1965

CHEVROLET CHEVELLE CHEVY II

CHASSIS SERVICE MANUAL

1965
CHEVROLET • CHEVELLE
CHEVY II

CHASSIS
SERVICE MANUAL

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FOREWORD

This manual includes procedures for maintenance and adjustments, minor service operations, removal and installation for components, except the body, of Chevrolet, Chevelle and Chevy II passenger vehicles. Procedures involving disassembly and assembly of major components for these vehicles are contained in the 1965 Chassis Overhaul Manual. Service information for 1965 body items is contained in the 1965 Body Service Manual.

The Section Index on this page enables the user to quickly locate any desired section. At the beginning of each section containing more than one major subject is a Table of Contents, which gives the page number on which each major subject begins. An Index is placed at the beginning of each major subject within the section.

Summaries of Special Tools, when required, are found at the end of major sections while specifications covering vehicle components are presented at the rear of the manual.

This manual should be kept in a handy place for ready reference. If properly used, it will enable the technician to better serve the owners of Chevrolet built vehicles.

All information, illustrations and specifications contained in this literature are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

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CHEVROLET MOTOR DIVISION
General Motors Corporation
DETROIT, MICHIGAN

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Printed in U.S.A.

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GENERAL INFORMATION AND LUBRICATION

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GENERAL INFORMATION

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	15369	15469	4-Door Sedan, 6-Passenger
	15335	15435	4-Door Station Wagon, 2-Seats
BEL AIR	15511	15611	2-Door Sedan, 6-Passenger
	15569	15669	4-Door Sedan, 6-Passenger
	15535	15635	4-Door Station Wagon, 2-Seats
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IMPALA	16369	16469	4-Door Sedan, 6-Passenger
	16339	16439	4-Door Sports Sedan, 6-Passenger
	16337	16437	2-Door Sport Coupe, 5-Passenger
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IMPALA SS	16537	16637	2-Door Sport Coupe, 4-Passenger
	16567	16667	2-Door Convertible, 4-Passenger

VEHICLE DIMENSIONS—CHEVROLET

Pertinent dimensions for the different models are shown in the following chart.

Model	Sedan	2-Door Sport Coupe	Convertible Coupe	Station Wagon
Length Overall	213.0"	213.0"	213.0"	213.3"
Width Overall (Body)	79.6"	79.6"	79.6"	79.6"
Height Overall	55.4"	54.1"	55.1"	55.4"
Wheelbase	119.0"	119.0"	119.0"	119.0"
Tread-Front.	62.5"	62.5"	62.5"	63.5"
Tread-Rear	62.4"	62.4"	63.4"	63.4"
Curb Weight: Approximately 3525 lbs. 4 Dr. Sedan with L-6 engine; 3685 lbs. with V-8 engine.				

MODEL IDENTIFICATION—CHEVELLE

Series	Model Number		Description
	6 Cyl.	V-8	
CHEVELLE 300	13111 13169 13115	13211 13269 13215	2-Door Sedan, 6-Passenger 4-Door Sedan, 6-Passenger 2-Door Station Wagon, 2-Seat
CHEVELLE 300 DELUXE	13311 13369 13335	13411 13469 13435	2-Door Sedan, 6-Passenger 4-Door Sedan, 6-Passenger 4-Door Station Wagon, 2-Seat
MALIBU	13569 13537 13567 13535	13669 13637 13667 13635	4-Door Sedan, 6-Passenger 2-Door Sport Coupe, 5-Passenger 2-Door Convertible, 5-Passenger 4-Door Station Wagon, 2-Seat
MALIBU SS	13737 13767	13837 13867	2-Door Sport Coupe, 4-Passenger 2-Door Convertible, 4-Passenger
EL CAMINO	13380 13580	13480 13680	2-Door Sedan Pickup, 3-Passenger Reg. 2-Door Sedan Pickup, 3-Pass. Deluxe

VEHICLE DIMENSIONS—CHEVELLE

Pertinent dimensions for the different models are shown in the following chart.

Model	Sedan	2-Door Sport Coupe	Convertible Coupe	Station Wagon	Sedan Pickup
Length Overall	196.6"	196.6"	196.6"	201.4"	196.6"
Width Overall (Body)	74.6"	74.6"	74.6"	74.6"	74.6"
Height Overall	53.2"	52.8"	52.9"	55.1"	53.2"
Wheelbase	115.0"	115.0"	115.0"	115.0"	115.0"
Tread-Front	58.0"	58.0"	58.0"	58.0"	58.0"
Tread-Rear	58.0"	58.0"	58.0"	58.0"	58.0"
Curb Weight: Approximately 3055 lbs. 4 Dr. Sedan with L-6 Engine 3210 lbs. with V-8 engine.					

