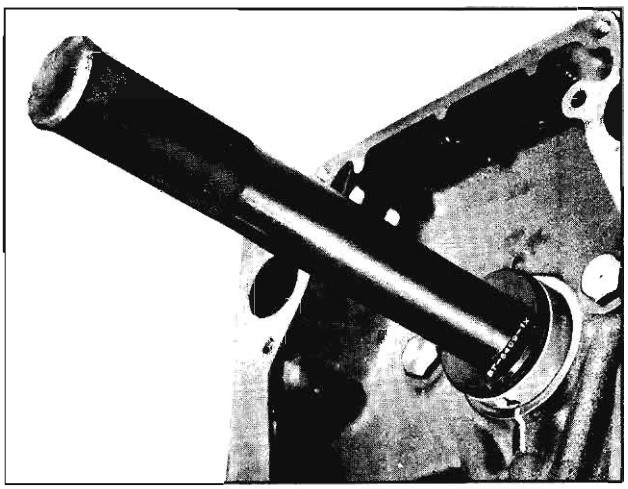


Fig. 3-447 Installing No. 1 Cam Bearing

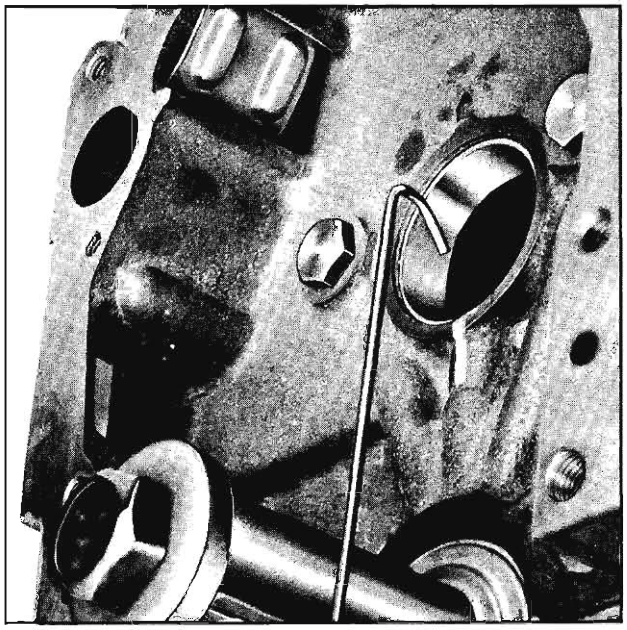


Fig. 3-448 Checking No. 1 Cam Bearing

5. Install Tool BT-6409-5 on Handle J-8092 and place #1 bearing on installer. (The pilot is not used to install #1 bearing). Drive bearing in until white line on Installer BT-6409-5 is flush with front face of block. (Fig. 3-447)

6. Use BT-6409-9 to check all oil hole openings. Wire must enter hole or the bearing will not receive sufficient lubrication. (Fig. 3-448)

7. Reinstall previously removed parts.

Camshaft and Oil Galley Plugs (Fig. 3-449)

To replace these plugs it is necessary to remove the transmission, flywheel housing, clutch assembly, and flywheel.

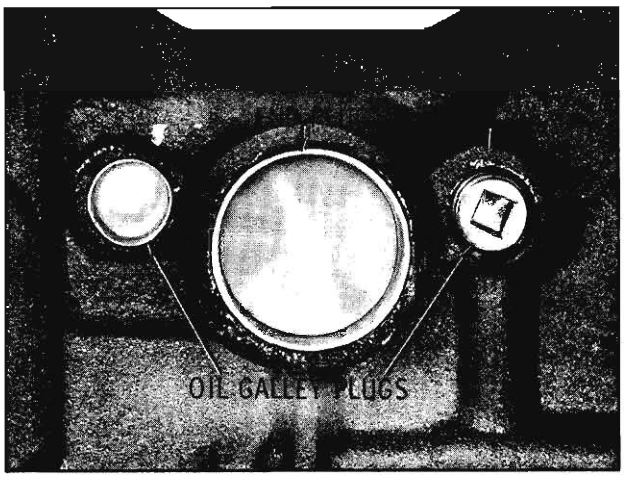


Fig. 3-449 Camshaft and Oil Galley Plugs

CRANKSHAFT

Removal

It is recommended that the crankshaft be replaced with the engine out of the chassis. In order to remove the crankshaft, the oil pan, front cover, connecting rods, transmission and flywheel must be removed from the engine.

The crankshaft may then be removed by noting the position of the five (5) main bearing caps and removing them.

Installation

1. Position upper half of main bearings in block and lubricate with SAE 10W30 oil.

2. Install a new rear main bearing seal. (Fig. 3-450)

3. After oil passages in crankshaft have been checked for being open and shaft is clean, place shaft in block. Lubricate thrust flanges of the center bearing with 567196 lubricant. Install caps with lower half of bearing lubricated with SAE 10W30 oil. Lubricate cap bolts with Part No. 980131 and install, but do not tighten.

4. With a block of wood (Fig. 3-451) bump shaft in each direction to align thrust flanges of center main bearing.

5. Torque Nos. 1, 2, 3 and 4 main bearing cap bolts 60-80 ft. lbs. and No. 5 bolt 90-120 ft. lbs.

6. Reassemble engine and install in chassis.

MAIN BEARINGS

Main bearing clearance must not exceed .0035" on all bearings. The .0035" clearance is permissible only if the engine is disassembled for other than a bearing noise condition. If bearings are noisy or if a visual inspection indicates defective bearings, new bearings must be installed within the specifications outlined under MAIN BEARINGS - REPLACE.

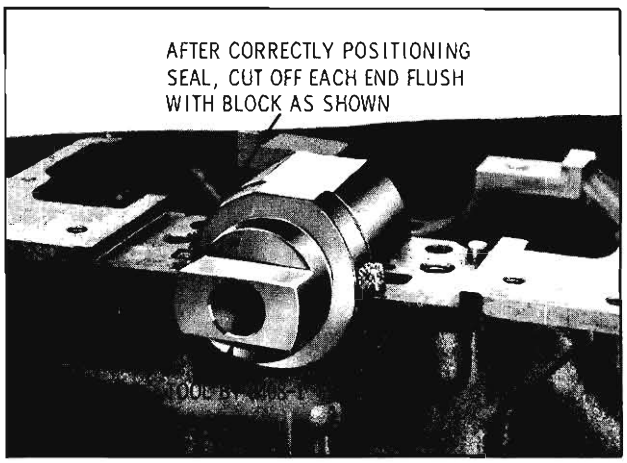


Fig. 3-450 Installing Rear Main Oil Seal-Upper Half

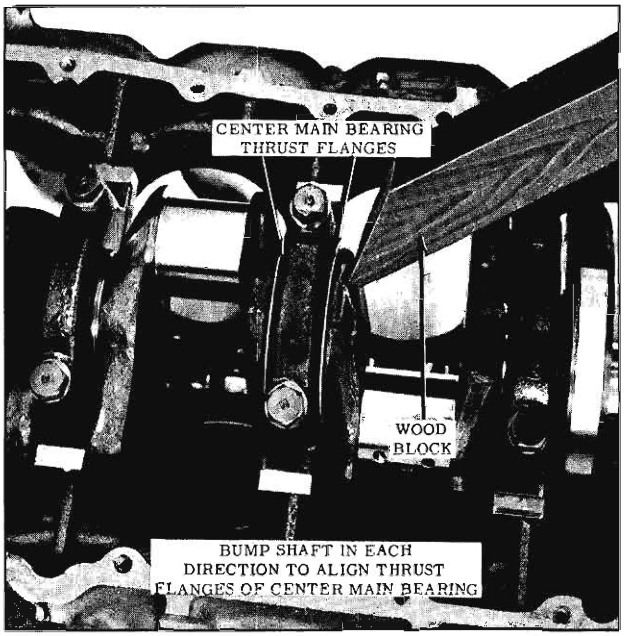


Fig. 3-451 Aligning Center Main Bearing Flanges

Bearings which fall within the .0035" specification should not be rejected if the bearings show a normal wear pattern or slight radial grooves, unless it has been established to be defective.

Checking Bearing Clearances

1. Remove bearing cap and wipe oil from crankshaft journal and outer and inner surfaces of bearing shell.

2. Place a piece of plastigauge in the center of bearing.

3. Use a floor jack or other means to hold crankshaft against upper bearing shell. This is necessary to obtain accurate clearance readings when using plastigauge.

4. Reinstall bearing cap and bearing. Place Part No. 980131 lubricant on cap bolts and install. Torque 60-80 ft. lbs. and No. 5 bolt 90-120 ft. lbs.

5. Remove bearing cap and determine bearing clearance by comparing the width of the flattened plastigauge at its widest point with the graduation on the plastigauge container. The number within the graduation on the envelope indicates the clearance in thousandths

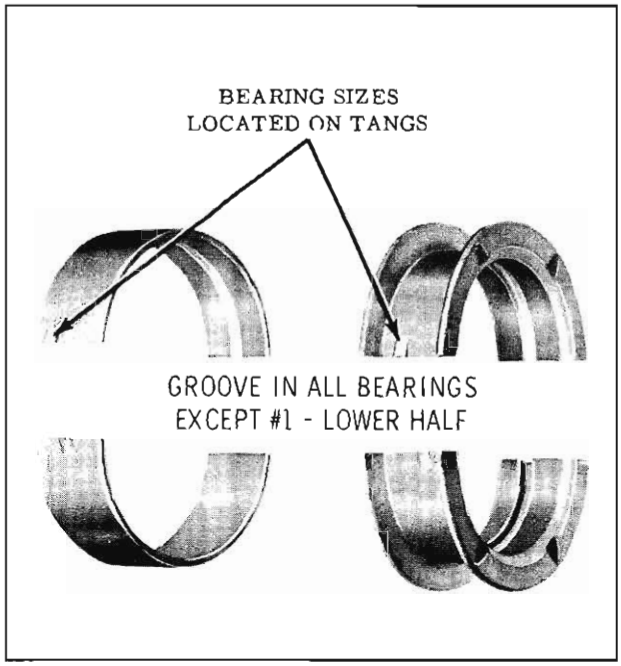


Fig. 3-452 Main Bearing Size Location

of an inch. (Fig. 3-427) If this clearance is greater than .0035", REPLACE BOTH BEARING SHELLS AS A SET. Recheck clearance after replacing shells. (Refer to MAIN BEARINGS - REPLACE)

NOTE: Main bearing end thrust clearance should be .004" to .008" as checked with a dial indicator.

Main Bearings—Replace

Main bearing clearances not within specifications (.0005" to .0021") must be corrected by the use of selective upper and lower shells. UNDER NO CIRCUMSTANCES should the use of shims behind the shells, to compensate for wear, be attempted.

IMPORTANT: The upper and lower shells must be installed in pairs. Sizes of the bearings are located on the tang. (Fig. 3-452)

To install main bearing shells, proceed as follows:

1. Remove bearing cap and remove lower shell.

2. Insert a flattened cotter pin or roll out pin in the oil passage hole in the crankshaft, then rotate the crankshaft in the direction opposite to cranking rotation. The pin will contact the upper shell and roll it out.

3. The main bearing journals should be checked for roughness and wear. Slight roughness may be removed with a fine grit polishing cloth saturated with SAE 10W30 oil. Burrs may be removed with a fine oil stone. If the journals are scored or ridged, the crankshaft must be replaced.

   NOTE: The journals can be measured for out-of-round with the crankshaft installed by using a crankshaft caliper and inside micrometer or a main bearing micrometer. The upper bearing shell must be removed when measuring the crankshaft journals. Maximum out-of-round of the crankshaft journals must not exceed .0015".

4. Clean crankshaft journals and bearing caps thoroughly before installing new main bearings.

5. Apply Special Lubricant (Part No. 567196) to the thrust flanges of bearing shells on No. 3 bearing.

6. Place new upper shell on crankshaft journal with locating tang in correct position and rotate shaft to turn it into place using cotter pin or roll out pin as during removal.

7. Place new bearing shell in bearing cap.

8. No. 5 bearing - install new asbestos oil seal in the rear main bearing cap. (REAR MAIN BEARING OIL SEAL) (Fig. 3-453)

9. Install bearing caps, lubricate bolt threads with Part No. 980131 lubricant and install. Torque Nos. 1, 2, 3 and 4, 60-80 ft. lbs. and No. 5, 90-120 ft. lbs.

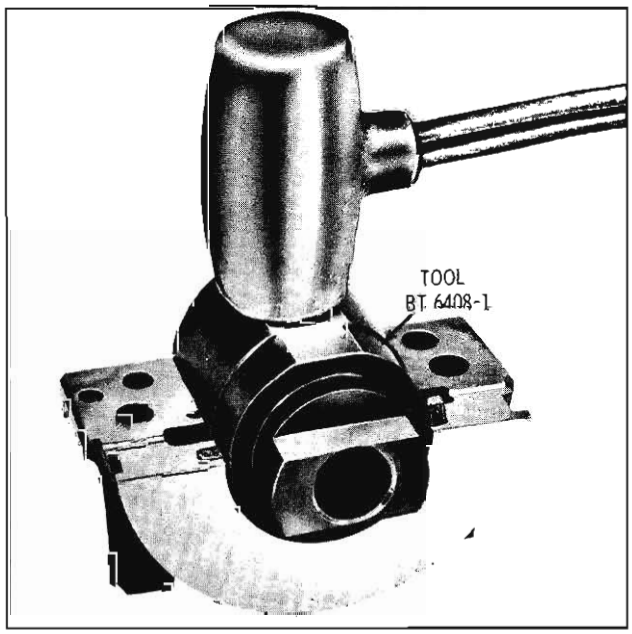


Fig. 3-453 Installing Rear Main Oil Seal-Lower Half

REAR MAIN OIL SEALS

Removal

1. Remove oil pan.
2. Remove the rear main bearing cap.
3. Remove bearing insert and old seals.
4. Clean bearing cap and seal grooves and inspect for cracks.

Installation

1. Install seal into bearing cap, packing by hand.
2. Using Seal Installer BT-6408-1, hammer seal into groove. (Fig. 3-453)

   NOTE: To check if seal is fully seated in the bearing cap, slide Tool BT-6408-1 away from seal. With Tool BT-6408-1 fully seated in the bearing cap, slide tool against the seal. If undercut area of tool slides over the seal, the seal is fully seated. If tool butts against the seal, the seal must be driven further into the seal groove. Rotate tool before cutting off excess seal packing. (Fig. 3-453)

3. Hold Tool BT-6408-1 as in Fig. 3-453. Cut seal 1/16" from bearing surface. Taper end of seal into a point. With screwdriver, pack seal fibers towards center, away from edges. Rotate seal installer to cut seal between notch and handle.
4. Install two side bearing cap seals, leaving seal extended on each side of cap.
5. Coat back of insert with light film of oil and install in bearing cap.
6. Clean crankshaft bearing journal and seal contact.
7. Install bearing cap guide pins.
8. Install bearing cap into place by tapping with block of wood.
9. Install bearing caps, lubricate bolt threads with Part No. 980131 lubricant and install. Torque Nos. 1, 2, 3, and 4, 60-80 ft. lbs. and No. 5, 90-120 ft. lbs.
10. Apply Part No. 980131 lubricant to cap bolts. Torque Nos. 1, 2, 3, and 4, 60-80 ft. lbs. and No. 5, 90-120 ft. lbs.
11. Do not trim ends of side seals.
12. Install pan with new gasket. (Fig. 3-421)

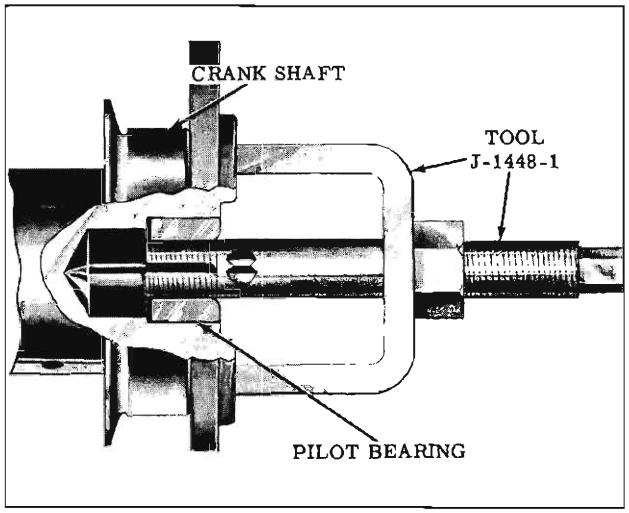


Fig. 3-454 Removing Pilot Bearing

13. Install lower flywheel cover.

PILOT BEARING (SYNCHROMESH)

On Synchromesh equipped cars a pilot bearing is located in a bore in the rear end of the crankshaft.

When removing the pilot bearing, remove with Pilot Bearing Puller J-1448-1. (Fig. 3-454). All old lubricant in the reservoir behind the bearing should be removed.

Install the new bearing using Tool J-4530-1, (Fig. 3-455). Add 1/4 ounce (level tablespoonful) of front wheel bearing grease to the reservoir.

FLYWHEEL

One bolt hole in the flywheel is offset and it will attach to the crankshaft in only one position.

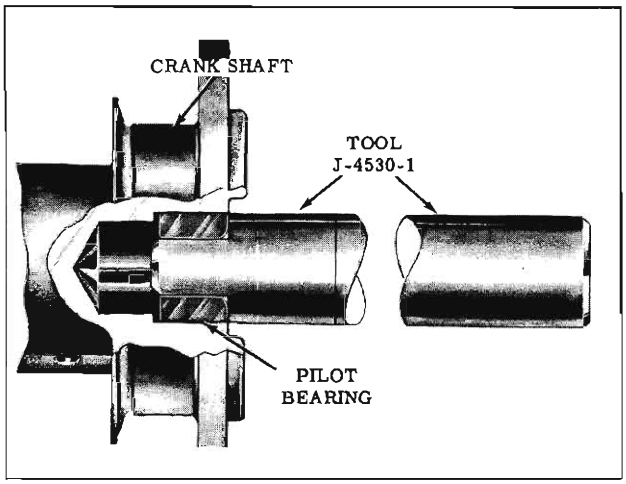


Fig. 3-455 Installing Pilot Bearing

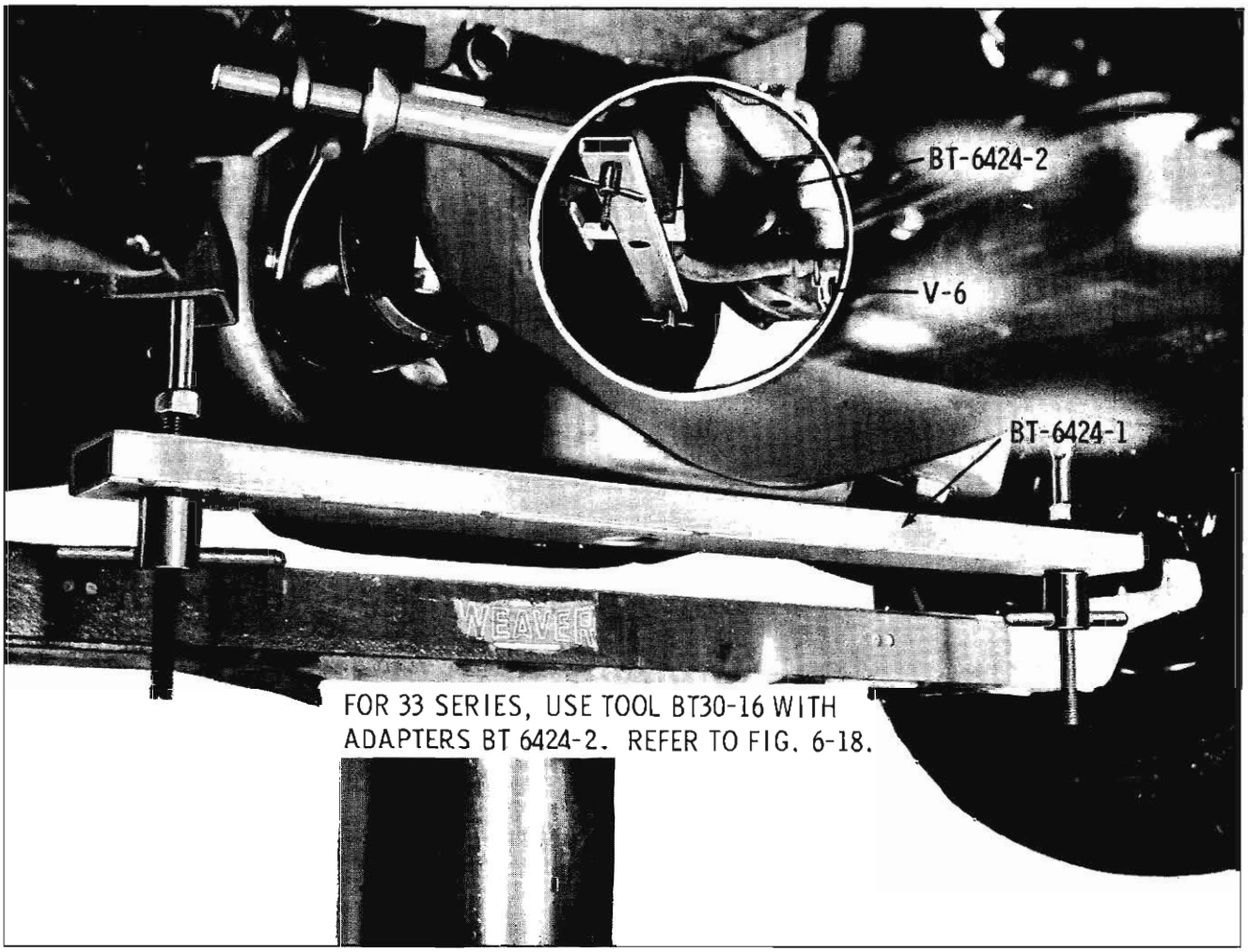


Fig. 3-456 Engine Support Tool BT-6424-1

All flywheels, original and service replacement, are balanced individually. This is accomplished by inserting and staking a balancing pin or pins, if necessary, into the holes provided along the outer circumference of the flywheel. These staked balance pins are not to be removed. After the flywheel is attached to the crankshaft, the engine and flywheel are again balanced as an assembly and, if necessary, additional balancing pins are installed in the flywheel. These pins are not staked.

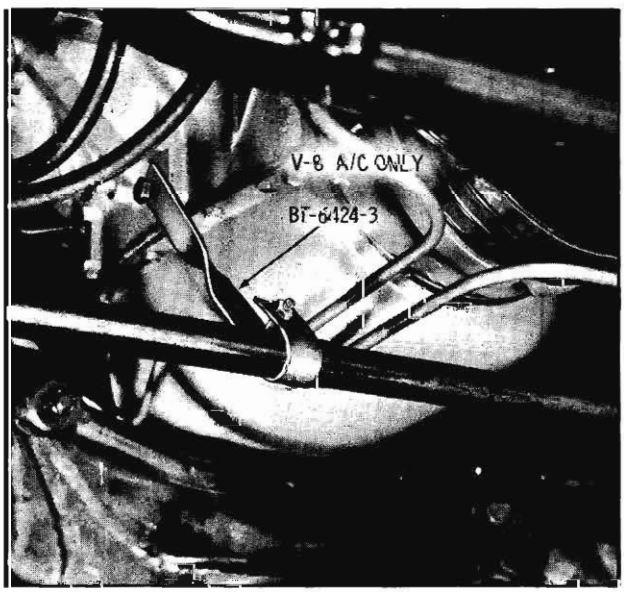


Fig. 3-457 Engine Support Tool BT-6424-3 Adapter

When installing a service replacement flywheel, it is essential that the flywheel be balanced with the engine. If there are no unstaked balance pins in the original flywheel, the new flywheel may be installed on the crankshaft as is. If unstaked balance pins are found on the original flywheel, proceed as follows:

1. Position the original flywheel over the new flywheel and align the flywheel to crankshaft attaching bolt holes.
2. Mark the position of the unstaked balancing pins on new flywheel.
3. Transfer the balancing pins from the original flywheel to the new flywheel in the holes marked.

NOTE: If an unstaked pin cannot be installed in the exact position as the original due to the presence of a staked pin, insert the pin into an adjoining hole on either side of the staked pin.

Flywheel Ring Gear

The flywheel ring gear may be replaced if damaged. Drill two 3/16" holes in the gear, and then split with a sharp chisel.

Heat the new gear with a torch and place in position on the flywheel. As the gear cools, it will become tight on the flywheel.

POSITIVE CRANKCASE VENTILATION

DESCRIPTION

The positive crankcase ventilating system draws, by intake manifold vacuum, unburned fuel gases out of the crankcase and returns them to the combustion chamber to be burned.

It is very important that crankcase oil level be correctly maintained and not overfilled. Because of the nature of materials carried, it is recommended that the check valve be cleaned every 12,000 miles or more often if necessary. (Fig. 3-458).

TESTING

A rough idle or crankcase fumes escaping through the crankcase breather is an indication the system may need service.

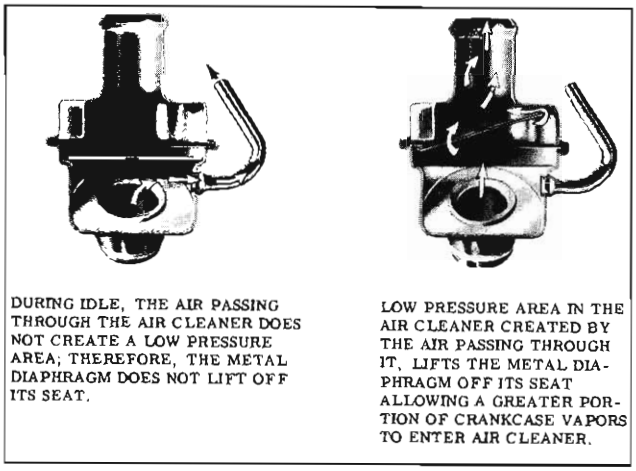


Fig. 3-458 Positive Crankcase Ventilation

SERVICE

At every 12,000 miles (or at the oil change period nearest to this interval), remove the ventilation valve and hoses from engine and clean as follows:

1. Blow compressed air through both hoses.
2. Submerge valve in kerosene, slosh around in fluid. Blow compressed air through small tubing of valve assembly.
3. Clean bleed hole in connector at carburetor with 1/16" diameter wire, or drill. It is not necessary to remove the connector; however, if carburetor service is performed, clean out hole with Kerosene and compressed air.

ENGINE MOUNTS

FRONT

Removal

1. Support engine with Tool BT-6424-1. (Fig. 3-456)
2. Remove mount to support bolt, and engine to mount bolts.

Installation

To install new mount, install bolts loosely then torque mount to engine bolts 40-45 ft. lbs., then mount to support bolt 45-60 ft. lbs.

REAR (TRANSMISSION MOUNT)

Removal

The rear mount is commonly referred to as the rear transmission mount or the rear engine mount.

It can be removed by:

1. Removing mount to support bar bolts.
2. Removing mount to transmission rear bearing retainer bolts.
3. Raise rear of transmission slightly and remove mount.

When installing, torque all bolts 40-45 ft. lbs.

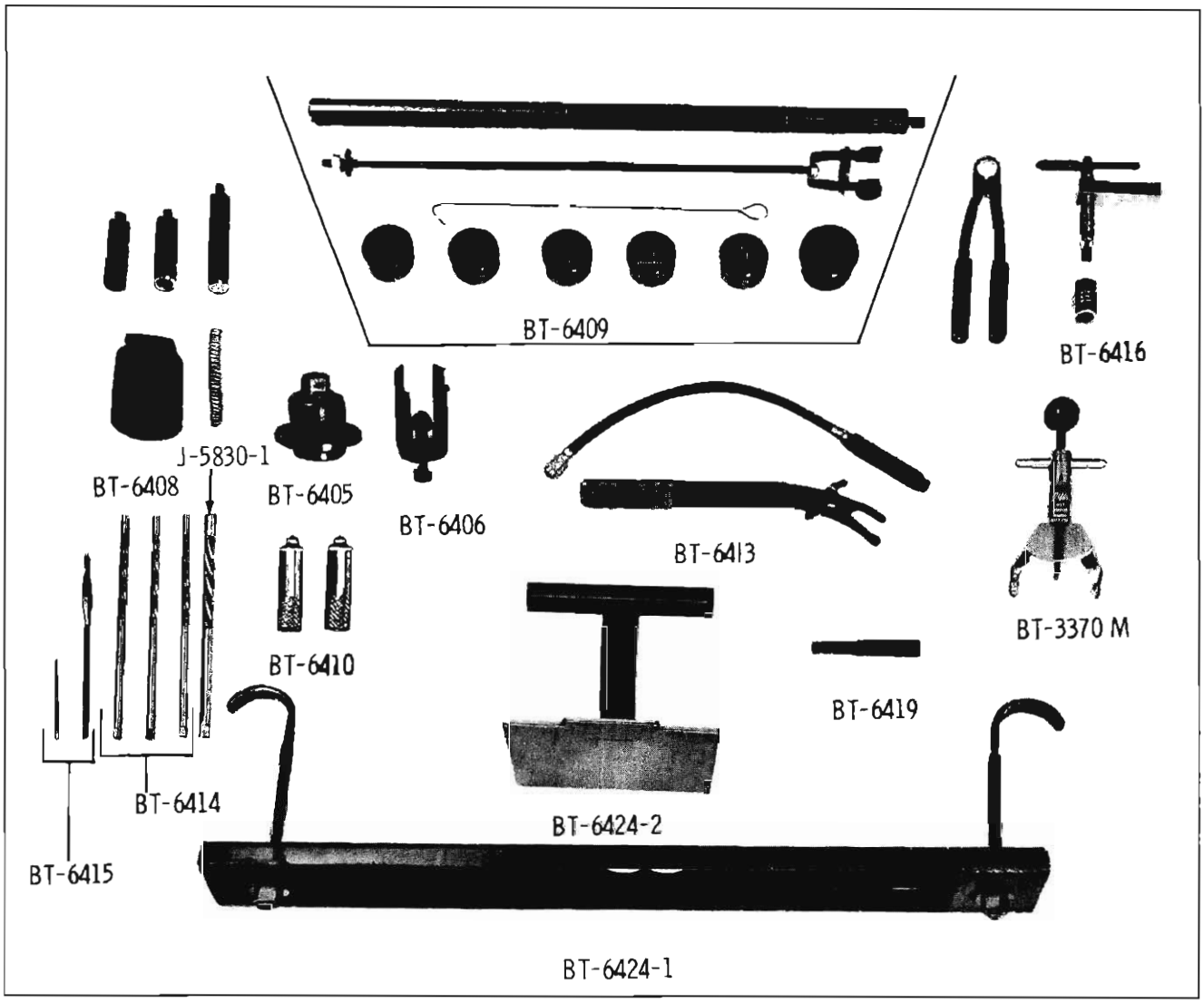


Fig. 3-459 Tools

BT-33-70M Belt Gauge Narrow Legs for New Engine Application

BT-6405 Front Cover Crankshaft Seal Installer

BT-6406 Front Cover Crankshaft Seal Remover

BT-6408 Combination Piston Pin Remover and Installer and Rear Main Bearing Seal Installer

BT-6409 Cam Bearing Remover and Installer Set. Used Without R&R Engine or Transmission

BT-6410 Existing Bar BT-30-16 (used for 33 Series)

BT-6413 Valve Spring Compressor V-6 and V-8 (On Car)

BT-6414-1 .003" Oversize Valve Guide Reamer

BT-6412-2 .006" Oversize Valve Guide Reamer

BT-6413-3 .013" Oversize Valve Guide Reamer

BT-6415 Valve Guide Cleaner

BT-6416 Valve Lifter Plunger Puller

BT-6419 Exhaust Manifold Heat Riser Bushing Remover and Installer

BT-6424-1 Engine Support Bar - 3000 to 3200 Series

BT-6424-2 V-6 Adapter

BT-6424-3 V-8 Adapter For Air Conditioner Only (Not Shown)

COOLING, FUEL, AND EXHAUST SYSTEM

COOLING SYSTEM

MAINTENANCE RECOMMENDATIONS

Refer to Section 2, PERIODIC MAINTENANCE.

DESCRIPTION

The engine cooling system is of the pressure type employing a 15 lb. pressure radiator cap. The water pump is a centrifugal type, and circulation is controlled by a thermostat located under the water outlet in the intake manifold. Full length water jackets allow the engine coolant to completely surround all cylinders.

OPERATION

The water pump discharges coolant through the front engine cover into both banks of the block. The coolant then flows through the full length water jackets in the block, up into the two cylinder heads, through the heads and then flows from the front of each cylinder head through the intake manifold water passage to the water outlet and finally to the radiator.

When the thermostat is closed, all the coolant flows through the bypass to the inlet side of the water pump and back to the engine block.

The 15 pound pressure radiator cap raises the boiling point of the coolant to approximately 258° F.

CAUTION: When removing the radiator cap, turn the cap counterclockwise to the point where pressure is released. After all the pressure has been released, the cap can then be SAFELY removed.

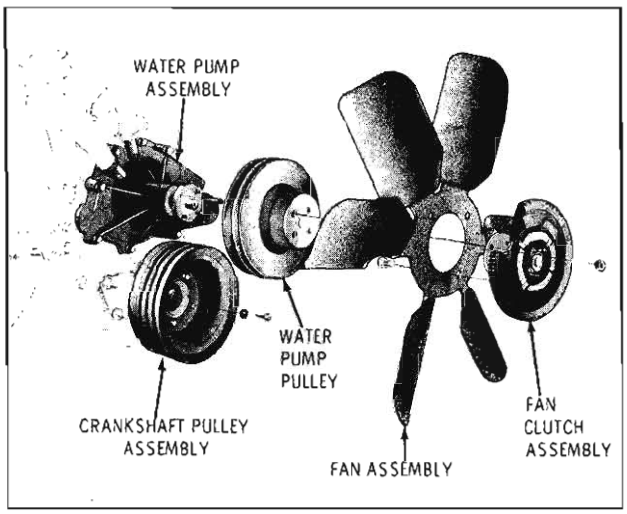


Fig. 3-470 Fan and Pulley - Exploded View

DRAIN AND REFILL

Before draining the cooling system, inspect the system and perform any necessary service to insure that it is clean, does not leak, and is in proper working order.

1. Completely drain the system by opening drain valves at the radiator lower tank and removing plugs on each side of the engine block.

   NOTE: If coolant drains out dirty, or if deposits are seen in the radiator, the cooling system should be flushed.

2. Refill cooling system with recommended coolant. (Refer to PERIODIC MAINTENANCE Section 2 for recommended coolant)

FAN (Fig. 3-470)

The fan blades and pulley can be removed without disturbing the water pump or radiator. On air conditioned equipped cars it will be necessary to detach fan ring and slide it back over the fan.

NOTE: If belt tension on pulley is not released, the fan can be removed without disturbing the pulley by removing four (4) attaching bolts. When the first two (2) bolts are removed, replace with aligning studs. The tension of the belt will keep the pulley in position.

PULLEY (Fig. 3-470)

Removal

1. Loosen Delcotron and link adjusting bolt and remove belts from pulley.

   NOTE: If equipped with air conditioning, detach fan ring and slide back over fan.

2. If equipped with power steering, remove power steering pump belt.

3. a. All except air conditioned cars - remove fan and pulley to water pump attaching bolts.

   b. Air conditioned equipped cars - remove fan clutch to water pump attaching nuts.

4. Remove fan pulley.

Installation

1. Reverse removal procedure.

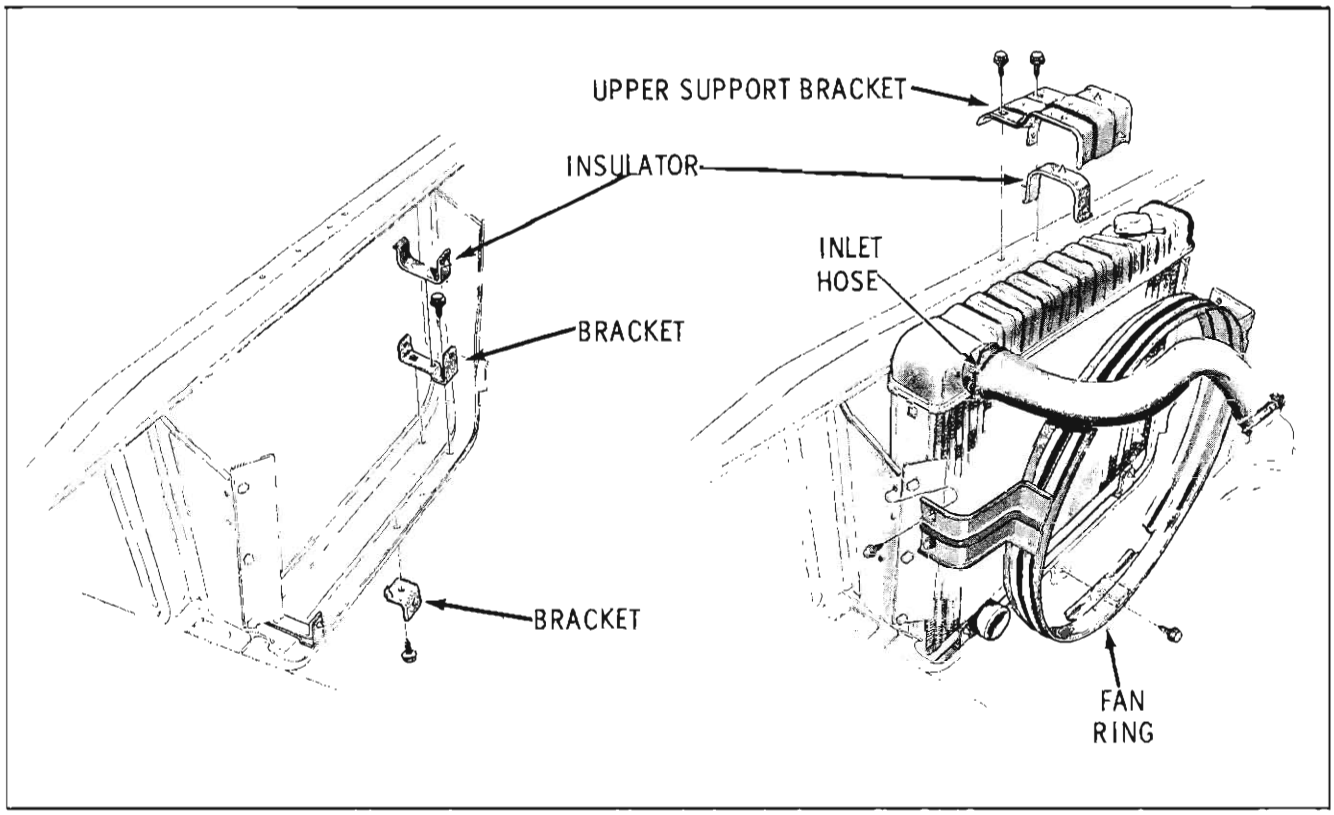


Fig. 3-471 Radiator Attachment

2. Install belt(s) on pulley and adjust to proper tension using Tool BT-33-70-M.

RADIATOR (Fig. 3-471)

Removal

1. Drain cooling system.
2. Remove upper radiator bracket.

NOTE: On air conditioned equipped cars, detach the fan ring and slide back over fan.

3. Remove upper and lower radiator hose and overflow hose.
4. If car is equipped with Jetaway transmission, disconnect and cap cooler lines.
5. Lift radiator upward to disengage from lower supports and remove from car.

Installation

1. Reverse removal procedure.
2. Fill radiator as recommended in Periodic Maintenance Section 2.

WATER PUMP

Removal

1. Drain cooling system.
2. Disconnect heater and lower radiator hose from pump.
3. Loosen pulley belts and remove fan and pulley. On air conditioned equipped cars, remove the clutch and fan assembly and pulley.
4. Remove water pump to front cover attaching bolts (Fig. 3-439).

Installation

1. Apply a thin coat of gasket cement to the pump housing to retain the gasket, then position the gasket on the housing.
2. Install the pump assembly in the front cover. Torque self-tapping bolts 8 to 13 ft. lbs. and 5/16" bolts 20 to 25 ft. lbs. Use SAE 10W30 oil on the self-tapping bolts and sealer on the 5/16" bolts.
3. Install pulley and fan. Torque fan to pump bolts 15 to 20 ft. lbs. On air conditioned equipped cars install pulley and fan and clutch assembly. Torque nuts 15 to 20 ft. lbs.
4. Install pulley belt(s) and adjust belt tension using Tool BT-33-70-M.
5. Refill cooling system, See Section 2, PERIODIC MAINTENANCE for recommended coolant.

FUEL SYSTEM
(Figs. 3-472, 3-473, 3-474 & 3-475)

DESCRIPTION

All 30-31-32 Series fuel tanks have a capacity of 20 gallons. The filler cap is located behind the license plate on all models except station wagons. On station wagons the filler cap is located in the left quarter panel. Venting is provided by a hose and pipe on all models except station wagons. On station wagons, the venting is through a hose to the top of the filler neck. All 33 Series tanks have a capacity of 21 gallons. The filler cap is located in the left quarter panel.

The tank gauge unit has a Saran fuel filter, (Fig. 3-476) on the end of the suction pipe which prevents entry of dirt or water into the fuel lines. The filter is a push fit on the end of the pipe and should be pressed on approximately 1-11/16" so that the pipe bottoms on the shoulder inside the filter.

NOTE: Due to the engine operating temperatures, a fuel return from the fuel filter to the gas tank has been incorporated, on the air conditioned-equipped cars only, to prevent excessive fuel pressure build-up in the line between the fuel pump and the carburetor.

CAUTION: If a car is to be stored for any appreciable length of time, the gasoline should be drained from the complete fuel system - including carburetor, fuel pump, all fuel lines, and fuel tank, in order to prevent gum formations and resultant improper engine performance.

FUEL GAUGE TANK UNIT (Except 33 Series Refer to 34, 35, 36, 38 and 39 Series ENGINE SECTION)

Removal

1. Disconnect gauge wire at connector.
2. Remove fuel gauge retainer using Tool J-21518. (Fig. 3-477)
3. Remove fuel gauge.

Installation

1. Position fuel gauge in tank as shown in Fig. 3-478.
2. Install gauge retainer using Tool J-21518.
3. Connect fuel gauge wire.

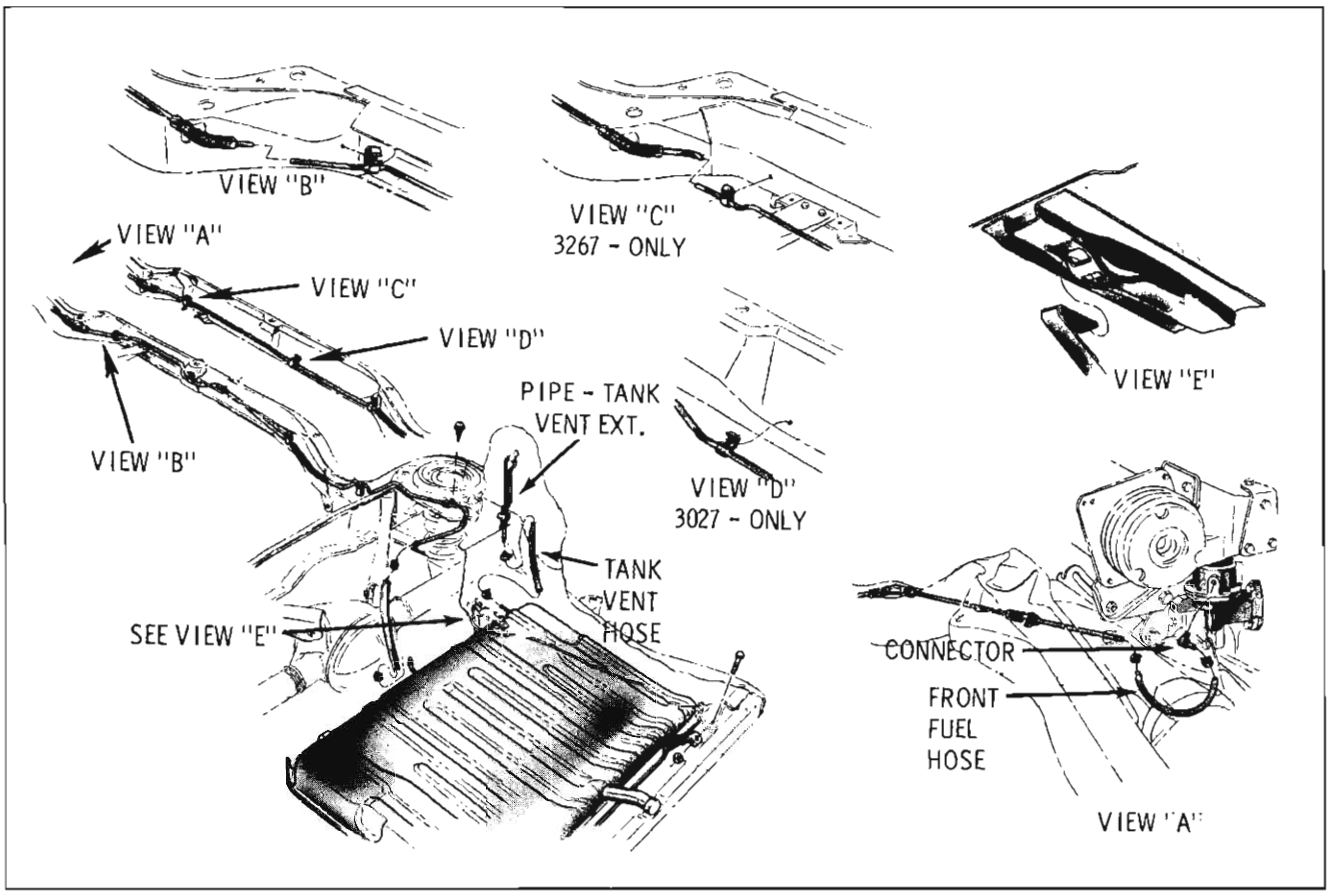


Fig. 3-472 Fuel Line Routing

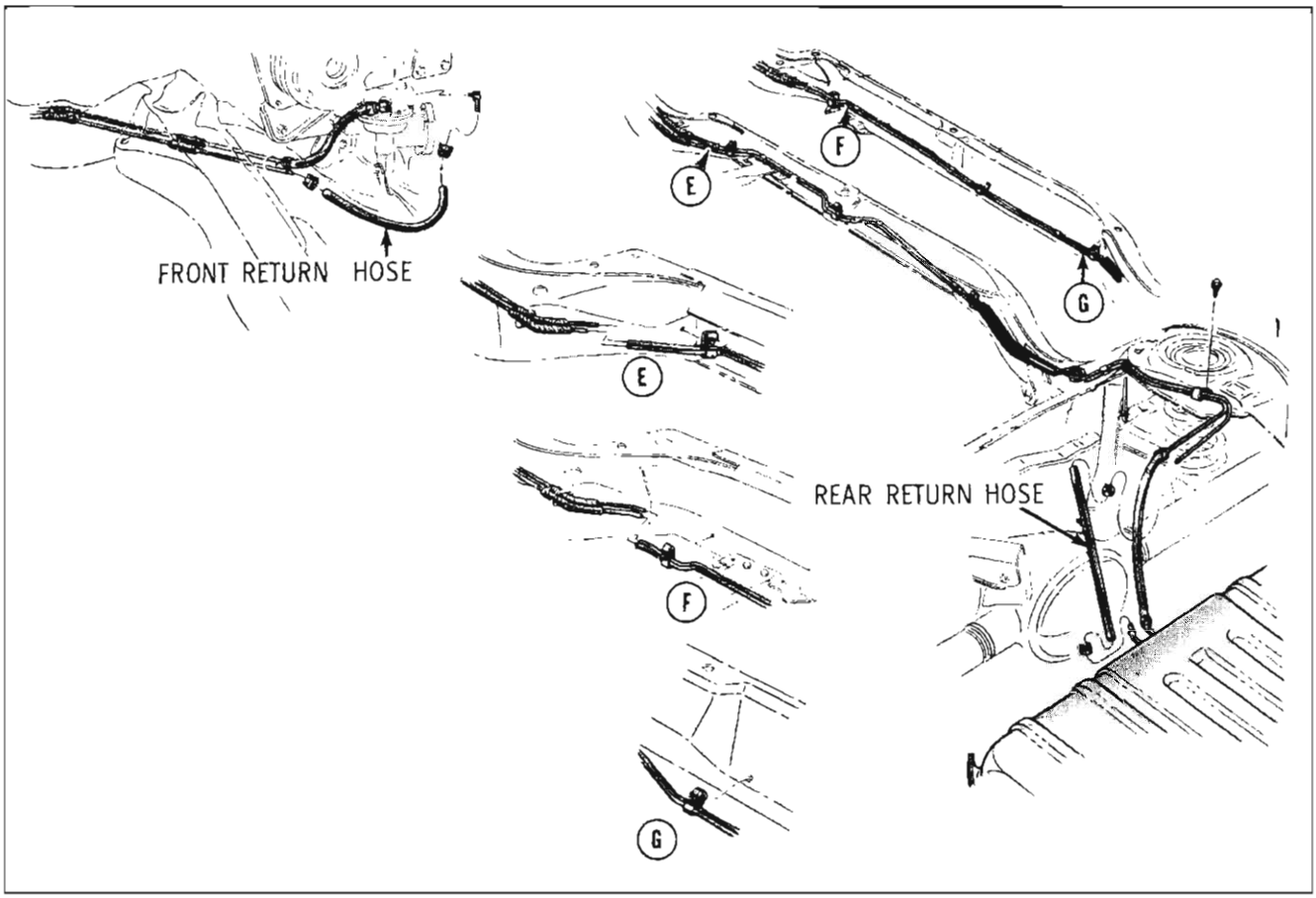


Fig. 3-473 *Fuel Return System*

FUEL TANK (For 33 series—refer to 34, 35, 36, 38 and 39 Series Engine Section)

Draining Fuel Tank

1. Insert a length of hose into the gas tank, pipe nipple end first, until weighted end of hose rests on bottom of tank.

2. Cut a small slit in hose near the outer end and insert chuck of air hose into hose slit; a short blast of air will cause the gas to flow.

NOTE: The tank can be drained rapidly by raising the front of car several feet off the floor when performing the above operation.

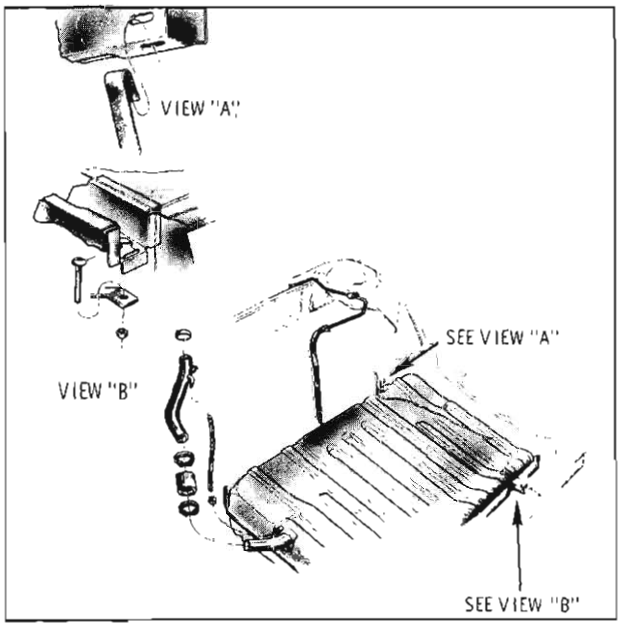


Fig. 3-474 Fuel System - Station Wagons

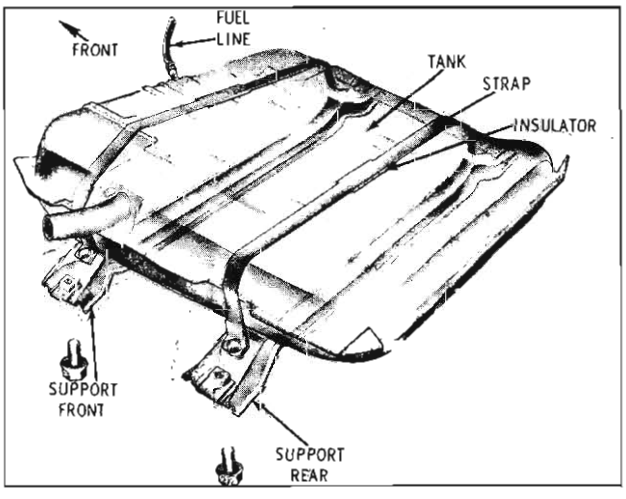


Fig. 3-475 Fuel Tank Mounting - Station Wagons

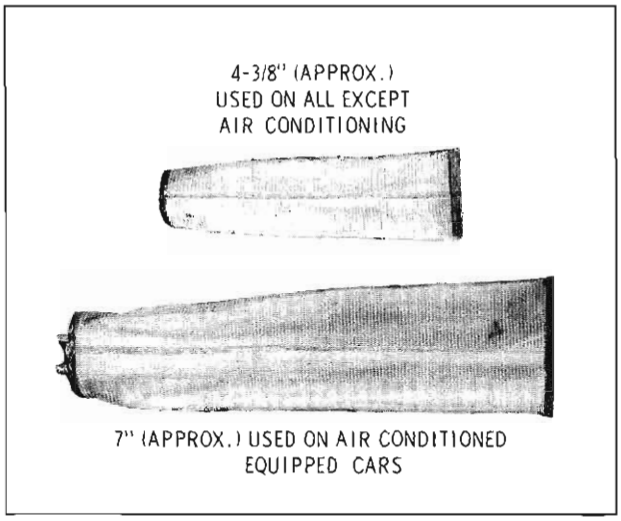


Fig. 3-476 Fuel Tank Filters

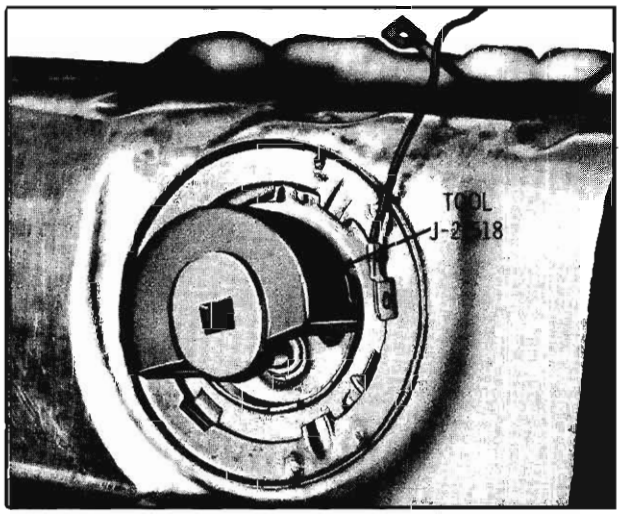


Fig. 3-477 Removing Fuel Gauge

Removal (All except station wagons)

1. Drain tank.

2. Disconnect gas hose from fuel line.

3. Disconnect the gauge wire at connector in rear compartment; then feed wire through floor. Remove the two (2) tank straps and lower tank.

Installation (All except station wagons)

1. Position tank gauge wire to the rear of tank.

2. Install tank and position the two (2) tank straps and tighten bolts.

3. Feed gas gauge wire through floor and connect at the connector in the rear compartment.

4. Connect gas hoses at tank.

5. Fill tank.

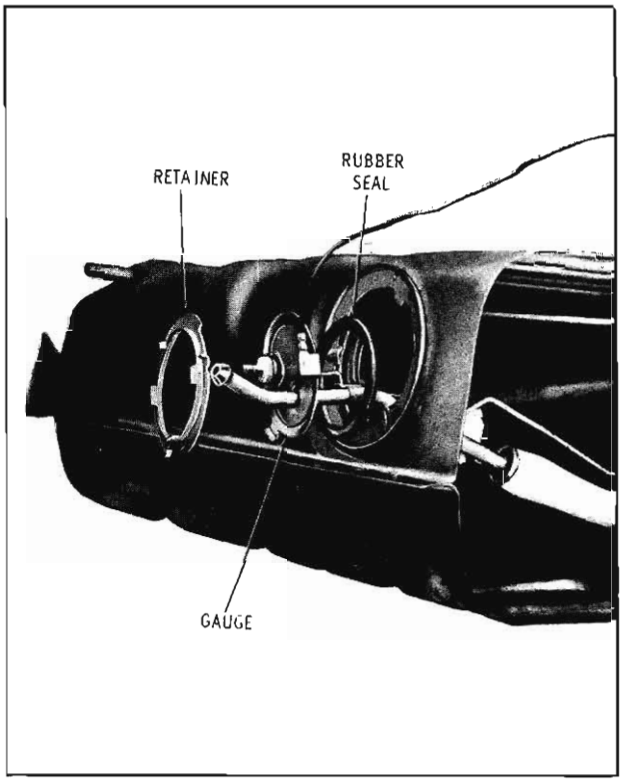


Fig. 3-478 Installing Fuel Gauge

FUEL TANK—Removal and Installation—Station Wagons

The fuel tank on station wagons is attached as shown in Fig. 3-475.

FUEL PUMP

The fuel pump on all models with or without heater or air conditioning, is a single action pump.

The fuel pump rocker arm is held in constant engagement with the eccentric on the camshaft by the rocker arm spring. As the outer end of the rocker arm moves downward, the fuel link pulls the fuel diaphragm upward. The action of the diaphragm enlarges the fuel chamber drawing fuel from the tank through the inlet valve and into the fuel chamber (Fig. 3-479).

The pump delivers fuel to the carburetor only when the pressure in the outlet line is less than the pressure maintained by the diaphragm spring. Therefore, when the carburetor float needle valve opens, the spring will expand to move the diaphragm downward to force fuel past the outlet valve to the carburetor. When the carburetor float needle valve closes, the pump builds up pressure in the fuel chamber until the diaphragm spring is again compressed. The diaphragm will then remain stationary until more fuel is required by the carburetor.

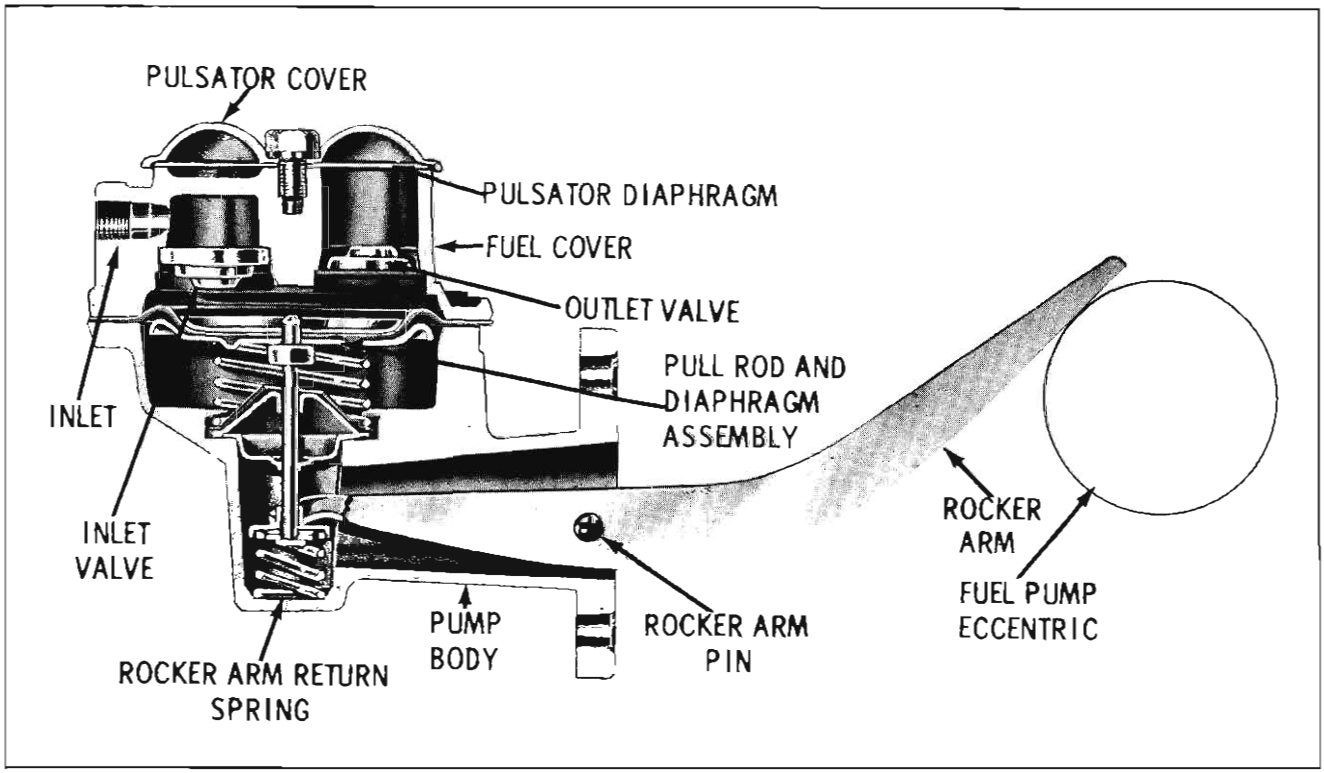


Fig. 3-479 Fuel Pump Assembly

INSPECTION AND TEST (ON CAR)

1. Be sure there is gasoline in the tank.

2. Check for loose line connections. A leak at the pressure side of the system (line from pump to filter to carburetor) will be indicated by dripping fuel. A leak in the suction side of the system (line from gas tank to pump) will not be apparent except in its effect of reducing volume or fuel on the pressure side of the system. Tighten fuel pump diaphragm flange screws.

3. Look for bends or kinks in lines which will reduce flow.

4. Test fuel flow as follows:

   a. Disconnect fuel line at the carburetor.

   b. Ground primary terminal of distributor with jumper lead so that engine can be cranked without firing.

   c. Place suitable container at end of fuel line and crank engine a few revolutions.

   NOTE: If little or no gasoline flows from open end of line, then the fuel line is restricted, gas tank filter restricted or the pump is inoperative. Before removing pump, disconnect fuel lines at fuel pump and at gas tank and blow through them with an air hose to make sure they are clear. Reconnect fuel lines to pump and gas tank.

5. Even if fuel flows in good volume from line at carburetor, it is advisable to make certain that pump is operating within limits.

   a. Disconnect fuel line at carburetor and attach a low reading pressure gauge.

   b. Run engine at approximately 1000 rpm (using gasoline in carburetor bowl) and note reading on pressure gauge.

   c. If pump is operating properly, the pressure will be 7 to 8 1/2 psi constant. If pressure is too low or too high or varies materially at different speeds, the pump should be removed for repair or replacement.

Removal and Installation

1. Disconnect fuel lines at fuel pump.

2. Remove fuel pump to engine block mounting bolt and nut, and then remove fuel pump. (Fig. 3-480)

Disassembly

1. Clamp the pump carefully in vise.

2. Using a 3/16" drill, drill through the aluminum plugs at each end of the rocker arm pin.

   NOTE: These plugs are approximately 1/4" long.

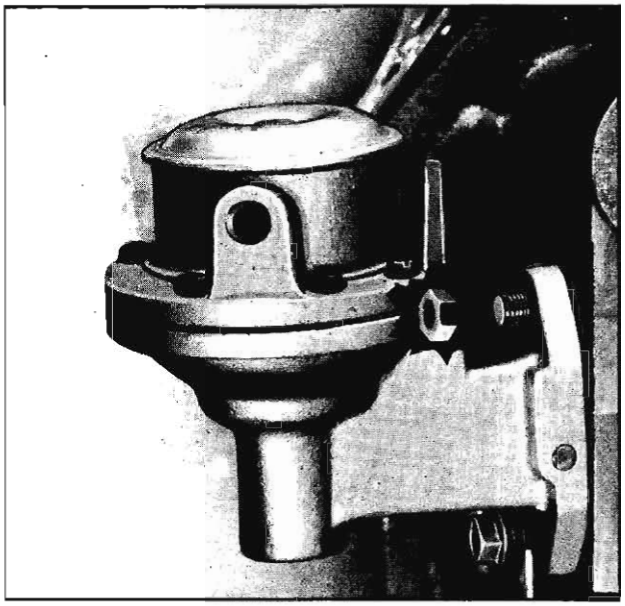


Fig. 3-480 Fuel Pump Mounting

3. Drive out the rocker arm pin using a small punch, then remove the arm. (Fig. 3-481)

   CAUTION: Use care not to damage the pump body when removing the pin.

4. Remove the pulsator diaphragm cover attaching bolt then remove the diaphragm cover and diaphragm.

5. Remove the six fuel cover attaching screws, then remove the cover.

6. Remove the pull rod and diaphragm assembly, and rocker arm return spring.

7. To remove the valves, remove the burrs produced from staking then:

   a. Pry the inlet valve assembly from the fuel cover.

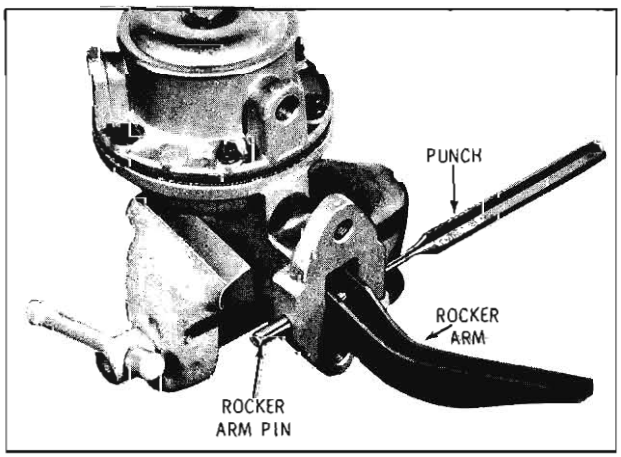


Fig. 3-481 Removing Rocker Arm Pin

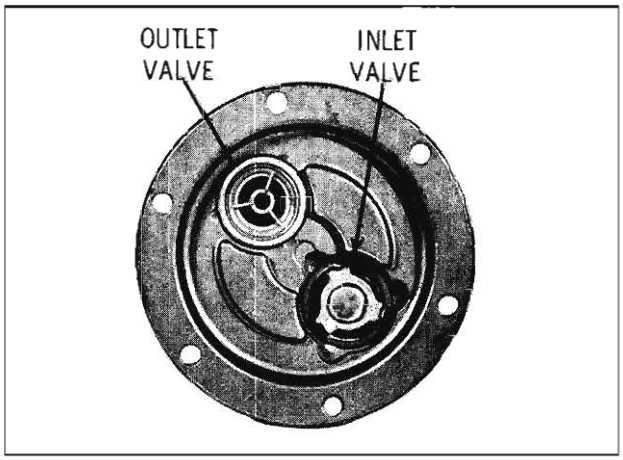


Fig. 3-482 Fuel Valves

   b. Push the outlet valve assembly through the cover from the pulsator side of the cover.

Cleaning and Inspection

1. Clean and rinse all metal parts in solvent. Blow out all passages with compressed air.

2. Inspect the pump body and cover for cracks, breakage, and distorted flanges. Examine all screw holes for stripped or crossed threads. Replace the pump assembly if damage to the body is encountered.

Assembly

1. Place the valve gaskets in the fuel cover recesses provided in the fuel cover.

   a. Place the inlet valve on top of the gasket with the spring cage facing out of the cover as shown in Fig. 3-482.

   b. Place the outlet valve on top of the gasket with the spring cage facing into the cover. (Fig. 3-482)

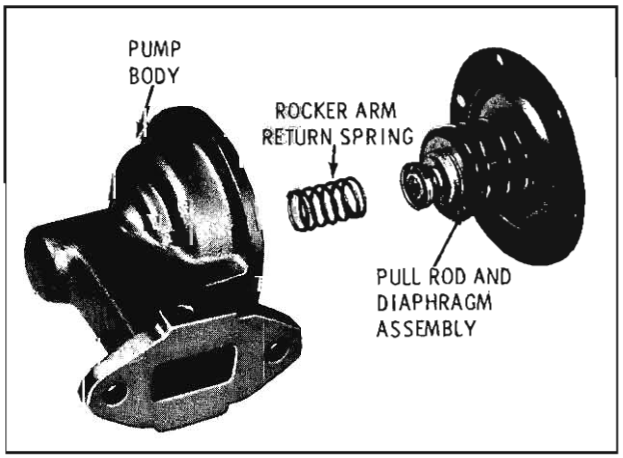


Fig. 3-483 Fuel Pump - Exploded View

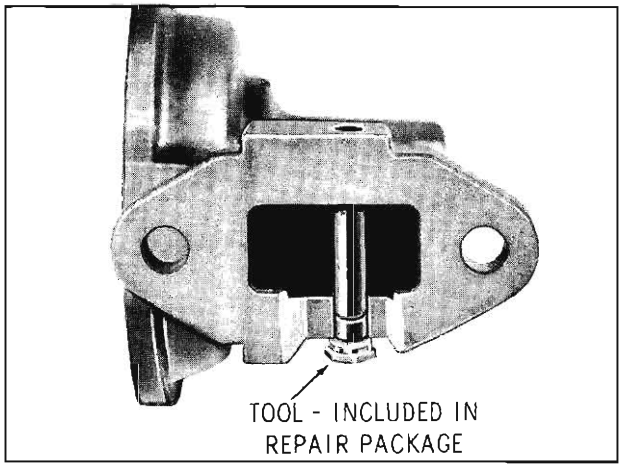


Fig. 3-484 Centering Rocker Arm Pin

c. Stake the valves in place.

2. Install the rocker arm spring in the pump body making sure that the spring is properly seated in the pull rod end of the diaphragm assembly. (Fig. 3-483)

3. Position the fuel cover, aligning the "outlet" opening with the ear of the mounting flange. Install and tighten the six attaching screws evenly and securely.

4. Install a new pulsator diaphragm on the fuel cover, then position the cover and secure with the attaching bolt.

5. Position the rocker arm in the pump body with the forked end of the rod on the rocker arm return spring retainer portion of the pull rod assembly. Make sure that the rocker arm return spring is properly seated in the spring retainer of the pull rod end of the diaphragm assembly. (Fig. 3-479)

6. Install the rocker arm pin through the pump body and the rocker arm, with the chamfered end first. Use the centering tool furnished in the kit to insure the correct positioning of the pin, thus making sure that it is centered in the pump body. (Fig. 3-484)

7. Place one aluminum plug on each side of the rocker arm pin.

8. Position an expander tool, furnished in the kit, against each aluminum plug. (Fig. 3-485)

   a. Push the point of the expander tool into the aluminum plug far enough by hand to make a centering dimple. This will give the correct relationship between the expander tool and the plug.

   b. Place the pump in a vise with the expander tools against the jaws.

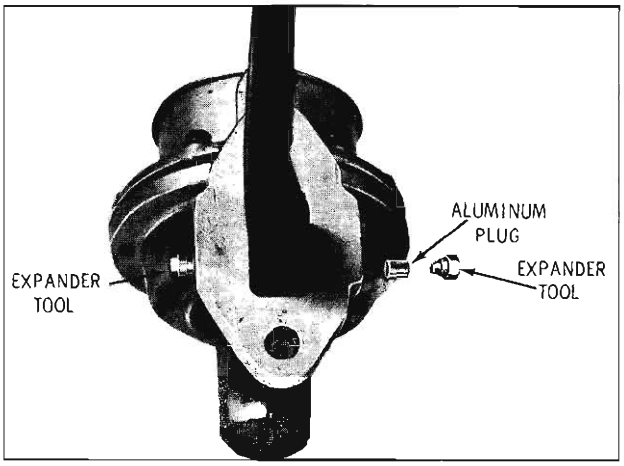


Fig. 3-485 Installing Rocker Arm Pin

   c. Close the vise jaws until the expander tools just shoulder against the pump body. This properly expands the aluminum plugs in the pump body. (Fig. 3-486)

   NOTE: Care must be exercised to prevent breaking the pump body with the vise.

9. Remove the pump from the vise, then remove the expander tools.

EXHAUST SYSTEM (Figs. 3-487, 3-488, 3-489, 3-490 & 3-491)

DESCRIPTION

The single and dual exhaust system is shown in Fig. 3-487. The 32 Series exhaust system is shown in Fig. 3-488. The exhaust system used on the 33 Series is shown in Fig. 3-489.

The exhaust system should be installed so as to obtain the following recommended cleanances on 30-31-32 Series.

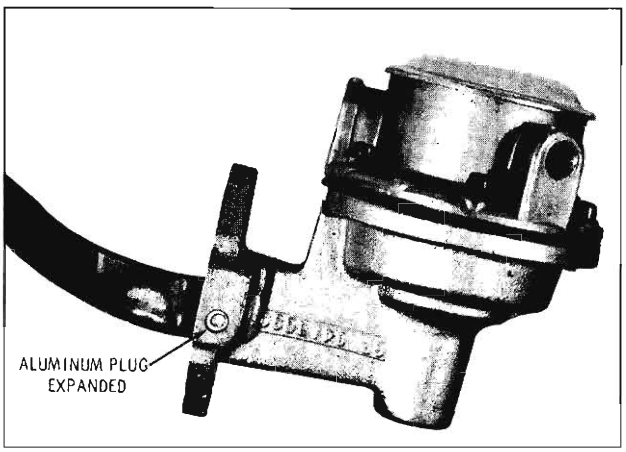


Fig. 3-486 Aluminum Plug Expanded

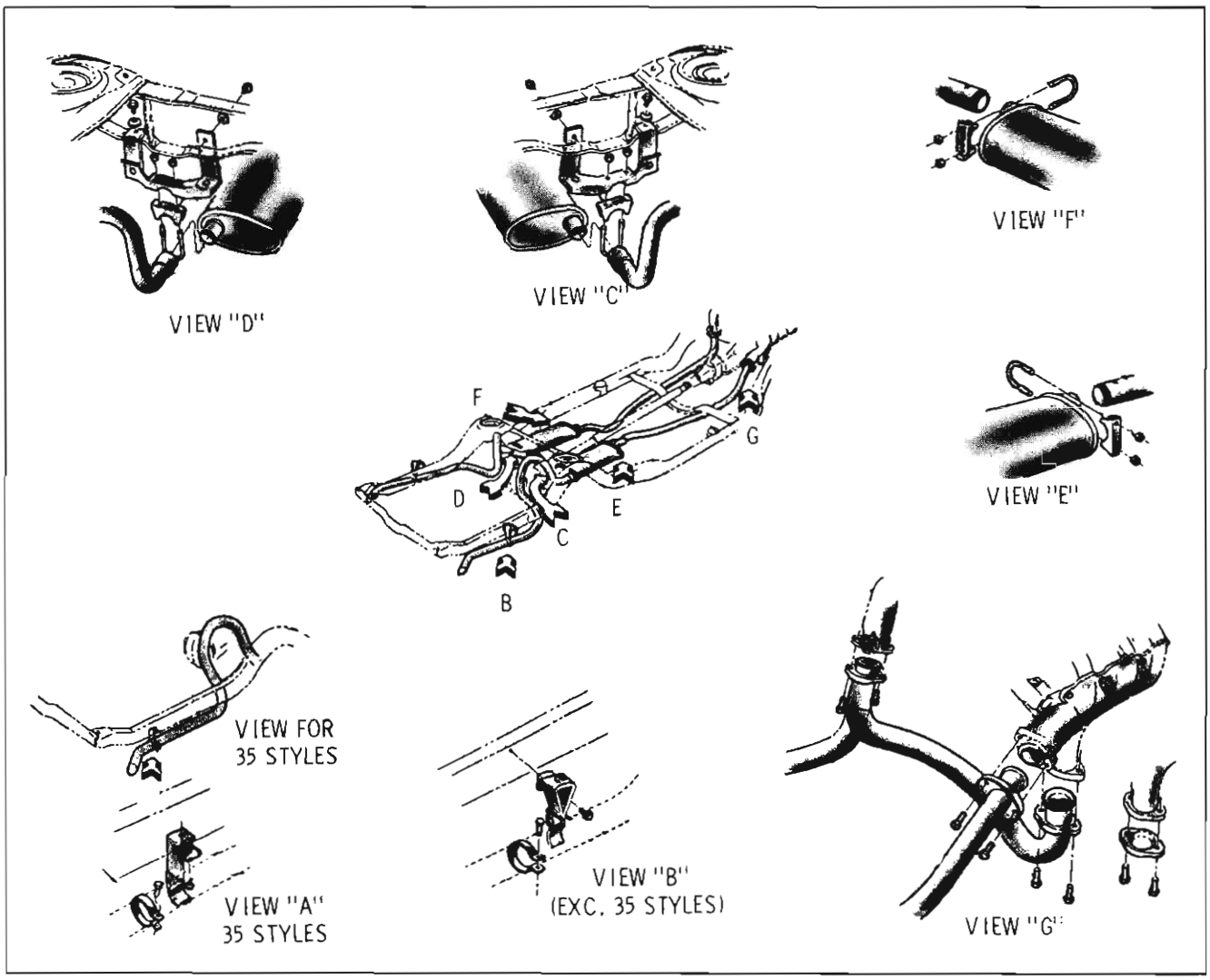


Fig. 3-487 30-31 Series Single Exhaust and 30-31-32

Right Side

1. Exhaust Pipe to Transmission Support . . 3/4"
2. Exhaust Pipe to Brake Line . . . . . 7/8"
3. Exhaust Pipe to Underbody . . . . . 7/8"
4. Muffler to Underbody . . . . . 7/8"
5. Muffler to Propeller Shaft . . . . . 1-1/8"
6. Rear of Muffler to Spring Cross Bar . . 3/4"
7. Tail Pipe to Spring Seat . . . . . 7/8"

Left Side

1. Exhaust Pipe to Frame Lower Control Arm Bracket . . . . . 5/8"
2. Exhaust Pipe to Synchromesh Transmission Linkage . . . . . 1-1/8"
3. Exhaust Pipe to Jetaway Transmission Linkage . . . . . 3/4"

EXHAUST MANIFOLD HEAT VALVE

The exhaust manifold heat valve, located in the left manifold, is the integral type, but can be replaced with the following procedure:

1. Remove the manifold from the engine.
2. Cut the shaft on each side of the valve welds with a hacksaw or cutting torch.

   NOTE: A hacksaw blade can be removed from the frame, put through the manifold and reassembled.

3. Remove the valve and the weight end of the shaft from the manifold. The shaft end and plug can be removed by using a punch from the weight side.
4. Remove the bushings with BT-6419, Bushing Remover and Installer.

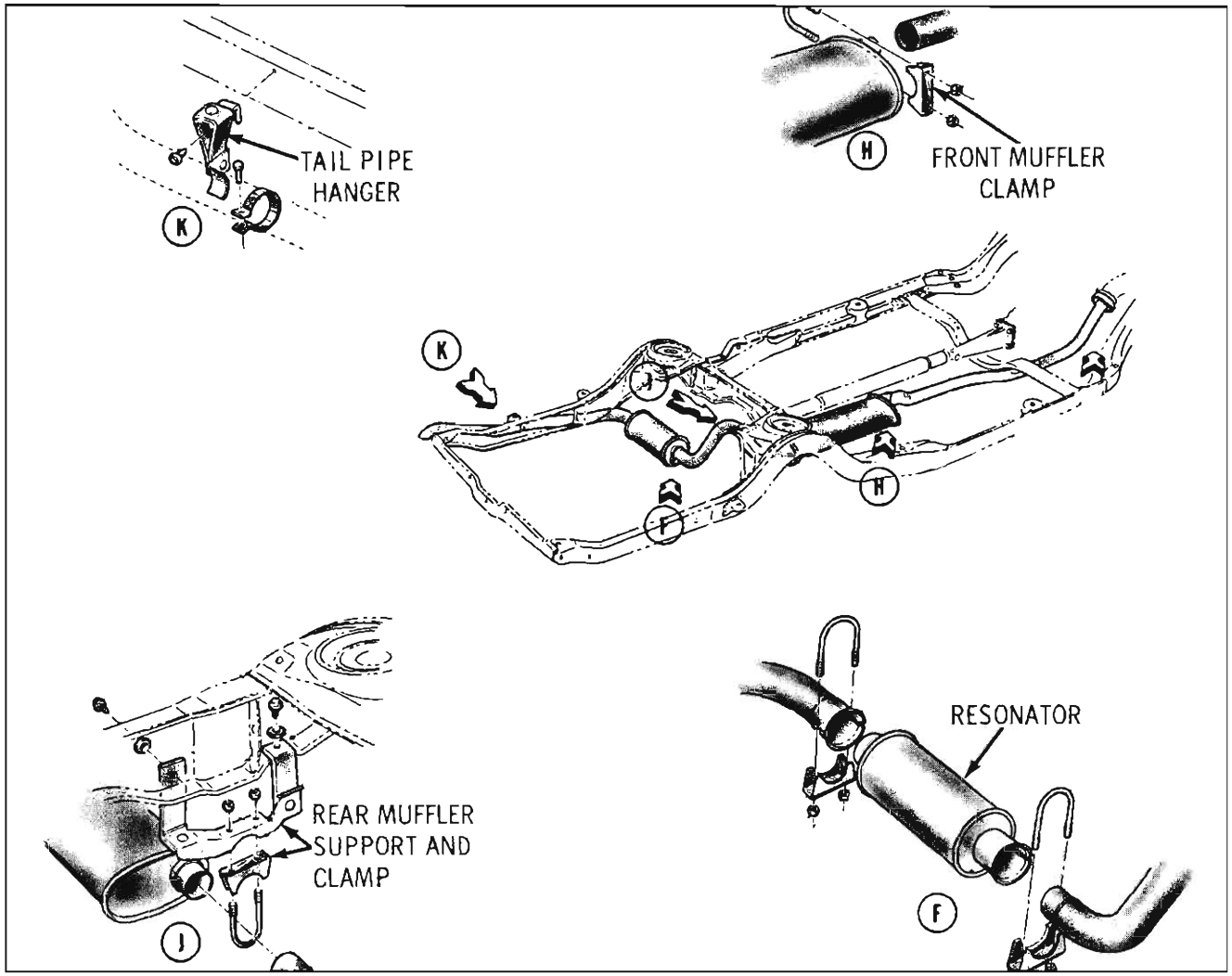


Fig. 3-488 32 Series Single Exhaust

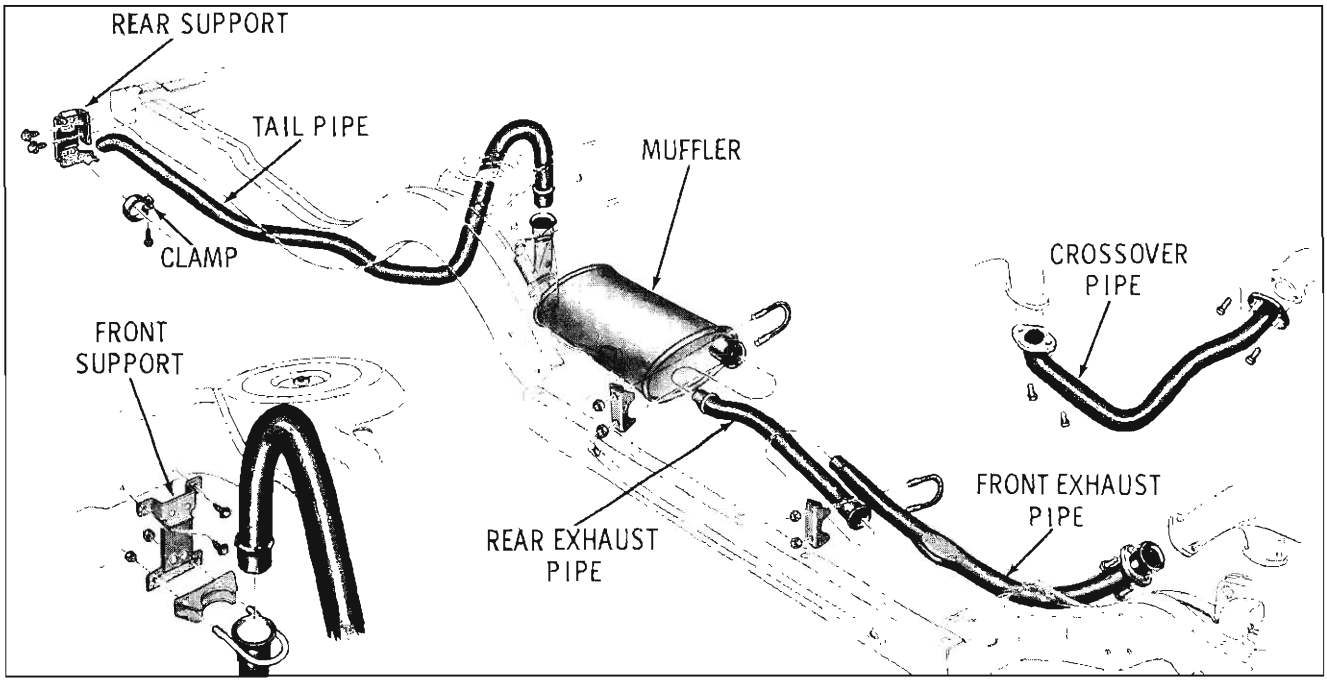


Fig. 3-489 33 Series Single Exhaust

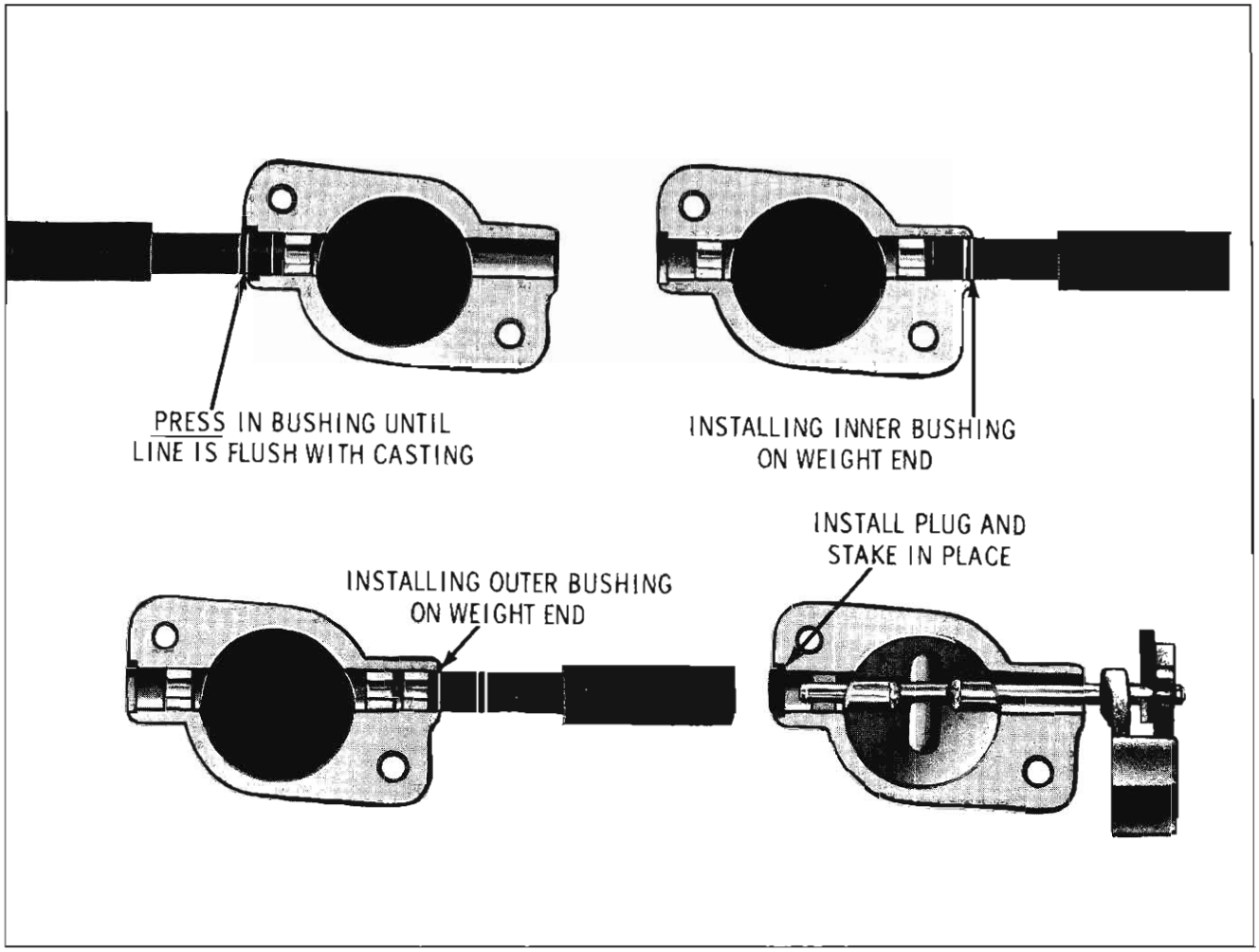


Fig. 3-490 Exhaust Manifold Heat Valve Replacement

5. Clean the bushing bore of the manifold.

6. Lubricate the OD of the bushings, with the largest taper inboard, then press the new ceramic lined steel bushings into the manifold with BT-6419, Bushing Remover and Installer, as shown in Fig. 3-491. Two bushings are used on the weight end.

7. Install the plug in the counterbore of the manifold opposite the weight end, then stake in place.

8. Slide a new valve into the manifold.

9. Insert a new shaft into the manifold, through the valve and bushings. Install the spring on the shaft and position on the weight and shaft in the closed position with 140" clearance between the weight and the manifold.

10. Position a new valve with the long portion of the valve closer to the manifold outlet than on the short side of the valve.

11. With stainless steel welding rod, electric arc weld the valve to the shaft.

NOTE: The valve should be welded in the same places as the original valve.

ENGINE SPECIFICATIONS

CYLINDER BLOCK	
Engine Type	90° V-Type
No. of Cylinders	8
Bore and Stroke (all)	3.9385" x 3.3850"
Piston Displacement (all)	330 cu. in.
Compression Ratio	2 Bbl. 9.0:1, 4 Bbl. 10.25:1
Firing Order	1-8-4-3-6-5-7-2
Main Bearing Bore (I.D.)	2.687" - 2.688"
CRANKSHAFT	
Diameter-Main Bearing Journal (all)	2.4993" - 2.4983"
Width-Main Bearing Journal (with fillets)	
No. 1	1.185"
No. 2 & 4	1.156" - 1.166"
No. 3	1.199" - 1.201"
No. 5	1.862" - 1.882"
Diameter-Connecting Rod Bearing Journal	2.1248" - 2.1238"
Width-Connecting Rod Bearing (with fillets)	1.877" - 1.880"
Length-Overall Crankshaft	26.470"
Diameter - Oil Holes in Crankshaft	.201" - .209"
Clearance - Crankshaft End Thrust	.004" - .008"
MAIN BEARINGS	
Oil Clearance-Crankshaft Vertical (all)	.0005" - .0021"
Width Bearing Sheet	
No. 1, 2, and 4	.970" - .980"
No. 3	1.193" - 1.195"
No. 5	1.624"
CONNECTING RODS	
Length-Center to Center	5.998" - 6.002"
Diameter-Connecting Rod Bore	2.2495" - 2.2500"
Diameter-Pin Bore	.9791" - .9795"
Bearing Clearance - Crankshaft (vertical)	.0005" - .0026"
Side Clearance - Crankshaft End	.0020" - .011"
PISTON	
Diameter Nominal Outside	3.9375"
Length Overall	3.620"
Top of Piston Pin to Center	1.615"
Clearance at Thrust Surface (selective)	.00075" - .00125"
Weight Less Pin & Rings (all)	20.670 oz.
Skirt Taper	.0000" - .0010" Larger at Bottom
Ring Width (2 compression)	.0803"
(1 oil)	.1886"
PISTON PINS	
Diameter	.9803" - .9807"
Length Overall	3.116" - 3.136"
Pin to Piston Clearance	.0003" - .0005" Loose
Pin to Rod Clearance	.0008" - .0016" Tight
PISTON RINGS	
No. of Compression Rings (per piston)	2
Width of Compression Rings (top & bottom)	.0780" - .0775"
Gap Clearance Compression Rings	.010" - .020"
Clearance in Groove Compression Rings	.0018" - .0038"
No. of Oil Rings (per piston)	1
Gap Clearance, Oil Ring	.015" - .055"
Clearance in Groove - Oil Ring	.0001" - .0051"

ENGINE SPECIFICATIONS—Continued

CAMSHAFT	
Bearing Journal Diameters	
No. 1	2.0380" - 2.0372"
No. 2	2.0180" - 2.0172"
No. 3	1.9980" - 1.9972"
No. 4	1.9780" - 1.9772"
No. 5	1.9580" - 1.9572"
Width (including chamfers)	
No. 1	.810"
No. 2, 3, and 4	.700"
No. 5	.790"
Journal Clearance in Bearing (all)	.0005" - .0043"
End Thrust	.011" - .077"
VALVE - INTAKE	
Diameter - Head	1.880" - 1.870"
Diameter - Stem	.3425" - .3432"
Angle - Valve Seat	45°
Width - Valve Seat	.037" - .075"
Overall Length (all)	4.740"
Clearance in Guide	.0010" - .0027"
Lash	Hydraulic
VALVE - EXHAUST	
Diameter - Head	1.567" - 1.557"
Diameter - Stem	.3420" - .3427"
Angle - Valve Seat	45°
Width - Valve Seat	.037" - .075"
Overall Length (all)	4.728"
Clearance in Guide	.0015" - .0032"
Lash	Hydraulic
VALVE GUIDES	
Inside Diameter (intake & exhaust)	.3442" - .3452"
VALVE SPRINGS	
Length	1.87"
Diameter - Wire	.200"
Inside Diameter	1.065" - 1.041"
Load @ 1.600"	76 - 84 Lbs.
Load @ 1.200"	193 - 207 Lbs.
VALVE LIFTERS	
Diameter - Body	.8422" - .8427"
Length - Overall	2.000"
Clearance in Boss (selective)	.0005" - .0020"
CAMSHAFT SPROCKET	
Width of Sprocket	.410" - .400"
Pitch	.500"
No. of Teeth	36
Overall Width of Gear	.471" - .461"
CRANKSHAFT SPROCKET	
Width of Sprocket	.410" - .400"
Overall Width of Gear	1.001" - .993"
Pitch	.500"
No. of Teeth	18
TIMING CHAIN	
Width	.740" - .750"
No. of Links	48
Pitch	.500"

ENGINE SPECIFICATIONS—Continued

FLYWHEEL	
No. of Teeth on Starter Gear	160
No. of Teeth on Starter Pinion	9
LUBRICATION SYSTEM	
Crankcase Capacity Drain and Refill	4 Qts.
Drain & Refill with Filter Change	5 Qts.
Oil Pump	
Clearance Pressure Relief Valve in Bore	.0025" - .0050"
End Clearance - Gear	.0025" - .0065"

SPECIFICATIONS

COOLING SYSTEM	
CAPACITY A/C	19 1/4 Qts.
All except A/C	17 Qts.
Without Heater, Subtract	3/4 Qts.
Pressure Cap	
With or Without Air Conditioning	15 Lbs.
Thermostat	180°
FUEL PUMP	
Pressure	7 to 8-1/2 Lbs.

TORQUE SPECIFICATIONS

FUEL PUMP	
Fuel Pump to Block Bolt and Nut	20 to 25
Fuel Pump Eccentric to Camshaft	40 to 50
EXHAUST SYSTEM	
Intermediate Pipe to Muffler	13 to 17
Muffler to Exhaust Pipe	13 to 17
Tail Pipe to Support Assembly	10 to 15
Exhaust Pipes to Exhaust Manifold	10 to 18
Intermediate Pipe and Muffler to Support	13 to 17
Intermediate Pipe to Adapter	13 to 17

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CARBURETION

(34-35-36-38-39 SERIES)

CONTENTS OF SECTION 4

ROCHESTER CARBURETOR

MODEL 4GC

THEORY OF OPERATION

FLOAT SYSTEM (Fig. 4-1)

The 4GC carburetor employs two sets of twin floats. As fuel is consumed, the floats drop and open the needle seats. Fuel enters on the primary side and some of this fuel passes through the air horn to the secondary side, maintaining correct fuel level in the float bowl under all operating conditions.

IDLE SYSTEM (Fig. 4-2)

The idle system located on the primary side of

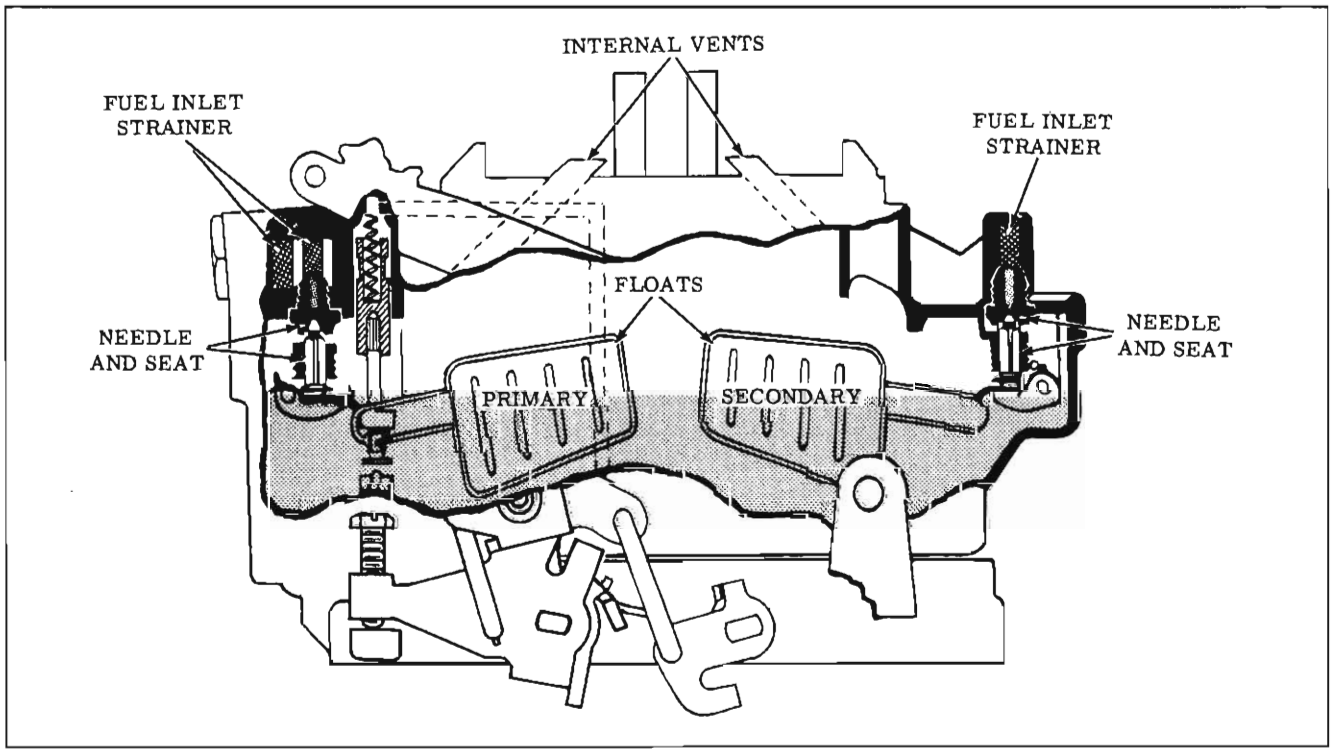


Fig. 4-1 Float System

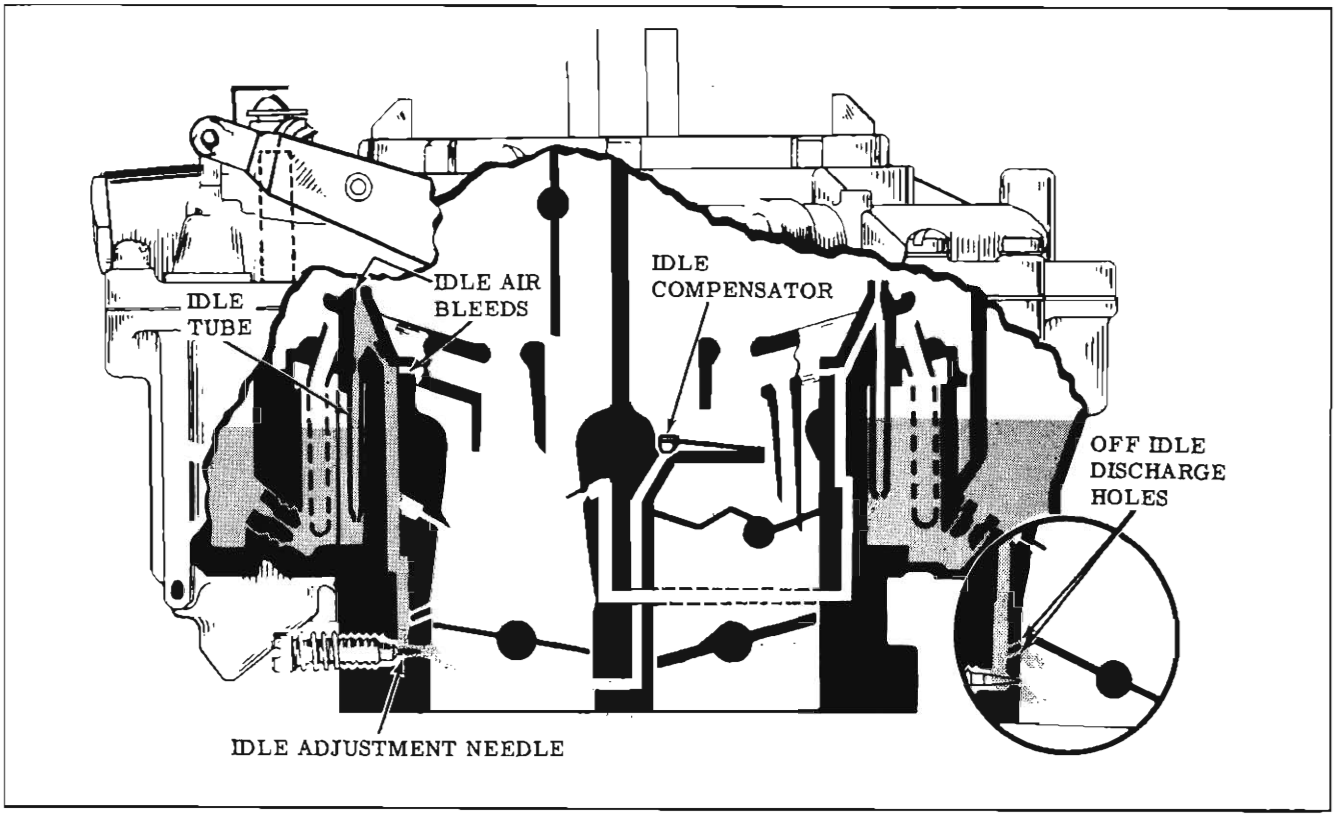


Fig. 4-2 Idle System

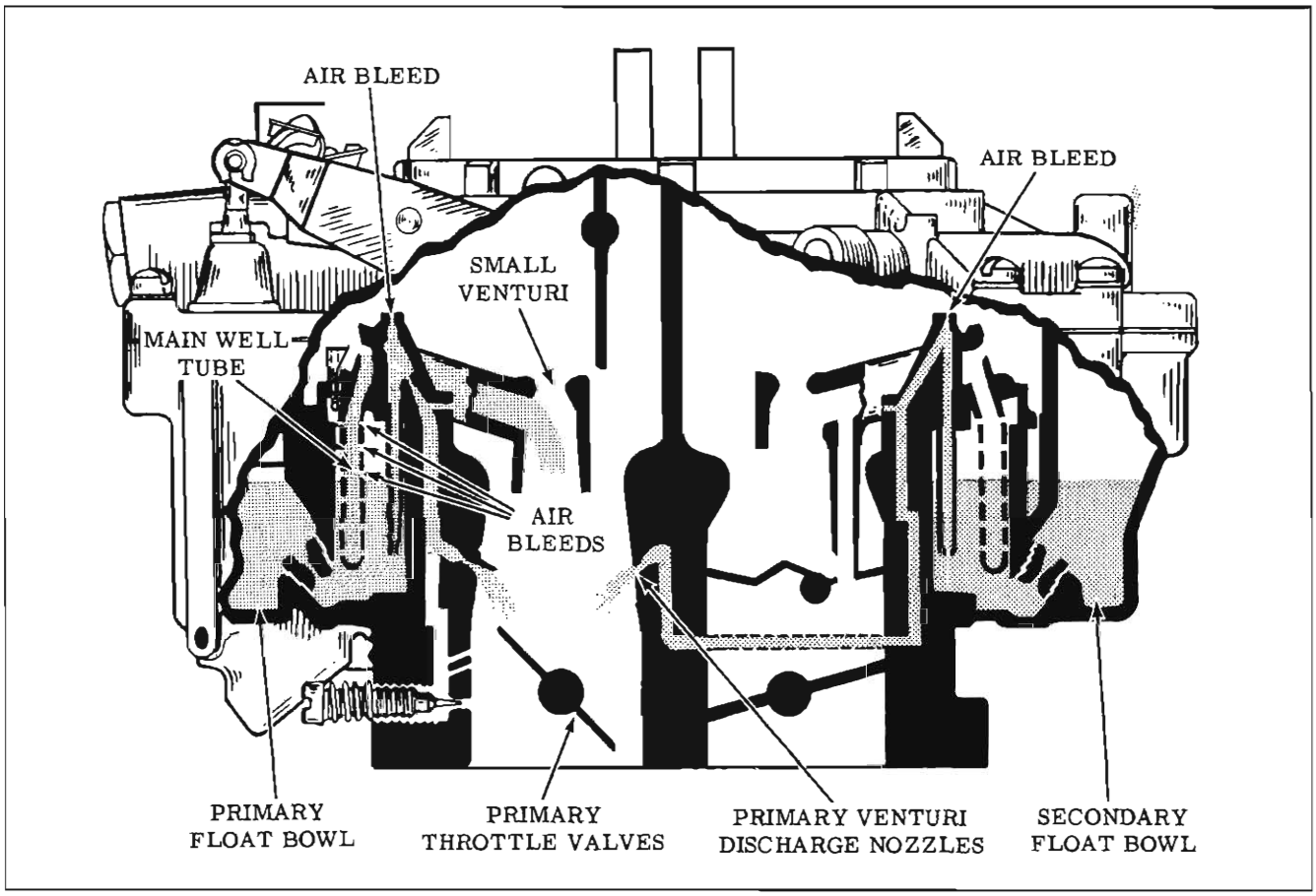


Fig. 4-3 Part Throttle System

the carburetor supplies the fuel required for normal curb idle, off idle and low speed operation.

To minimize fuel vapor formation in the carburetor bowl, an external vent opens when the throttle valves are in the idle position.

Cars equipped with factory installed A/C are equipped with an idle compensator to prevent stalling under prolonged "hot idle" conditions. When underhood temperatures rise, a bi-metal strip lifts the valve off its seat allowing additional air to enter below the throttle valves, offsetting the enrichening effects of the higher temperatures.

PART THROTTLE (Fig. 4-3)

As the primary throttle valves open, the speed of air entering the carburetor bore increases and raises the vacuum in the small venturi area. Fuel is then drawn from the float bowl into the main well up the main well tubes, where air bleeds are provided, and into the venturi. However, at wide primary throttle valve openings, prior to the opening of the secondary throttle valves, and continuing through wide open secondary throttle operation, an additional source of fuel is provided from the secondary side through a discharge nozzle that opens into the primary venturi.

POWER SYSTEM (Fig. 4-4)

When more power is needed or high speed driving is maintained, a vacuum operated power piston and power valve provide additional fuel.

When manifold vacuum drops below approximately 9" hg. the power piston spring forces the piston down to unseat the spring loaded power valve, permitting additional fuel to flow through the main well tubes.

PUMP SYSTEM (Fig. 4-5)

The accelerator pump provides the fuel necessary for smooth operation during acceleration by forcing additional fuel into the air stream.

CHOKE SYSTEM (Fig. 4-6)

The choke system is designed to work independently of the fast idle which provides a relatively short choking period with adequate fast idle for a cold engine. A thermostatic coil closes the choke valve for cold operation and gradually releases the choke during the warm-up period. To maintain a more exacting air fuel ratio during warm-up, the force of the thermostatic coil is opposed by air velocity against the offset choke valve and a vacuum piston and link assembly. To prevent a closed choke condition with a wide open throttle,

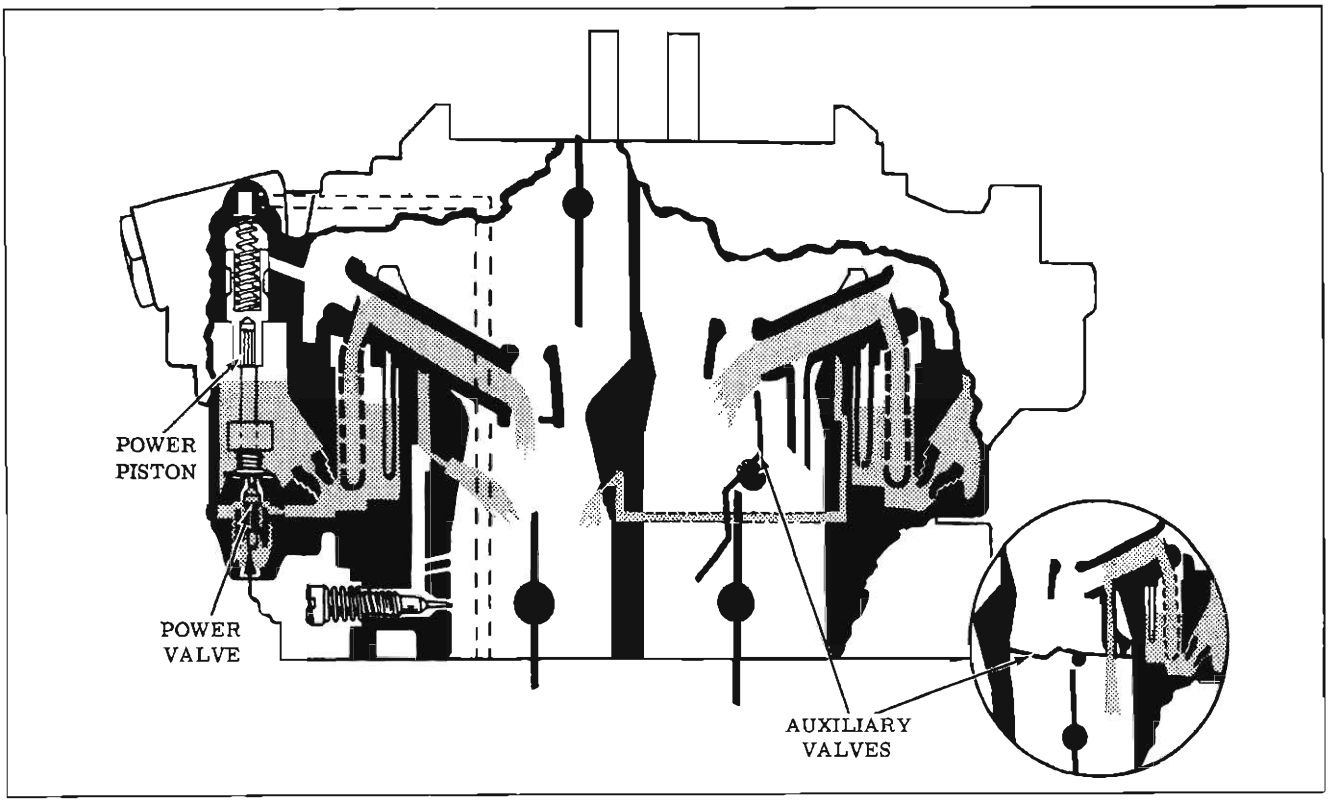


Fig. 4-4 Power System

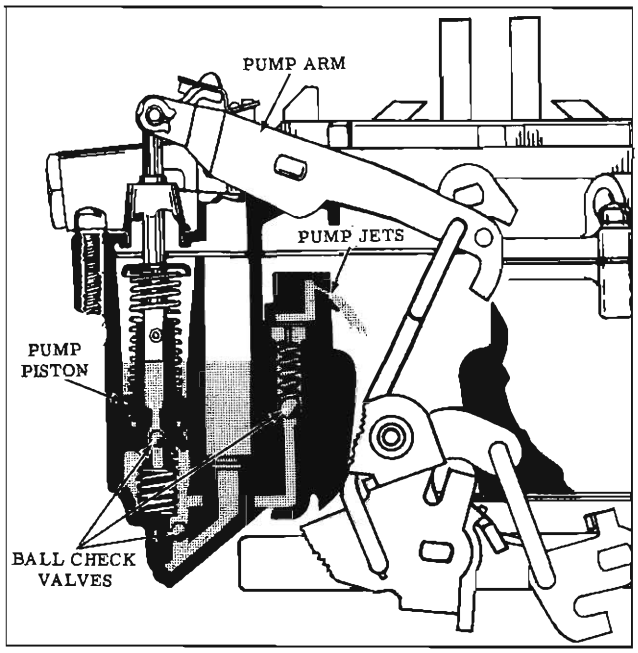


Fig. 4-5 Pump System

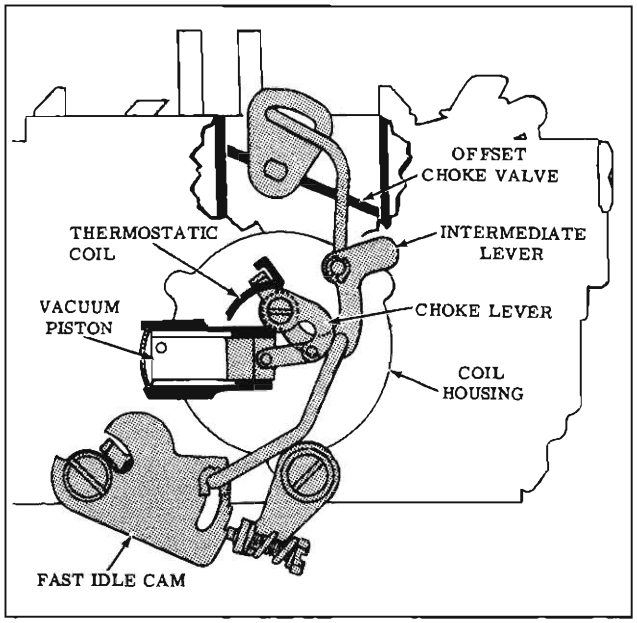


Fig. 4-6 Choke System

a tang on the pump arm mechanically opens the choke a sufficient amount to prevent a loading condition. This also provides an unloader to open the choke valve when starting a flooded engine.

REMOVE AND INSTALL

1. Remove air cleaner.
2. Remove cotter key, which retains bellcrank, and retainer from bellcrank rod and remove bellcrank and rod as an assembly.
3. Disconnect fuel line from front of carburetor.
4. Disconnect choke pipe from choke cover.
5. Disconnect vacuum lines.
6. Remove four throttle body to intake manifold nuts and remove carburetor.

To install, reverse removal procedure and make adjustments outlined under ADJUSTMENTS (ON CAR). Torque carburetor to intake manifold nuts 11 to 14 ft. lbs.

CARBURETOR DISASSEMBLY

AIR HORN (Fig. 4-7)

1. Mount the carburetor on Holding Fixture J-5923-B, or 30-14.
2. Remove the fuel inlet fitting and gasket, then remove the filter screen from the air horn.
3. Remove idle vent valve screw, shield and valve.
4. Remove the retainer from the upper end of the pump rod and disengage rod.
5. Remove the retainer from pump plunger shaft and unhook the shaft from pump arm.
6. Remove the retainer from the intermediate choke rod and unhook rod from choke lever.
7. If the choke shaft is to be removed:
   a. Remove the small screw holding the choke unloader lever to the choke shaft, then remove the lever.

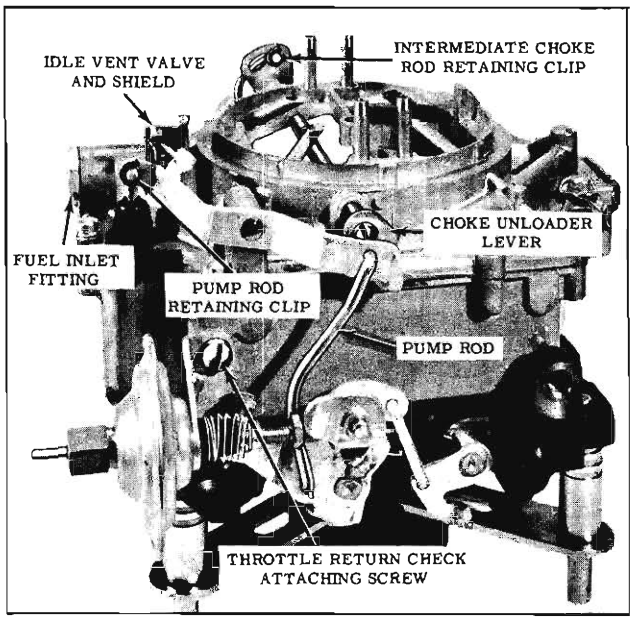


Fig. 4-7 4GC Carburetor

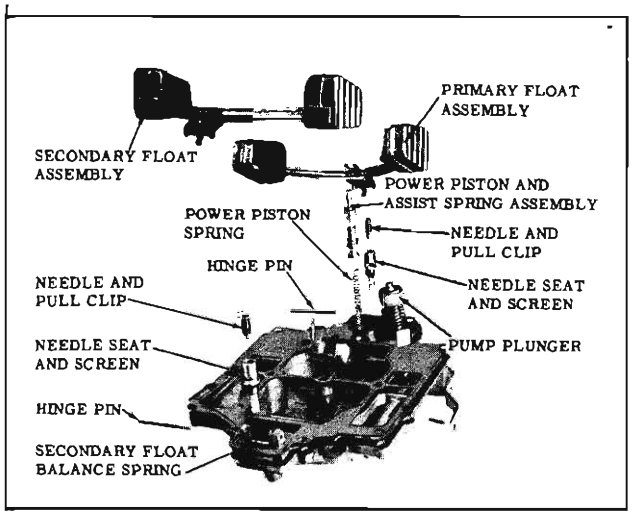


Fig. 4-8 Air Horn Assembly

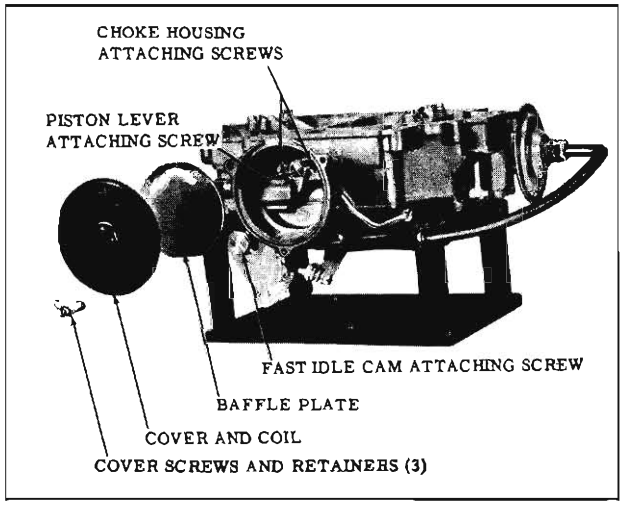


Fig. 4-9 Choke Assembly and Fast Idle Cam

b. Remove the two small brass choke valve retaining screws and discard. Remove the choke valve and the choke shaft.

8. Remove the 13 air horn attaching screws, one screw is recessed in the top of the air horn.

9. Carefully lift the air horn until the float assemblies are clear of the carburetor body.

10. Remove the hinge pin from the primary float assembly, then slide the float and needle away from the power piston stem. (Fig. 4-8)

11. Remove primary float needle seat and gasket, using Tool BT-52. Remove the small filter screen from the needle seat bore.

NOTE: The float needle and seat are matched and must be installed as an assembly.

12. Remove the hinge pin, float assembly, needle seat gasket and filter screen from the secondary side of the air horn. Do not remove the float balance spring unless it is distorted and needs replacement.

13. Remove the air horn gasket.

14. Remove burrs around power piston bore due to staking and remove the power piston assembly by depressing the stem and allowing it to snap back into position. Remove the spring under the piston.

15. Remove the pump plunger assembly by sliding the shaft through the rubber seal. Remove the rubber seal from the top side of the air horn casting.

FLOAT BOWL

1. Remove the fast idle cam attaching screw. (Fig. 4-9)

2. Remove the three choke cover attaching screws and retainers, then remove the choke cover, gasket and baffle from the choke housing.

3. Remove the choke piston lever attaching screw, then remove the lever link and piston assembly from the choke housing.

4. Remove the two choke housing attaching screws, then remove the choke housing and linkage from the carburetor body.

5. Remove the intermediate choke lever and shaft with linkage from the choke housing, then remove choke housing gasket.

6. Remove the throttle return check by removing the attaching screw, and the rubber tee from the vacuum fitting on the throttle body.

7. Remove the three attaching screws and lock

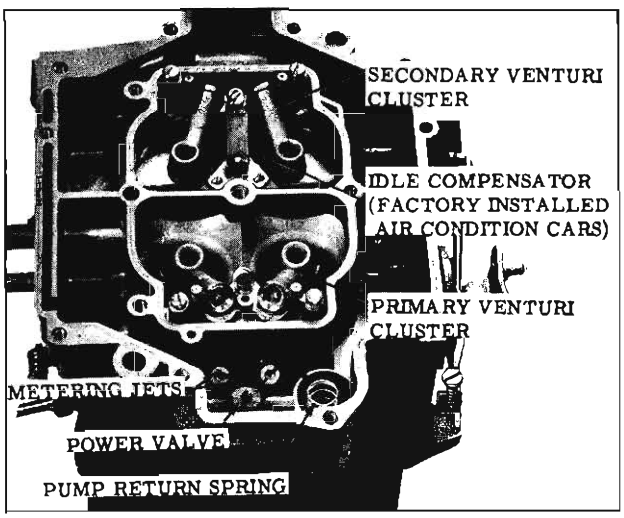


Fig. 4-10 Float Bowl Assembly

washers from the venturi cluster on the primary side, then remove the cluster and gasket. (Fig. 4-10)

8. Remove the main well inserts. (Fig. 4-11)

9. Remove the three attaching screws and lockwashers from the venturi cluster on the secondary side, then remove the cluster and gasket.

10. If equipped with idle compensator, remove attaching screws then remove the idle compensator and gasket.

11. Remove both metering jets from the primary (pump) side of the carburetor body.

12. Remove the power valve and gasket.

13. Remove both metering jets from the secondary side of the carburetor. Keep them in a separate group.

14. Remove the pump return spring from the pump well, then invert the carburetor body to remove the aluminum pump inlet ball from the well.

15. Remove the small "T" shaped pump discharge spring guide with needle nose pliers, then remove the small spring and steel ball. (Fig. 4-11)

16. If it is necessary to clean or replace the small screen next to the pump plunger bore, remove the retainer ring and screen.

17. Invert the carburetor body and remove the four throttle flange attaching screws. Remove

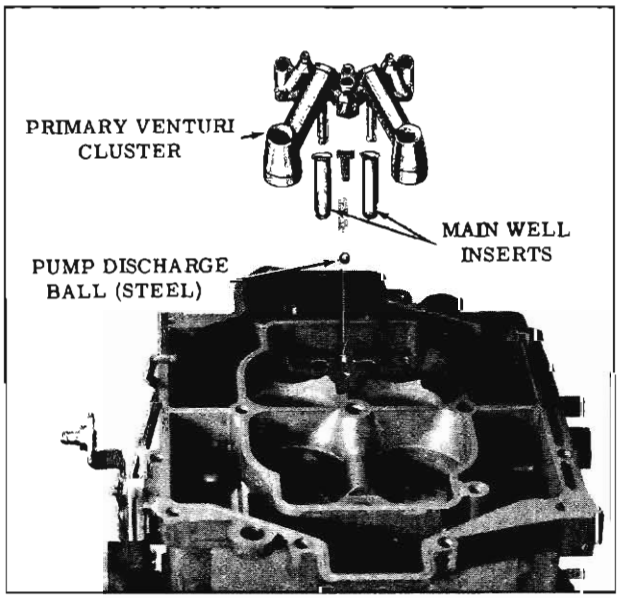


Fig. 4-11 Pump Discharge Spring, Guide and Main Well Inserts

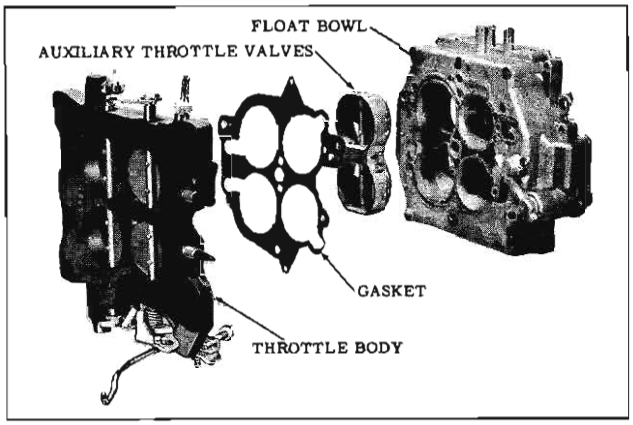


Fig. 4-12 Auxiliary Throttle Valves

the throttle flange and gasket. (Fig. 4-12)

18. Remove the secondary auxiliary throttle valve assembly from the carburetor body.

THROTTLE BODY

NOTE: No attempt should be made to remove the throttle valve or shaft from the throttle flange as it may be impossible to reassemble the throttle valves correctly in relation to the vacuum advance and idle discharge orifices.

The idle mixture needle screws may be removed for cleaning or replacement. Also the slow and fast idle speed screws can be removed if necessary.

CLEANING OF PARTS

The carburetor should not be cleaned in any solution other than a cold immersion type cleaner.

1. Thoroughly clean carburetor castings and metal parts in carburetor cleaning solvent.

   CAUTION: The choke coil, housing, and pump plunger should not be immersed in solvent. Clean pump in clean gasoline only.

2. Blow all passages in casting dry with compressed air. DO NOT PASS DRILLS THROUGH JETS OR PASSAGES.

3. Clean filter screens of dirt or lint. If the filter screens are distorted or plugged they should be replaced.

INSPECTION OF PARTS

1. Check floats for dents or excessive wear at hinge pin holes.

2. Shake floats to check for leaks.

3. Examine float needle and seat. If grooved, replace with a factory matched float needle, seat, and gasket assembly.

4. Inspect the idle mixture adjusting needles for burrs or ridges.

5. Inspect the upper and lower surfaces of the carburetor body to see that the small sealing beads are not damaged. Damaged beading may result in air or fuel leaks at that point.

6. Inspect holes in pump rocker arm, fast idle cam, and throttle shaft lever. If holes are worn excessively or out-of-round to the extent of improper operation of the carburetor, worn parts should be replaced.

7. Inspect the steps on the fast idle cam for excessive wear. If excessive wear is noted, cam should be replaced to assure proper engine operation during the warm-up and choking periods.

8. Inspect the pump plunger for cracks or creases. If the pump plunger is damaged, replace the pump plunger as a complete assembly.

9. Inspect the throttle flange assembly. Make sure the idle passages and vacuum channels are clean.

10. Inspect filter screens. If screens are distorted or plugged, they should be replaced.

As mentioned during the disassembly of the carburetor, there is a very close tolerance fit of the throttle valves in the throttle body. Also the idle discharge orifices are drilled in relation to a properly fitting valve. Therefore, if the throttle valves, levers or shafts are worn excessively or damaged, a complete throttle body assembly is required.

CARBURETOR ASSEMBLY

THROTTLE BODY

1. Install the idle mixture needles and springs finger tight. Back out the needles 1-1/2 turns as a preliminary idle adjustment.

2. If removed, install the slow and fast idle screws in the throttle levers.

FLOAT BOWL

1. With the carburetor body in the inverted position, install the auxiliary throttle valve assembly so that the calibrated spring operating pin is down. (Fig. 4-12)

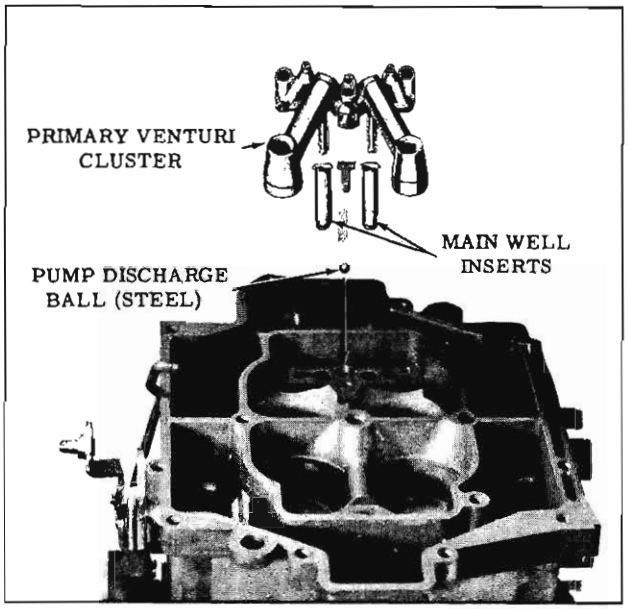


Fig. 4-13 Pump Discharge Spring, Guide and Main Well Inserts

2. Position the throttle body gasket on the float bowl so that all holes are properly aligned.

3. Place the throttle body on the float bowl and install the four attaching screws. Tighten the center screw 9 to 10 ft. lbs. and the outer screws 3 to 4 ft. lbs.

4. Place the float bowl upright on the holding stand.

5. Install the pump outlet steel ball, spring, and "T" shaped guide in the center hole of primary venturi cluster. (Fig. 4-13)

6. Install the main well inserts. (Fig. 4-13)

7. Install the power valve and gasket, and the two primary main metering jets. (Fig. 4-14)

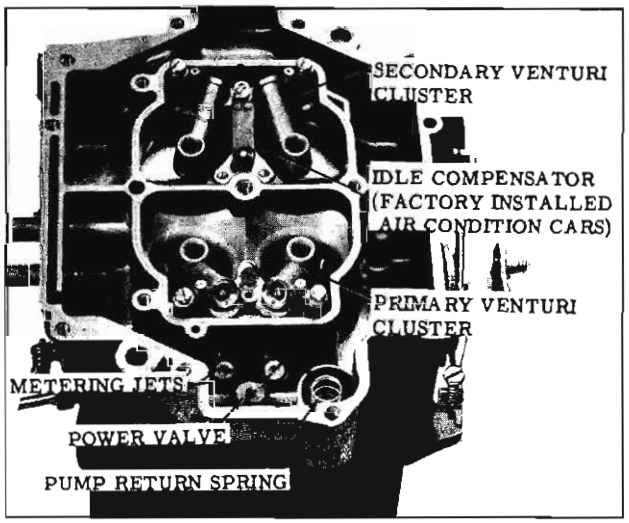


Fig. 4-14 Float Bowl Assembly

8. Install the two secondary main metering jets.

9. If equipped with idle compensator, install compensator and gasket and retain with two screws. Make sure the compensator is seated firmly in the passage and tighten screws securely.

10. Install the secondary venturi cluster and gasket and retain with three attaching screws and washers.

    NOTE: The secondary cluster does not have pump discharge nozzles.

11. Install primary venturi cluster and gasket and retain with three attaching screws and lockwashers.

12. Install the pump inlet aluminum ball and the pump return spring in the pump plunger well. Be sure the spring is seated over the ball.

13. Install the pump inlet screen and retainer if removed.

14. Install the choke housing gasket, intermediate choke lever and shaft with linkage, in the choke housing. (Fig. 4-15)

15. Install the choke housing on the float bowl and retain with two attaching screws. Be sure the intermediate choke shaft lever is extending downward between the two attaching screw bosses.

16. Install the choke lever, link, and piston assembly and attach lever to the intermediate choke shaft.

    NOTE: The choke piston pin hole in the piston should be pointing inward.

17. Install fast idle cam with attaching screw.

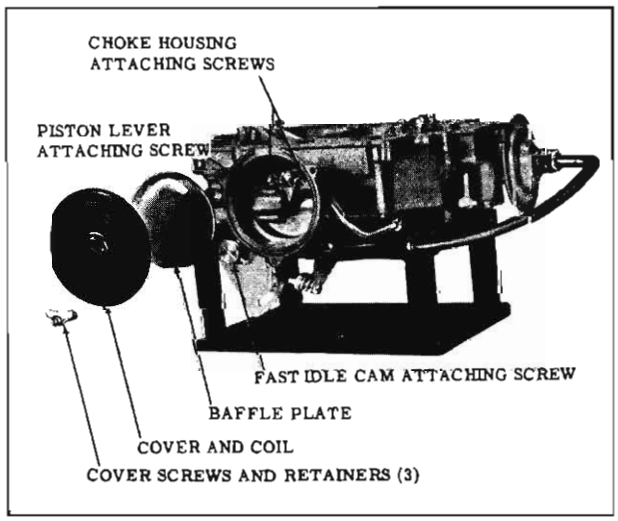


Fig. 4-15 Choke Assembly and Fast Idle Cam

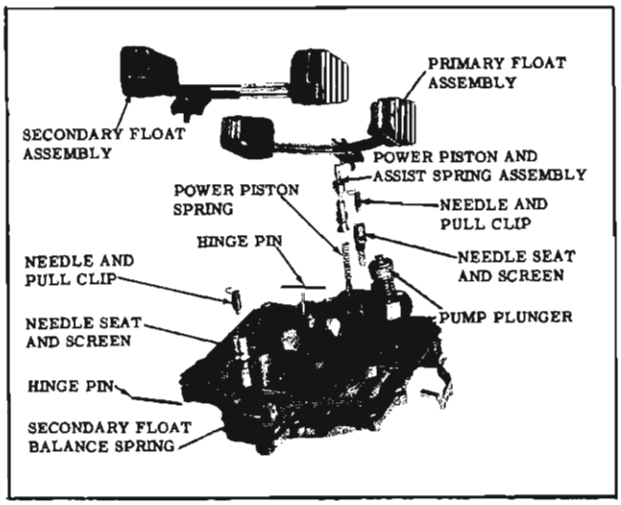


Fig. 4-16 Air Horn Assembly

AIR HORN (Fig. 4-16)

1. Install the power piston spring in the bore, then install the power piston in the air horn and stake the casting very lightly to hold the piston in place.

2. Install the pump plunger rubber seal in the air horn by inserting the small end through from the bottom. The lips of the seal must be seated on both sides of the cover.

3. Insert the pump plunger shaft through the rubber seal.

4. Position the gasket on the air horn.

5. Install both float needle seats and gaskets, with filter screens attached using Tool BT-52.

6. Install secondary float assembly on the air horn, retaining in place with hinge pin. Make sure tang on rear of the float arms is over the balance spring.

7. Install primary float assembly with the center of the float arms on the power piston shaft under the vacuum assist spring retainer.

8. Make float adjustments as outlined under FLOAT ADJUSTMENTS.

FLOAT ADJUSTMENTS

FLOAT LEVEL AND ALIGNMENT— PRIMARY SIDE

When checking the primary float level, be sure that the float arms do not rest on baffles. A minimum of .030" must be maintained between the float arms and the baffles. If the minimum clearance does not exist after the float adjustments are made, it will be necessary to file the float arms.

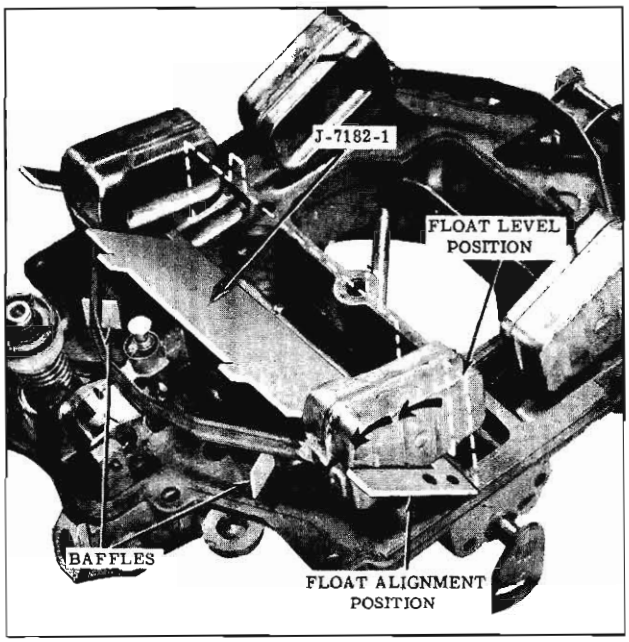


Fig. 4-17 Checking Primary Float Level and Alignment

NOTE: Do not file the baffles.

1. With gasket in place and the air horn inverted, position gauge J-7182-1 under the primary float as shown in Fig. 4-17.

2. With the gauge held vertical, the lower surfaces of each float pontoon should just touch the gauge. The lower surface of each pontoon should be parallel with the air horn.

3. If necessary to adjust, bend the float arm as indicated in Fig. 4-18.

4. To check float alignment, rotate gauge as indicated in Fig. 4-17. Float pontoon should be centered in the gauge cut-out.

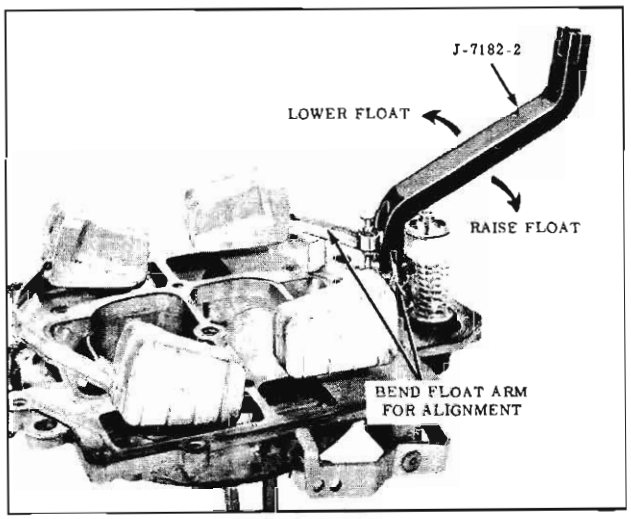


Fig. 4-18 Adjusting Float Level (Primary Shown)

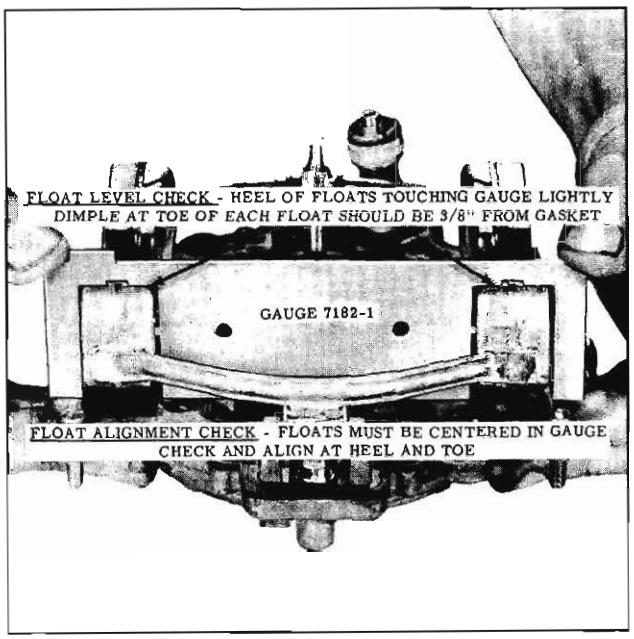


Fig. 4-19 Checking Secondary Float Level and Alignment

5. If adjustment is necessary, bend the float arms horizontally as required. After bending float arms, recheck the float level.

FLOAT LEVEL AND ALIGNMENT SECONDARY SIDE

1. With the gasket in place and the air horn inverted, position gauge as shown in Fig. 4-19.

2. The highest point of the float pontoons at the heel should just touch the gauge.

3. If necessary to adjust, bend the float arms at the center with Tool J-7182-2.

4. Measure distance from the dimple on the side of each pontoon to the air horn gasket. Distance should be 3/8".

5. If an adjustment is necessary, bend each float arm as required, then recheck float level.

6. To check for float alignment, position gauge J-7182-1 over the floats. With the gauge centered on the air horn, the float pontoons should be centered in the gauge.

7. If an adjustment is necessary, bend the float arm to center the pontoon in the gauge. Recheck the float level.

VACUUM ASSIST SPRING ADJUSTMENT

1. Position the air horn as shown in Fig. 4-20, with the power piston retained in the up position.

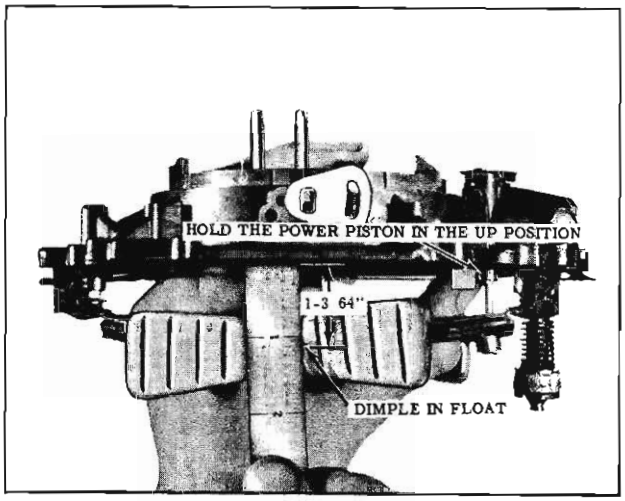


Fig. 4-20 Checking Vacuum Assist Spring

2. Bounce the floats lightly and measure the distance from the gasket to the dimple on the side of the primary float.

3. If an adjustment is necessary, bend the tang under the vacuum assist spring and retainer as indicated in Fig. 4-21.

FLOAT DROP ADJUSTMENT— PRIMARY AND SECONDARY

1. Position the air horn as shown in Fig. 4-22. Do not hold the power piston for this adjustment.
2. Bounce the floats lightly and measure the distance from the air horn gasket to the center of the dimple on the secondary and primary float pontoons. Distance on the secondary should be 1-3/16". Distance on the primary should be 1-1/2".

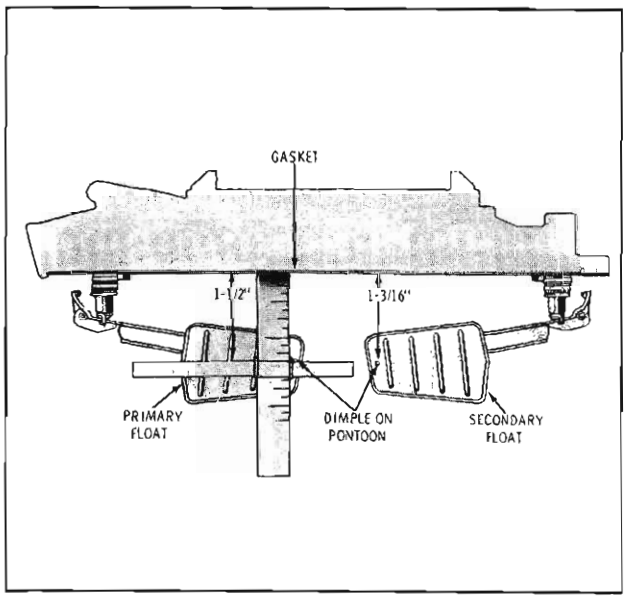


Fig. 4-21 Adjusting Vacuum Assist Spring

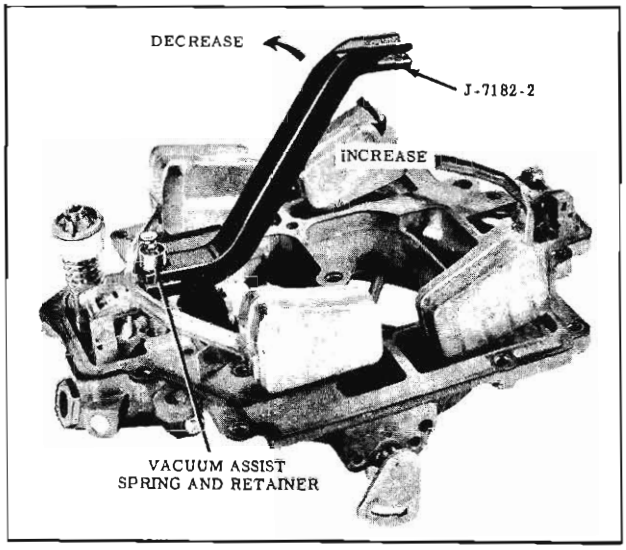


Fig. 4-22 Checking Primary and Secondary Float Drop

3. If an adjustment is necessary, bend the tang at the rear of the float arms toward the needle and seat to decrease the setting, away from the needle and seat to increase the setting.

COMPLETION OF CARBURETOR ASSEMBLY

1. Carefully guide the air horn assembly on the carburetor body so that the pump plunger, power valve stem, and floats will not be damaged.

2. Align the holes in the air horn, gasket and body and just start the 13 air horn attaching screws.

3. Tighten evenly and securely the inner attaching screws (including the screw through the inner wall), then tighten the remaining outside attaching screws in the same manner.

4. If choke shaft was removed, install the choke shaft in the air horn by inserting it in the hole from the same side as the choke.

   a. Slide the choke valve through the shaft so that the letters "RP" on the valve are facing up when the valve is closed.

   b. Install two new small choke valve-to-shaft attaching screws. Close the choke valve to align choke in air horn, then tighten screws.

5. Install the rubber idle vent valve and shield on top of the air horn. Make sure valve seats properly on air horn.

6. Insert upper end of the pump rod through the inner hole in the pump lever by lifting up on the lever, then install the retainer. Insert pump plunger shaft in pump lever and install retainer.

7. Install the fuel inlet screen, gasket and fitting in the air horn.

8. Install the choke unloader lever on the choke shaft.

9. Install the intermediate choke rod into the choke lever.

10. Adjust intermediate choke rod and choke coil as outlined under ADJUSTMENTS (ON OR OFF THE CAR).

11. Install the rubber tee on the vacuum fitting in the throttle body.

12. Adjust fast idle cam rod, secondary lockout, secondary throttle lockout, pump rod, and unloader as outlined under ADJUSTMENT (ON OR OFF CAR).

ADJUSTMENTS (On or Off the Car)

INTERMEDIATE CHOKE ROD AND CHOKE COIL ADJUSTMENT

The choke vacuum piston must be properly positioned with respect to the vacuum slots in the choke housing bore to provide proper choke pull-off action.

1. With the choke cover and baffle removed, position the fast idle screw on the high step of the fast idle cam. Raise the intermediate choke lever to its full up position then push lightly on the end of choke piston to remove all lash in the linkage, check to see if the choke position is flush to 1/32" out of the choke piston bore. (Fig. 4-23)

2. Bend the intermediate choke rod if necessary to correctly position choke piston.

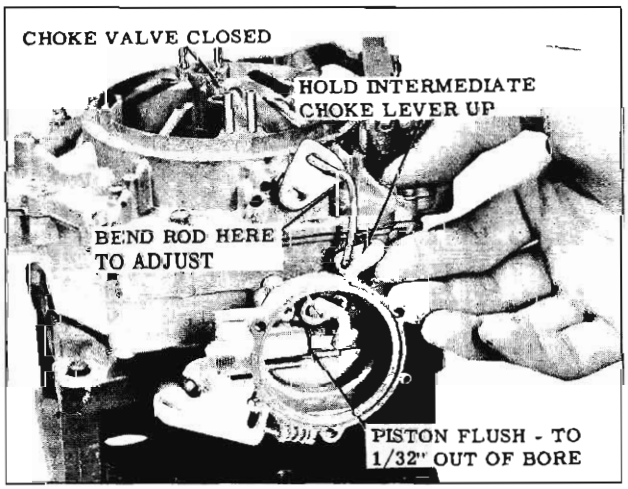


Fig. 4-23 Intermediate Choke Rod Adjustment

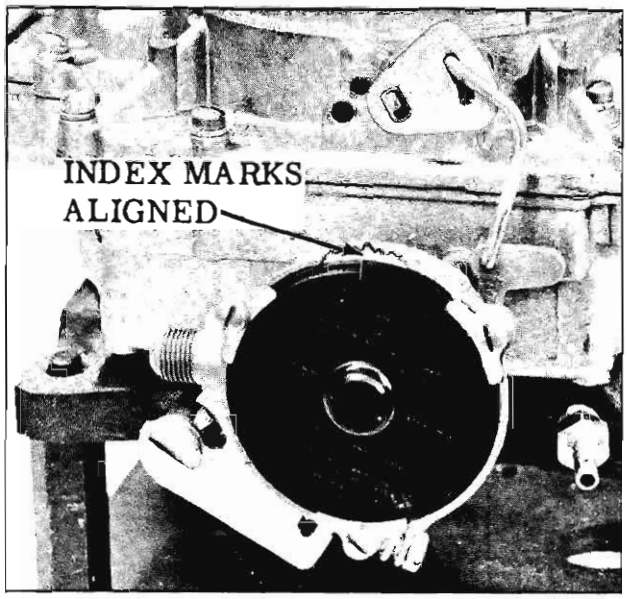


Fig. 4-24 Choke Coil Setting

3. Position baffle in choke housing, then install cover gasket, cover and coil assembly, and three screws and retainers.

4. Rotate cover counterclockwise until coil picks up tang on piston linkage. Continue rotating cover until scribe line on cover is on index. (Fig.4-24)

5. Tighten the three cover attaching screws.

FAST IDLE CAM ROD ADJUSTMENT

In addition to the intermediate choke rod and choke coil adjustment, it is necessary to adjust the fast idle cam rod to the cam. This insures proper positioning of the fast idle cam when the choke coil is in operation.

1. Turn in the fast idle screw until it just contacts the middle step of the fast idle cam.

2. With the shoulder of the highest step of the fast idle cam held against the fast idle screw, hold the intermediate choke lever in the extreme up position. The intermediate choke rod and the fast idle cam rod must be at the upper limit of travel in the slot to remove all travel. Check the clearance between the top edge of the choke valve and the dividing wall of the air horn. Check clearance with small end of gauge BT-68. Clearance should be .053". (Fig. 4-25)

3. If necessary to adjust, bend the fast idle cam rod (lower rod).

SECONDARY THROTTLE LOCKOUT ADJUSTMENT

The secondary throttle lockout prevents open-

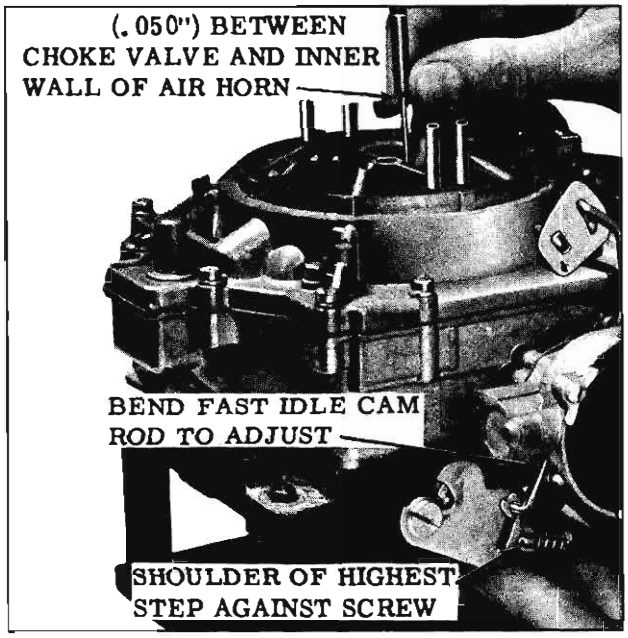


Fig. 4-25 Fast Idle Cam Rod Adjustment

ing of the secondary throttle valves until the engine has reached normal operating temperature. Insufficient clearance at the lock point will allow the fast idle cam to strike the tang and prevent the choke from closing.

1. Measure the clearance between the lockout tang and the top edge of the slot in the fast idle cam. The clearance should be .015"± .005". (Fig. 4-26)
2. If adjustment is necessary, bend the tang sideways using Tool BT-18 until the proper clearance is obtained.

SECONDARY THROTTLE CONTOUR CLEARANCE ADJUSTMENT

The secondary throttle contour clearance adjustment, which is performed after the lock-out

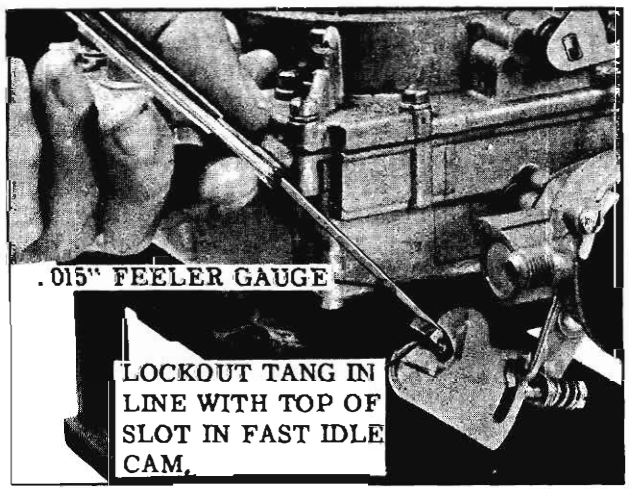


Fig. 4-26 Secondary Throttle Lock-Out Adjustment

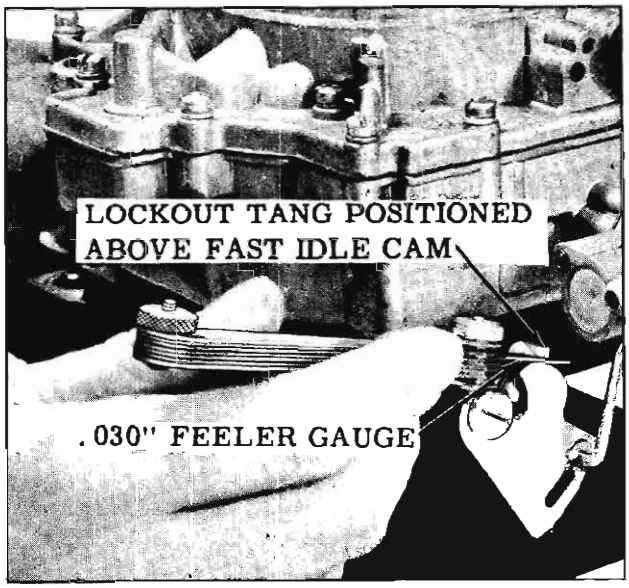


Fig. 4-27 Secondary Throttle Contour Clearance Adjustment

adjustment, actually times the unlocking of the secondary throttle valve in relation to engine temperature.

1. Hold the choke valve in the wide open position so that the secondary lock-out tang is positioned over the fast idle cam, then measure the clearance between the tang and the fast idle cam. The clearance should be .030"± .010". (Fig. 4-27)
2. If adjustment is necessary, allow the choke to close so that the tang is again in the slot of the fast idle cam, then use Tool BT-91 to bend the tang straight up or down as required for proper clearance.

PUMP ROD ADJUSTMENT

1. While holding the throttle valves closed, idle speed screw backed out, measure the distance from the top of the air horn casting to the bottom edge of the pump plunger shaft. It should be 1-1/64". (Fig. 4-28)
2. If adjustment is necessary, bend the pump rod using Tool BT-18.
3. Operate the pump rod several times to be sure the movement is free.

UNLOADER ADJUSTMENT

If the engine "loads up" or becomes flooded when cold starting, it is necessary to mechanically open the choke valve a small amount to admit more air and facilitate starting. This is accomplished when the tang on the pump lever contacts a tang on the choke shaft at wide open throttle.

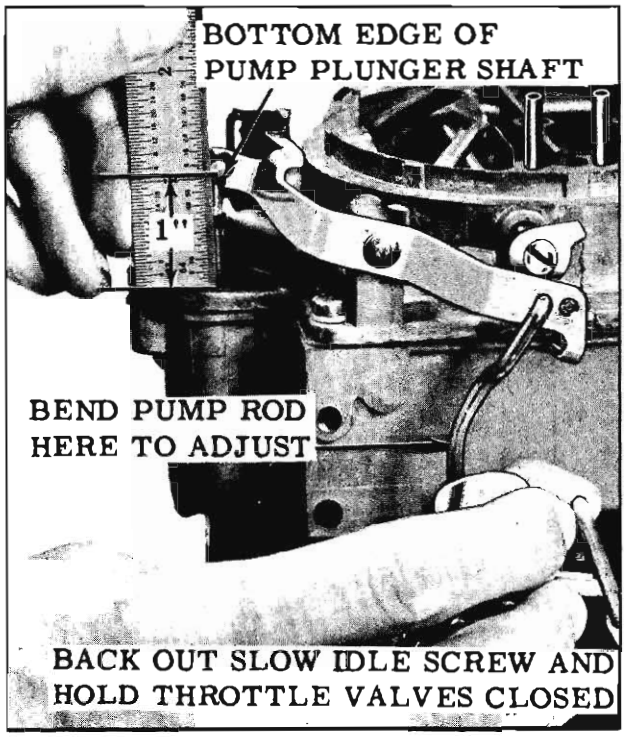


Fig. 4-28 Pump Rod Adjustment

1. Be sure the pump rod adjustment is correct.
2. While holding the throttle lever in the wide open position (with carburetor off car), or with accelerator pedal completely depressed (with carburetor on car), check the clearance between the top edge of the choke valve and the dividing wall. The correct clearance is .115" and can be checked with gauge BT-90. (Fig. 4-29)
3. If necessary, bend the small tang on the pump lever with Tool BT-91 to obtain the correct dimension.

   IMPORTANT: If the unloader adjustment was made off the car, it will be necessary to recheck the adjustment with the accelerator pedal completely depressed after the carburetor is installed.

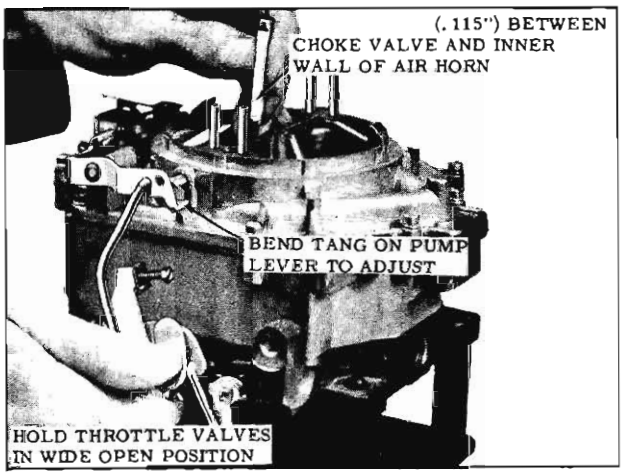


Fig. 4-29 Unloader Adjustment

SECONDARY ACTUATING LEVER ADJUSTMENT

1. Install the throttle return check on the carburetor with Holding Fixture J-6342-01 in place.
2. Back out the fast idle adjusting screw until the throttle valves are fully closed. Be sure the fast idle screw is not resting against the fast idle cam.
3. Remove slack from linkage and insert a feeler gauge between the actuating lever and the primary lever. (Fig. 4-30)
4. Clearance should be between .005" and .025".
5. To adjust, open the throttle valves and bend the actuating tang with Bending Tool BT-18.

ADJUSTMENTS (ON CAR)

There are four adjustments that must be made with the carburetor mounted on the engine. They are: Slow Idle, Fast Idle, Throttle Return Check and Atmospheric Idle Vent.

SLOW IDLE ADJUSTMENT

(Air Cleaner Removed)

Engine must be at operating temperature and throttle return check Holding Fixture J-6342-01 in place when making the slow idle speed adjustment.

After the idle rpm is stabilized, turn in or out each idle adjusting needle screw until the smoothest possible idle is obtained. This normally is accompanied by a higher manifold vacuum reading and/or an increase of idle rpm. Then, turn out (rich) each needle 1/4 turn, at which time both the

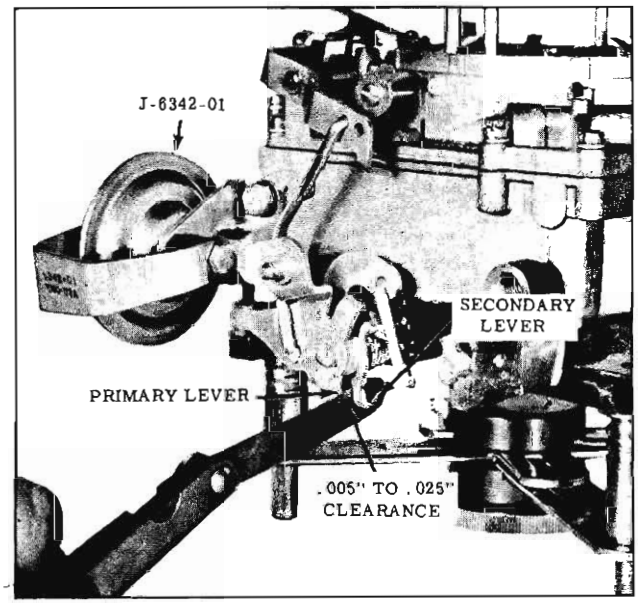


Fig. 4-30 Secondary Actuating Lever Adjustment

SLOW IDLE SPEED

TRANSMISSION	GEAR	RPM
Hydra-Matic	Drive	* 500
Synchromesh	Neutral	550

Factory Installed Air Conditioning - Air Conditioning turned OFF, Idle Compensator held closed.

Dealer Installed Air Conditioning (Without Idle Compensator) - Air Conditioning turned ON.

* If Equipped with Air Conditioning - 550

idle vacuum and rpm will drop off slightly. This adjustment will prove to be correct for all normal requirements.

NOTE: Idle speed and mixture should be re-checked with air cleaner installed.

When setting the idle speed and mixture on cars with an idle compensator (factory installed air conditioning only) make sure the idle compensator stays closed by holding it down. If the idle speed increases when the air cleaner is installed, do not reduce the idle speed setting since the idle compensator is open. If the speed decreases, readjust idle to correct rpm.

FAST IDLE ADJUSTMENT

When the engine is cold and the choke valve is partially closed, it is necessary that the engine rpm at idle be higher than normal to prevent stalling. This adjustment, if correct, will assure proper engine rpm during the warm-up period.

1. Open throttle valves and rotate the fast idle cam so that the fast idle screw is resting on the low step and against the shoulder of the next step. (Fig. 4-31)

2. With the engine running at operating temperature, transmission selector lever in "N" position and the parking brake applied, adjust the fast idle screw to obtain an engine speed of 1000 rpm.

   NOTE: Any time the fast idle is changed, it will be necessary to adjust the throttle return check.

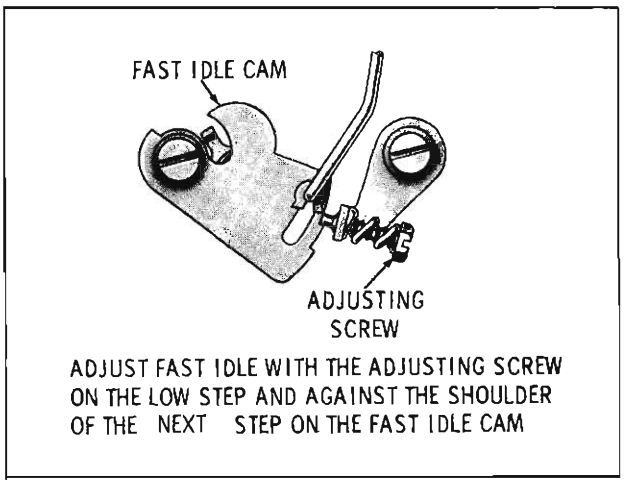


Fig. 4-31 Fast Idle Adjustment

THROTTLE RETURN CHECK ADJUSTMENT

NOTE: If first type, without the external spring is used, refer to the 1963 Service Manual for adjustments and specifications.

The throttle return check is designed to open the throttle valves to increase engine speed when engine vacuum drops if the engine loads up and starts to stall. It also acts to retard throttle closing when the driver suddenly takes his foot off the accelerator pedal.

The vacuum to the throttle return check has an air bleed above the throttle valves to give faster response to the return check on deceleration.

1. Be sure the fast idle adjustment has been made.
2. With engine running at operating temperature, transmission selector lever in "D" position, and the parking brake applied; measure the clearance between the contact screw and the contact on the throttle lever. The clearance should be .080".
3. If adjustment is necessary, adjust the contact screw using two wrenches.

   NOTE: Any time the fast idle is changed, it will be necessary to readjust the throttle return check. For throttle linkage adjustments refer to Hydra-Matic or Synchromesh, Section (6).

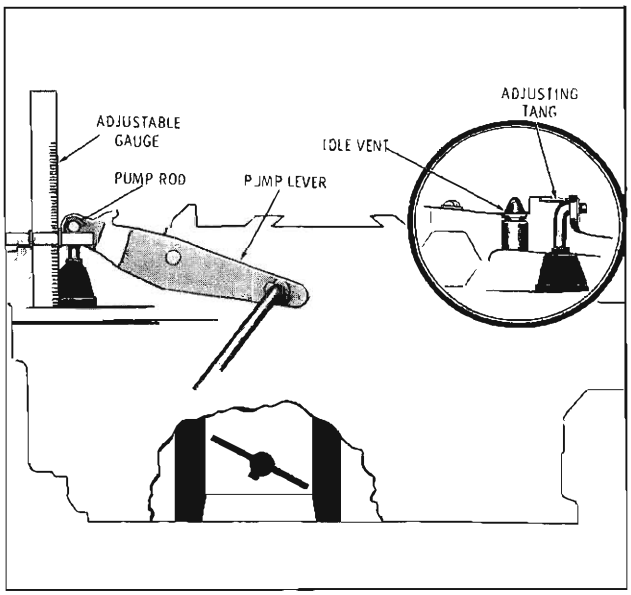


Fig. 4-32 Atmospheric Idle Vent Adjustment

ATMOSPHERIC IDLE VENT ADJUSTMENT

The atmospheric idle vent is designed to vent any vapor formed in the float bowl during slow idle operation. It is opened by a tang on the pump lever whenever the throttle valves are in the slow idle position.

1. Adjust pump rod.
2. Set the adjustable gauge to the specified dimension (1-11/32").
3. Place gauge as shown in Fig. 4-32.
4. With the throttle valves open far enough so that the vent valve just closes, the vertical seal should just touch the bottom of the pump rod.
5. To adjust, bend the tang on the pump lever.

ROCHESTER CARBURETOR
MODEL 2GC

THEORY OF OPERATION

FLOAT SYSTEM (Fig. 4-33)

The 2GC carburetor employs a single float. As fuel is consumed, the float drops and opens the needle seat. Fuel then enters the float bowl, raises the float and closes the needle seat, maintaining correct fuel level in the float bowl under all operating conditions.

IDLE SYSTEM (Fig. 4-34)

The idle system supplies the fuel required for normal curb idle, off idle and low speed operation.

To minimize fuel vapor formation in the carburetor bowl, an external vent opens when the throttle valves are in the idle position.

Cars equipped with factory installed A/C are equipped with an idle compensator to prevent stalling under prolonged "hot idle" conditions. When underhood temperatures rise, a bi-metal strip lifts the valve off its seat allowing additional air to enter below the throttle valves, offsetting the enrichening effects of the higher temperatures.

PART THROTTLE (Fig. 4-35)

As the throttle valves open, the speed of air entering the carburetor bore increases and raises the vacuum in the small venturi area. Fuel is then drawn from the float bowl into the main well, where air bleeds are provided, and into the venturi.

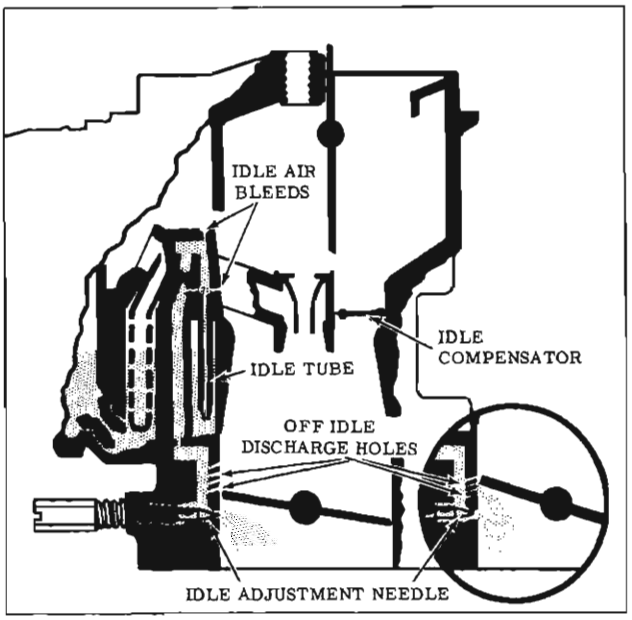


Fig. 4-34 Idle System

POWER SYSTEM (Fig. 4-36)

When more power is needed or high speed

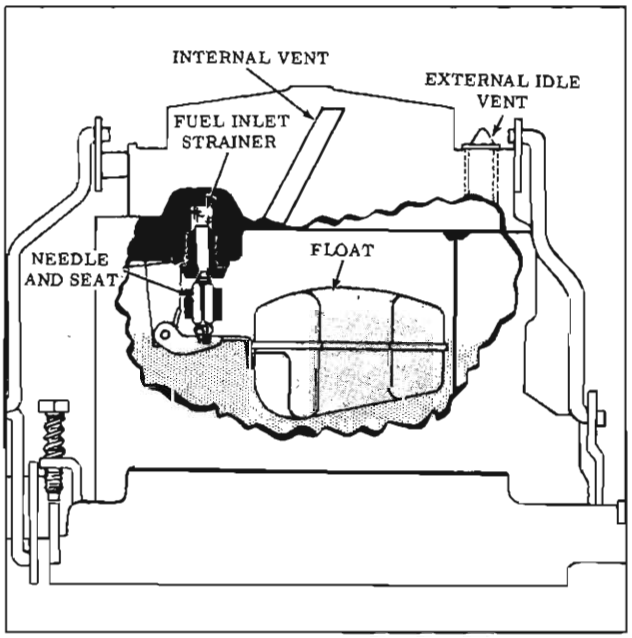


Fig. 4-33 Float System

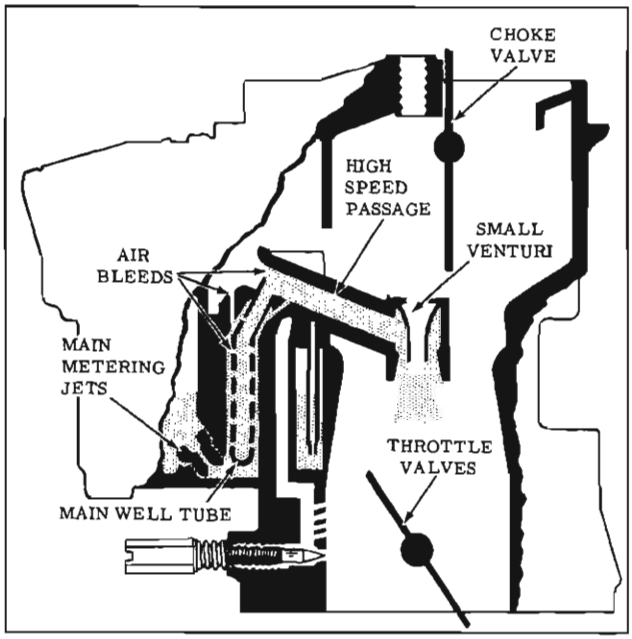


Fig. 4-35 Part Throttle System

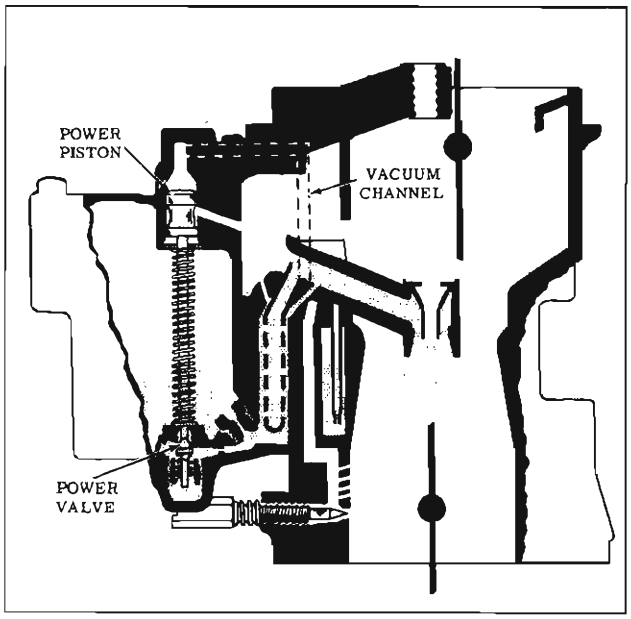


Fig. 4-36 Power System

driving is maintained, a vacuum operated power piston and power valve provide additional fuel.

When manifold vacuum drops below approximately 9" hg. the power piston spring forces the piston down to unseat the spring loaded power valve, permitting additional fuel to flow through the main well tubes.

PUMP SYSTEM (Fig. 4-37)

The accelerator pump provides the fuel necessary for smooth operation during acceleration by forcing additional fuel into the air stream.

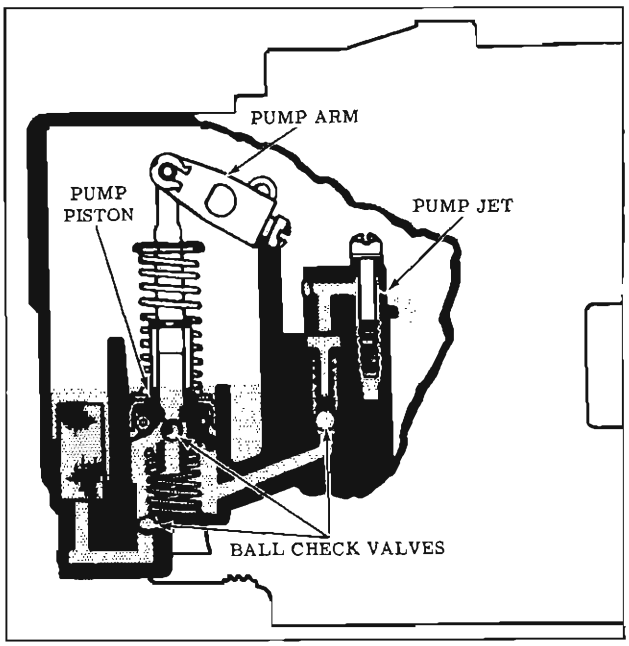


Fig. 4-37 Pump System

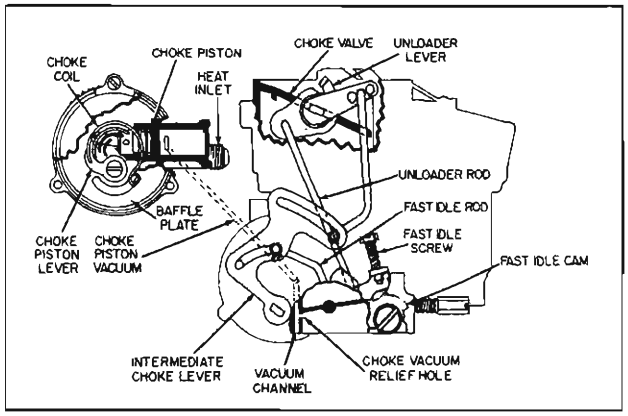


Fig. 4-38 Choke System

CHOKE SYSTEM (Fig. 4-38)

The choke system is designed to work independently of the fast idle which provides a relatively short choking period with adequate fast idle for a cold engine. A thermostatic coil closes the choke valve for cold operation and gradually releases the choke during the warm-up period. To maintain a more exacting air fuel ratio during warm-up, the force of the thermostatic coil is opposed by air velocity against the offset choke valve and a vacuum piston and link assembly. To prevent a closed choke condition with a wide open throttle, a tang on the unloader lever contacts the choke lever and holds the choke valve partially open to prevent a loading condition. This also provides an unloader to open the choke valve when starting a flooded engine.

REMOVE AND INSTALL

1. Remove air cleaner.
2. Remove retaining clip from bellcrank rod and remove rod from carburetor.
3. Disconnect fuel line from front of carburetor.
4. Disconnect choke pipe from choke housing.
5. Disconnect vacuum lines.
6. Remove four throttle body to intake manifold nuts.
7. Remove carburetor.

To install, reverse removal procedure and make adjustments outlined under ADJUSTMENTS (ON THE CAR).

Torque carburetor to intake manifold nuts 11 to 14 ft. lbs.

CARBURETOR DISASSEMBLY

AIR HORN

1. Mount carburetor on Holding Fixture BT-30-14 or J-5923-B. (Fig. 4-40)

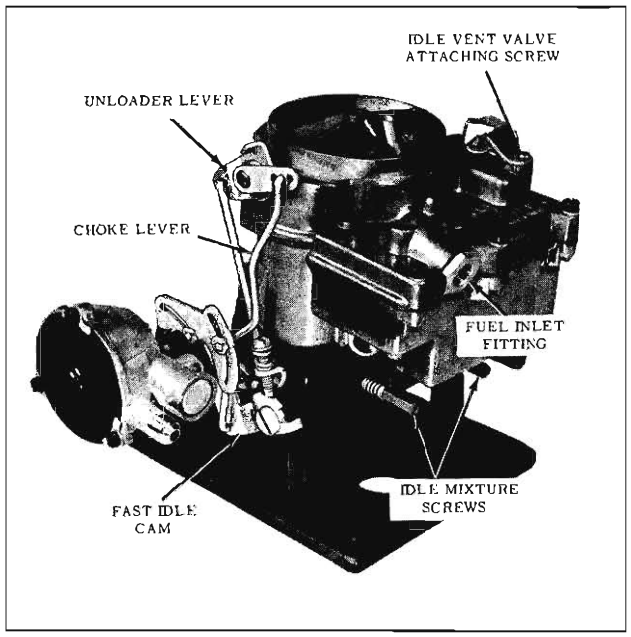


Fig. 4-39 2 GC Carburetor

2. Remove fuel inlet fitting and gasket, then remove the filter screen.

3. Remove the idle vent valve retaining screw, shield and vent.

4. Remove retainer clip from the intermediate choke rod and unloader rod and remove the intermediate choke and unloader rods.

5. Remove retainer spring clip from the upper end of the pump rod at the pump lever and disconnect the upper end of the pump rod.

6. Remove the eight air horn attaching screws, then lift the air horn straight up to remove.

7. Invert the air horn and place on a flat surface, then remove the float hinge pin, float and needle assembly. (Fig. 4-40)

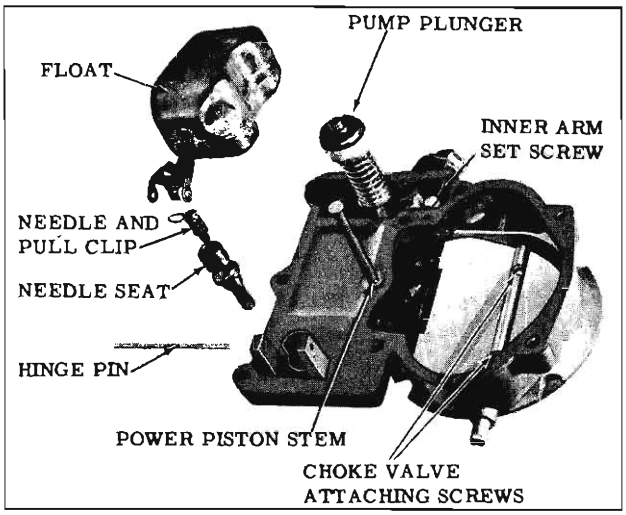


Fig. 4-40 Air Horn

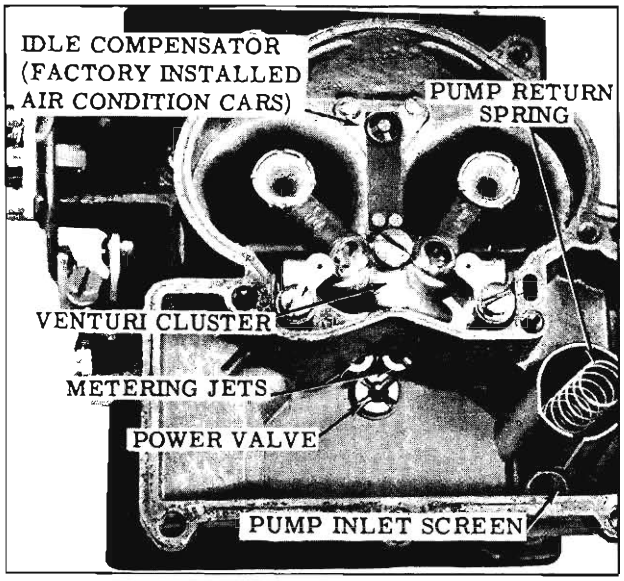


Fig. 4-41 Float Bowl Assembly

8. Remove the float needle and seat and gasket using Tool BT-52, then remove fuel filter from the needle seat bore.

9. Remove the power piston by depressing piston stem and allowing it to snap free.

10. Remove the retainer from the pump plunger shaft and remove pump plunger.

11. If the pump lever and shaft or inner arm is to be replaced, loosen the set screw on the inner arm.

12. Remove the air horn gasket.

13. If the choke valve or shaft is to be replaced, remove the two choke valve attaching screws, then remove the choke valve, choke valve shaft and unloader from the air horn.

FLOAT BOWL (Fig. 4-41)

1. Remove baffle, pump inlet filter screen and pump plunger return spring, then remove aluminum ball check from bottom of pump well.

2. Remove main metering jets and power valve.

3. If equipped with an idle compensator, factory installed air conditioned cars only, remove attaching screws and remove idle compensator and gasket.

4. Remove venturi cluster attaching screws and remove cluster and gasket.

   NOTE: The cluster center screw is larger and has a gasket since it is located in the pump discharge passage.

5. Using a pair of needle nosed pliers, remove the pump discharge spring guide, then remove the spring and steel ball. (Fig. 4-42)

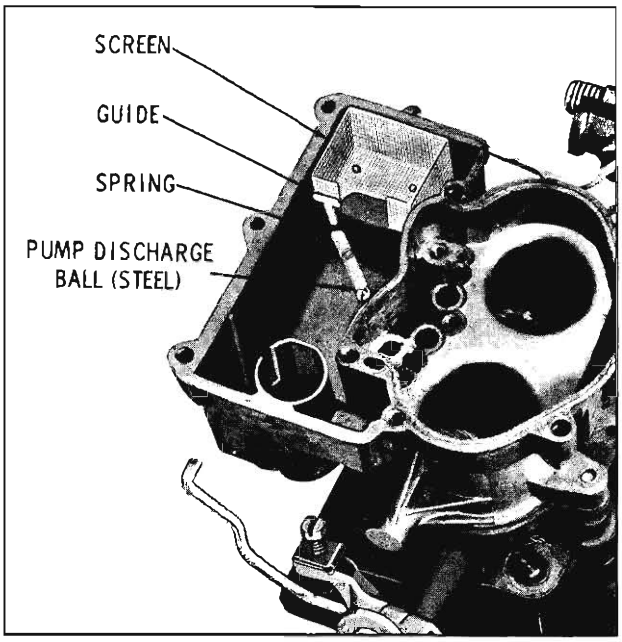


Fig. 4-42 Pump Discharge Guide

NOTE: The anti-foam screen should not be removed and is used only on carburetors without idle compensator.

6. Invert float bowl and remove the three throttle body attaching screws, then remove the throttle body and gasket.

THROTTLE BODY AND CHOKE LINKAGE (Fig. 4-43)

1. Remove the fast idle cam attaching screw.
2. Remove the three choke cover attaching screws and retainers, then remove the cover and gaskets.
3. Remove baffle plate from choke housing.
4. Remove the choke piston attaching screw, then remove piston link and lever assembly.

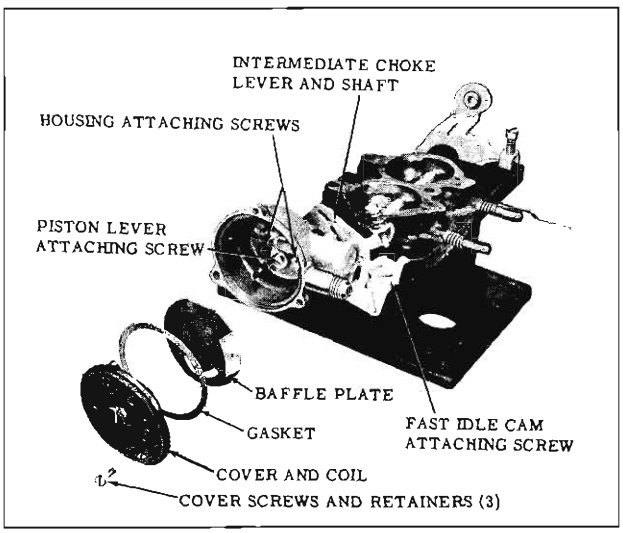


Fig. 4-43 Throttle Body and Choke

The piston can be removed from the link by removing the piston pin.

5. Remove the two choke housing attaching screws, then remove the choke housing with linkage and gasket.
6. Remove the choke housing gasket, then remove the choke lever and shaft with linkage from the choke housing.
7. The idle mixture needle screws may be removed for cleaning or replacement.

NOTE: No attempt should be made to remove the throttle valves or shaft as it may be impossible to assemble the throttle valve correctly in relation to the idle discharge orifices.

CLEANING OF PARTS

The carburetor should not be cleaned in any solution other than a cold immersion type cleaner.

1. Thoroughly clean carburetor castings and metal parts in carburetor solvent.

CAUTION: The choke coil, housing and pump plunger should not be immersed in solvent. Clean pump in clean gasoline only.

2. Clean and dry all passages in castings with compressed air. Do not pass drills through jets or passages.
3. Clean filter screens of dirt or lint. If filter screens are distorted or plugged, they should be replaced.

INSPECTION OF PARTS

1. Check float for dents or excessive wear at hinge pin holes.
2. Shake float to check for leaks.
3. Examine float needle and seat. If grooved, replace with a new matched float needle, seat and gasket assembly.
4. Inspect the idle mixture adjusting needles for burrs or ridges. Replace if necessary.
5. Inspect the upper and lower surfaces of the float bowl to see that the small sealing beads are not damaged. Damaged beading may result in air or fuel leaks at that point.
6. Inspect holes in pump rocker arm, fast idle cam and throttle shaft lever. If holes are worn excessively or out-of-round to the extent of improper operation of the carburetor, the worn parts should be replaced.
7. Inspect the steps on the fast idle cam for excessive wear. If worn, replace cam to assure proper engine operation during the warm-up and choking periods.
8. Inspect the pump plunger for cracks or creases. If damaged, replace the pump plunger as an assembly.

9. Inspect the throttle body to make sure idle passages and vacuum channels are open.

CARBURETOR ASSEMBLY

THROTTLE BODY (Fig. 4-43)

1. If removed, install the slow idle speed screw.
2. If removed, install the fast idle lever on the end of the throttle shaft with attaching screw. Install the fast idle speed screw and spring in the lever.
3. If removed, install the idle mixture needles and springs in the throttle body. Tighten finger tight, then back out 1-1/2 turns as a preliminary idle adjustment.
4. Install the intermediate choke lever and shaft, with linkage attached, in the choke housing. The lever should extend upward between the attaching screw bosses.
5. Install the choke housing gasket, then position the choke housing on the throttle body and install the two attaching screws.
6. If removed, install the choke piston on the link so that the piston hole is facing outward.
7. Install the choke piston lever and link assembly in the choke housing, then install the attaching screw.
8. Position the fast idle cam on the throttle body and install attaching screw.
9. Place a new gasket on the bottom of the float bowl with holes aligned, then position the throttle body on the gasket and install the three attaching screws. Tighten screws evenly and securely.

FLOAT BOWL

1. Install the pump discharge (steel) ball, spring and guide in the passage in the venturi cluster mounting surface. (Fig. 4-42)
2. Install the venturi cluster, gasket, and attaching screws. Screw with gasket must be inserted in center hole.
3. If equipped with idle compensator, install compensator and gasket between the two large venturi, using two self-tapping screws. Do not over-tighten.
4. Install the main metering jets and power valve.
5. Install the pump inlet (aluminum) ball and the pump return spring in the pump well. Install the pump inlet screen and the baffle in the float bowl.

AIR HORN

1. If removed, install choke unloader lever on choke shaft. Tang on unloader lever faces outward. Install the choke shaft in air horn by inserting it from the choke side, then install choke valve in the choke shaft with the letters RP facing upward.
   a. Install the choke valve screws. Center the choke valve before tightening choke valve screws. .020" clearance should be maintained between choke unloader lever and the air horn casting. Tighten choke valve screws and stake lightly in place.
2. If removed, position the pump inner lever in the air horn, install the pump lever and shaft and tighten retaining screw.

   NOTE: Lubricate shaft with light grease.
3. Install the pump plunger shaft in the pump lever so that the end is pointing inward, then install the retainer.
4. Position the float needle seat gasket and small filter screen on the seat. Install seat in air horn with BT-52.
5. Install the power piston and lightly stake the casting. Make sure piston travels freely.
6. Install the air horn gasket, float and needle assembly and float hinge pin.

FLOAT LEVEL ADJUSTMENT

Make sure the float is properly aligned on the air horn. If it is necessary to bend the float arm for alignment purposes, recheck the float level setting. (Fig. 4-44)

FLOAT DROP ADJUSTMENT (Fig. 4-45)

If necessary to adjust, bend the float tang which

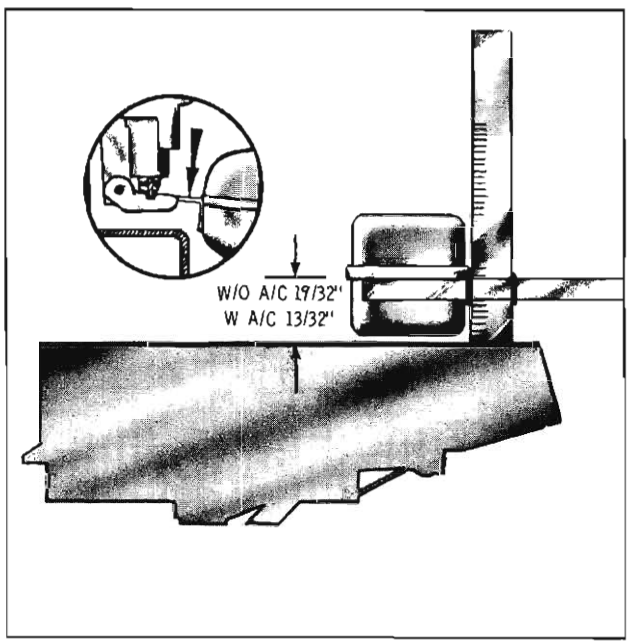


Fig. 4-44 Float Level Adjustment

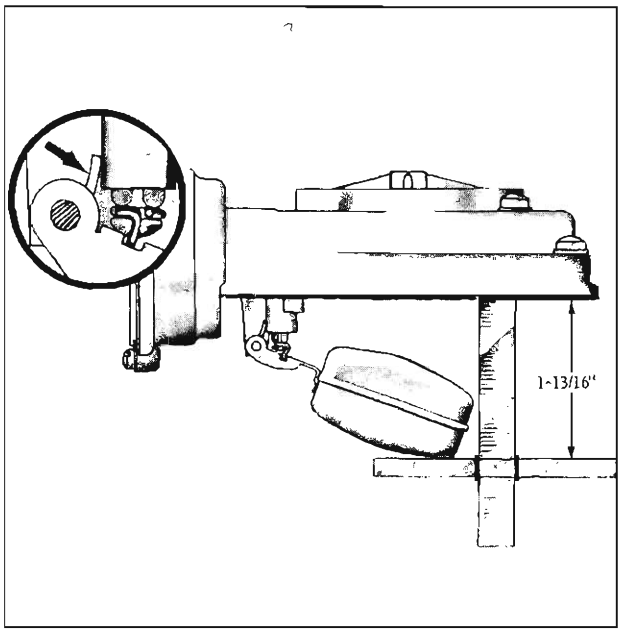


Fig. 4-45 Float Drop Adjustment

contacts the needle seat. Bend the tang toward the seat to decrease the float drop and away from the seat to increase the drop.

COMPLETION OF CARBURETOR ASSEMBLY (Fig. 4-46)

1. Install the air horn on the float bowl while guiding accelerator pump in place. Install and tighten the eight air horn screws evenly and securely.

2. Position the upper end of the pump rod on the pump lever and retain with spring clip.

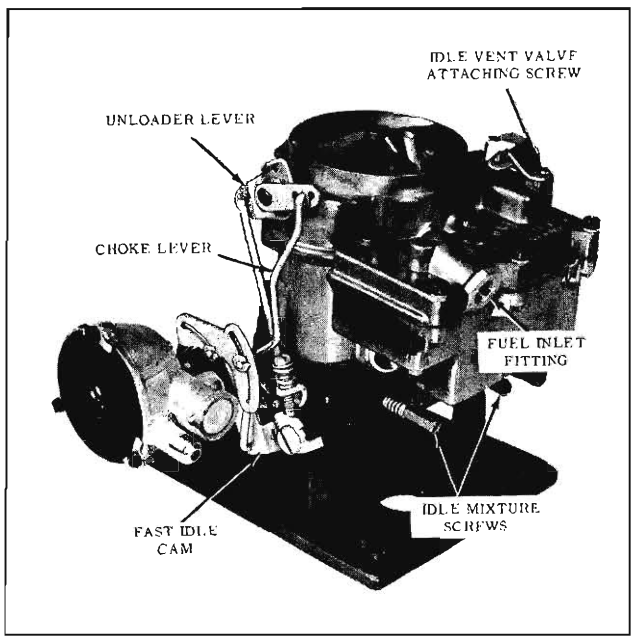


Fig. 4-46 Carburetor Assembly

3. Position idle vent valve and shield on air horn and retain with attaching screw.

4. Install the fuel inlet filter screen with the closed end inward, then install the inlet fitting and gasket.

5. Install choke unloader rod into unloader lever (end of rod facing inward). Then connect lower end of rod to fast idle lever, retaining with clip.

6. Install intermediate choke rod into upper choke lever (end of rod facing inward). Then connect lower end of rod to intermediate lever retaining with horseshoe clip.

7. Install rubber tee on the vacuum fitting in the throttle body.

8. Adjust fast idle cam rod, pump rod, and unloader as outlined under ADJUSTMENTS (ON OR OFF CAR).

ADJUSTMENTS (On or Off the Car)

INTERMEDIATE CHOKE ROD AND CHOKE COIL ADJUSTMENT

A three hole upper choke lever is used which will allow a finer choke piston adjustment in all temperatures and climatic conditions.

With the lever in the outer hole, the choke valve will open less for a given throttle opening resulting in richer mixtures under loads while accelerating. By moving the lever into the center, or inboard hole, the choke valve will open progressively more resulting in leaner mixtures. Normal position of the intermediate choke rod is in the center hole.

1. Adjust the intermediate choke rod as outlined in Fig. 4-47.

2. After choke rod adjustment is made, position the baffle plate, coil cover and gasket and the three screws with retainers in the choke housing. Do not tighten screws.

3. Rotate the choke cover counterclockwise until the coil picks up the choke shaft tang, and the mark on the choke cover is on index. (Fig. 4-48)

4. Tighten the three cover screws evenly and securely.

FAST IDLE CAM ROD ADJUSTMENT

1. Turn in fast idle speed screw until it just contacts the second step of the fast idle cam.

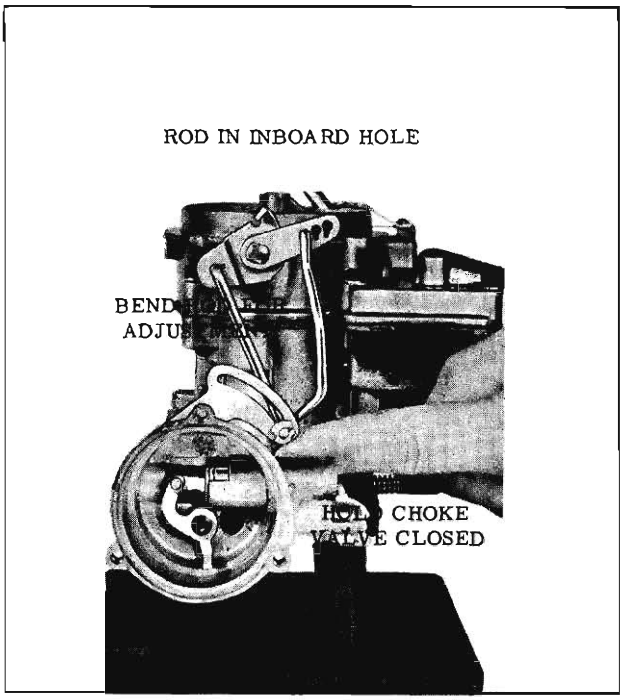


Fig. 4-47 Intermediate Choke Adjustment

2. Hold up on the intermediate choke lever so that the shoulder of the highest step of the fast idle cam is against the fast idle speed screw. Check the clearance between top edge of the choke valve and the air horn at the rear edge, using Gauge Set 100-31 (.150"). Make sure the intermediate choke rod is at the bottom of its slot in the intermediate lever. (Fig. 4-49)

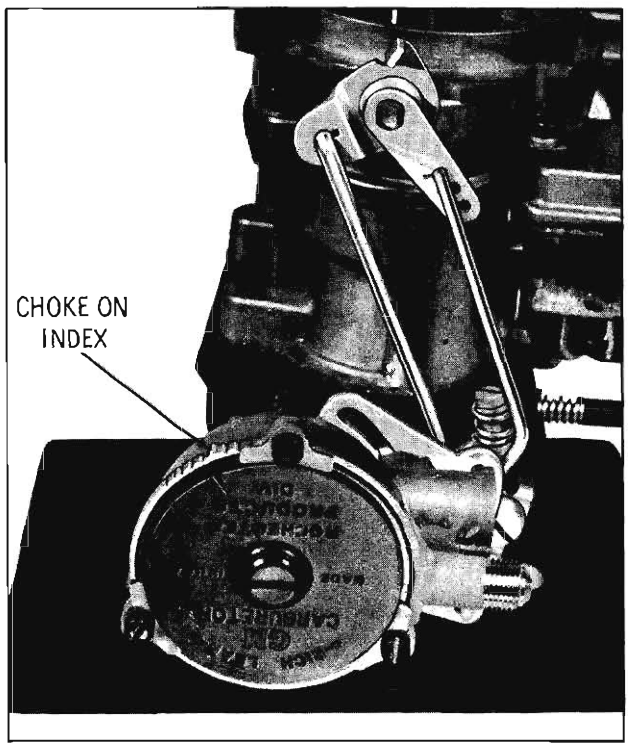


Fig. 4-48 Choke Coil Setting

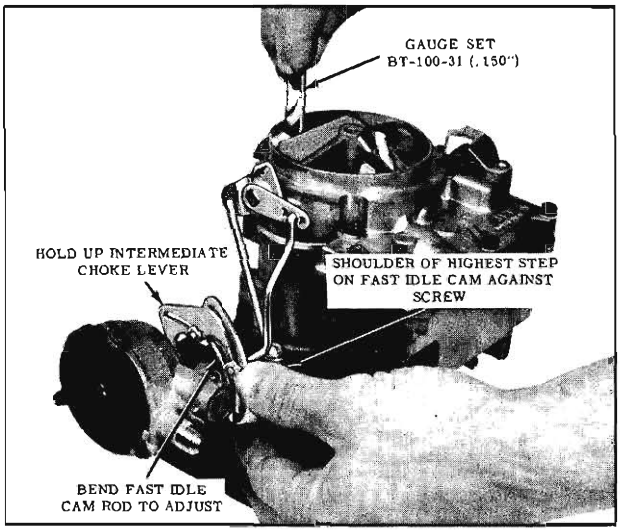


Fig. 4-49 Fast Idle Cam Rod Adjustment

3. If necessary to adjust, bend the fast idle cam rod.

PUMP ROD ADJUSTMENT

1. Using Gauge Set 100-31 check the distance from the top of the air cleaner mounting ring to the top of the pump rod. The leg of the gauge marked "Pump" should just touch the top of the pump rod. (Fig. 4-50)

2. If necessary to adjust, bend the pump rod in the location shown.

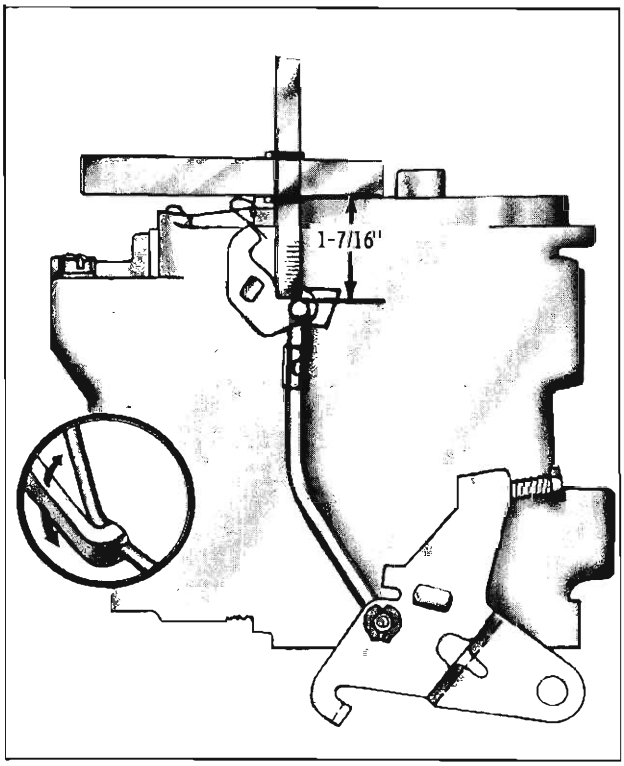


Fig. 4-50 Pump Rod Adjustment

UNLOADER ADJUSTMENT

1. With throttle valves held wide open, check clearance between the top edge of the choke valve and the air horn. (Fig. 4-51)
2. If necessary to adjust, bend the tang on the unloader lever which contacts the choke lever.

NOTE: If the unloader adjustment is made with the carburetor off the car, recheck the adjustment after the carburetor is installed while the accelerator pedal is completely depressed.

ADJUSTMENTS (ON CAR)

There are three adjustments that must be made with the carburetor mounted on the engine. They are: Slow Idle, Fast Idle and Throttle Return Check.

SLOW IDLE SPEED

TRANSMISSION	GEAR	RPM
Hydra-Matic	Drive	*500
Synchromesh	Neutral	550

Factory Installed Air Conditioning - Air Conditioning turned OFF, Idle Compensator held closed.

Dealer Installed Air Conditioning (Without Idle Compensator) - Air Conditioning turned ON.

*If equipped with Air Conditioning - 550

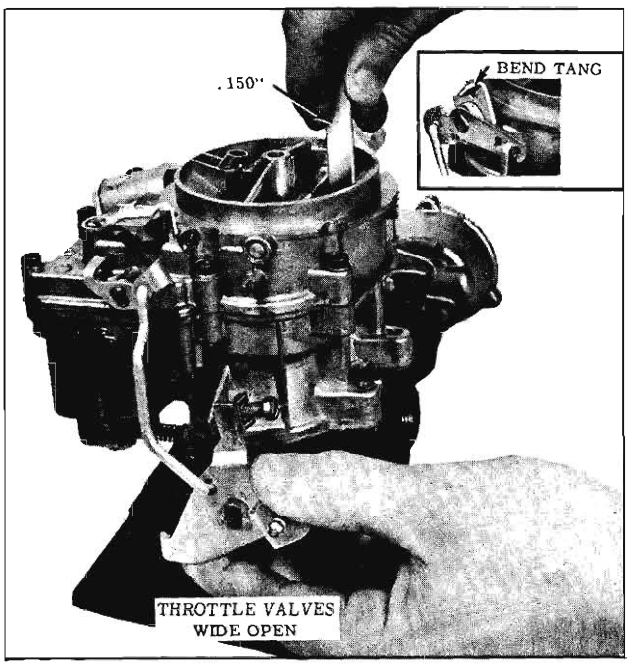


Fig. 4-51 Unloader Adjustment

SLOW IDLE ADJUSTMENT

With the engine at normal operating temperature, throttle return check Holding Fixture J-6342-01 in place, and air cleaner removed, adjust slow idle as outlined in chart. Tool BT-1501 can be used to turn adjusting screws.

After the idle rpm is stabilized, turn in or out each idle adjusting screw until the smoothest possible idle is obtained. This is normally accompanied by a higher manifold vacuum reading and/or an increase in the idle rpm. Then turn out each needle 1/4 turn, at which time both vacuum and idle rpm will drop off slightly.

NOTE: It may be necessary to readjust idle speed and mixture after air cleaner is installed on car.

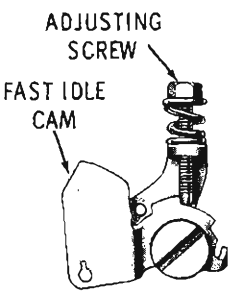
When setting idle speed and mixture on carburetors with an idle compensator (factory installed air conditioning only) make sure the idle compensator is closed by holding it down. If the idle speed increases when the air cleaner is installed, do not reduce idle speed setting since the idle compensator is open. If idle speed decreases, readjust to correct rpm.

FAST IDLE ADJUSTMENT

The fast idle adjustment can be made as follows:

1. Rotate fast idle cam so that the fast idle screw is resting on the low step and against the shoulder of the next step. (Fig. 4-52)
2. With engine running at operating temperature and transmission selector lever in "N" position, adjust the fast idle screw to obtain an engine speed of 1100 rpm.

Any time the fast idle is changed, it will be necessary to adjust the throttle return check.



ADJUST FAST IDLE WITH THE ADJUSTING SCREW ON THE LOW STEP AND AGAINST THE SHOULDER OF THE NEXT STEP ON THE FAST IDLE CAM.

Fig. 4-52 Fast Idle Adjustment

THROTTLE RETURN CHECK ADJUSTMENT

NOTE: If first type, without the external spring is used, refer to the 1963 Service Manual for adjustments and specifications.

The throttle return check adjustment can be made as follows:

1. Be sure the fast idle adjustment has been made.
2. With engine running at operating temperature, transmission selector lever in "D" position, and the parking brake applied; measure the clearance between the contact screw and the contact on the throttle lever. The clearance should be .070".
3. If adjustment is necessary, adjust the contact screw using two wrenches.

NOTE: Any time the fast idle is changed, it will be necessary to readjust the throttle return check. For throttle linkage adjustment, refer to Hydra-Matic or Synchromesh, Section (6).

ATMOSPHERIC IDLE VENT ADJUSTMENT

The atmospheric idle vent is designed to vent any vapor formed in the float bowl during slow idle operation. It is opened by a tang on the pump lever whenever the throttle valves are in the slow idle position.

1. Adjust pump rod.
2. Set the adjustable gauge to the specified dimension (29/32").
3. Place gauge on top of the air horn ring as shown in Fig. 4-53.
4. With the throttle valves open far enough so so that the vent valve just closes, the vertical seal on the gauge should just touch the top of the pump rod.
5. To adjust, bend the tang on the pump lever.

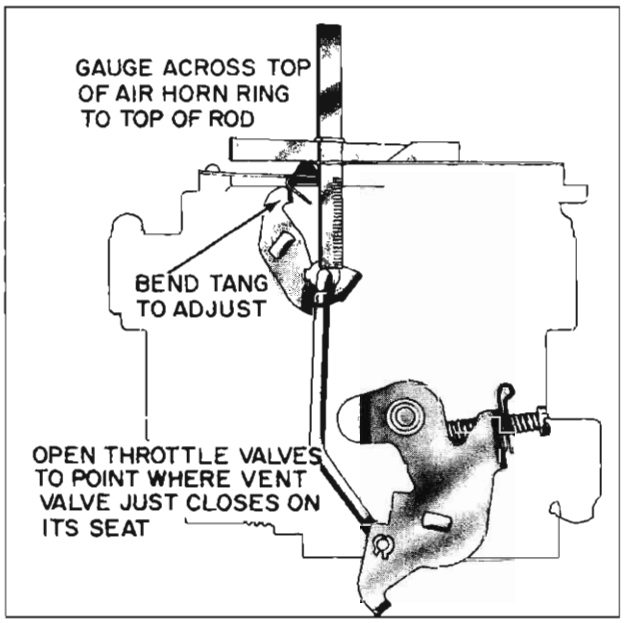
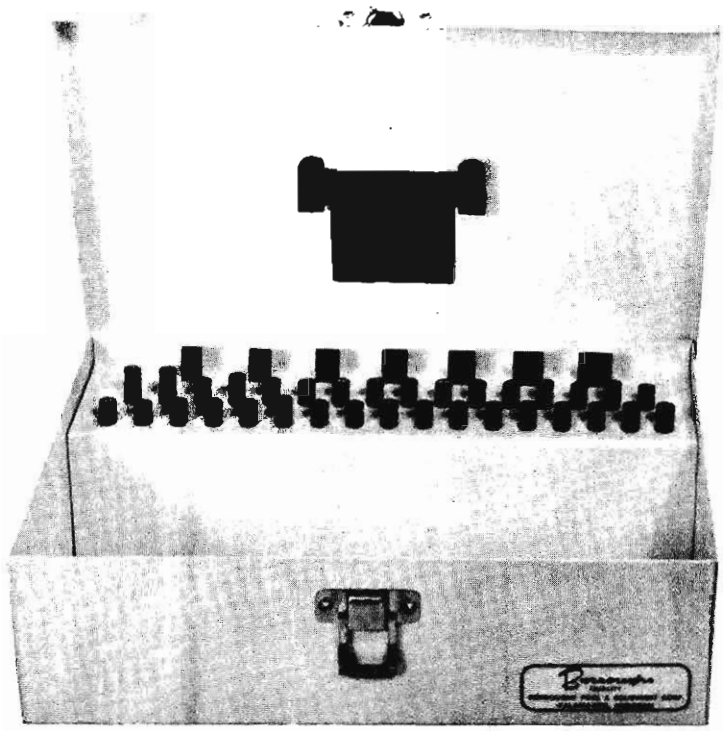


Fig. 4-53 Atmospheric Idle Vent Adjustment

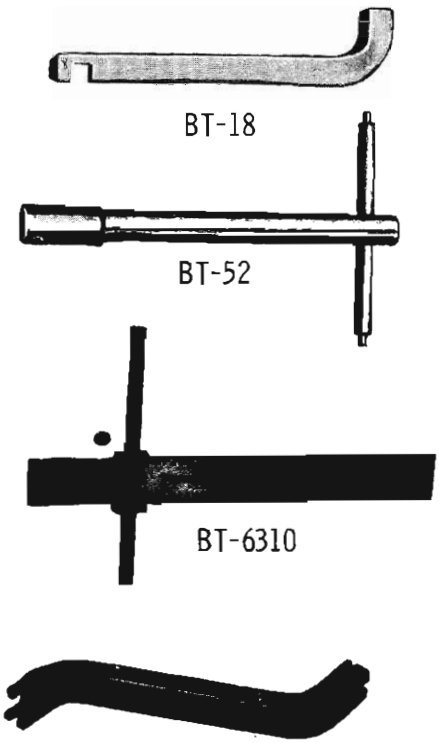
SPECIFICATIONS

CARB.	FLOAT LEVEL				FLOAT DROP		Assist Spring	Choke Rod	Choke Coil	Fast Idle Cam Rod	Lock-out	Sec. Throtl. Clear-ance	Pump Rod	Un-Loader	Sec. Act. Lever	Slow Idle	Fast Idle	Return Check	Idle Vent
	Prim.		Sec.		Prim.	Sec.													
			Toe	Heel															
2-GC W/O A/C	19/32"		-	-	Mim. 1-13/16"		-	1st V Groove	Index	.150"	-	-	1-7/16"	.150"	-	500 & 550	1100	.070	1-11/32"
W A/C	13/32"		-	-	1-13/16"														
4-GC	Toe 11/16"	Heel 1-15/32"	3/8"	1-3/8"	1-1/2"	1-3/16"	1-3/64"	Flush	Index	.050"	.015"	.030"	1" Inner Hole	.115"	.015"	500 &	1000	.080	29/32"

*For detailed information as to adjustment procedures for the specifications refer to their respective sections.



BT-3005



J-7182-2

BT-18	BENDING TOOL - PUMP ROD
BT-52	FLOAT NEEDLE SEAT REMOVER
BT-3005	UNIVERSAL CARBURETOR ADJUSTING KIT
BT-6310	CARBURETOR FLOAT GAUGE
J-7182-2	BENDING TOOL - FLOAT AND VACUUM ASSIST TANG 4GC

Fig. 4-54 Carburetor Tools

CARBURETION

(30-31-32 & 33 SERIES)

CONTENTS OF SECTION 4

MODEL BC

MODEL 2GC

MODEL 4GC

MODEL BC CARBURETOR

THEORY OF OPERATION

The Rochester Model BC carburetor is a single, downdraft, automatic choke model, used on the V16, 225 cu. in. engine, for both Jetaway transmission and synchromesh application.

GENERAL DESCRIPTION (Fig. 4-101)

The Model BC carburetor incorporates several distinct features. It has a concentric float bowl, which completely surrounds the main bore of the carburetor. The design of the float bowl, in conjunction with the centrally located discharge nozzle, prevents fuel loss on inclined roads. Regardless of the angle the car assumes, the fuel level is below the nozzle spill point at all times.

Another feature of this carburetor is the design of the main well assembly. This assembly contains the main metering jet and power valve. It is attached to the carburetor air horn and is suspended in the float bowl. Engine heat cannot be directly transmitted from the float bowl into the main well area.

On the Model BC carburetor the choke housing is located on the air horn and is connected to manifold vacuum by an external tube. Clean, the tered air is supplied to the choke heat stove from a pipe in the air horn located just below the air cleaner. The heated air is drawn into the bottom of the choke housing through a tube from the choke heat stove.

The Model BC carburetor incorporates the six systems of carburetion: Float, Idle, Main Metering, Power, Pump and Choke.

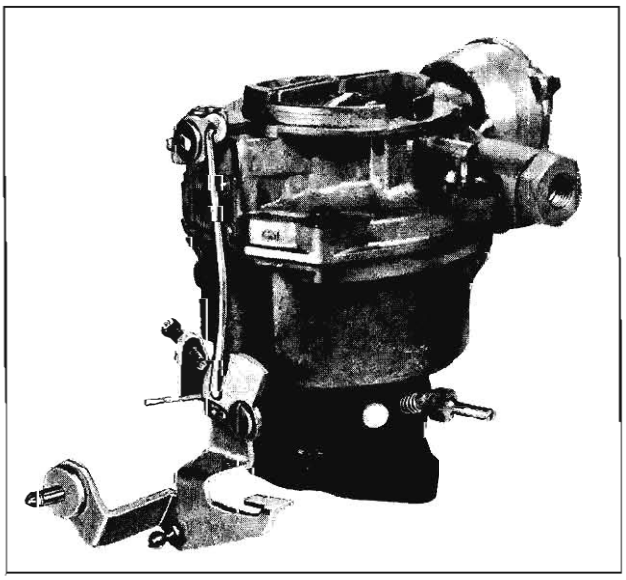


Fig. 4-101 Carburetor Assembly

FLOAT SYSTEM (Fig. 4-102)

The Model BC carburetor employs the conventional needle and seat to control fuel level in the float bowl. With the concentric float bowl design, dual floats are used to maintain a constant fuel level at all times. This is important because fuel level directly affects the air-fuel ratio by determining the distance the fuel must rise to enter the nozzle bar for the idle and main discharge systems. A low fuel level will produce a leaner mixture, while a high fuel level will produce a richer mixture and possibly cause flooding. The float bowl is designed so that the fuel is centrally located around the main well, so that efficient carburetor metering can be maintained under all engine operating conditions.

As shown, components of the float system are the inlet fitting and gasket, fuel filter and gasket, pressure relief spring, needle valve and seat and the float. It should be noted that the fuel filter at the fuel line connection, behind the fuel inlet nut, is spring loaded. This provides a pressure relief feature so that in the event the filter should plug, the restriction would cause fuel pump pressure to overcome the spring and allow fuel to bypass the filter.

When the float bowl fuel level is low, the float drops downward and allows the needle to come off its seat. This allows fuel to flow into the float bowl from the engine fuel pump supply. The fuel intake continues until the fuel level reaches the correct height set by the float level adjustment.

At this point, the needle again seats and fuel intake ceases. While the engine is running, the float needle is continuously unseating an amount proportional to the rate of fuel consumption by the engine. The float drop tang at the rear of the float

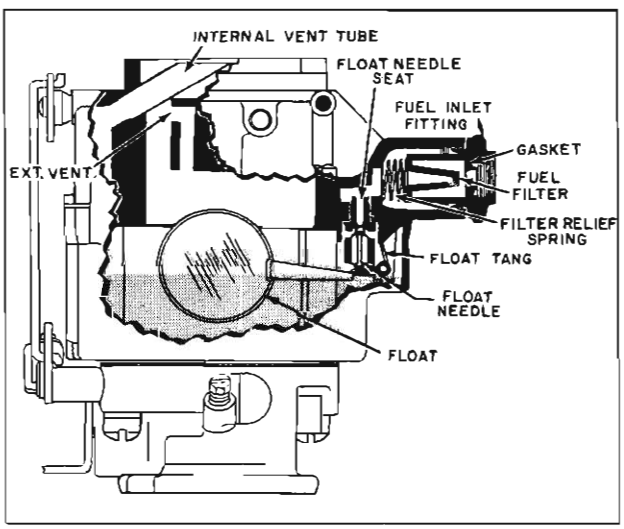


Fig. 4-102 Float System

hanger prevents the float needle from dropping out of the seat during disassembly and assembly operations.

Three air vents are used for transmitting air pressure to the fuel in the float bowl. Two external vents, located in the air horn just beneath the air cleaner, supply atmospheric pressure to the fuel in the float bowl and are used to remove fuel vapors which might disrupt engine operation during prolonged, hot engine idling.

An internal vent tube, located inside the air horn bore, extends upward from the float bowl to the base of the air cleaner to provide a balance between external and internal air pressures acting upon the fuel in the float bowl.

IDLE SYSTEM (Fig. 4-103)

At idle speeds, the throttle valve is nearly closed so there is not enough air flow through the venturi to lift fuel from the float bowl. Therefore, to supply enough fuel for idle and off idle requirements, a separate system is used called the idle system. To make fuel flow, manifold vacuum is applied directly to the fuel in the bowl from the idle needle hole and off idle port as the throttle valve is gradually opened. The idle system consists of the idle pickup tube, idle tube, idle passages, idle air bleeds, idle mixture adjustment needle, idle discharge holes, and an idle speed adjustment screw.

The idle mixture needle hole is in the high vacuum area below the throttle valve while the fuel bowl is vented to atmospheric pressure. Vacuum can be called lack of pressure, so a high vacuum area can be spoken of as an area of low pressure. There is considerable pressure difference between the normal atmospheric pressure on the fuel in the bowl and the low pressure (or high vacuum) at the idle mixture needle hole. The air-fuel mixture will be forced by atmospheric pressure to occupy any low pressure area. Due to the difference in pressure, the fuel will flow from the fuel bowl to the engine manifold.

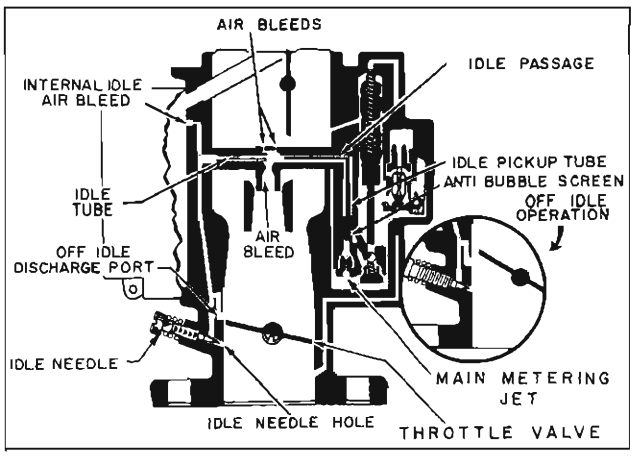


Fig. 4-103 Idle System

Atmospheric pressure acting on the fuel in the float bowl, forces fuel through the main metering jet into the main well. The fuel then travels through an anti-bubble screen located inside the main well to break up any vapor bubbles which might form during hot engine idle. The fuel then travels up through the idle pickup tube and through the crossbar channel in the air horn. Air is then bled into the idle fuel at the center of the crossbar through the two top bleeds and nozzle hole. The air-fuel mixture then is picked up by the horizontal idle tube in the crossbar and metered through a calibrated restriction, then passes on into the vertical down channel where it is further bled with air by an internal idle air bleed in the vertical channel in the top of the float chamber. The fuel then travels downward, past the off idle discharge port where more air is picked up to mix with the fuel mixture and it then passes out the idle needle port below the throttle valve. Here the fuel mixture mixes with air coming past the slightly open throttle valves and passes on into the engine as a combustible idle mixture.

Except for the idle mixture adjustment needle, the idle system is specifically calibrated for low engine speeds.

Off-idle Operation (See inset of Fig. 4-103)

As the throttle valve is opened slightly and engine speed increases, extra fuel is needed to combine with the additional air going by the throttle valve. This fuel is supplied by the off-idle discharge port. This supplies additional fuel to the engine until air velocity is high enough in the venturi area to obtain efficient metering from the main metering system.

The idle air bleed passage in top of the float chamber serves a second purpose. When the engine is first stopped, the fuel in the carburetor is heated by warm air rising from the engine and tends to form vapor in the idle system. A bleed to the float chamber permits the idle system to vent, thereby, preventing hard, hot starting due to vapor build-up in the idle system.

Further opening of the throttle valve causes increased air flow through the carburetor bore which causes pressure drop in the small venturi sufficient to cause fuel delivery from the main nozzle. It should be remembered, however, that idle port discharge does not cease at this transfer point, but rather diminishes as main nozzle discharge increases. Thus, the two systems interact and produce a smooth air-fuel flow at all engine speeds.

MAIN METERING SYSTEM (Fig. 4-104)

As mentioned, once air flow is sufficient to create enough pressure differential in the small venturi for fuel flow to start from the main nozzle, the transfer point has been reached and the carburetor starts metering from the main metering system.

Since the low pressure point is now in the small venturi area, fuel will be forced from the fuel bowl through the main metering system into the venturi, as follows:

The fuel passes through the main metering jet into the main well where it rises in the main well passage and idle pickup tube. The fuel continues up the main well tube to the horizontal crossbar in the air horn and through the crossbar to the main discharge nozzle. At this point, air is bled into the fuel by the two air bleeds in the top of the crossbar channel. The mixture is then discharged through the main discharge nozzle into the small venturi. Here, the air-fuel mixture mixes with additional air and moves on to the bore of the carburetor and into the intake manifold.

The calibration of the main metering jet and air bleeds in the crossbar maintain economical air-fuel ratios throughout the main metering or cruising range. Therefore, no adjustments are necessary in the main metering system.

POWER SYSTEM (Fig. 1-105)

A vacuum operated power system is used in the carburetor to provide additional fuel for sustained high speed operation or increased road load power. A direct manifold vacuum passage within the carburetor to the engine intake manifold connects to the power piston. Under heavy engine load, the manifold vacuum drops, thereby, decreasing the vacuum pull on the power piston and the piston is forced downward by a spring above

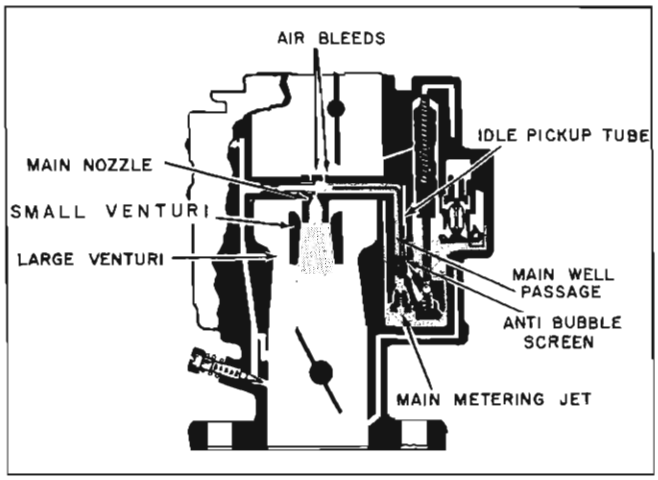


Fig. 4-104 Main Metering System

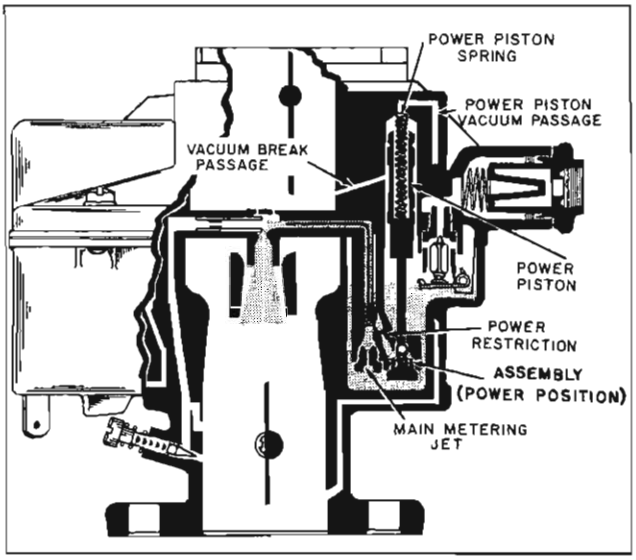


Fig. 4-105 Power System

the power piston. The power piston spring is specifically calibrated to force the power piston downward at a given manifold vacuum.

The downward motion of the power piston unseats the spring loaded ball in the power valve assembly. Fuel passes around the ball in the base of the main well support. The calibrated power restriction meters the fuel prior to joining the fuel from the main metering jet. Conversely, as the manifold vacuum rises above a specific point, the power piston is drawn up immediately to the up position and the spring loaded ball of the power valve closes, returning the carburetor to the economical part throttle mixture. There is no adjustment required for the power system.

The vacuum break passage which is drilled from the bore of the air horn to the power piston chamber serves to relieve any vacuum build-up around the piston diameter. This vacuum, if unrelieved, will draw fuel vapors from the float bowl past the piston and down the vacuum passage into the manifold, resulting in an overly rich mixture.

PUMP SYSTEM (Fig. 4-106)

Extra fuel for smooth, quick acceleration is supplied by a double spring pump plunger. Rapid opening of the throttle valve, as in the case where accelerating from low speed, causes an immediate increase in air velocity in the carburetor venturi and bore area. Since fuel is heavier than air, it requires a short period of time to "catch up" with the air flow. To avoid a leanness during this momentary lag, the accelerator pump furnishes a quantity of liquid fuel sprayed into the air stream to mix with the incoming air and maintain the proper air-fuel mixture.

The pump is operated by the combined action of two springs which are calibrated to move the

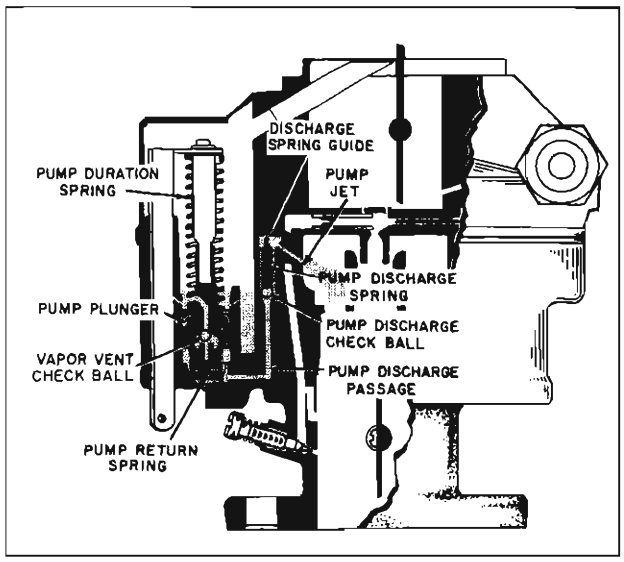


Fig. 4-106 Pump System

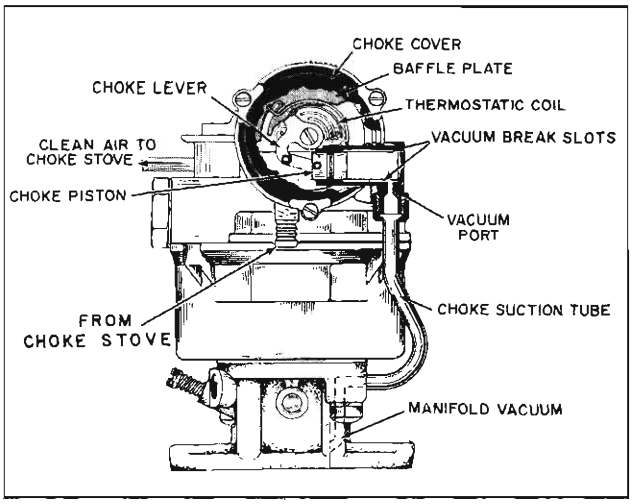


Fig. 4-107 Choke System

plunger in such a manner that a sustained charge of fuel is delivered for smooth acceleration. The pump is attached by linkage to the throttle lever. When the throttle valve is closed, the pump plunger moves upward in its cylinder allowing fuel to flow from the float bowl through a slot in the side of the pump well, into the pump well, through the vapor check ball passage, by-passing the plunger head, and on into the bottom of the pump well. The pump discharge ball is seated at this time to prevent fuel and air from draining into the pump well from the pump discharge passage.

When the pump plunger is moved downward for acceleration, the force of the stroke seats the vapor check ball in the pump plunger head to prevent fuel flow back into the float bowl. Downward motion of the pump plunger forces fuel up through the discharge passage and lifts the pump discharge check ball from its seat and then passes on through the pump jets into the venturi area where it strikes the side of the small venturi atomizing the fuel with the air and is delivered to the engine.

The check ball, inside the pump plunger head, provides relief for any vapors which might form in the pump well during "hot idle" or "hot soak". The check ball is designed so that it can move up and down in its passage. Normally, the ball is down or unseated by gravity and fuel vapors forming in the bottom of the pump well are automatically vented into the fuel bowl area and, consequently, out the air horn vent.

CHOKE SYSTEM (Fig. 4-107)

The purpose of the choke system is to provide a richer mixture for cold engine starting and operation. Mixture enrichment is necessary because fuel vapor has a tendency to condense on cold engine parts, such as the inside area of the intake manifold and cylinder head, thereby, decreasing the amount of combustible mixture available in the engine cylinder.

The choke system includes a thermostatic coil, choke housing, choke piston, choke valve, fast idle cam and linkage. It is controlled by combination of manifold vacuum, air velocity against the offset choke valve, and tension of the thermostatic coil.

When the engine is cold, tension of the thermostatic coil holds the choke valve closed. Starting the engine causes air velocity to strike the offset choke valve which tends to open it along with the action of intake manifold vacuum connected by a passage directly to the choke piston bore. After a slight opening of the choke valve, the tension of the thermostatic coil balances the force of air on the valve and the pull of vacuum at the choke piston.

As the engine warms up, the manifold vacuum which exists in the choke housing pulls hot air from the choke stove through an air passage in the side of the choke housing to heat the thermostatic coil.

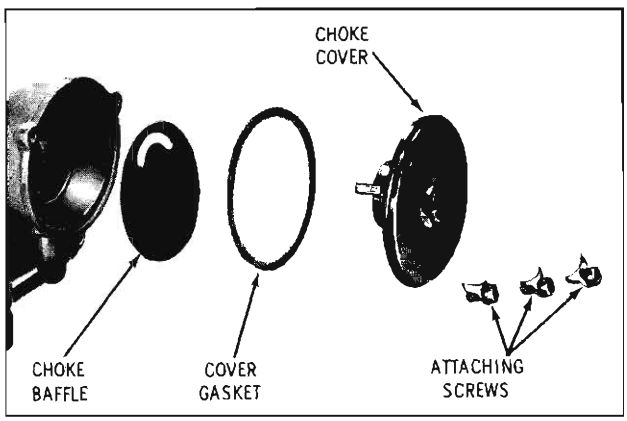


Fig. 4-108 Choke Baffle and Cover

A baffle plate inside the choke housing, next to the thermostatic coil, serves to distribute heat from its entry point at the side of the coil evenly throughout the choke housing, to prevent hot spots which would cause uneven opening of the choke valve. The thermostatic coil relaxes gradually until the choke valve is fully opened.

As the engine is accelerated during warm-up, the corresponding drop in manifold vacuum on the choke piston and reduced air flow against the offset choke valve, allows the thermostatic coil to momentarily close the choke, providing a richer mixture.

During warm-up it is necessary to provide a faster idle to prevent engine stalling. This is accomplished by a fast idle cam which is connected by a link to the upper choke lever on the choke shaft. The idle screw on the throttle lever contacts graduated steps on the fast idle cam to provide a faster idle than normal, to prevent engine stalling during the warm-up period. When the engine is fully warm and the choke valve is wide open, the fast idle cam rotates so the idle screw rests on the low step on the fast idle cam where normal curb idle is obtained.

If the engine becomes flooded during the starting period, the choke valve can be partially opened manually to allow increased air flow to the carburetor. This is accomplished by depressing the accelerator pedal to the floor. The unloader projection on the throttle lever contacts the edge of the fast idle cam and, in turn, partially opens the choke valve.

DISASSEMBLY, CLEANING AND INSPECTION OF MODEL BC CARBURETOR

DISASSEMBLY OF CHOKE

1. Loosen 1/2" fitting on choke suction tube and push fitting and gasket seal downward on the tube.

   Visibly check location of scribe mark on choke cover in relation to index point on choke housing.

2. Remove three choke cover attaching screws and retainers, remove choke cover, cover gasket, and thermostatic coil assembly from carburetor.

3. Remove baffle plate inside choke housing.

4. Remove choke piston and lever assembly from inside choke housing by removing lever attaching screw from center of choke shaft. (Fig. 4-109)

5. The choke piston may be removed from the choke piston lever by shaking out the choke piston pin.

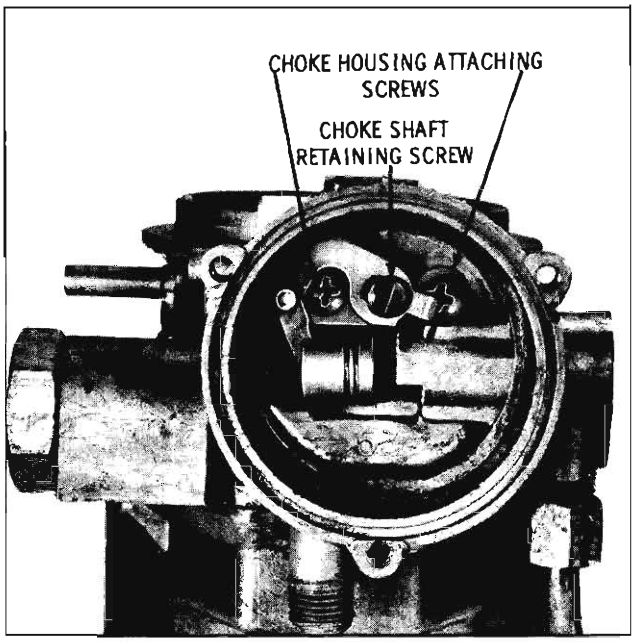


Fig. 4-109 Choke Housing Attachment

6. Remove two choke housing attaching screws inside choke housing, then remove choke housing from the air horn. (Fig. 4-109)

7. Remove fast idle cam attaching screw. Then the 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 the fast idle cam by rotating cam over the end of the choke rod.

8. To remove choke valve, remove stake on the end of choke valve screws. Remove the two choke valve attaching screws from the 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.

AIR HORN DISASSEMBLY

1. Remove fuel filter inlet nut and gasket. Then remove filter, filter spring and gasket between filter element and back side of inlet nut. (Fig. 4-110)

   NOTE: Large open end of filter element always faces the fuel inlet nut. (Fig. 4-110)

2. Remove four air horn attaching screws. Lift

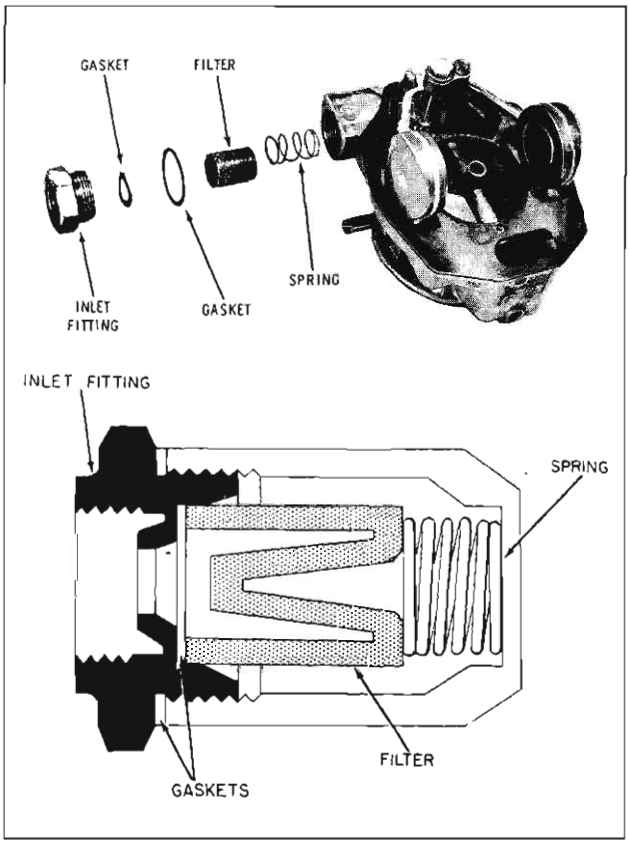


Fig. 4-110 Fuel Inlet Filter

air horn straight up from bowl so as not to damage float. Place air horn, float side up, on a flat surface. (Fig. 4-111)

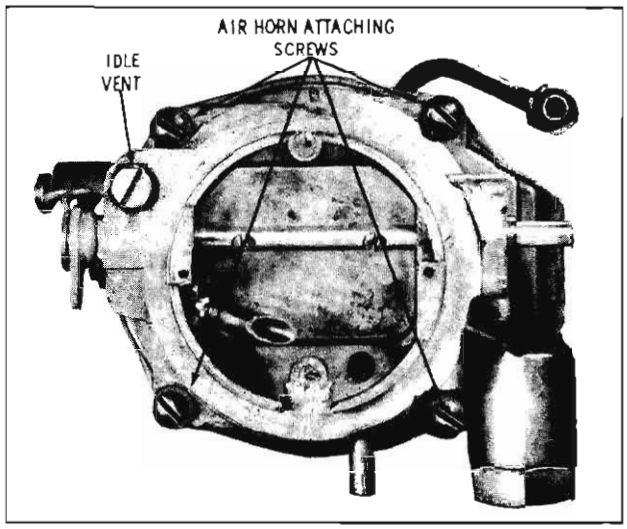


Fig. 4-111 Air Horn Attachment

3. Remove float hinge pin and lift float assembly from air horn. Float needle may now be removed.

4. Remove float needle seat and gasket.

5. Remove main metering jet from bottom of main well support. (Fig. 4-112)

6. Remove hex head power valve check ball retainer from bottom of support, then remove power valve spring and ball. (Fig. 4-112)

7. Remove screw at base of main well support,

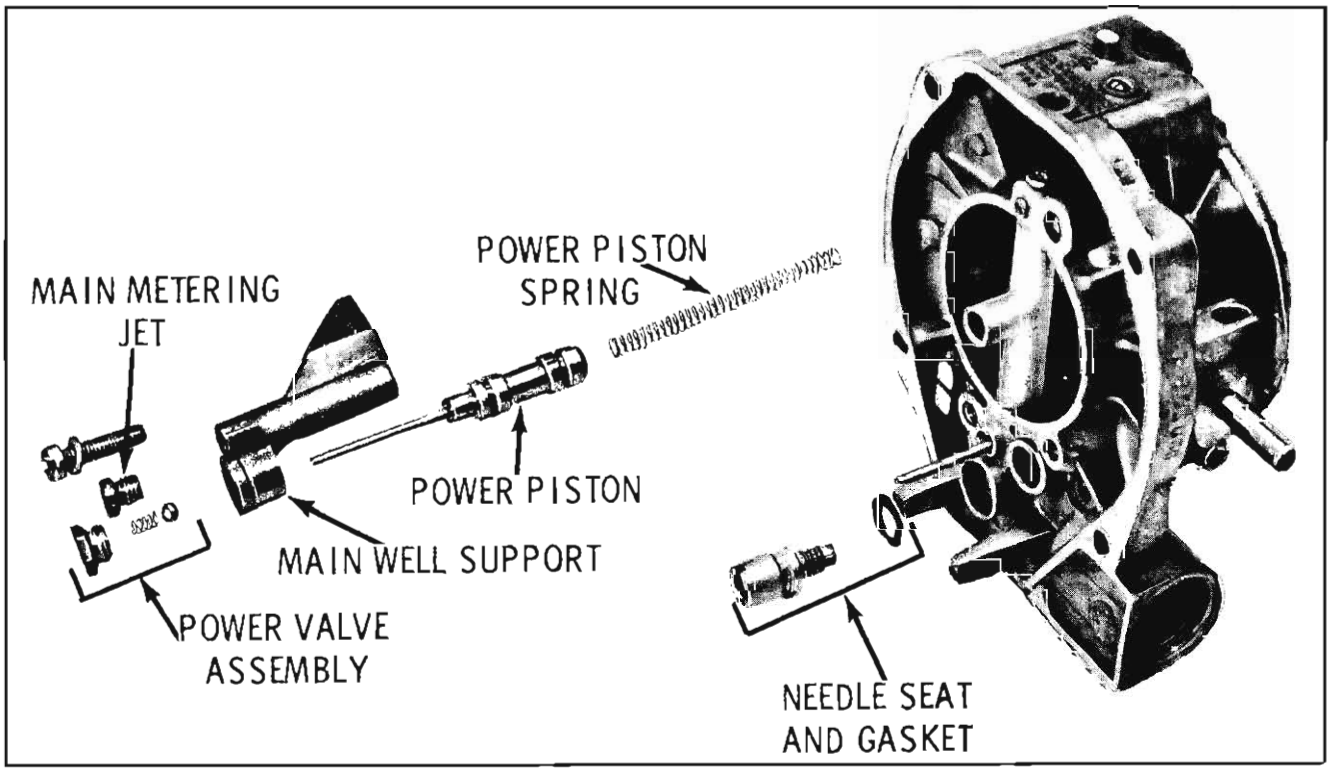


Fig. 4-112 Air Horn

then remove the main well support from air horn. (Fig. 4-112)

NOTE: Screen in the main well is not removable. If necessary to replace the screen it will be necessary to replace the main well support.

8. Remove power piston and power piston spring from air horn.

NOTE: Do not remove idle pickup tube from air horn as it is pressed in place.

9. Remove air horn gasket.

FLOAT BOWL DISASSEMBLY (Fig. 4-113)

1. Remove small "O" ring seal around power piston vacuum tube on top of inner bowl parting surface.

2. Using a pair of long nose pliers, remove pump discharge guide. Pump discharge spring and ball may now be removed by inverting bowl and shaking into palm of hand.

3. Remove two hairpin clips from pump link and then remove pump link from throttle lever and pump plunger rod.

4. Remove the pump plunger from the float bowl by pulling straight upward.

5. Remove pump return spring from bottom of pump well.

NOTE: Do not remove choke suction tube from throttle body.

6. 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.

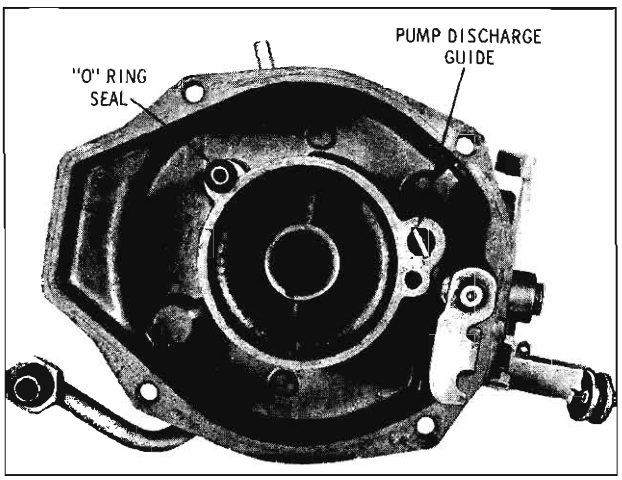


Fig. 4-113 Float Bowl Disassembly

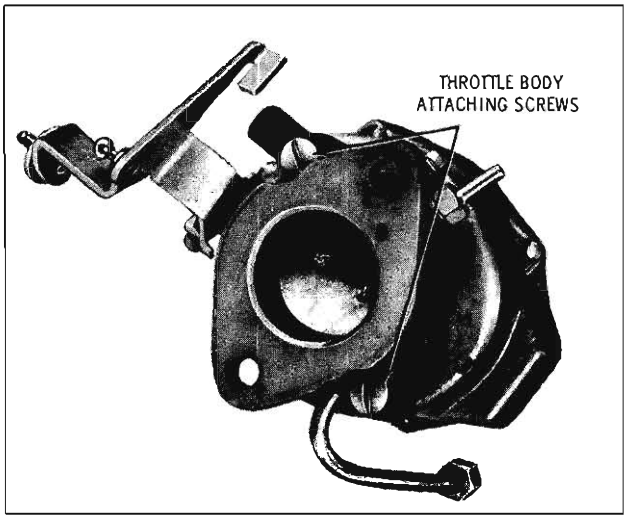


Fig. 4-114 Throttle Body

THROTTLE BODY DISASSEMBLY (Fig. 4-114)

1. Remove idle mixture adjusting needle and spring.

2. Remove idle stop screw from throttle lever if necessary to replace.

NOTE: Due to close tolerance fit of the throttle valve in the bore of the throttle body, do not remove the throttle valve or shaft from the throttle body.

CLEANING OF PARTS

The carburetor should not be cleaned in any solution other than a cold immersion type cleaner.

1. Thoroughtly clean carburetor castings and metal parts in carburetor solvent.

CAUTION: The pump plunger, gaskets and any fiber or rubber parts should not be immersed in the carburetor cleaner. Clean the pump assembly in clean gasoline only.

2. Clean and dry all passages in castings with compressed air. Do not pass drills or wires through jets or passages, as this may score the passage and upset metering.

3. Clean filter and screen of dirt or lint. If filter is plugged or screen is distorted or plugged, they should be replaced.

ASSEMBLY AND ADJUSTMENT

THROTTLE BODY ASSEMBLY (Fig. 4-114)

1. Install idle stop screw in throttle lever, if removed.

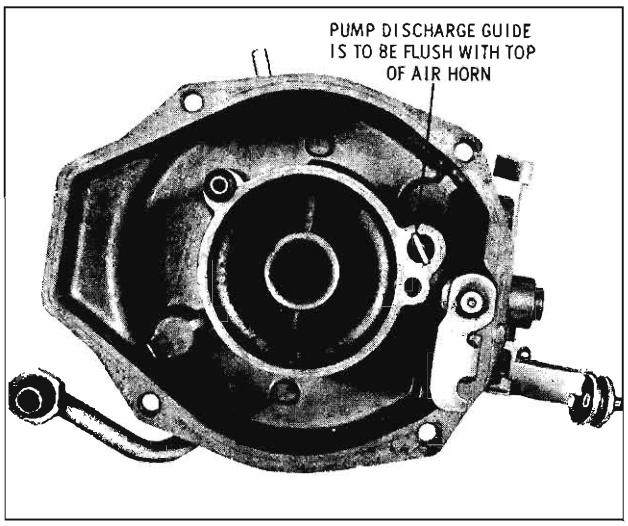


Fig. 4-115 Float Bowl Assembly

2. Screw idle mixture adjusting needle and spring into throttle body until it is finger tight. Back needle out 1-1/2 turns as a temporary idle mixture adjustment.

3. Using a new gasket, attach throttle body to bowl using two screws and lockwashers. Tighten screws evenly and securely.

FLOAT BOWL ASSEMBLY (Fig. 4-115)

1. Install 3/16" steel ball into pump discharge cavity. Carefully insert pump discharge spring and guide on top of ball. Tap the discharge guide lightly to seat flush with the float bowl casting.

   NOTE: The pump discharge guide is installed correctly when it is at right angles with the 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 cup during installation.

4. Install small "O" ring seal around power piston vacuum tube on top of inner bowl parting surface.

5. Attach pump link to pump plunger rod and throttle lever using two hairpin clips.

   NOTE: Bend in pump link will face away from throttle shaft when installed correctly.

AIR HORN ASSEMBLY (Fig. 4-116)

1. Install float needle seat and gasket.

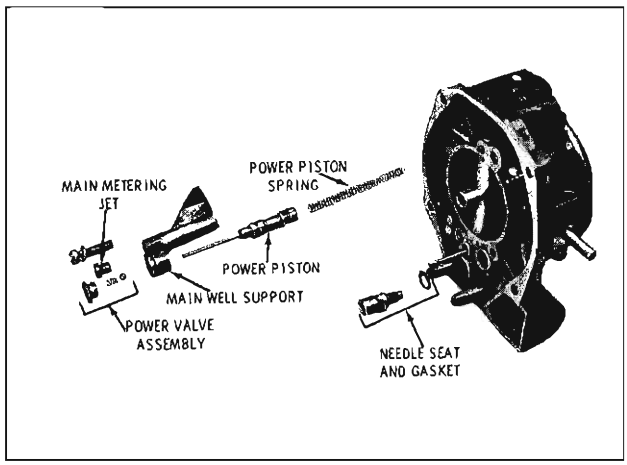


Fig. 4-116 Air Horn

2. Place new air horn gasket on top of 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.

5. Attach main well support to air horn assembly and tighten attaching screw securely. Tighten power valve retainer.

   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. 4-117)

With the air horn inverted and gasket in place, measure the distance from the air horn gasket to the bottom of each float using Tool BT-6310 as shown. Bend the adjustment tang and float arm which contacts float needle as necessary to obtain the specified dimension 1-9/32".

Align floats by making sure they are parallel and centered in the air horn gasket cut-out. Recheck float level adjustment if float alignment is necessary.

FLOAT DROP ADJUSTMENT (Fig. 4-118)

Bend the float tang at the rear of the float arm,

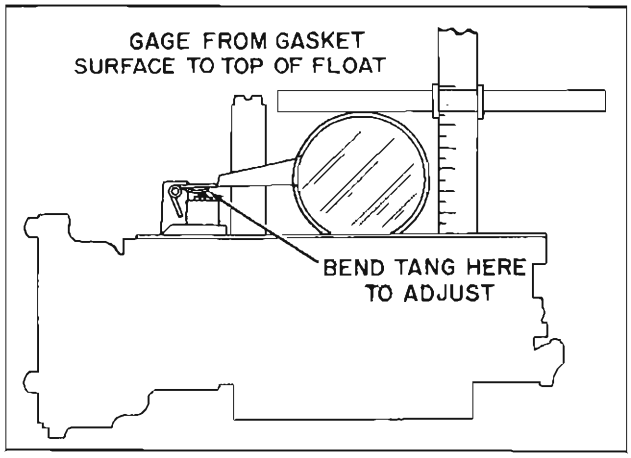


Fig. 4-117 Float Level Adjustment

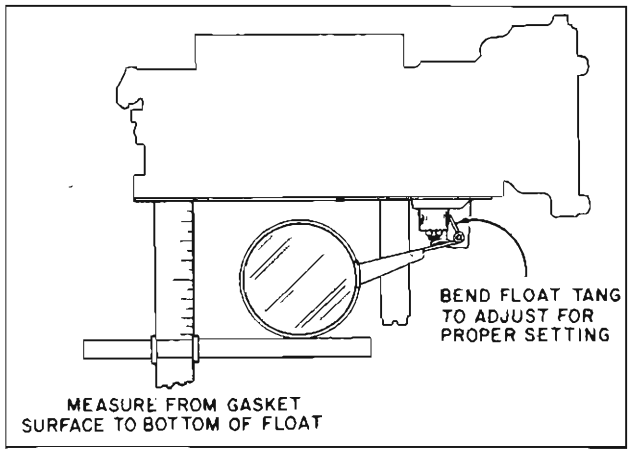


Fig. 4-118 Float Drop Adjustment

next to the needle seat, as necessary to obtain a distance of 1-3/4" from the gasket surface to the bottom of the float with the air horn held in the upright position and the float hanging free. Measure with Tool BT-6310.

9. Install air horn to bowl assembly being careful to lower the air horn straight down so that the 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, and filter element, retaining in place with the fuel inlet nut and gasket.

CHOKE ASSEMBLY

1. Install hex choke suction tube fitting and new packing over choke suction tube before assembling choke housing to the air horn. Install choke housing to air horn. Tighten screws evenly and securely.

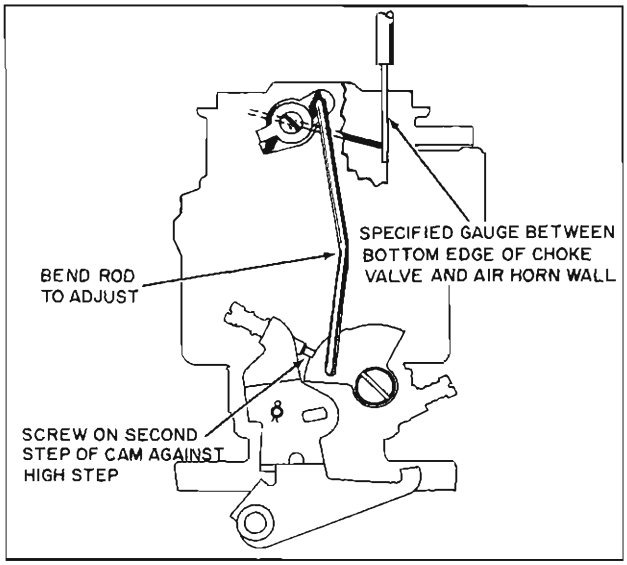


Fig. 4-119 Choke Rod Adjustment

2. Tighten choke housing suction tube fitting sufficiently to prevent loss of vacuum.

3. Install upper choke lever on choke shaft so that the tang points toward the air horn casting.

4. Assemble choke shaft into air horn from the throttle lever side. Tang on the trip lever should be above the tang on the upper choke lever. See Fig. 4-119.

5. Install choke valve into the slot in the choke shaft. RP trade mark should face upward. Install two choke valve attaching screws.

6. To insure proper end clearance between the choke trip lever and choke rod lever, move the choke shaft horizontally to obtain .020" clearance between the two levers. Then tighten the two choke valve attaching screws securely and stake in place.

7. Assemble choke piston to the choke piston lever using small piston pin. Install choke piston and lever assembly into choke housing by placing choke piston into the choke piston bore.

8. Align flats on the choke shaft with the flats in the choke piston lever. Install attaching screw into the end of the choke shaft and tighten securely to retain choke piston lever to the choke shaft. Make sure choke piston lever is seated on the flats of the choke shaft.

9. Install baffle plate into the choke housing. Place new choke cover gasket onto the thermostatic coil and cover assembly and then install the thermostatic coil to the choke housing.

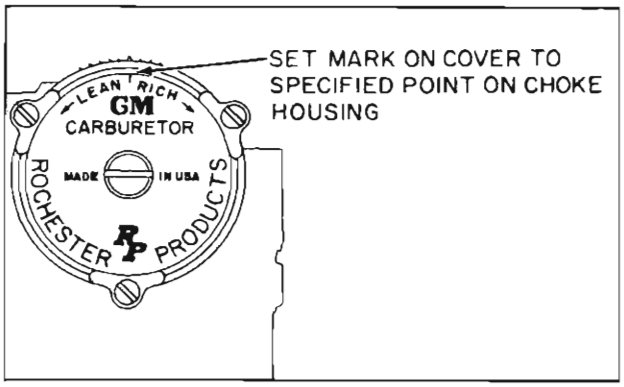


Fig. 4-120 Choke Setting

10. Rotate the thermostatic cover and coil assembly clockwise until the tang on the thermostatic coil picks up the tang on the choke piston lever and begins to close the choke valve. Keep rotating in a clockwise direction until the index mark on the choke cover is in the proper position, as specified, with the center mark on the choke housing. See Fig. 4-120.

11. Install three retainers and attaching screws to the choke cover and housing. Tighten securely. Recheck to see that the adjustment previously made was not moved.

12. Install the choke rod to the fast idle cam as shown, then carefully insert the upper end of the choke rod into the upper choke lever. The bend of rod must face towards the idle mixture adjusting needle.

13. Attach the fast idle cam to the throttle body assembly with the fast idle cam screw and tighten securely. The steps on the fast idle cam should face towards the idle speed screw.

CHOKE ROD ADJUSTMENT (Fig. 4-119)

With the idle screw resting on the second step of the fast idle cam and against the shoulder of the high step, bend the choke rod as shown to obtain sufficient clearance to allow the insertion of the correct gauge (.075") between the lower edge of the choke valve and the dividing wall of the air horn.

UNLOADER ADJUSTMENT (Fig. 4-121)

Bend the unloader tang on the throttle lever as necessary to allow the insertion of the proper gauge (.300) between the lower edge of the choke valve and the dividing wall of the air horn, with the throttle valves held wide open.

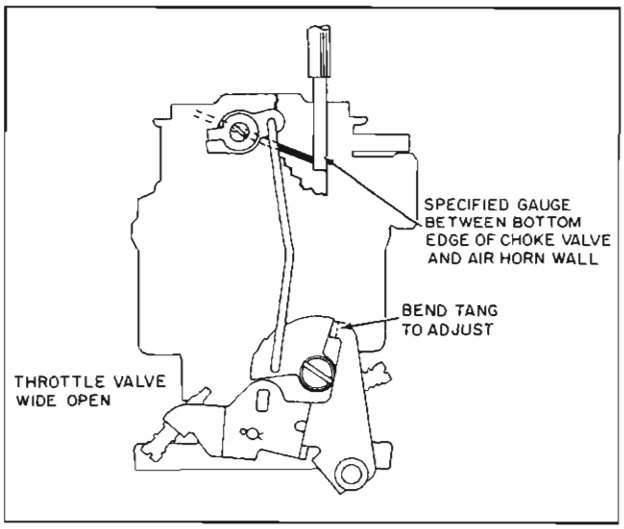


Fig. 4-121 Unloader Adjustment

14. If the choke suction tube and seal assembly in the throttle body requires replacement, proceed as follows. This operation must be performed after the carburetor is completely assembled.

    a. Loosen throttle body to bowl attaching screws.

    b. Place the flared end of the choke suction tube with the seal, into throttle body. Using Tool BT-45, tap lightly to hold seal into the throttle body. Rotate tube while tapping seal so that it is started uniformly and evenly into the throttle body assembly.

    c. Install hex fitting and new packing under upper end of tube and fasten the tube to the choke housing by turning hex nut finger tight.

    d. Using Tool BT-45 and hammer, spread the seal into throttle body securely.

    e. Completely loosen hex nut and check that tube is tight in throttle body (will not turn).

    f. Tighten throttle body to bowl attaching screws evenly and securely, then tighten hex nut to choke housing securely.

MODEL 2GC CARBURETOR

THEORY OF OPERATION

There are six basic systems used in the model 2GC. The six basic systems used are float, idle, part throttle, power, pump and choke.

FLOAT SYSTEM (Fig. 4-123)

The float system controls the level of the fuel in the carburetor float bowl. Fuel level is very important because it must be maintained to give proper metering throughout all operating ranges. Too low a fuel level can cause excessive leanness, resulting in flat spots and hesitation. Too high a fuel level may cause flooding or excessive richness, resulting in poor mileage.

Fuel entering the carburetor must pass through a sintered bronze filter, by the inlet needle seat, then past the float needle into the float bowl; fuel flow continues until the fuel level raises the float to a position where it closes the float needle valve. As fuel is used from the carburetor bowl, the float drops, moving the float needle off its seat and replenishing the fuel in the bowl, thereby, keeping the fuel level constant. The fuel level is regulated by setting the float to close the valve when the proper fuel level is reached in the carburetor bowl.

It should be noted that the fuel filter behind the fuel inlet nut, is spring loaded. This provides a pressure relief feature so that in the event the filter should plug, the restriction would cause fuel pump pressure to overcome the spring and allow fuel to by-pass the filter. A pin, cast into the fuel inlet cavity, prevents the filter element from being installed backwards. If the element is reversed, the pin will interfere with the center cone of the element so the fuel inlet element cannot be installed.

The float drop tang at the rear of the float hanger prevents the float needle from dropping out of its seat during disassembly and assembly operations. A float needle pull clip connecting the float arm to the needle valve, keeps the needle from sticking closed in the seat.

The carburetor is internally vented by a vent tube located inside the air horn bore just beneath the air cleaner. The air vent tube balances the air pressure from beneath the air cleaner to the fuel in the float bowl. The amount of fuel metered by the carburetor is dependent upon the air pressure in the float bowl causing fuel to flow. By locating the float bowl vents internally below the air cleaner, the carburetor automatically compensates for air cleaner restriction, since the same pressure causing air to flow will also be causing fuel to flow. With this method of venting, the carburetor is completely internally balanced and air cleaner restriction will have little affect upon air fuel mixture ratios for efficient engine operation.

An external idle vent valve located on top of the air horn is operated by the pump lever and vents fuel vapor from the float bowl during hot engine idle and "hot soak". This feature greatly improves hot engine idle and starting. The idle vent automatically closes after the throttle valve has moved from the idle position, into the part throttle range, at which point the carburetor returns to an internal balance.

IDLE SYSTEM (Fig. 4-124)

The idle system consists of idle tubes, idle

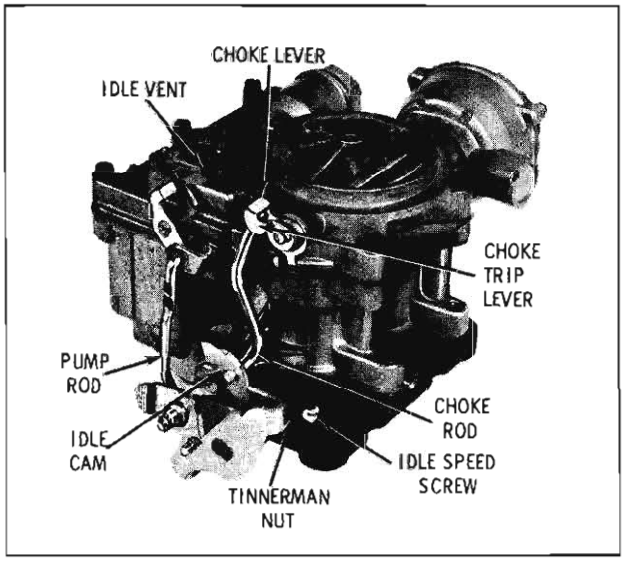


Fig. 4-122 Carburetor Assembly

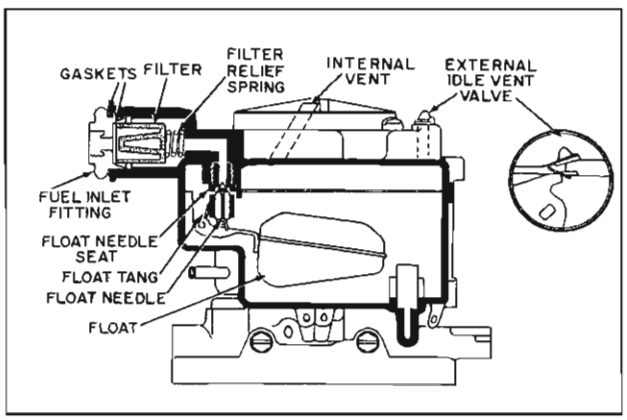


Fig. 4-123 Float System

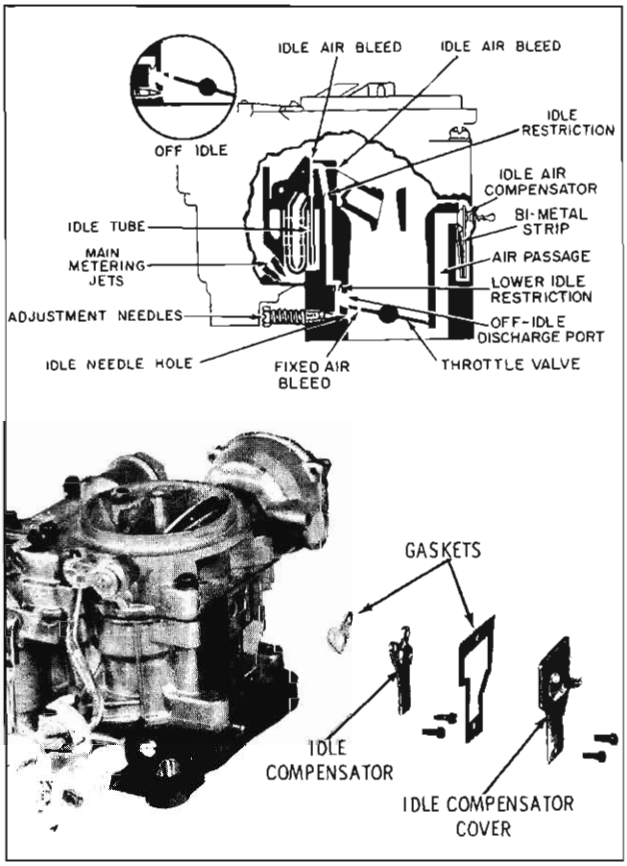


Fig. 4-124 Idle System and Idle Compensator

passages, idle air bleeds, idle channel restrictions, off idle discharge port, idle needle discharge holes and idle mixture needles.

In the curb idle speed position, the throttle valve is slightly open, allowing a small amount of air to pass between the wall of the carburetor bore and the edges of the throttle valve.

The idle needle hole is in the high vacuum (low pressure) area below the throttle valves, while the fuel bowl is vented to atmospheric pressure.

The higher atmospheric pressure forces the fuel from the float bowl through the main metering jets into the main well. The fuel is metered by the calibrated orifice at the lower tip of the idle tube and travels up the idle tube. When the fuel reaches the top of the idle tube, it is mixed with air through two idle air bleed holes; one is located directly over the idle tube in the idle channel and one below the channel restriction. The air/fuel mixture then moves down the idle passage, through a channel restriction located in the cluster just above the fuel bowl. It then moves down the vertical passage through a second idle channel restriction located in the throttle body just above the off-idle port. More air is added to the mixture through the off-idle port slot just above the throttle valve. The mixture then moves down to the idle needle hole and on into the bore of the carburetor to mix with the incoming air, past the slightly opened throttle valve. For smooth operation, the air from the carburetor bore and the air/fuel mixture from the idle needle hole must combine to form the correct final mixture for curb engine idle speed.

The position of the idle mixture adjusting needle regulates the amount of air/fuel mixture admitted into the carburetor bore. Turning inward on the idle mixture screw makes a leaner idle mixture, while turning the screw outward, or counterclockwise, enriches the idle mixture. Except for this variable at the idle mixture needle and curb idle adjusting screw, the idle system is specifically calibrated for low engine speed.

As the throttle valves are opened, a pressure differential occurs. Opening of the throttle valve progressively exposes the off-idle port slot to manifold vacuum and the air flow, with the result that it delivers additional air/fuel mixture for off-idle engine requirements.

A hot idle compensator, which is an integral part of the carburetor, is used on the air conditioned equipped cars to give a more stable idle when underhood temperatures are above normal. (Fig. 4-124)

A hot idle compensator is incorporated in all carburetors on cars equipped with factory-installed air conditioning. The function of the idle compensator is to prevent rough idle and stalling during prolonged hot idle conditions. Its function is as follows.

It consists of a bi-metal strip, a valve, and a mounting bracket. The idle compensator is mounted on the back of the carburetor float bowl. Beneath the compensator valve is a passage which leads from above the carburetor venturi into the manifold vacuum area below the throttle valve. The complete valve assembly is covered with a metal plate.

As engine and underhood temperatures rise to a predetermined degree, the bi-metal strip lifts the compensator valve off its seat. This allows fresh air to enter the engine manifold below the throttle valves to offset richer mixtures caused by fuel vapors, thereby, maintaining a smooth idle and preventing stalling.

When underhood temperatures return to normal, the bi-metal strip will lower and the compensator valve will close and normal idle operation will resume.

No adjustments are necessary on the idle compensator as it is specifically calibrated for the engine on which it is used. The compensator valve must be held closed while adjusting engine idle and this can be done by pushing inward on the spring loaded plunger in the cover plate over the compensator valve.

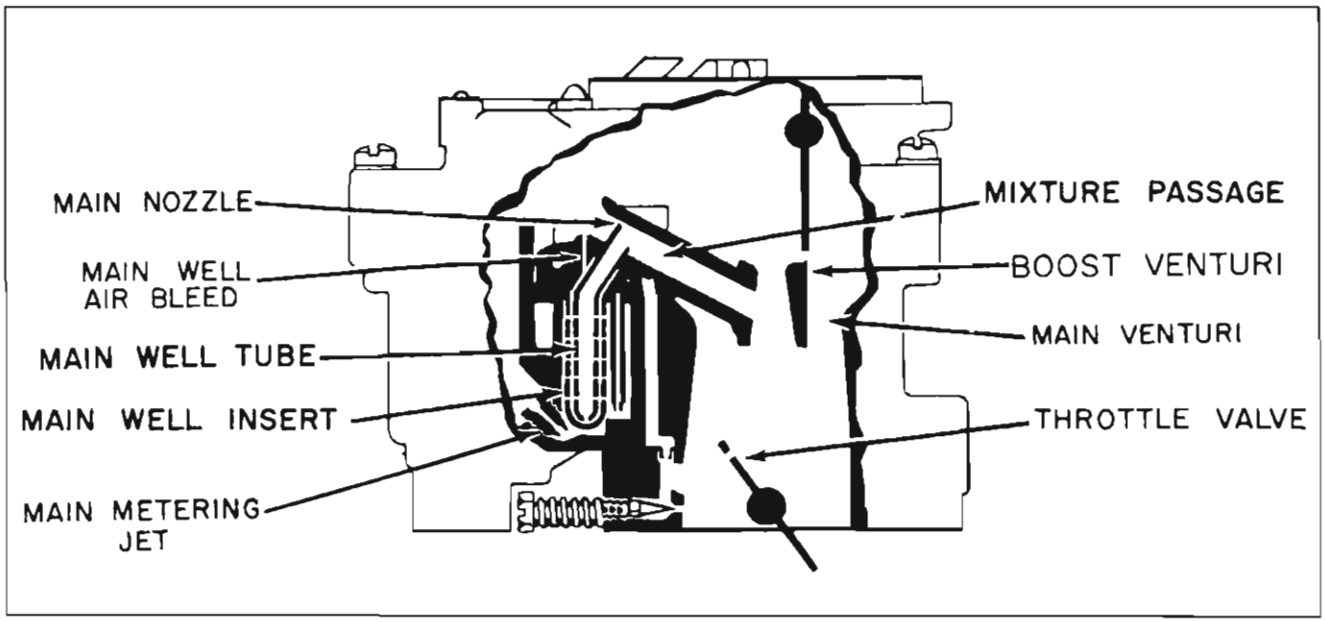


Fig. 4-125 Main Metering System (Part Throttle)

PART THROTTLE SYSTEM (Fig. 4-125)

As the throttle valves are opened to a greater degree and more air is drawn through the carburetor, it is necessary to provide means, other than the idle system, for supplying additional fuel to meet engine requirements.

Further opening of the throttle valve increases the speed of the air stream passing through the venturi, thus lowering the pressure, (raising the vacuum) in the small venturi area of the carburetor bore. At the same time, the edge of the throttle valve is moved away from the wall of the carburetor bore, gradually reducing the vacuum until the discharge of the fuel mixture at the idle needle bore and off-idle port gradually diminishes.

Since the low pressure point is now in the small venturi area, fuel will be forced from the fuel bowl through the main metering system to the venturi, as follows.

The fuel passes through the main metering jets into the main well, there it passes through the holes in the main well tube insert and rises in the main well tube. Air, entering through the main well air bleeds in the top of the venturi cluster, is mixed with the fuel in the main well tube through the holes located in each side of the tube. The mixture continues up the main well tube, through the nozzle, where more air is added at the tip of the nozzle through the mixture passage. The air/fuel mixture then passes down through the mixture passage to the small venturi, where it mixes with the intake air for complete and final mixture for part throttle operation. The calibrated main well air bleeds control the level of the fuel in the main well and also maintains the proper air/fuel mixture to the engine throughout the part throttle range.

Jets and air bleeds calibrate the main metering system for efficient part throttle operation.

It should be noted that main well inserts are used in conjunction with the main well tubes in this model carburetor. The purpose of the main well inserts is to help break up any vapor bubbles which may form in the main well so that efficient carburetor metering can be maintained during hot engine operation. The addition of the main well inserts helps to maintain a more stable engine idle and also more efficient operation of the main metering system.

POWER SYSTEM (Fig. 4-126)

The power system provides additional fuel as required for heavy load and high speed engine requirements.

A spring loaded power piston controlled by engine manifold vacuum regulates the power valve to supply additional fuel required by the engine in respect to speed and load.

The power piston vacuum chamber is open to manifold vacuum beneath the throttle valves. This allows the vacuum in the channel to rise and fall with engine manifold vacuum.

During idle and part throttle operation, the vacuum in the chamber is normally high enough to hold the power piston in the fully raised position against the tension of the power valve spring. As the manifold vacuum drops with engine load, the calibrated spring forces the piston down

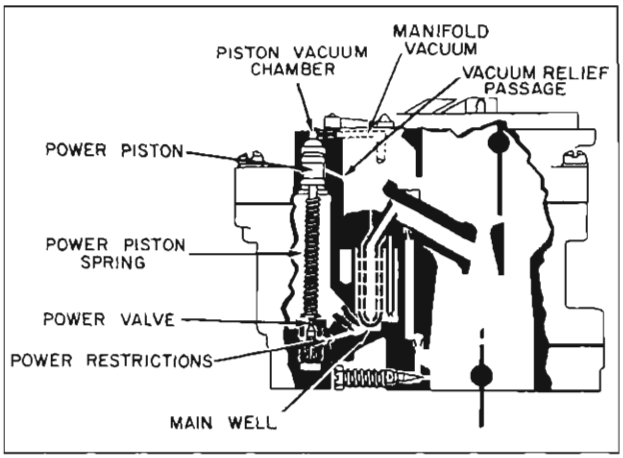


Fig. 4-126 Power System

against the power valve. The power valve is opened and allows additional fuel to flow through calibrated power restriction in the power system fuel passage and then on into the main wells.

The power valve allows the gradual increase in fuel flow as the power valve is fully opened to permit an efficient calibrated fuel flow from the power system.

As the engine load decreases, manifold vacuum increases. The increasing vacuum pull on the power piston gradually overcomes the spring tension of the power piston spring and the power piston returns to its original raised position; then the power valve is fully closed.

It will be noted that the power piston cavity in the carburetor air horn is connected to the main air flow passage by a vacuum break hole. The purpose of this hole is to prevent the transfer of vacuum acting on the power piston to the top of the fuel in the float bowl. Any leakage of air past the upper grooves of the piston will be compensated for by this vacuum break hole and therefore will not affect carburetor calibration.

PUMP SYSTEM (Fig. 4-127)

When the throttle is opened rapidly, the air flow and manifold vacuum change almost instantaneously, while the heavier fuel tends to lag behind causing a momentary leanness. The accelerator pump provides the fuel necessary for smooth operation on rapid acceleration.

Fuel for acceleration is supplied by a double spring loaded pump plunger. The top and bottom springs combine to move the plunger so that a smooth, sustained charge of fuel is delivered for acceleration.

On the pump intake or up-stroke of the plunger, fuel from the float bowl passes through the pump filter screen, unseating the aluminum inlet ball

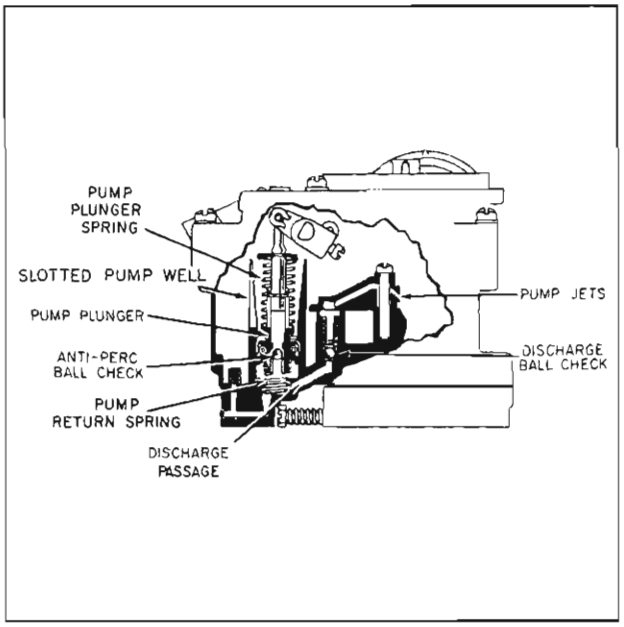


Fig. 4-127 Pump System

and filling the pump well. Under some conditions, fuel may enter the top of the pump well and flow by the ball check in the pump plunger head.

Downward motion of the plunger seats the check ball in the pump plunger head and also seats the aluminum inlet ball. Fuel is forced through the pump discharge passage where it unseats the discharge ball check and then passes on through the passage at the pump discharge holes in the cluster, where it sprays into the venturi.

The ball check in the pump plunger head also serves as a vapor vent from the pump well. Without this vent, vapor pressure in the pump well might force fuel from the pump system into the engine manifold, causing hard starting and pump sludging under conditions of extreme heat. The pump discharge ball check in the accelerator pump passage prevents pull-over or discharge of fuel from the pump nozzles when the accelerator pump is not in operation.

CHOKE SYSTEM (Fig. 4-128)

For cold engine operation, a richer mixture at the carburetor is required so that a combustible mixture enters the manifold system to be drawn into the engine cylinders after considerable condensation of the fuel vapor on the cold engine parts. The function of the choke system is to subject all fuel outlets in the bore of the carburetor to high vacuum while restricting the intake of the air. The choke system is composed of a thermostatic coil, vacuum piston, offset choke valve, fast idle cam and choke linkage. Its operation is controlled by the combination of intake manifold vacuum, the offset choke valve, atmospheric temperature and exhaust manifold heat.

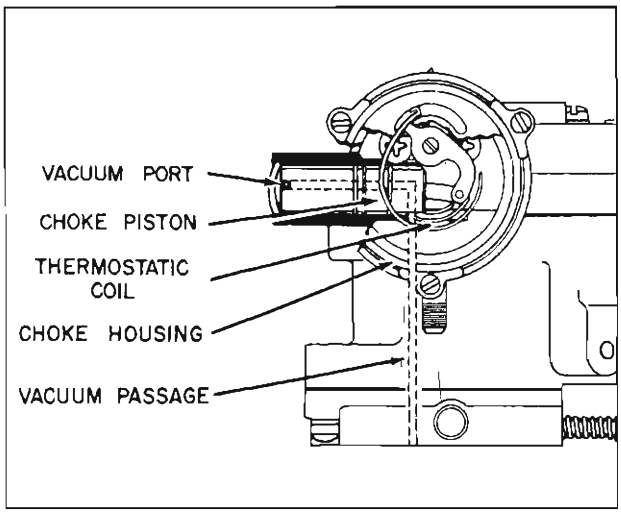


Fig. 4-128 Choke System

The thermostatic coil is calibrated to hold the choke valve closed when the engine is cold. As the engine is started, air velocity against the offset choke valve causes the valve to open slightly against the torque of the thermostatic coil. In addition, intake manifold vacuum applied to the choke piston through the vacuum channel also tends to pull the choke valve open. Vacuum pull on the choke piston is offset by tension on the thermostatic coil. As the engine warms up, heated air is drawn into the choke housing through the choke heat tube by vacuum, through a passage hole in the choke housing. As the engine temperature increases, it causes the thermostatic coil to relax its tension, which together with vacuum pull on the choke piston, causes the choke valve to open to wide open position.

A mechanical choke unloader is incorporated to open the choke valve slightly when the engine is cold. The choke unloader provides a means for opening the choke valve to allow additional air to enter and mix with any over-rich mixtures encountered during cold starting.

To prevent stalling during the warm-up period, it is necessary to run the engine at a slightly higher idle rpm than for a warm engine. This is accomplished by the idle screw, which rests on the steps of the fast idle cam. The fast idle cam is, in turn, linked to the choke valve shaft by the choke rod, choke trip lever and choke lever and collar assembly. This holds the throttle valves open sufficiently during the warm-up period to give the increased idle rpm, until the choke valve moves to the full open position.

CARBURETOR

Removal

1. Remove air cleaner assembly.
2. Disconnect choke tubes, vacuum lines and fuel inlet line.
3. Disconnect dashpot assembly from carburetor.
4. Disconnect accelerator linkage, remove four carburetor-to-intake manifold nuts and remove carburetor.

Installation

1. Place carburetor on intake manifold and install nuts. Torque 14-17 ft. lbs.
2. Connect linkage, fuel line, vacuum lines and heat tube.
3. Perform adjustments as outlined under ON CAR ADJUSTMENTS.
4. Install air cleaner assembly.

DISASSEMBLY

Air Horn

1. Mount carburetor on proper holding fixture.
2. Remove fuel inlet nut and filter assembly.
3. Remove three thermostat cover retaining screws and then remove the thermostat cover coil assembly, gasket and inside baffle plate. (Fig. 4-129)
4. Remove pump rod by removing the upper retaining clip at the upper pump lever and retaining clip at the throttle lever end.
5. Remove fast idle cam attaching screw; then remove cam and choke rod.
6. Remove retaining screw at the end of choke

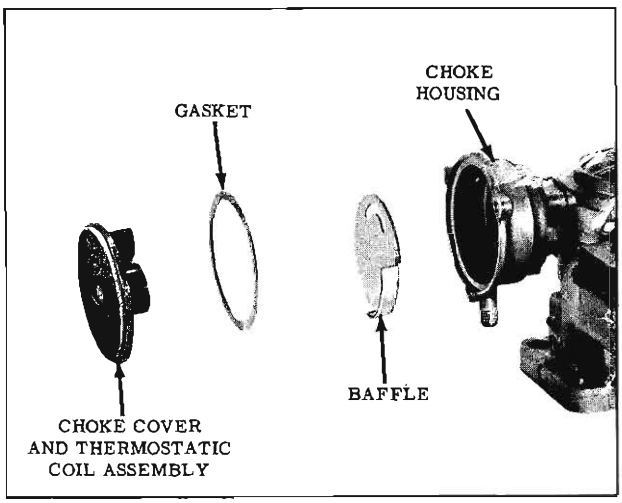


Fig. 4-129 Choke Thermostat Assembly

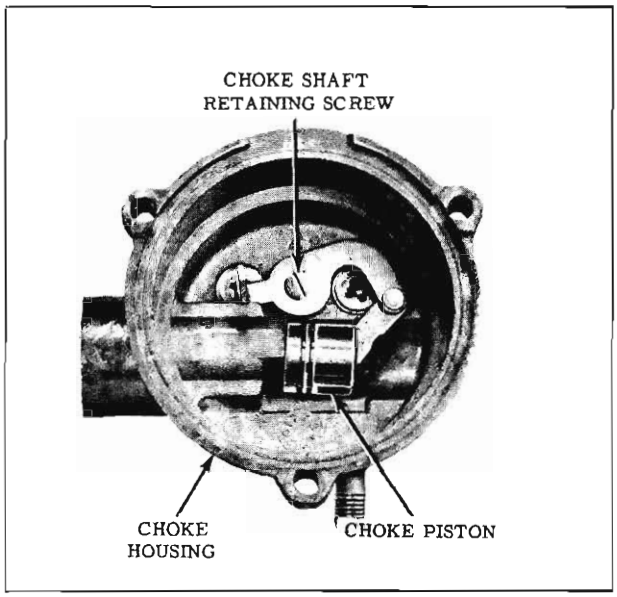


Fig. 4-130 Choke Piston Removal

shaft in choke housing and remove choke piston assembly. (Fig. 4-130).

7. Remove two choke housing attaching screws and remove choke housing. (Fig. 4-131)

8. Remove eight air horn attaching screws and carefully remove air horn from float bowl by lifting upward. (Fig. 4-132)

9. Invert the air horn and place on a flat surface, then remove the float hinge pin, float, and needle assembly. Float needle may be removed from float. (Fig. 4-133)

10. Remove two choke valve retaining screws and discard (file off staked ends). Remove choke valve. (Fig. 4-134)

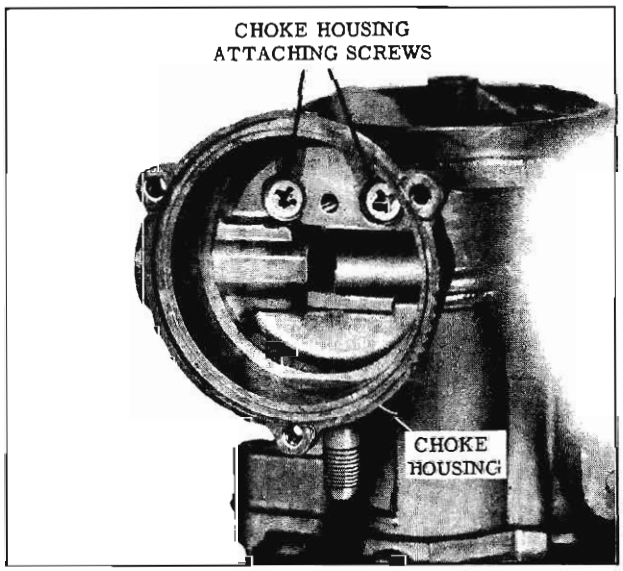


Fig. 4-131 Choke Housing Attaching Screws

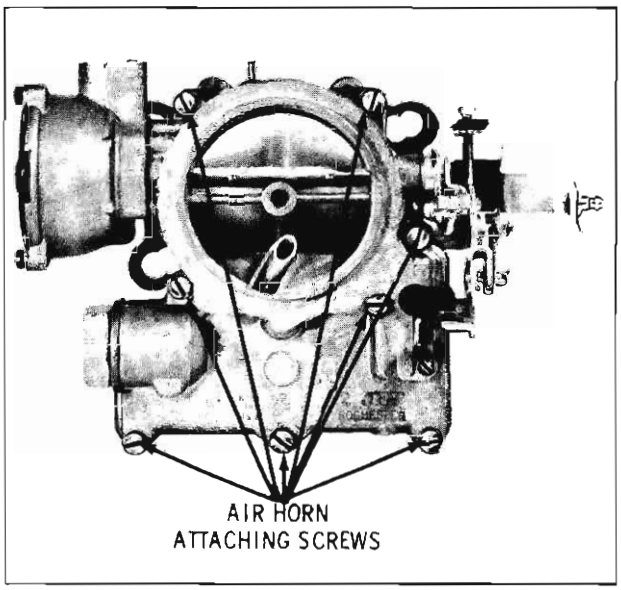


Fig. 4-132 Air Horn Attachment

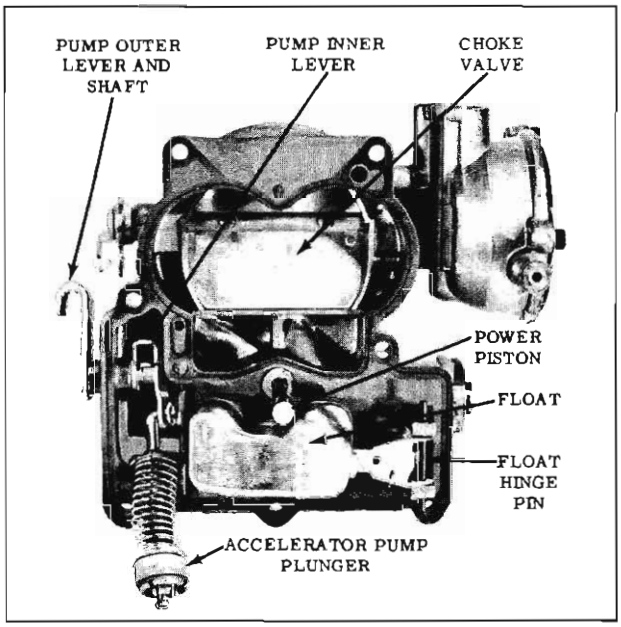


Fig. 4-133 Air Horn Assembly

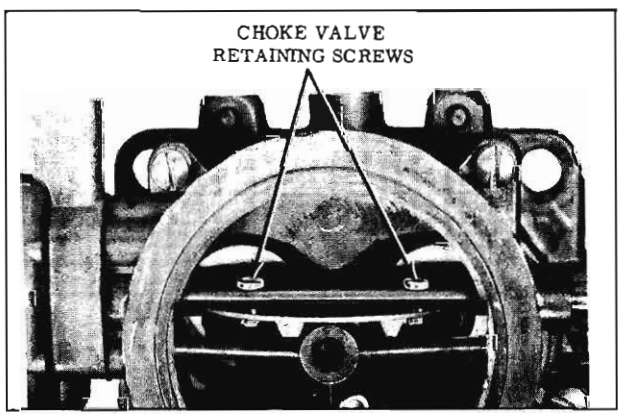


Fig. 4-134 Choke Valve and Shaft

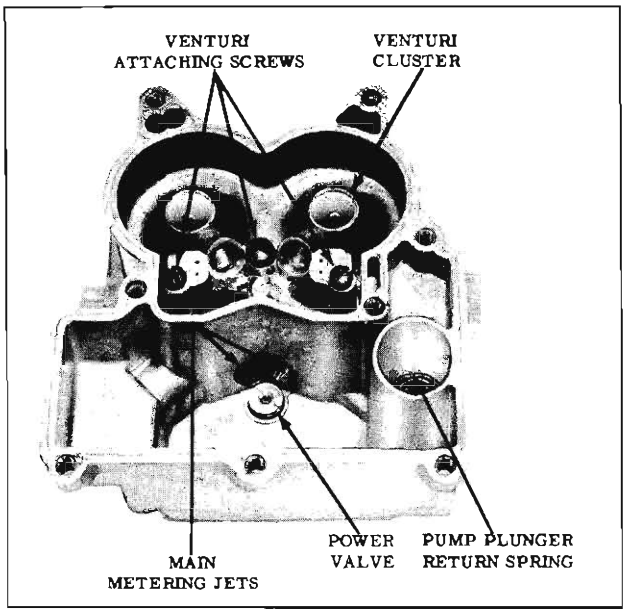


Fig. 4-135 Float Bowl Assembly

11. Remove choke shaft and choke trip lever.

12. Remove the float needle seat and gasket. (Use Tool BT-52)

13. Remove the air horn gasket.

14. Remove power piston by depressing shaft, allowing spring to snap, thus forcing piston from casting.

NOTE: If heavy staking is encountered, remove from around power piston retaining washer.

15. Remove the retainer from the pump plunger shaft and remove pump plunger.

16. The pump lever and shaft may be removed by loosening set screw on inner arm and removing outer lever and shaft assembly.

Float Bowl

1. Remove pump plunger return spring and aluminum inlet ball from the pump well (Fig. 4-135)

2. Remove the two main metering jets and power valve and gasket.

3. Remove three venturi cluster attaching screws and remove cluster and gasket.

NOTE: The cluster center screw has a larger head and has a gasket since it is located in the pump discharge passage.

4. Using a pair of needle-nosed pliers, remove the pump discharge spring guide, then remove the spring and steel ball. (Fig. 4-136)

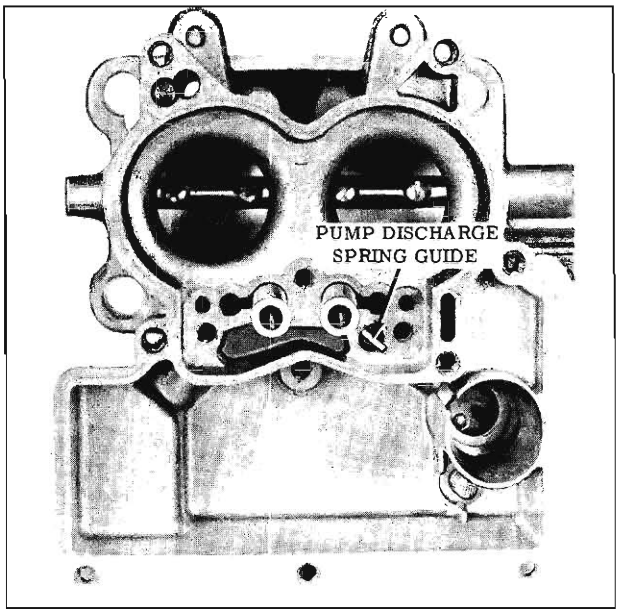


Fig. 4-136 Pump Discharge Spring Guide

5. Remove two main well inserts from the main well.

Throttle Body

1. Invert float bowl and remove three throttle body attaching screws, then remove the throttle body and gasket. (Fig. 4-137)

2. Remove idle mixture adjusting needles and springs.

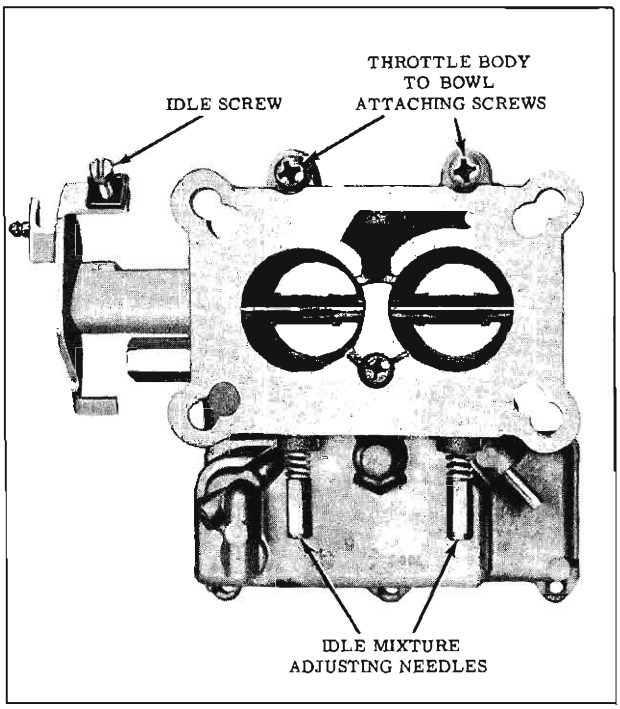


Fig. 4-137 Throttle Body

3. Remove idle screw from throttle lever if replacement is necessary.

   No other disassembly of throttle body is necessary. The throttle valves should not be removed, as the idle ports are located in direct relation to the location of the throttle valves. Removal of the throttle valves will upset this location. The throttle body is serviced as a complete unit with throttle valves intact.

CLEANING OF PARTS

The carburetor should not be cleaned in any solution other than a cold immersion type cleaner.

1. Thoroughly clean carburetor castings and metal parts in carburetor solvent.

   CAUTION: The pump plunger, gaskets and any fiber or rubber parts should not be immersed in the carburetor cleaner. Clean the pump assembly in clean gasoline only.

2. Clean and dry all passages in castings with compressed air. Do not pass drills or wires through jets or passages, as this may score the passage and upset metering.

3. Clean filter and screen of dirt or lint. If filter is plugged or screen is distorted or plugged, they should be replaced.

INSPECTION OF PARTS

1. Check floats for dents or excessive wear at hinge pin holes.

2. Shake floats to check for leaks.

3. Examine float needle and seat. If grooved or scored, replace with a new matched float needle seat and gasket assembly.

4. Inspect the idle mixture adjusting needle for burrs or ridges, or being bent out of alignment. Replace if necessary.

5. Inspect the upper and lower surface of the float bowl to see if the small sealing beads are not damaged. Damaged beading may result in air or fuel leaks at this point.

6. Inspect hole in pump rocker arm, fast idle cam and throttle shaft lever. If holes are worn excessively or out-of-round to the extent of improper operation of the carburetor, the worn parts should be replaced.

7. Inspect the steps on the fast idle cam for excessive wear. If worn, replace cam to assure proper engine operation during the warm-up and choking period.

8. Inspect the pump plunger cup for pliability. If the pump cup is damaged, replace the pump plunger as an assembly.

9. Inspect the throttle body to make sure the idle passages and vacuum channels are open.

ASSEMBLY

Throttle Body

1. If removed, install the idle speed screw. (Fig. 4-137)

2. Install the idle mixture needles and springs into the throttle body. Tighten the screws until finger tight, then back out 1-1/2 turns as a preliminary idle adjustment.

3. Place a new gasket on the bottom of the float bowl with holes aligned, then position the throttle body assembly on the gasket and install the three attaching screws. Tighten screws evenly and securely.

Float Bowl

1. Install steel pump discharge ball, spring and guide into the pump discharge passage in the venturi cluster mounting surface. (Fig. 4-136)

2. Install the two main well tube inserts into the main wells. Make sure the lip on the main well inserts are seated properly in the casting. (Fig. 4-138)

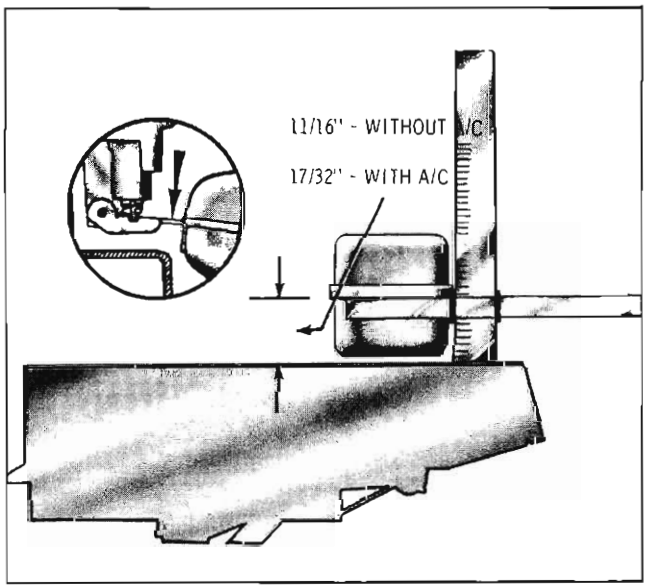


Fig. 4-138 Float Level Adjustment

3. Install the venturi cluster, gasket and attaching screws. Screw with gasket must be inserted in center hole.

4. Install the main metering jets and power valve with gasket.

5. Install pump aluminum inlet ball and return spring into the pump well. Push the pump return spring downward with finger to make sure the spring is seated in the bottom of the pump well.

Air Horn

1. Install pump lever and shaft if removed.

2. Install pump plunger (pump shaft pointing inward) and retainer.

3. Install float needle seat and gasket to the air horn. Tighten securely using Tool BT-52.

4. Install choke shaft and choke trip lever.

5. Install choke valve in the choke shaft with letters "RP" facing upward. Install two choke valve retaining screws but do not tighten securely until choke valve is centered.

6. Install power piston into vacuum cavity; piston should travel freely in cavity. Lightly stake retainer in place.

7. Install air horn gasket on the air horn.

8. Attach float needle to float, carefully position float and insert hinge pin.

FLOAT LEVEL ADJUSTMENT (Fig. 4-138)

1. With the air horn inverted and gasket in place, position the Adjustable Gauge BT-6310 on the gasket as shown. The sharp edge of the seam of the float should be even with the top edge of the gauge.

2. Bend the float arm as shown in Fig. 4-138.

NOTE: To insure proper seating of needle, raise float until needle is off its seat; then drop float allowing needle to seat.

FLOAT DROP ADJUSTMENT (Fig. 4-139)

1. With the air horn held upright and gasket in place, measure the distance from the gasket to the bottom of the float. Use Adjustable Gauge BT-6310 as shown to check this setting.

2. If necessary to adjust, bend the float tang which contacts the needle and seat. Bend the tang toward the needle and seat to decrease float drop and away from the seat to increase the drop.

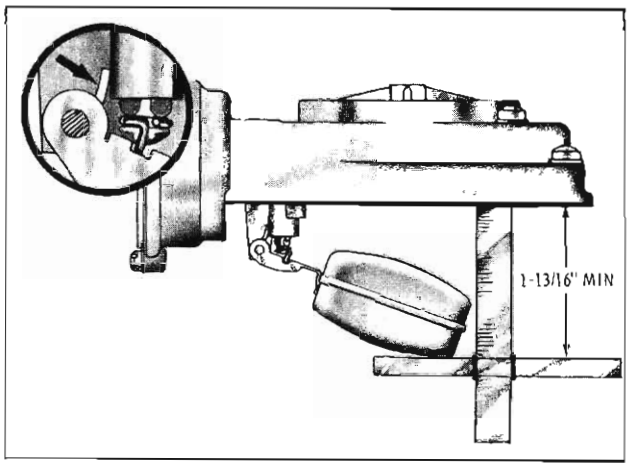


Fig. 4-139 Float Drop Adjustment

COMPLETION OF ASSEMBLY (Fig. 4-140)

1. Install the air horn on the float bowl while guiding accelerator pump in place. Install and tighten the air horn screws evenly and securely.

2. Insert the choke rod into the upper choke lever and install the idle cam on the lower end of the lever; then attach idle cam to float bowl, retaining with the idle cam screw. (Fig. 4-140)

3. Install accelerator pump rod and retainers in position as shown in Fig. 4-140.

4. Place new choke housing gasket in position on

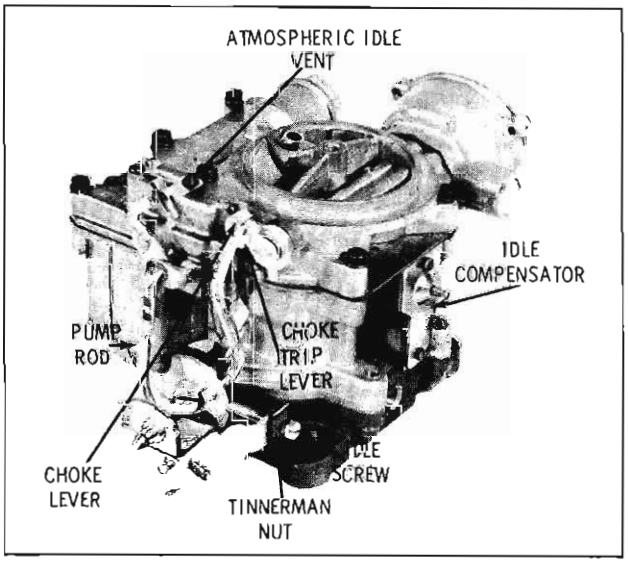


Fig. 4-140 Carburetor Assembly

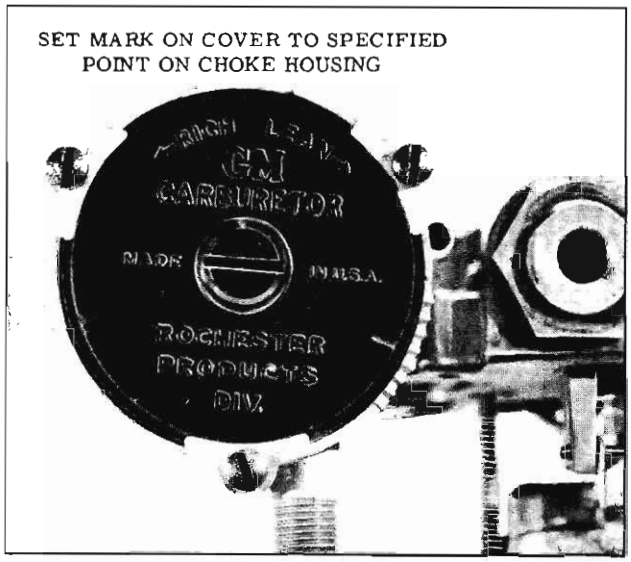


Fig. 4-141 Choke Cover Index Mark

air horn and install choke housing, retaining with two Phillips head attaching screws. Tighten screws evenly and securely.

5. Install choke piston assembly and install retaining screw.

6. Place baffle plate into choke housing and then install thermostatic coil, cover assembly and gasket.

7. Rotate thermostatic cover counterclockwise until the choke valve begins to close and continue in rotation until the proper index marking is aligned as specified. (Fig. 4-141)

8. Attach three choke cover retainers and screws to choke housing and tighten securely. Choke setting: One notch lean on all cars.

ADJUSTMENTS (Off Car)

PUMP ROD (Fig. 4-142)

Back out idle screw until the throttle valves are completely closed in the throttle bore. Place gauge across top of air horn casting, as shown, with leg of gauge pointing downward towards the top of the pump rod. Bend the pump rod, as shown, until the top of the pump rod is 1-3/32" below the top of the air horn casting

ATMOSPHERIC IDLE VENT ADJUSTMENT (Fig. 4-143)

To adjust the idle vent valve, make the pump rod setting first. Then set the adjustable gauge to the specified dimension. Place gauge on top of the air horn ring, as shown. With the throttle valves open far enough so that the vent valve just closes, the vertical scale on the gauge should just touch the top of the pump rod, as shown.

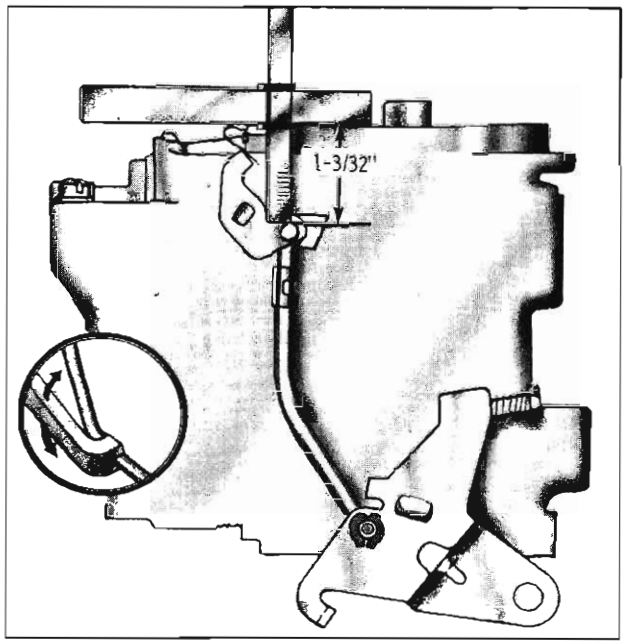


Fig. 4-142 Pump Rod Adjustment

To adjust, bend the tang on the pump lever, as shown.

CHOKE ROD

Turn the idle screw in until it just contacts the second step of the fast idle cam. With the screw resting on the second step and against the high step, bend the choke lever tang as necessary to obtain .055" clearance between the upper edge of the choke valve and the air horn wall.

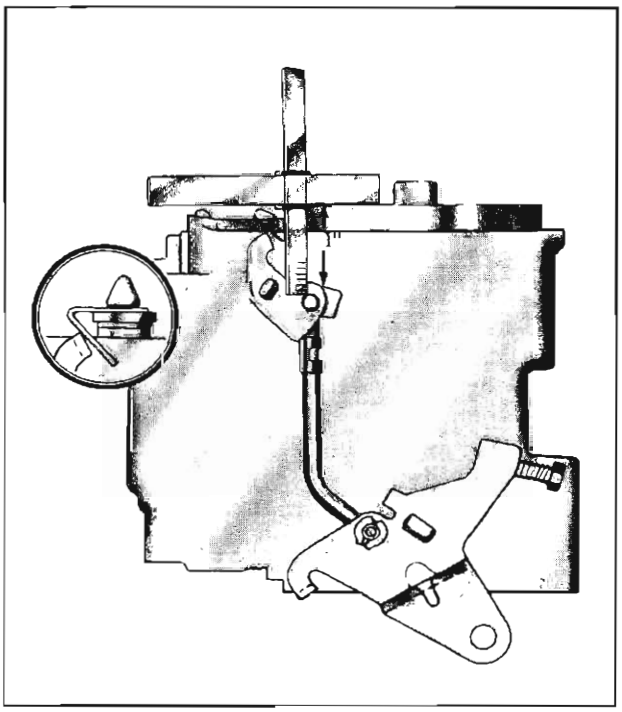


Fig. 4-143 Atmosperic Idle Vent Adjustment

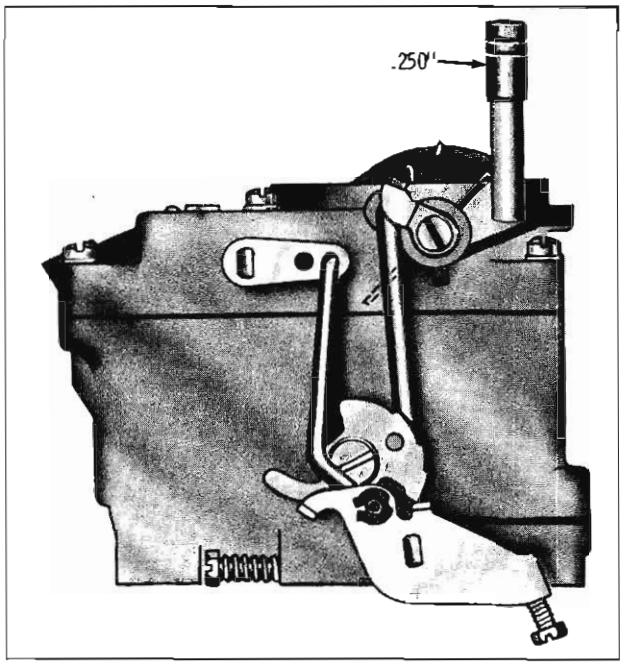


Fig. 4-144 Unloader Adjustment

UNLOADER ADJUSTMENT (Fig. 4-144)

1. Hold the throttle valves in the wide open position.
2. Obtain .250" clearance between the upper edge of the choke valve and the inner air horn wall.
3. To adjust, bend the tang on the throttle lever as shown.

ADJUSTMENTS (ON CAR)

AUXILIARY BELLCRANK TO CARBURETOR LINK ADJUSTMENT (SYNCHROMESH AND JETAWAY)

A. Required Conditions

1. Slow idle screw backed out.
2. Idle cam positioned so it will not contact idle screw.
3. Throttle return spring load to be effectively holding throttle lever in closed bore position.

B. Adjustment

1. Bend auxiliary bellcrank to carburetor link as required to attain .020" - .040" clearance between the tang on the auxiliary bellcrank and the gauge surface on the auxiliary bellcrank bracket.

SLOW IDLE ADJUSTMENT (SYNCHROMESH AND JETAWAY)

A. Required Conditions

1. On cars equipped with Jetaway Transmission, dashpot plunger is to be held in so switch circuit will be closed while slow idle is being adjusted.
2. Engine to be warm.
3. Air cleaner installed.
4. Jetaway in "D" or Drive Range.

B. Adjustments

1. Adjust the slow idle speed to obtain the following:

Trans.	Air Cond.	Range	RPM
S.M.	Without	N	600
S.M.	With*	N	600
J.T.	Without	D	500
J.T.	With*	D	550

*Idle Compensator Held Closed

2. After idle rpm is stablized, turn in or out each idle mixture adjusting screw until the smoothest possible idle is obtained. (Fig. 4-145)
3. Fast idle adjustment is automatically obtained when slow idle is adjusted due to single idle screw.

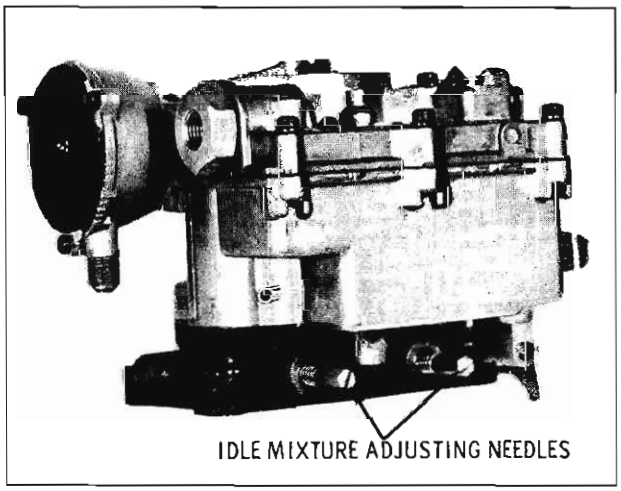


Fig. 4-145 Idle Mixture Adjusting Needles

ACCELERATOR LINKAGE ADJUSTMENT (SYNCHROMESH AND JETAWAY)

A. Required Conditions

1. Slow idle speed properly adjusted.
2. Throttle return spring effectively holding the carburetor lever in slow idle position.

B. Adjustment

1. Adjust swivel on accelerator lever to auxiliary bellcrank rod to give the proper pedal height dimension; pedal height dimension to be 4.040" - 4.160" from centerline of swivel to top of well in dash. (Break line of lower vertical and upper tapered surfaces of dash, directly in back of swivel.)

SLOW IDLE DASHPOT AND SWITCH ADJUSTMENT (JETAWAY ONLY)

A. Required Conditions

1. Slow idle to be properly adjusted.
2. Fast idle cam positioned to allow throttle return spring to hold carburetor lever in slow idle position.
3. Dashpot adjusted away from carburetor lever.
4. Ignition switch turned on.
5. Test light connected to black lead terminal on throttle switch and ground.

B. Adjustment

By turning clipped nut on bracket, adjust dashpot into carburetor lever until test light comes on. Then adjust dashpot by turning nut one complete turn more and tighten locknut.

THROTTLE SWITCH ADJUSTMENT (JETAWAY ONLY)

A. Required Conditions

1. Auxiliary bellcrank to carburetor link properly adjusted.
2. Throttle switch and link assembly adjusted short.
3. Ignition switch turned on and engine not running.
4. Test light connected to white lead terminal on throttle switch and ground.

B. Adjustment

1. Hold a .040" shim in front of the wide open throttle stop on the throttle body.
2. Open carburetor by pulling on accelerator lever to auxiliary bellcrank rod until tang on carburetor lever stops against shim.
3. With carburetor held in this position, lengthen link and switch assembly by turning switch plunger until test light comes on. Tighten locknut.

NOTE: This adjustment can only be made by lengthening switch assembly. If necessary to shorten switch assembly, let carburetor return to idle, shorten beyond necessary amount, and then repeat procedure of opening carburetor to shim and lengthening switch and link assembly.

MODEL 4GC CARBURETOR

THEORY OF OPERATION

FLOAT SYSTEM (Fig. 4-146)

The Rochester Model 4GC carburetor uses two sets of twin floats to maintain correct fuel level in both primary and secondary sides of the float bowl under all conditions of operation.

Fuel enters the carburetor through the inlet fitting on the primary side of the air horn. It first passes through a sintered bronze fuel filter located just behind the fuel inlet nut. It should be noted that the fuel filter is spring loaded. This provides a pressure relief feature so that, in the event the filter should plug, the restriction will cause fuel pump pressure to overcome the spring and allow fuel to by-pass the filter. After the fuel passes through the inlet filter, it goes to the primary needle seat and to the secondary needle seat through a channel, across the top of the air horn. As the fuel level on the primary side of the carburetor drops, the twin floats drop, moving the float needle off its seat.

When the fuel is used from either the primary or secondary side of the float bowl, the float automatically drops, allowing the float needle to come off its seat. Fuel under pressure from the fuel pump forces fuel through the inlet filter, past the float needle, into the float bowl, until the desired fuel level is reached and the float needle is forced against the needle seat stopping fuel flow.

The floats are spring loaded by a spring located between the float hanger posts on both the primary and secondary side of the carburetor. The purpose of the float balance spring is to supply additional pressure on the float tang at the rear of the float arm to assist in closing the float needle valve.

Both primary and secondary sides of the carburetor float bowl are individually and internally vented by vent tubes which transmit the air pressure from beneath the air cleaner to the fuel in the float bowl. The air vent tubes balance the air pressure from beneath the air cleaner to the fuel in the float bowl. The amount of fuel metered by the carburetor is dependent upon the air pressure in the float bowl causing fuel to flow. By locating the vents below the air cleaner, or internally, the carburetor automatically compensates for air cleaner restriction, since the same pressure causing air to flow will also be causing fuel to flow.

A cored passage in the float bowl, slightly above the normal fuel level, brings the primary and secondary float bowls together. In this way, any abnormal rise in level on one side will be absorbed by the other and will not seriously disrupt the operation of the engine due to high fuel level or flooding. It should be noted the secondary side of the balance channel extends around to the rear of the float bowl. This helps prevent fuel from transferring from the secondary to the primary side of the carburetor when the vehicle is parked downhill on a very steep grade.

IDLE SYSTEM (Fig. 4-147)

At small throttle openings (1) vacuum created

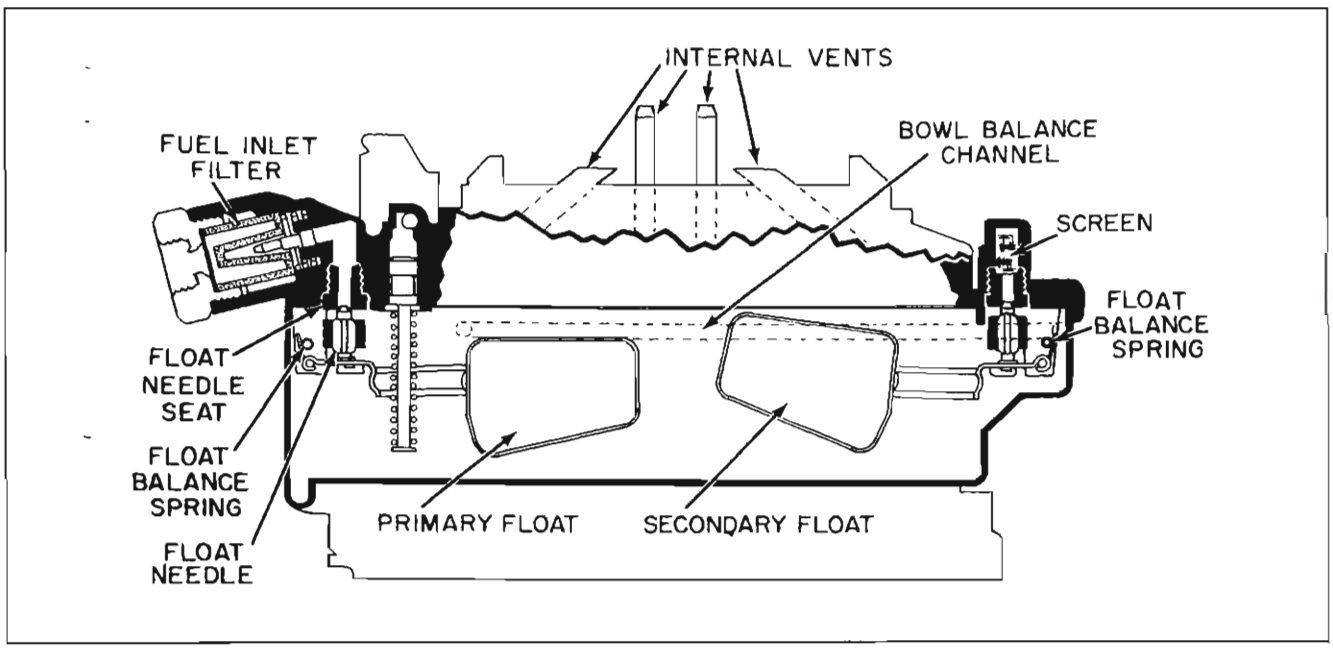


Fig. 4-146 Float System

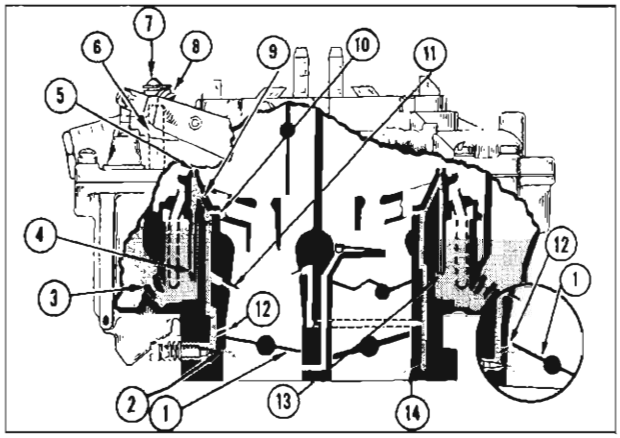


Fig. 4-147 Idle System

by the main venturi is not sufficient to cause fuel to flow. Therefore, an additional system has been provided to furnish the proper mixture ratios required throughout the low speed range.

An adjustable idle system (2) in the primary side and a fixed idle system (14) in the secondary side of the carburetor, supplies the fuel required for normal curb idle, off-idle and low speed range.

In the primary bores, the quantity of air/fuel mixture supplied for curb idle is controlled by the idle mixture needles (2) which may be adjusted to provide smooth idle operation. In the secondary bores, the quantity of idle air/fuel mixture is controlled by the fixed size of the discharge holes (14) located in the rear of the secondary throttle bores. The secondary fixed idle mixture supplements the primary adjustable idle mixture to provide a stable air/fuel mixture for the engine cylinders.

Operation of the primary and secondary idle system is similar. The idle fuel is drawn from the float bowl through the main metering jets (3) into the main well, passing through the calibrated idle tube restriction (4) and idle tubes. Air joins this fuel at the calibrated air bleed at (5). The air/fuel mixture then passes through a calibrated restriction (9). More air is added at the second idle air bleeds (10) and passes down through the lower idle air bleeds (11) and idle discharge holes (12). The resultant mixture is then discharged into the throttle bore from the idle needle holes (2).

As the throttle valves (1) are opened from the curb idle position, air entering the idle discharge holes (12) gradually diminishes. When these holes become exposed to manifold vacuum, they then become fuel discharge holes to meet the increased demand of the engine.

Further opening of the throttle valves increases the air velocity through the carburetor sufficiently to cause the air to strike the end of the extended lower idle air bleed (11), creating a lower pressure within the bleed tube. As a result, fuel begins to discharge from this bleed tube and continues to do so throughout the part throttle and wide open throttle ranges, supplementing the nozzle delivery.

To adjust the idle mixture, a tapered needle (2) is used to vary the opening of the discharge hole. When the needle is turned in, the area is decreased and the idle mixture becomes leaner.

In order to minimize difficulty in hot weather starting or rough idling due to fuel vapor formation in the carburetor bowl, the model 4GC carburetor incorporates an external vent (6) which opens when the throttle valves are in the idle position. The external idle vent (6) is located in the center of the carburetor air horn on the primary side of the carburetor. It consists of an actuating tang (8) integral with the pump lever which operates a rubber valve (7) mounted over the vent hole. The rubber vent is attached to a spring steel arm.

When the throttle valves are closed, the actuating tang contacts the spring arm and holds the vent valve open. This permits vapors from the fuel bowl to be vented to the outside. As the throttle valves are opened, the spring closes the vent valve returning the carburetor to an internal balance.

All carburetors incorporate an idle compensator to prevent stalling under prolonged "hot idle" conditions (Fig. 4-148). The idle compensator consists of a bi-metal strip, a valve and a mounting bracket. It is mounted between the venturi on the secondary side. The valve seats on a hole drilled into the center throttle body attaching bolt hole leading to the underside of the primary throttle valves.

When underhood temperatures rise to a predetermined value, the bi-metal strip lifts the valve off its seat. This allows additional idle air to enter below the throttle valves, offsetting the enrichening effects of the high engine temperatures. When underhood temperatures are lowered,

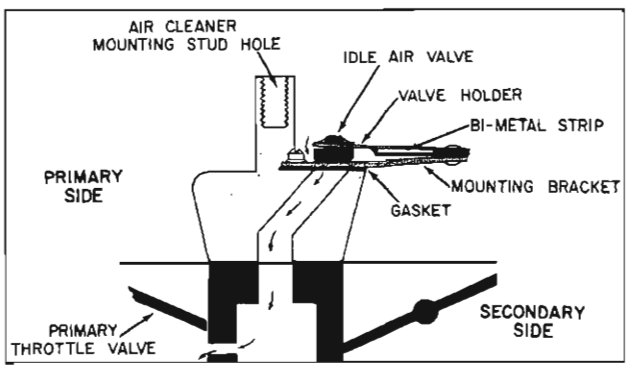


Fig. 4-148 Idle Compensator

the valve closes and the idle operation returns to normal.

PART THROTTLE SYSTEM (Fig. 4-149)

As the throttle valves are opened to a greater degree and more air is drawn through the carburetor, it is necessary to provide means, other than the idle system, for supplying additional fuel to meet the engine requirements. The primary side of the carburetor meets the increased demand for fuel in the following manner.

At a point of sufficient throttle opening, manifold vacuum, multiplied several times in the primary (9) and secondary venturi (8), is transmitted to the tip of the main well tubes or main discharge nozzles (6). This vacuum draws fuel from the float bowl through the calibrated main metering jets (2) and into the main well tubes (3). After passing through the main well tubes (3), air joins the mixture at the main well bleeds (4). The mixture then passes from the tip of the nozzle (6) through the mixture passage (7), to the secondary venturi (8), and into the intake manifold.

As the throttle opening is progressively increased and more fuel is drawn through the main well tubes, the fuel level in the main well drops. The calibrated holes (4) in the main well tubes are proportionately exposed to the air in the upper well area. When this occurs, they become air bleeds mixing progressively more air with the fuel passing through the main well tubes. Although the nozzle suction is increased by increasing the throttle opening, the fuel mixture to the engine remains constant throughout the part throttle range.

As throttle opening increases, the lower idle air bleeds become part throttle feed nozzles in the main bore below the primary venturi (9). Discharge nozzles (11) are located in the venturi wall on the primary side and are fed by the idle tubes (12) on the secondary cluster. These nozzles provide an additional source of fuel to maintain a constant mixture ratio at wide primary throttle openings. The tubes act as nozzles and supplement the fuel discharge of the main system to fill the gap between late part throttle and prepower system operation. Fuel is discharged from these nozzles at throttle openings which correspond to a steady speed of approximately 70 to 90 mph. No fuel is discharged until the primary throttles are opened sufficiently to allow air flow to create a low pressure area at the tube. Fuel then flows throughout the remainder of the part and wide-open throttle range. The secondary throttle valves of the carburetor do not open until the primary linkage engages the secondary throttle shaft. They then open fully during the final few degrees of primary throttle travel. The secondary side, therefore, supplies fuel through a portion of the part throttle range and through the power range.

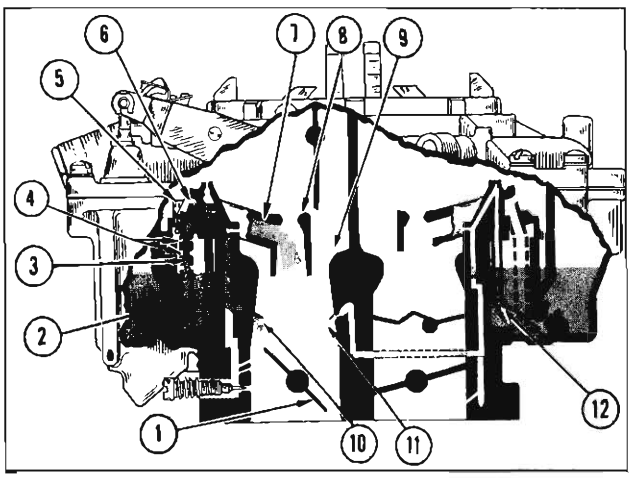


Fig. 4-149 Part Throttle System

POWER SYSTEM (Fig. 4-150)

To achieve the proper mixtures required when more power is desirable or sustained high speed driving is to be maintained, the carburetor employs the use of a vacuum-operated power piston (11) in the air horn and a power valve (12) in the float bowl.

The power system is located on the primary side of the carburetor. The power piston vacuum channel (4) is exposed to manifold vacuum beneath the throttle valves. The vacuum in this channel varies drrectly with manifold vacuum. In the idling and part throttle ranges, the manifold vacuum is normally quite high. This vacuum is sufficent to hold the power piston (11) in its extreme up position. However, as the throttle valves are progressively opened, the vacuum drops.

When the vacuum drops below approximately 9" hg., the calibrated spring (1) beneath the power piston forces the piston down. This situation

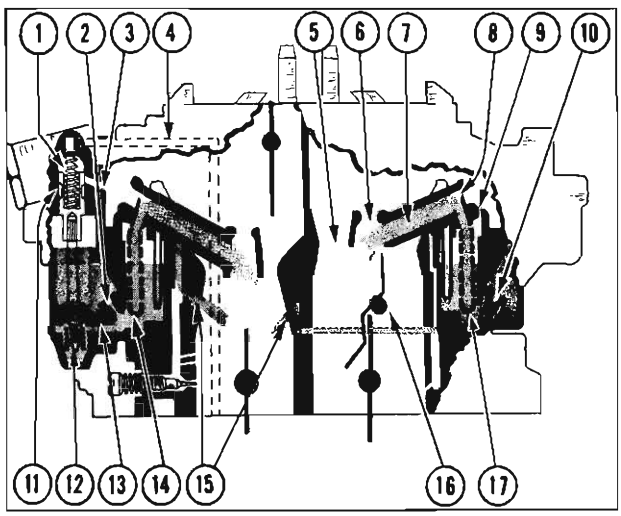


Fig. 4-150 Power System

occurs at very high driving speeds or on rapid accelerations. When the piston drops, it unseats the spring loaded power valve (12). This permits additional fuel to flow from the float bowl through the calibrated power restriction (13), and into the main wells. The additional fuel supplements fuel already flowing through the main metering system, making the mixture being delivered to the manifold considerably richer than normal part throttle mixtures.

This power mixture continues to be supplied as long as the manifold vacuum remains below approximately 9" hg. When the manifold vacuum again increases sufficiently, the force of the power piston spring (1) is overcome and the piston is drawn up, returning the carburetor to the economical part throttle mixtures. It will be noted that the power piston cavity in the carburetor air horn is connected to the main air flow passage by a vacuum break hole (3). This hole prevents the vacuum, acting on the piston, from also acting on the top of the fuel in the float bowl. Any leakage of air past the upper grooves of the piston will be compensated for by this vacuum break hole and will not affect carburetor calibration.

It is also in this range that the secondary side of the carburetor provides additional air and fuel to the engine for increased power. For high speed operation, beyond the part throttle range, the throttle linkage engages the secondary throttle valves and opens them completely in the remaining few degrees of primary throttle travel. Manifold vacuum acting on the secondary side of the carburetor is multiplied at the primary (5) and secondary (6) venturi, drawing fuel from the float bowl through the calibrated main metering jets (10) into the main wells. This fuel then passes through the main well tubes (17) and is bled in a manner similar to that described previously in the operation of the primary main well air bleeds.

This mixture is bled further at the main well bleeds (9) and is then drawn to the tips of the main well tubes (8). It then passes through the mixture passage (7) to the secondary venturi (6) and is discharged into the intake manifold.

The lower idle air bleeds (15) also supply fuel throughout the power range in a manner similar to that described under the part throttle system operation.

The auxiliary valves (16) provide a means for controlling secondary bore opening according to air velocity at wide-open throttle. High velocity allows good metering and also holds the valves open, so that the secondary metering system can supply the correct air/fuel mixture.

Low air velocity, in turn, reduces metering efficiency. When this condition occurs, the spring tension overcomes the air velocity and closes the valves. Air which was going through four bores, now passes through only two; the velocity is twice as high and good metering control is extended over a wider range of low speed and wide-open throttle operation.

PUMP SYSTEM (Fig. 4-151)

When the throttle is opened rapidly, the air flow and manifold vacuum change almost instantaneously, while the heavier fuel tends to lag behind, causing a momentary leanness. The accelerator pump provides the fuel necessary for smooth operation during rapid acceleration. Since the throttle valves on the secondary side of the carburetor remain fully closed throughout part-throttle operation, it is necessary to have only one accelerator pump located on the primary side of the carburetor.

A double spring pump plunger is used on the carburetor. The rates of compression of the top spring (7) and the bottom spring (4) are calibrated to insure a smooth sustained charge of fuel for acceleration. On the pump intake, or up-stroke of the plunger, fuel from the float bowl passes through the pump filter screen (2), unseating the aluminum inlet ball (3), and filling the pump well. The accelerator pump is connected through the pump shaft and lever assembly and pump rod to the throttle lever.

Upon acceleration or down stroke of the pump plunger, the force of fuel in the pump well seats the inlet ball (3). The fuel is then forced through the discharge channel (1), unseating the pump outlet ball (11), and then discharges through the pump jets (9) into the air stream. At the end of the discharge, the outlet ball is returned to its seat by the spring (10), which prevents air being drawn back into the fuel channel during the intake stroke.

The pump plunger head is vented to minimize the effect of fuel percolation in the pump well.

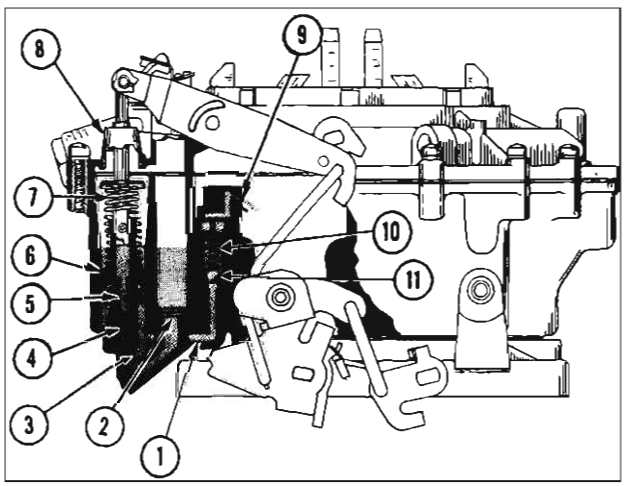


Fig. 4-151 Pump System

This is accomplished by the design of a ball check and seat in the plunger head (5). Any build-up of fuel vapors in the pump well will rise, by-pass the ball and vent into the float bowl. This insures a solid charge of fuel beneath the plunger head for rapid acceleration. Without this feature, any vapor pressure build-up would evacuate the charge of fuel in the pump system, causing poor initial acceleration as well as difficult hot weather starting.

The carburetor also makes use of a pump plunger shaft dust boot (8), which serves the dual purpose of preventing dirt and foreign material from entering the fuel bowl through the shaft opening on the top of the air horn, and also provides the proper seal necessary to maintain internal balance.

CHOKE SYSTEM (Fig. 4-152)

The choke system provides the engine with extra fuel during cold engine starting to maintain the correct air/fuel mixture ratios in the cylinders for combustion.

The system includes a choke valve, thermostatic coil, a vacuum choke piston supplemented with a vacuum diaphragm unit, fast idle cam and linkage. The fast idle cam operates independently from the choke valve. This provides a relatively short choking period with adequate fast idle for a cold engine.

The thermostatic coil closes the choke valve when the engine is cold. To maintain the correct air/fuel ratio during warm-up, the choke piston under manifold vacuum opposes the choke coil and opens the choke valve. The vacuum diaphragm unit assists the choke piston to give additional pulling power against the choke coil and hold the choke valve open to prevent loading during severe cold weather operation.

As the engine begins to warm up, the thermostatic coil gradually relaxes its tension through the application of manifold heat. Air velocity against the offset choke valve and continued vacuum pull on the choke piston opens the choke valve until it is completely open, at which point the engine will be at operating temperature and choking is no longer needed.

CARBURETOR ASSEMBLY

Removal and Installation

1. Remove air cleaner assembly.
2. Disconnect linkage.
3. Disconnect choke tube.
4. Disconnect fuel and vacuum lines.
5. Remove four throttle body-to-intake manifold bolts and remove carburetor.

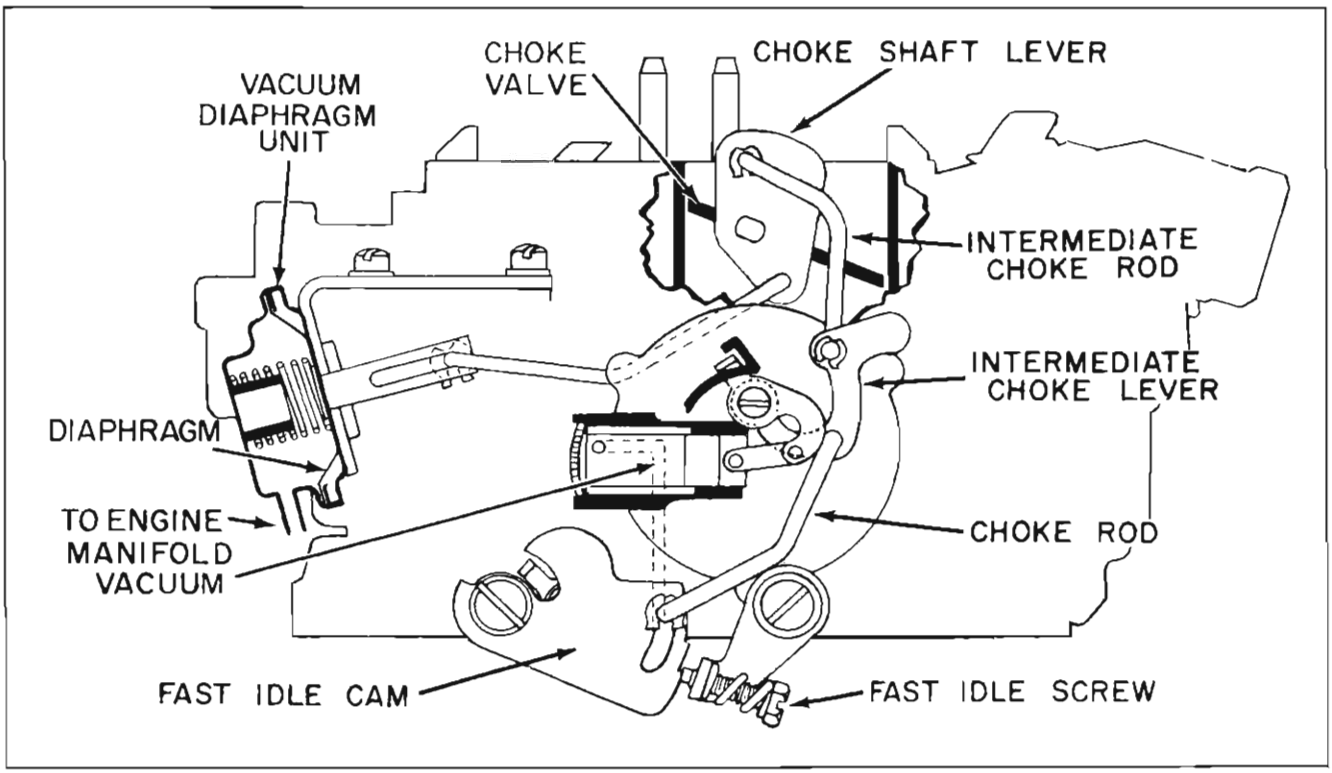


Fig. 4-152 Choke System

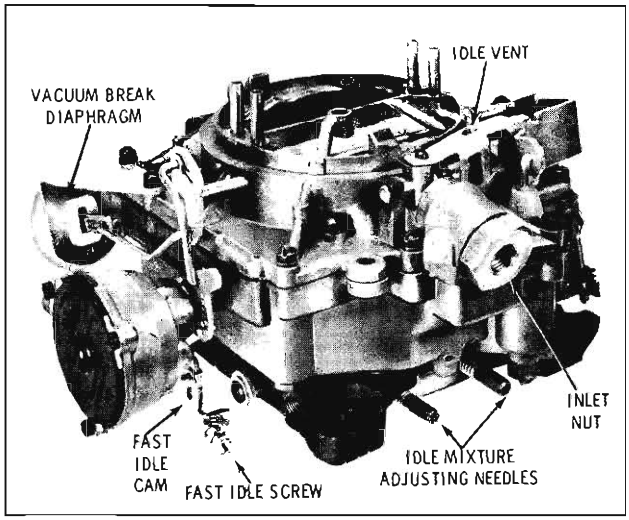


Fig. 4-153 4GC Carburetor

To install, reverse removal procedure and make adjustments outlined under ADJUSTMENTS (ON CAR). Torque carburetor to intake manifold bolts 14 to 17 ft. lbs.

DISASSEMBLY

Disassembly of Air Horn (Fig. 4-154)

1. Mount the carburetor on Holding Fixture J-5923-B or 30-14.

2. Remove the fuel inlet nut and gasket, then remove the filter and gasket between filter element and back side of inlet nut. (Fig. 4-155)

3. Remove idle vent valve screw, shield and valve.

4. Remove the retainer from the upper end of the pump rod and disengage rod.

5. Remove the retainer from pump plunger shaft and remove the pump plunger and pump rod from carburetor.

6. Remove the retainer from the intermediate choke rod and unhook rod from choke lever.

7. If the choke shaft is to be removed:

   a. Remove the small screw holding the choke unloader lever to the choke shaft, then remove the lever.

   b. Remove the two small brass choke valve retaining screws and discard. Remove the choke valve and the choke shaft.

8. Remove the 13 air horn attaching screws, (one screw is recessed in the top of the air horn), and remove the vacuum break diaphragm.

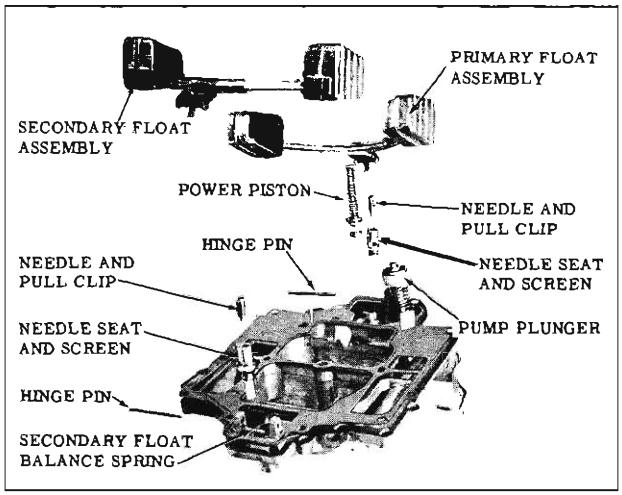


Fig. 4-154 Air Horn Assembly

9. Carefully lift the air horn until the float assemblies are clear of the carburetor body.

   CAUTION: The air horn gasket must be removed with the air horn or the primary float assembly will be damaged.

10. Remove the hinge pin from the primary float assembly, and remove the float and needle. (Fig. 4-154) Do not remove the float balance spring unless it is distorted and needs replacement.

11. Remove the primary float needle seat and gasket, using Tool BT-52.

    NOTE: The float needle and seat are matched and must be installed as an assembly.

12. Remove the hinge pin, float assembly, needle

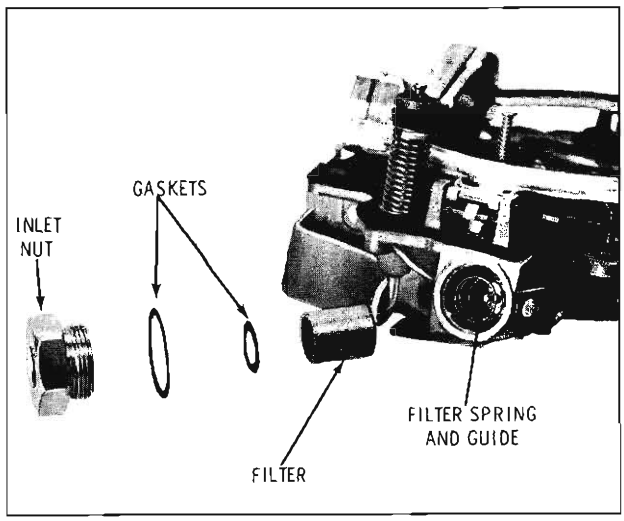


Fig. 4-155 Fuel Inlet Filter

seat gasket and filter screen from the secondary side of the air horn. Do not remove the float balance spring unless it is distorted and needs replacement.

13. Remove the air horn gasket.

14. Remove the power piston assembly by depressing the stem and allowing it to snap back into position.

15. Remove the pump plunger assembly by removing the retainer and sliding the shaft through the seal. Remove the seal from the top side of the air horn casting.

Disassembly of Float Bowl

1. Remove the fast idle cam attaching screw. (Fig. 4-153)

2. Remove the three choke cover attaching screws and retainers, then remove the choke cover, gasket and baffle from the choke housing. (Fig. 4-156)

3. Remove the piston lever attaching screw and remove piston and lever.

4. Remove the two choke housing attaching screws, then remove the choke housing and linkage from the carburetor body.

5. Remove the intermediate choke lever and shaft with linkage from the choke housing, then remove choke housing gasket.

6. Remove the throttle dashpot and switch assembly as a unit by removing the attaching screw.

7. Remove the three attaching screws and lockwashers from the venturi cluster on the primary side, then remove the cluster and gasket. (Fig. 4-157)

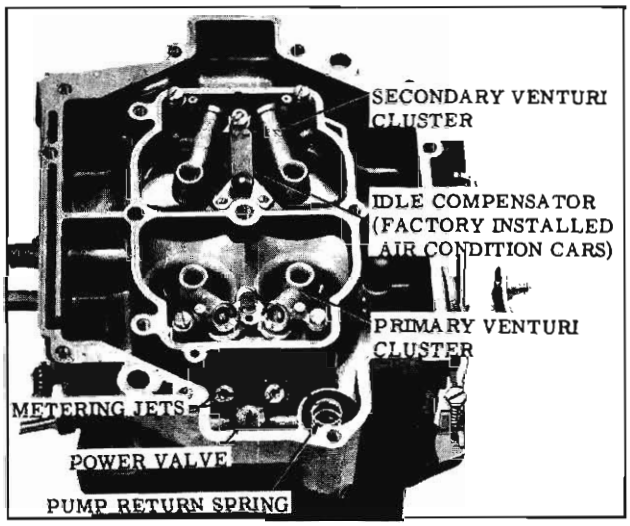


Fig. 4-157 Float Bowl Assembly

8. Remove the three attaching screws and lockwashers from the venturi cluster on the secondary side, then remove the cluster and gasket.

9. Remove the idle compensator attaching screws, then remove the idle compensator and gasket.

10. Remove both metering jets from the primary (pump) side of the carburetor body.

11. Remove the power valve and gasket.

12. Remove both metering jets from the secondary side of the carburetor. Keep them in a separate group.

13. Remove the pump return spring from the pump well, then invert the carburetor body to

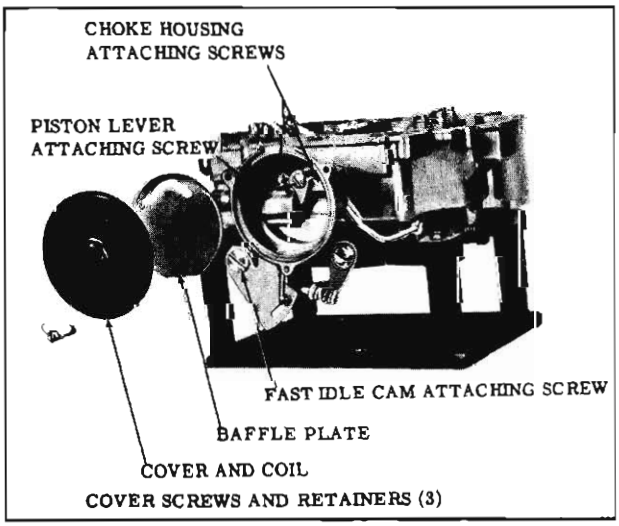


Fig. 4-156 Choke Assembly and Fast Idle Cam

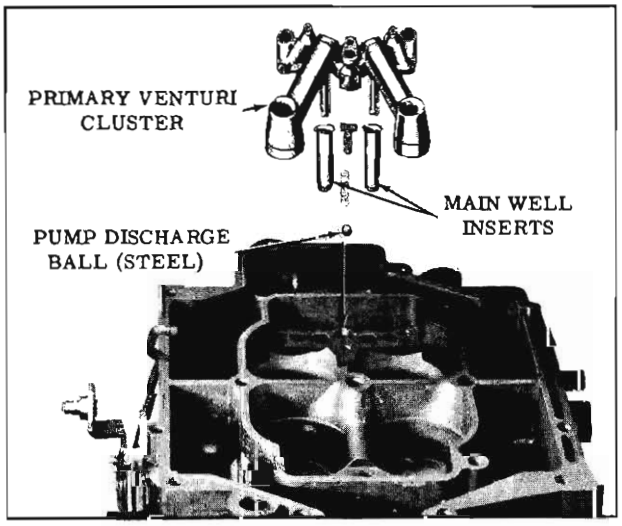


Fig. 4-158 Pump Discharge and Cluster

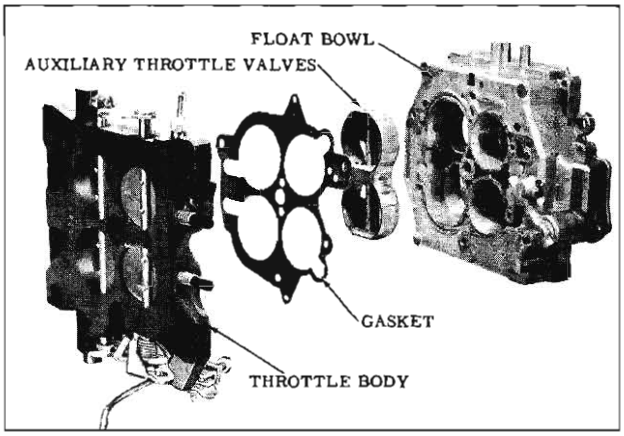


Fig. 4-159 Auxiliary Throttle Valve

remove the aluminum pump inlet ball from the well.

14. Remove the small T-shaped pump discharge spring guide with needle nose pliers, then remove the small spring and steel ball. (Fig. 4-158)

15. If it is necessary to clean or replace the small screen next to the pump plunger bore, remove the retainer ring and screen.

16. Invert the carburetor body and remove the four throttle body attaching screws. Remove the throttle body and gasket. (Fig. 4-159)

17. Remove the secondary auxiliary throttle valve assembly from the carburetor body.

Disassembly of the Throttle Body

NOTE: No attempt should be made to remove the throttle valve or shaft from the throttle body as it may be impossible to reassemble the throttle valves correctly in relation to the vacuum advance and idle discharge orifices.

The idle mixture needle screws may be removed for cleaning or replacement. Also the slow and fast idle speed screws can be removed if necessary.

CLEANING OF PARTS

The carburetor should not be cleaned in any solution other than a cold immersion type cleaner.

1. Thoroughly clean carburetor castings and metal parts in carburetor cleaning solvent.

   CAUTION: The choke coil, housing and pump plunger should not be immersed in solvent. Clean pump in clean gasoline only.

2. Blow all passages in casting dry with compressed air. DO NOT PASS DRILLS THROUGH JETS OR PASSAGES.

3. Clean filter screens of dirt or lint. If the filter screens are distorted or plugged, they should be replaced.

INSPECTION OF PARTS

1. Check floats for dents or excessive wear at hinge pin holes.

2. Shake floats to check for leaks.

3. Examine float needle and seat. If grooved, replace with a factory matched float needle, seat and gasket assembly.

4. Inspect the idle mixture adjusting needles for burrs or ridges. Replace if necessary.

5. Inspect the upper and lower surfaces of the carburetor body to see that the small sealing beads are not damaged. Damaged beading may result in air or fuel leaks at that point.

6. Inspect holes in pump rocker arm, fast idle cam and throttle shaft lever. If holes are worn excessively or out-of-round to the extent of improper operation of the carburetor, worn parts should be replaced.

7. Inspect the steps on the fast idle cam for excessive wear. If excessive wear is noted, cam should be replaced to assure proper engine operation during the warm-up and choking periods.

8. Inspect the pump plunger cups for cracks or creases. If the pump plunger cups are damaged, replace the pump plunger as a complete assembly.

9. Inspect the throttle body assembly. Make sure the idle passages and vacuum channels are clean.

10. Inspect filter and screens. If screens or filter are distorted or plugged, they should be replaced.

As mentioned during the disassembly of the carburetor, there is a very close tolerance fit of the throttle valves in the throttle body. Also the idle discharge orifices are drilled in relation to a properly fitting valve. Therefore, if the throttle valves, levers or shafts are worn excessively or damaged, a complete throttle body assembly is required.

ASSEMBLY

Throttle Body

1. Install the idle mixture needles and springs finger tight. Back out the needles 1-1/2 turns as a preliminary idle adjustment.

2. If removed, install the slow and fast idle screws in the throttle levers.

Float Bowl

1. With the carburetor body in the inverted position, install the auxiliary throttle valve assembly so that the calibrated spring operating pin is down. (Fig. 4-159)

2. Position the throttle body gasket on the float bowl so that all holes are properly aligned.

3. Place the throttle body on the float bowl and install the four attaching screws. Tighten the center screw 9 to 10 ft. lbs. and the outer screws 3 to 4 ft. lbs.

4. Place the float bowl upright on the holding stand.

5. Install the pump outlet steel ball, spring and T-shaped guide in the center hole of primary venturi cluster mounting surface in float bowl. (Fig. 4-160)

6. Install the power valve and gasket, and the two primary main metering jets. (Fig. 4-161)

   NOTE: The metering jets have a number stamped on the slotted end. The two jets with the lower number are the primary metering jets.

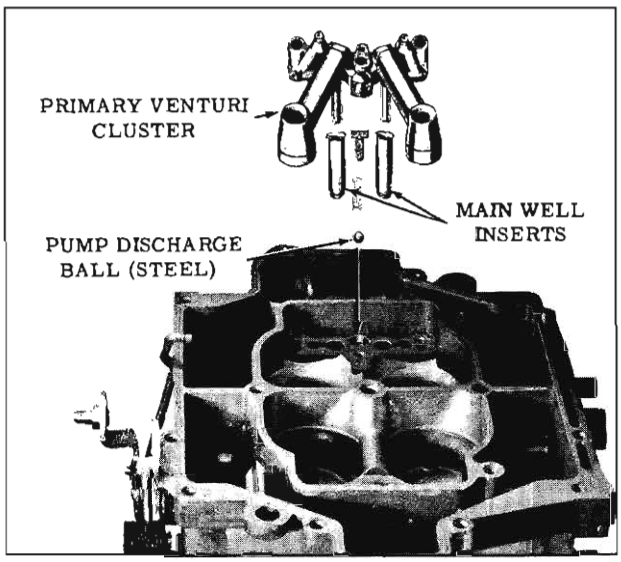


Fig. 4-160 Pump Discharge Parts and Cluster

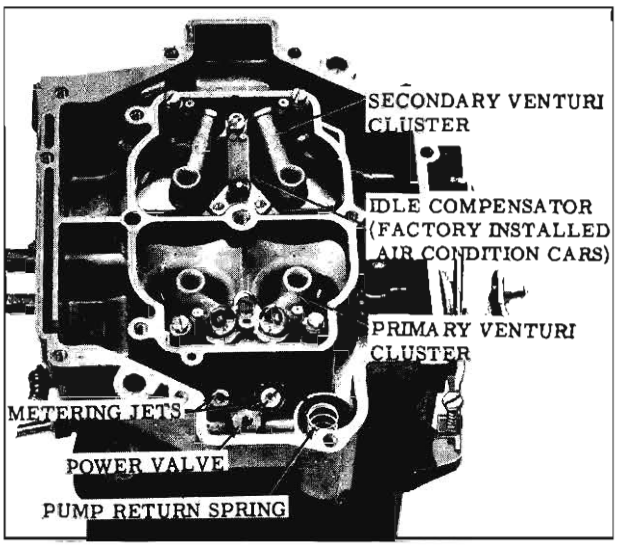


Fig. 4-161 Float Bowl Assembly

7. Install the two secondary main metering jets.

8. Install compensator and gasket and retain with two screws. Make sure the compensator is seated firmly in the passage and tighten screws securely.

9. Install the secondary venturi cluster and gasket and retain with three attaching screws and washers.

   NOTE: The secondary cluster does not have pump discharge nozzles.

10. Install primary venturi cluster and gasket and retain with three attaching screws and lockwashers.

11. Install the pump inlet aluminum ball and the pump return spring in the pump plunger well. Be sure the spring is seated over the ball.

12. Install the pump inlet screen and retainer if removed.

13. Install the choke housing gasket, intermediate choke lever and shaft with linkage in the choke housing. (Fig. 4-162)

14. Install the choke housing on the float bowl and retain with two attaching screws. Be sure the intermediate choke shaft lever is extending downward between the two attaching screw bosses.

15. Install the choke lever, link and piston assembly and attach lever to the intermediate choke shaft.

    NOTE: The choke piston pin hole in the piston should be pointing inward.

16. Install fast idle cam with attaching screw.

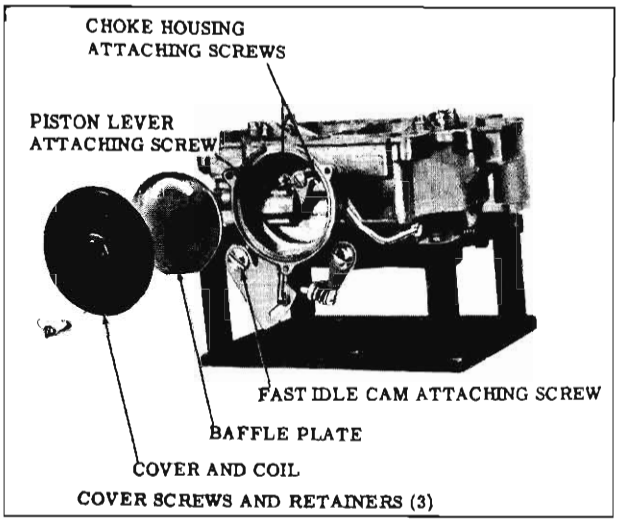


Fig. 4-162 Choke and Fast Idle Cam

Assembly of the Air Horn (Fig. 4-163)

1. Install the power piston in the bore and stake the casting very lightly to hold the piston in place.

2. Install the pump plunger rubber seal in the air horn by inserting the small end through from the bottom. The lips of the seal must be seated on both sides of the cover.

3. Insert the pump plunger shaft through the rubber seal.

4. Position the gasket on the air horn.

5. Install both float needle seats and gaskets, with filter screen on secondary side only using Tool BT-52.

6. Install secondary float assembly on the air horn, retaining in place with hinge pin. Make sure tang on rear of the float arms is over the balance spring.

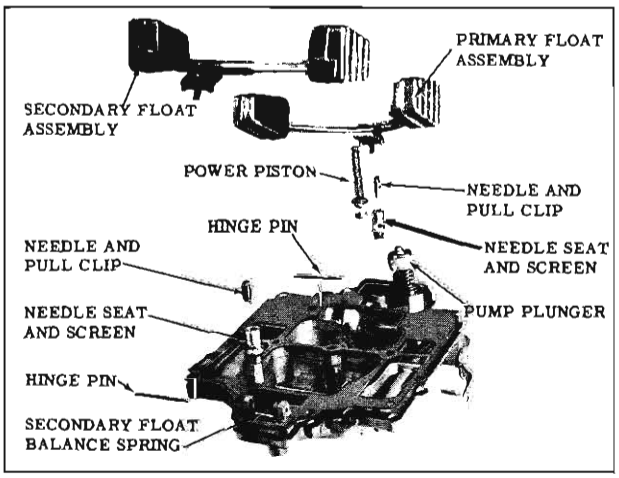


Fig. 4-163 Float Bowl Assembly

7. Install primary float assembly. Make sure tang on rear of the float arms is over the balance spring.

8. Make float adjustments as outlined under FLOAT ADJUSTMENTS.

FLOAT ADJUSTMENTS

Float Level

When checking the primary float level, be sure that the float arms do not rest on the baffles. A minimum of .030" must be maintained between the float arms and the baffles. If the minimum clearance does not exist after the float adjustments are made, it will be necessary to file the float arms.

NOTE: Do not file the baffles.

1. With gasket in place and the air horn inverted, position Gauge BT-6310 as shown in Fig. 4-164.

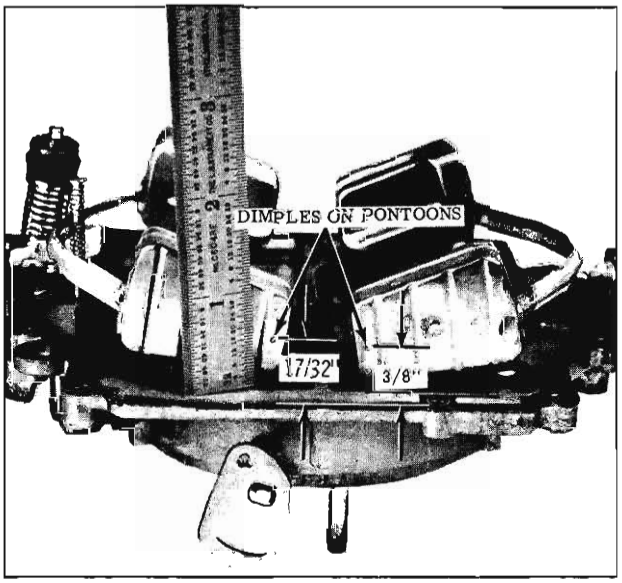


Fig. 4-164 Primary Float Level

2. Measure the dimension from the gasket on the air horn to the dimple on the float pontoon. This dimension should be 1/2" for the primary floats and 3/8" for the secondary floats.

NOTE: The floats must be positioned so that they do not contact the side of the carburetor body.

3. Using the adjustable Gauge BT-6310, check the dimension from the gasket to the highest point of the float pontoons. This dimension should be 1-7/16" for the primary and 1-3/8" for the secondary. (Fig. 4-165)

4. If necessary to adjust, bend the float arm as

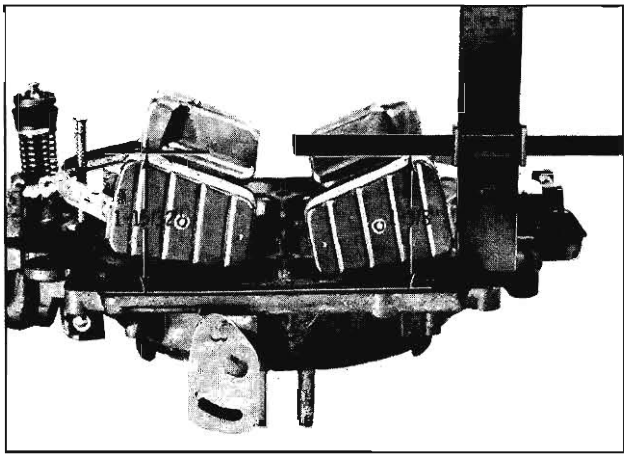


Fig. 4-165 Float Adjustment

indicated in Fig. 4-166.

Float Drop

1. Position the air horn as shown in Fig. 4-167.

2. Bounce the floats lightly and, using Tool BT-6310, measure the distance from the air horn gasket to the dimple on the float pontoon. This distance should be 1-3/8" for the primary and 1-1/8" for the secondary.

3. If an adjustment is necessary, bend the tang at the rear of the float arms toward the needle and seat to decrease the setting; away from the needle and seat to increase the setting.

COMPLETION OF CARBURETOR ASSEMBLY

1. Carefully guide the air horn assembly on the carburetor body so that the pump plunger power valve stem, and floats will not be damaged.

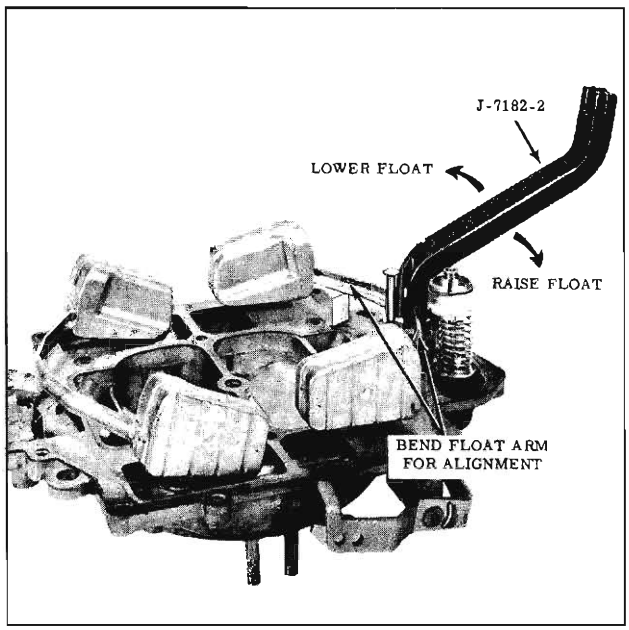


Fig. 4-166 Adjusting Float Arm

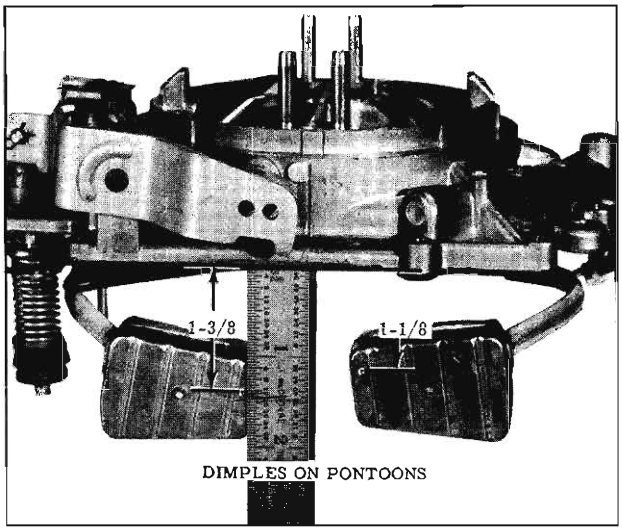


Fig. 4-167 Checking Float Drop

2. Position the vacuum break diaphragm, align the holes in the air horn, gasket, and body and just start the 13 air horn attaching screws.

3. Tighten evenly and securely the inner attaching screws (including the screw through the inner wall), then tighten the remaining outside attaching screws in the same manner.

4. If choke shaft was removed, install the choke shaft in the air horn by inserting it in the hole from the same side as the choke.

   a. Slide the choke valve through the shaft so that the letters "RP" on the valve are facing up when the valve is closed.

   b. Install two new small choke valve-to-shaft attaching screws. Close the choke valve to align choke in air horn, then tighten screws.

5. Install the rubber idle vent valve and shield on top of the air horn. Make sure valve seats properly on air horn.

6. Insert upper end of the pump rod through the outer hole in the pump lever by lifting up on the lever, then install the retainer. Insert pump plunger shaft in pump lever and install retainer.

7. Install the fuel inlet filter, the gasket between inlet nut and the filter, the inlet nut gasket and the inlet nut.

8. Install the choke unloader lever on the choke shaft.

9. Install the intermediate choke rod into the choke lever.

10. Install dashpot and switch assembly.

11. Adjust intermediate choke rod and choke coil as outlined under ADJUSTMENTS (ON OR OFF THE CAR).

12. Adjust fast idle cam rod, secondary lockout, secondary throttle lockout, pump rod and unloader as outlined under ADJUSTMENTS (ON OR OFF CAR).

ADJUSTMENTS (ON OR OFF THE CAR)

Intermediate Choke Rod and Choke Coil Adjustment

The choke vacuum piston must be properly positioned with respect to the vacuum slots in the choke housing bore to provide proper choke pull off action.

1. With the choke cover and baffle removed, position the fast idle screw on the high step of the fast idle cam. Raise the intermediate choke lever to its full up position, then push lightly on the end of choke piston to remove all lash in the linkage; check to see if the choke piston is flush to 1/32" out of the choke piston bore. (Fig. 4-168)

2. Bend the intermediate choke rod if necessary to correctly position choke piston.

3. Position baffle in choke housing, then install cover gasket, cover and coil assembly, and three screws and retainers.

4. Rotate cover counterclockwise until coil picks up tang on piston linkage. Continue rotating cover until scribe line on cover is on index. (Fig. 4-169)

5. Tighten the three cover attaching screws.

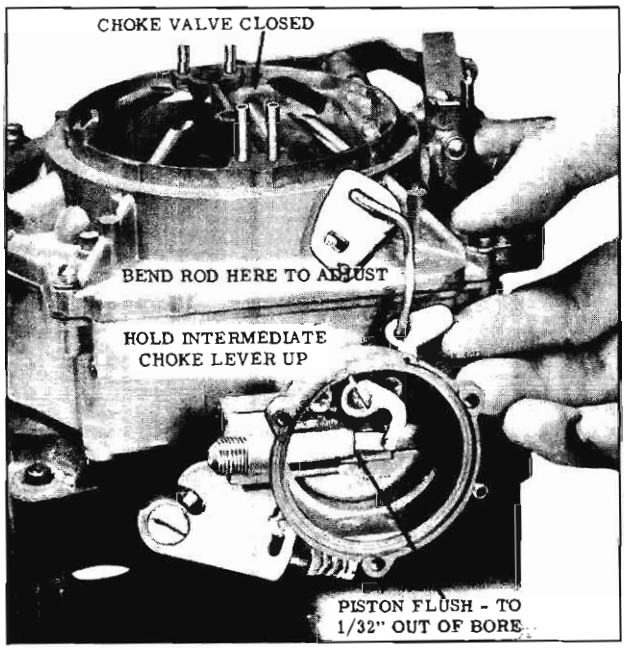


Fig. 4-168 Intermediate Choke Rod Adjustment

Fig. 4-169 Choke Coil Setting

Fast Idle Cam Rod Adjustment

In addition to the intermediate choke rod and choke coil adjustment, it is necessary to adjust the fast idle cam rod to the cam. This insures proper positioning of the fast idle cam when the choke coil is in operation.

1. Turn in the fast idle screw until it just contacts the second step (next to highest step) of the fast idle cam.

2. With the shoulder of the highest step of the fast idle cam held against the fast idle screw, hold the intermediate choke lever in the extreme up position. The intermediate choke rod and the fast idle cam rod must be at the upper limit of travel in the slot to remove all travel. Check the clearance between the top edge of the choke valve and the dividing wall of the air horn. Clearance should be .050". (Fig. 4-170)

3. If necessary to adjust, bend the fast idle cam rod (lower rod).

Secondary Throttle Lockout Adjustment

The secondary throttle lockout prevents opening of the secondary throttle valves until the engine has reached normal operating temperature. Insufficient clearance at the lock point will allow

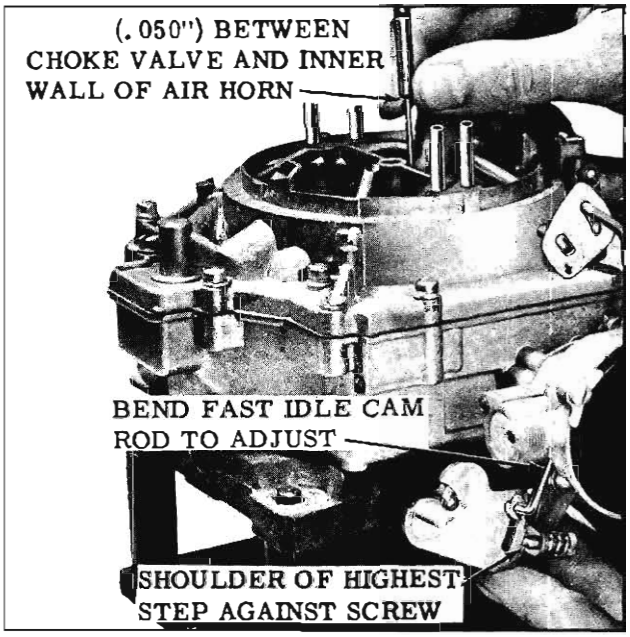


Fig. 4-170 Fast Idle Cam Rod Adjustment

the fast idle cam to strike the tang and prevent the choke from closing.

1. Measure the clearance between the lockout tang and the top edge of the slot in the fast idle cam. The clearance should be .015" ± .005". (Fig. 4-171)
2. If adjustment is necessary, bend the tang sideways using Tool BT-18 until the proper clearance is obtained.

Secondary Throttle Contour Clearance Adjustment

The secondary throttle contour clearance adjustment, which is performed after the lockout adjustment, actually times the unlocking of the secondary throttle valve in relation to engine temperature.

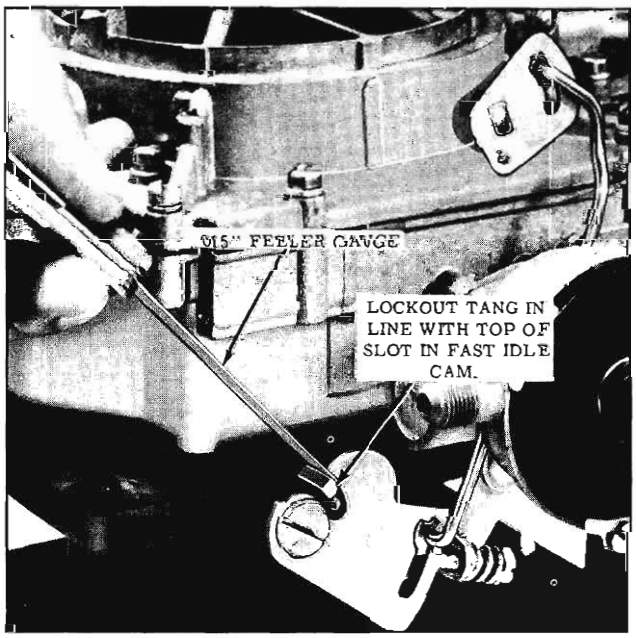


Fig. 4-171 Secondary Throttle Lockout Adjustment

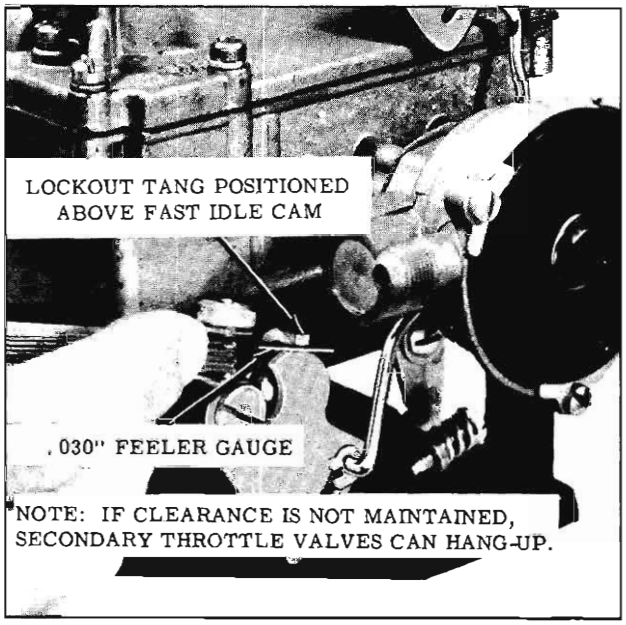


Fig. 4-172 Secondary Throttle Contour Clearance Adjustment

1. Hold the intermediate choke lever in the down position so that the secondary lockout tang is positioned over the fast idle cam, then measure the clearance between the tang and the fast idle cam. The clearance should be .030" ± .010". (Fig. 4-172)
2. If adjustment is necessary, allow the choke to close so that the tang is again in the slot of the fast idle cam, then use Tool BT-91 to bend the tang straight up or down as required for proper clearance.

Pump Rod Adjustment

1. While holding the throttle valves closed, idle speed screw backed out, measure the distance from the top of the air horn casting to the bottom edge of the pump plunger shaft. It should be 1. (Fig. 4-173)
2. If adjustment is necessary, bend the pump rod using Tool BT-18.
3. Operate the pump rod several times to be sure the movement is free.

Unloader Adjustment

If the engine "loads up" or becomes flooded when cold starting, it is necessary to mechanically open the choke valve a small amount to admit more air and facilitate starting. This is

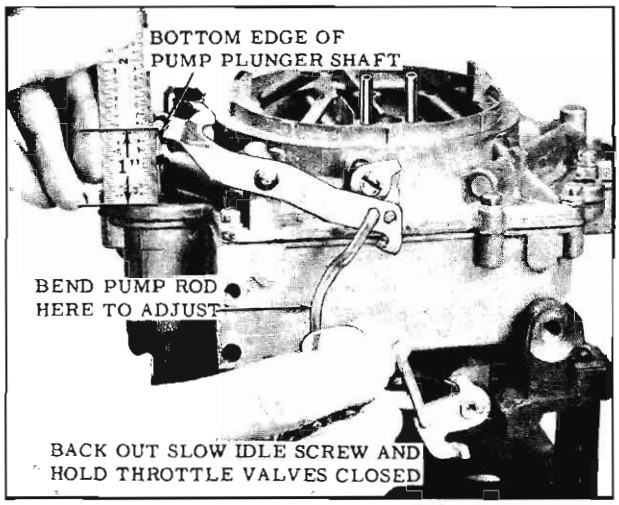


Fig. 4-173 Pump Rod Adjustment

accomplished when the tang on the pump lever contacts a tang on the choke shaft at wide-open throttle.

1. Be sure the pump rod adjustment is correct.

2. While holding the throttle lever in the wide open position (with carburetor off car), or with accelerator pedal completely depressed (with carburetor on car), check the clearance between the top edge of the choke valve and the dividing wall. The correct clearance is .115". (Fig. 4-174)

3. If necessary, bend the small tang on the pump lever with Tool BT-91 to obtain the correct dimension.

IMPORTANT: If the unloader adjustment was made off the car, it will be necessary to recheck the adjustment with the accelerator pedal completely depressed after the carburetor is installed. If the unloader adjustment appears to be incorrect, the throttle linkage adjustment should be checked to insure complete opening of the throttle valves.

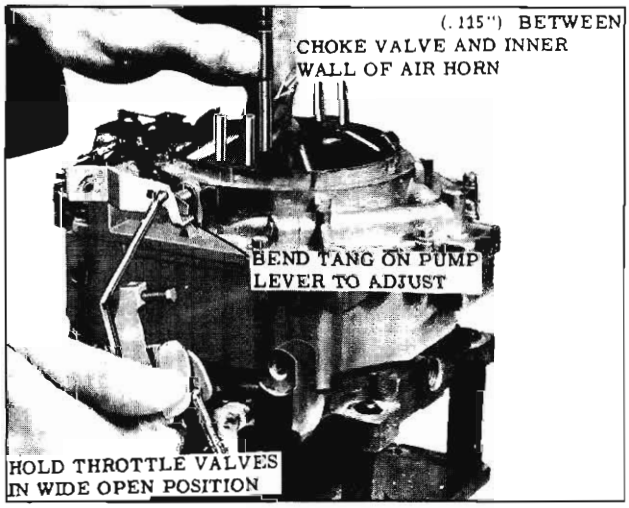


Fig. 4-174 Unloader Adjustment

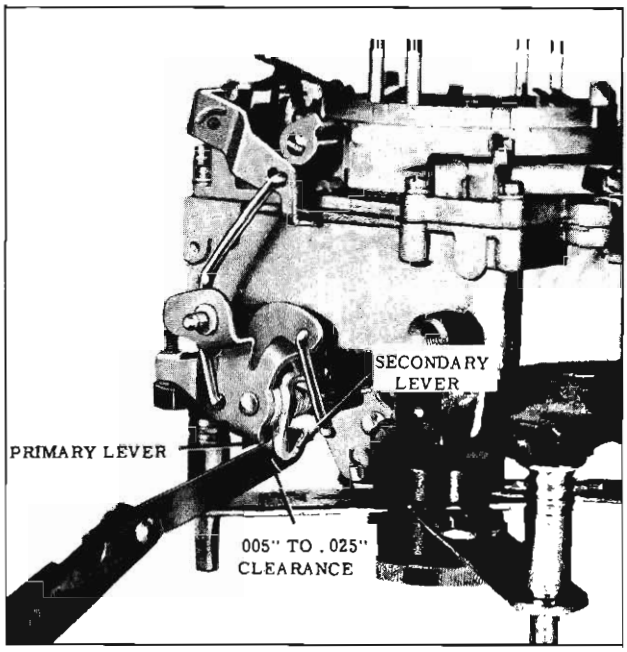


Fig. 4-175 Secondary Actuating Lever Adjustment

Secondary Actuating Lever Adjustment

1. Back out the fast idle adjusting screw until the throttle valves are fully closed. Be sure the fast idle screw is not resting against the fast idle cam.

2. Remove slack from linkage and insert a feeler gauge between the actuating lever and the primary lever. (Fig. 4-175)

3. Clearance should be between .005" and .025".

4. To adjust, open the throttle valves and bend the actuating tang with Bending Tool BT-18.

Vacuum Break Diaphragm Adjustment (Fig. 4-176)

ADJUSTMENTS (ON CAR)

Auxiliary Bellcrank to Carburetor Link Adjustment—Synchromesh and Jetaway

1. Required Conditions

   a. Slow idle screw backed out.

   b. Idle cam positioned so it will not contact idle screw.

   c. Throttle return spring load to be effectively holding throttle lever in "closed bore" position.

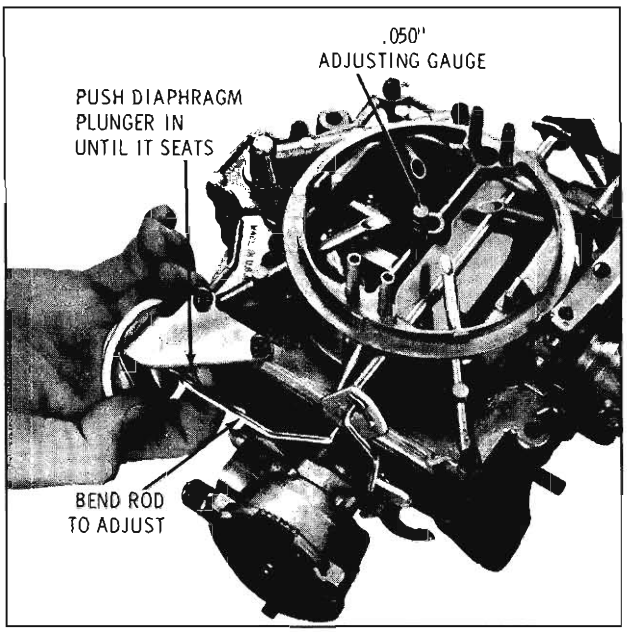


Fig. 4-176 Vacuum Break Diaphragm Adjustment

2. Adjustment

   a. Bend auxiliary bellcrank to carburetor link as required to attain .050" ± .010" clearance between the inner edge of the choke valve and the air horn casting.

Slow Idle Adjustment — Synchromesh and Jetaway

1. Required Conditions

   a. On cars equipped with Jetaway Transmission, dashpot plunger is to be held in so switch circuit will be closed while slow idle is being adjusted.

   b. Engine to be warm.

   c. Air cleaner removed.

   d. Jetaway in "D" or drive range.

2. Adjustments

   a. Adjust slow idle as follows:

Trans.	Air Cond.	Range	RPM
S.M.	Without	N	600
S.M.	With	N	600
J.T.	Without	D	500
J.T.	With	D	550

   NOTE: The idle compensator must be held closed on all carburetors.

   b. After adjusting idle to specified speed, install air cleaner and recheck idle speed. Note speed change. Repeat slow idle adjustment procedure and compensate for speed change due to air cleaner.

Fast Idle Adjustment — Synchromesh and Jetaway

1. Required Conditions

   a. Transmission in neutral.

   b. Throttle return spring load to be effectively holding throttle lever fast idle screw on lowest step of fast idle cam.

   c. Engine to be warm.

2. Adjustment

   a. Set fast idle screw to obtain 1000 RPM

Accelerator Linkage Adjustment — Synchromesh and Jetaway

1. Required Conditions

   a. Slow idle speed properly adjusted.

   b. Throttle return spring effectively holding the carburetor lever in "slow idle" position.

2. Adjustment

   a. Adjust swivel on accelerator lever to auxiliary bellcrank rod to give the proper pedal height dimension. Pedal height dimension is 4 3/32 " from break line of lower vertical and upper tapered surfaces of dash, directly in back of swivel. On 33 series, place gauge flat against dash. Use six inch scale to make measurement.

Slow Idle Dashpot and Switch Adjustment — Jetaway Only

1. Required conditions

   a. Slow idle to be properly adjusted.

   b. Fast idle cam positioned to allow throttle return spring to hold carburetor lever in "slow idle" position.

   c. Dashpot adjusted away from carburetor lever.

   d. Ignition switch turned on.

e. Test light connected to black lead terminal on throttle, switch and ground.

2. Adjustment

a. By turning clipped nut on bracket, adjust dashpot into carburetor lever until test light comes on. Then turn nut one complete turn more and tighten locknut.

Throttle Switch Adjustment — Jetaway Only

1. Required Conditions

a. Auxiliary bellcrank to carburetor link properly adjusted.

b. Throttle switch and link assembly adjusted short.

c. Ignition switch turned on and engine not running.

d. Test light connected to white lead terminal on throttle switch and ground.

2. Adjustment

a. Hold a .040" shim in front of the wide open throttle stop on the throttle body.

b. Open carburetor by pulling on accelerator lever to auxiliary bellcrank rod until tang on carburetor lever stops against shim.

c. With carburetor held in this position, lengthen link and switch assembly by turning switch plunger until test light comes on. Tighten locknut.

NOTE: This adjustment can only be made by lengthening switch assembly. If necessary to shorten switch assembly, let carburetor return to idle. Shorten beyond necessary amount, and then repeat procedure of opening carburetor to shim and lengthening switch and link assembly.

Atmospheric Idle Vent Adjustment

The atmospheric idle vent is designed to vent any vapor formed in the float bowl during slow idle operation. It is opened by a tang on the pump lever whenever the throttle valves are in the slow idle position.

1. Place gauge as shown in Fig. 4-177.

2. With the throttle valves open far enough so that the vent valve just closes, the vertical scale should just touch the bottom of the pump rod. Set scale at 29/32".

3. To adjust, bend the tang on the pump lever.

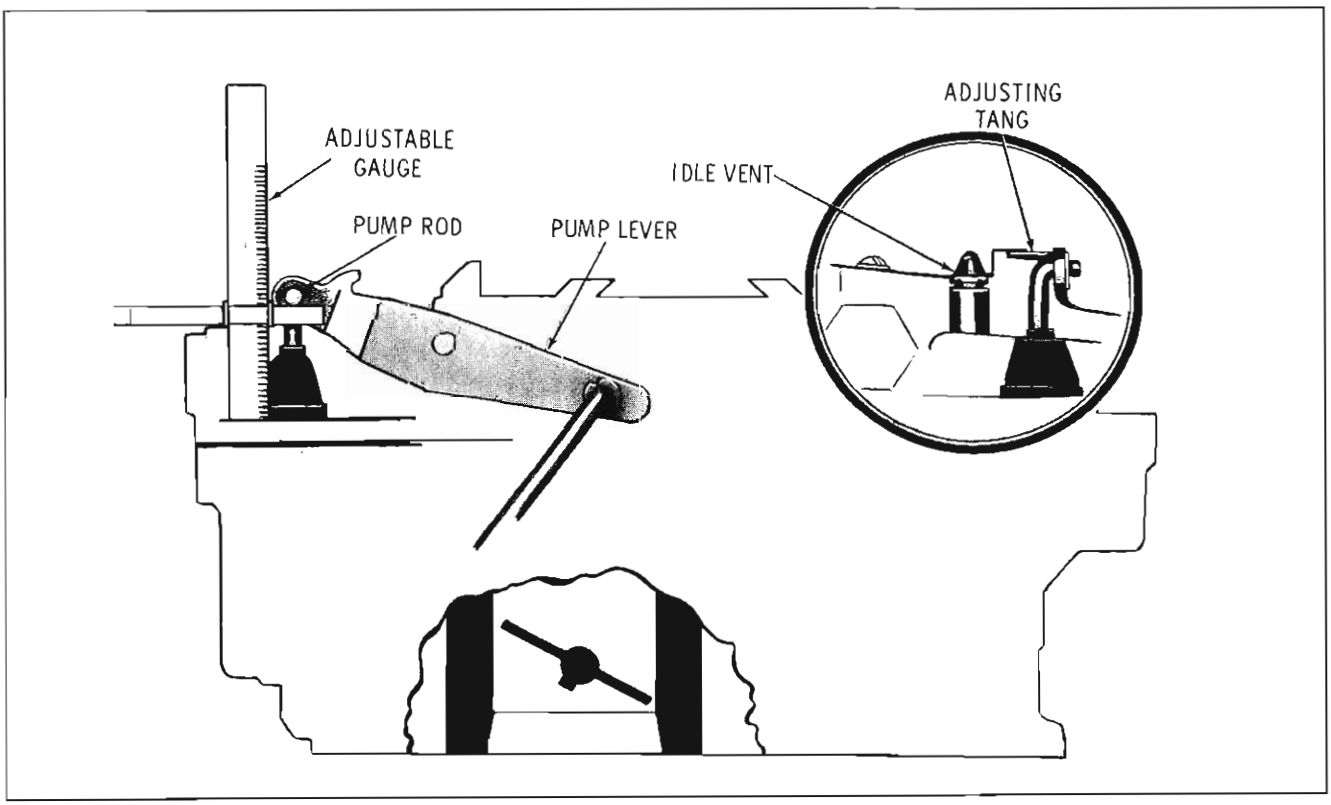
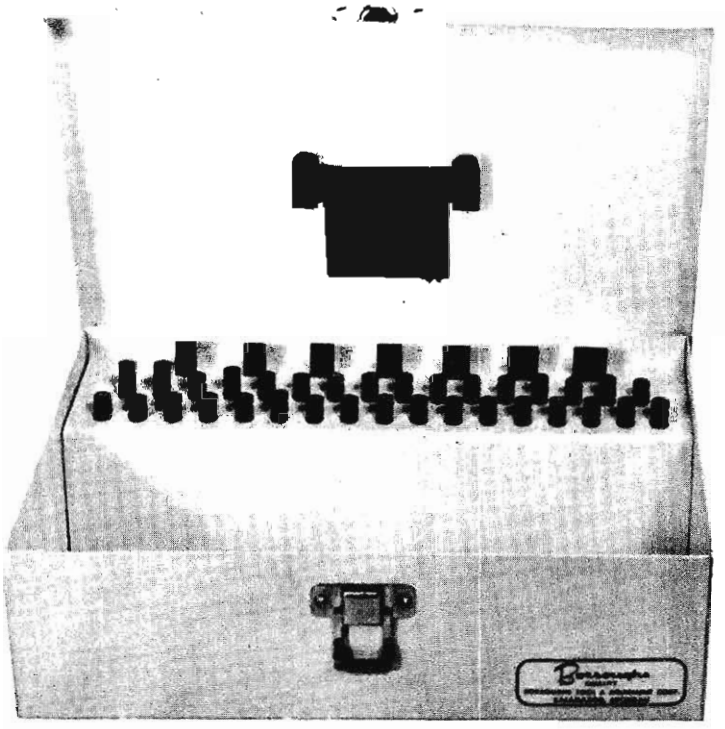
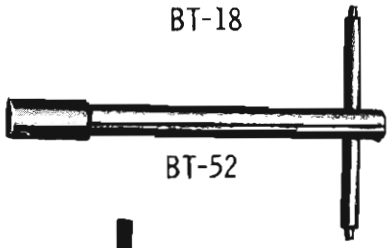


Figure 4-177 Idle Vent Adjustment (4GC)

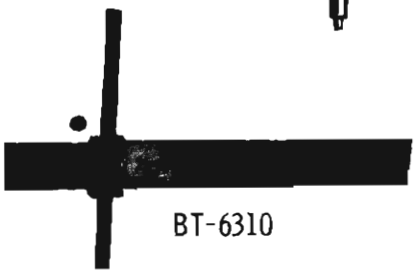


BT-3005

BT-18



BT-52



BT-6310

J-7182-2

BT-18	BENDING TOOL - PUMP ROD
BT-52	FLOAT NEEDLE SEAT REMOVER
BT-3005	UNIVERSAL CARBURETOR ADJUSTING KIT
BT-6310	CARBURETOR FLOAT GAUGE
J-7182-2	BENDING TOOL - FLOAT AND VACUUM ASSIST TANG 4GC

Fig. 4-178 Carburetion Tools

ENGINE TUNE-UP

(ALL SERIES)

CONTENTS OF SECTION 5

ENGINE TUNE-UP

To maintain the most satisfactory engine performance, it is recommended that the following items be performed every 12,000 miles: Service the spark plugs and ignition points, check the timing, idle mixture, slow and fast idle speed.

SPARK PLUGS

1. Remove foreign material from around the spark plug holes and remove the spark plugs.
2. Clean exterior of plugs and inspect for cracked insulators or excessively burned electrodes.

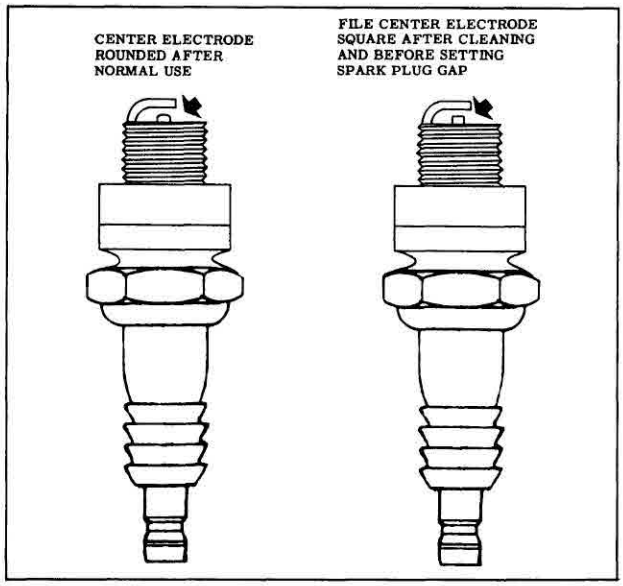


Fig. 5-1 Filing Center Electrode

3. Clean all serviceable plugs with an abrasive type cleaner. File center electrode flat. (Fig. 5-1) Do not file center electrode on new plugs.
4. Adjust spark plug gap to .030" using a round feeler gauge.
5. Install plugs using new gaskets and torque 35 ft. lbs.

DISTRIBUTOR CONTACT POINTS

1. Inspect points, check for excessive burning or pitting. Replace if necessary.
2. Remove scale from points with a fine cut contact point file. Do not attempt to remove all roughness.
3. Apply a film of cam and ball bearing lubricant or equivalent to the breaker cam.

DWELL ANGLE

1. Calibrate dwell meter to set line and connect one lead of dwell meter to the primary distributor lead terminal and the other lead to ground.
2. With engine running at idle speed, insert Dwell Adjusting Tool J-6296 or BT-1501 through distributor window into the head of the adjusting screw. (Fig. 5-2) Adjust dwell angle to 30°.

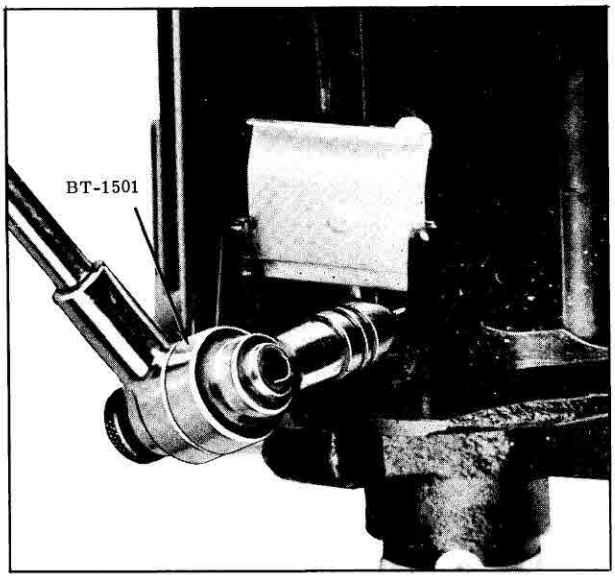


Fig. 5-2 Adjusting Dwell Angle

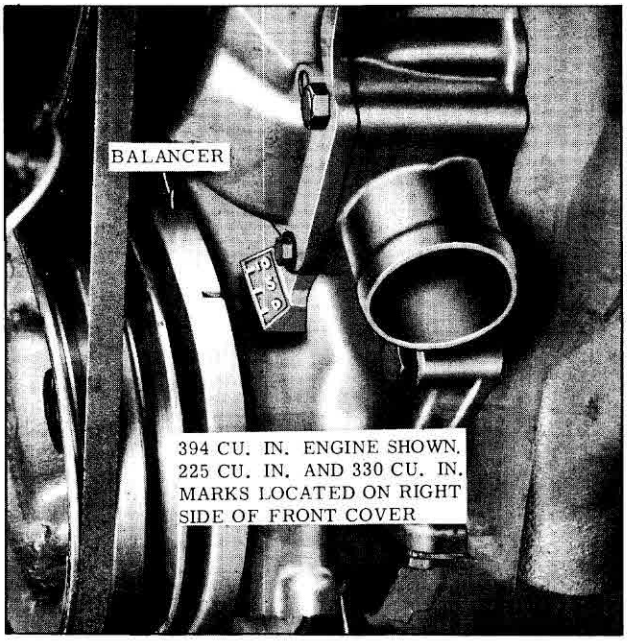


Fig. 5-3 Timing Marks

IGNITION TIMING

The ignition timing marks are located on the engine front cover. A saw slot on the balancer indicates engine top dead center. (Fig. 5-3)

To adjust ignition timing, proceed as follows:

1. Disconnect distributor vacuum line at carburetor and cover fitting with tape.

2. Adjust engine speed to 850 rpm.

3. With the use of a timing light set timing according to chart. To adjust the ignition timing loosen the distributor clamp bolt and rotate the distributor.

   NOTE: If a tuned engine detonates with this setting, the cause is low octane fuel or excessive carbon build-up in the combustion chamber. If these factors are not corrected, the timing should be retarded 2-1/2° from the specified settings. In areas that have an extra high octane, the timing may be advanced beyond the specified setting providing spark knock is not encountered.

4. Tighten the distributor clamp bolt and recheck timing to make sure distributor was not moved during tightening of bolt.

5. Remove tape and connect distributor vacuum advance line.

SLOW IDLE ADJUSTMENT

With the engine at normal operating temperature, Throttle Return Check Holding Fixture J-6342 in place, and air cleaner removed, adjust slow idle as outlined in chart. Tool BT-1501 can be used to turn idle mixture adjusting screws.

After the idle rpm is stabilized, turn in or out each idle adjusting screw until the smoothest possible idle is obtained. This is normally accompanied by a higher manifold vacuum reading and/or an increase in idle rpm. Then turn out each needle 1/4 turn, at which time both vacuum and idle rpm will drop off slightly.

NOTE: It may be necessary to readjust idle speed and mixture after air cleaner is installed on car.

When setting idle speed and mixture on carburetors with an idle compensator (factory installed air conditioning only), make sure the idle compensator is closed by holding it down with a pencil or other suitable tool. If the idle speed increases when the air cleaner is installed, do not reduce idle speed setting since the idle compensator is open. If idle speed decreases, readjust to correct rpm.

ROAD TEST

Road test car thoroughly. Check engine performance at HIGH SPEED, LOW SPEED and IDLE. After road test is complete, inspect engine for oil and coolant leaks.

If car does not perform properly after the plugs and points have been serviced and the timing, idle mixture, slow and fast idle speed have been checked and adjusted, additional possible causes are as follows:

IGNITION SYSTEM

1. High resistance in spark plug cables (Refer to MILLIAMP TEST - ELECTRICAL SECTION).
2. Loose or faulty primary ignition wiring or connections.
3. High resistance in ignition system (Refer to ELECTRICAL SECTION).
4. Distributor mechanical advance mechanism binding or sticking.
5. Distributor vacuum advance unit leaking vacuum.

FUEL SYSTEM

1. Carburetor float level adjusted too low or too high or leak at float needle seat.
2. Dirt and/or corrosion in carburetor fuel or air passages.
3. Low capacity fuel pump. (See ENGINE SECTION).
4. Plugged fuel filter.
5. Water in fuel filter bowl.

Careful examination of the carburetor and fuel system should reveal defects if present. Always be ACCURATE with the carburetor adjustments.

VALVE SYSTEM

1. Sticking valve due to carbon and/or varnish deposits.
2. Broken or weak valve springs.
3. Warped, cracked or burned valve.
4. Valve not seating correctly.
5. Faulty hydraulic valve lifter.
6. Bent push rod, push rod worn excessively or push rod seat worn in rocker arm.
7. Incorrect valve timing.

COMPRESSION TEST

CAUTION: The 30-31 & 32 series have a revised ignition system whereby the ignition resistor is by-passed during cranking through a contact in the starter instead of through a contact in the ignition switch.

With this system, the starter must not be energized when the ignition switch is in the "off" or "lock" position. In these positions, the ignition system primary is grounded in the ignition switch. Energizing the starter will cause damage to the ground contact in the ignition switch and to the ignition contact in the starter solenoid.

To determine if the valves or pistons are at fault, a test should be made to determine the cylinder compression pressure. When checking cylinder compression, the throttle and choke should be open, all spark plugs removed, and the battery at or near full charge. The lowest reading cylinder should not be less than 80% of the highest, and no cylinder reading should be less than 100 pounds.

NORMAL - Compression builds up quickly and evenly to specified compression on each cylinder.

PISTON RINGS - Compression low on first stroke tends to build up on following strokes but does not reach normal. Improves considerably with addition of oil.

VALVES - Low on first stroke does not tend to build up on following strokes. Does not improve much with addition of oil.

MISCELLANEOUS CAUSES

1. Restricted exhaust system.
2. Pre-ignition, due to carbon deposits in the combustion chamber.
3. Poor ground connection between engine and frame or body.
4. Malfunctioning manifold heat control valve. (Refer to ENGINE SECTION)