MODEL IDENTIFICATION—CHEVY II

Series	Model Number			Description
	L-4	6 Cyl.	V-8	
100	11111	11311	11411	2-Door Sedan, 6-Passenger
	11169	11369	11469	4-Door Sedan, 6-Passenger
		11335	11435	4-Door Station Wagon, 2-Seat
NOVA		11569	11669	4-Door Sedan, 6-Passenger
		11537	11637	2-Door Sport Coupe, 5-Passenger
		11535	11635	4-Door Station Wagon, 2-Seat
NOVA SS		11737	11837	2-Door Sport Coupe, 4-Passenger

VEHICLE DIMENSIONS—CHEVY II

Model	Sedan	2-Door Sport Coupe	Station Wagon
Length Overall	182.9"	182.9"	187.6"
Width Overall (Body)	69.9"	69.9"	69.9"
Height Overall	55.0"	54.0"	55.1"
Wheelbase	110.0"	110.0"	110.0"
Tread-Front	56.8"	56.8"	56.3"
Tread-Rear	56.3"	56.3"	55.8"
Curb Weight: Approximately 2640 lbs. 4-Door Sedan with L-4 engine; 2735 lbs. with L-6 engine; 2930 with V-8 engine.			

UNIT AND SERIAL NUMBER LOCATIONS

For the convenience of servicemen when writing up certain business papers, such as L. & M.R.'s Product Information Reports, or reporting product failures in any way, we are showing below the location of various unit numbers. These unit numbers and their prefixes and suffixes are necessary on these papers for various reasons--such as accounting, follow-up on production, etc.

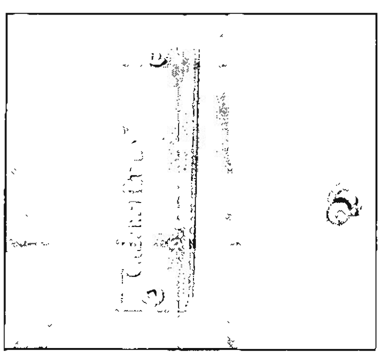


Fig. 1—Vehicle Serial Number Located on Left Front Hinge Pillar—Chevrolet Shown

Fig. 2—Four and Six Cylinder Engine Unit Number Located on Pad at Right Hand Side of Cylinder Block at Rear of Distributor

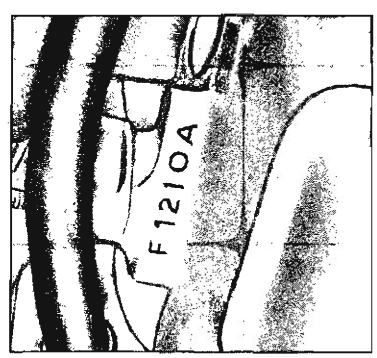


Fig. 3—Eight Cylinder Engine Unit Number Located on Pad at Front, Right Hand Side of Cylinder Block

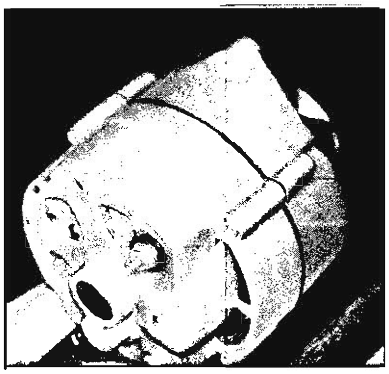


Fig. 4—Delcotron Unit Serial Number

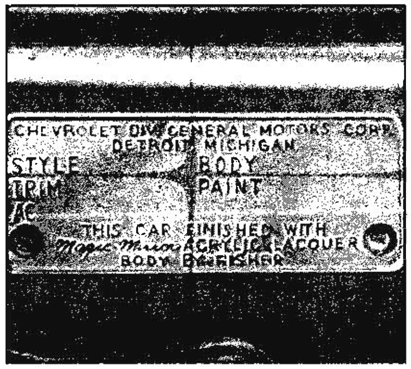


Fig. 5—Body Style, Body Number Trim Type and Paint Combination Located on Upper Right Hand Side of the Cowl Panel—Chevrolet

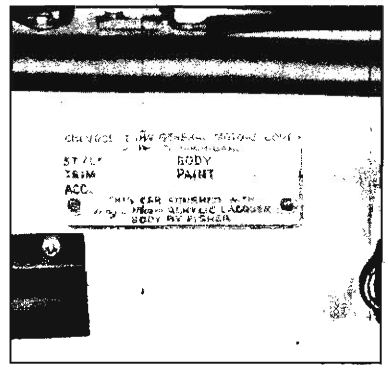


Fig. 6—Body Style, Body Number, Trim Type and Paint Combination Located on the Upper Left Hand Side of the Dash Panel—Chevelle

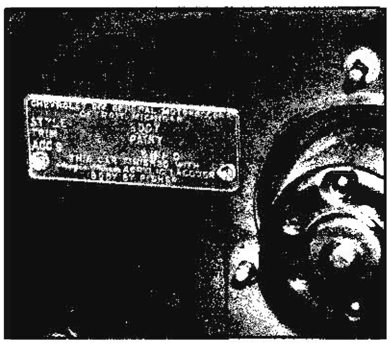


Fig. 7—Body Style, Body Number, Trim Type and Paint Combination Located on the Upper Right Hand Part of the Dash Panel—Chevy II

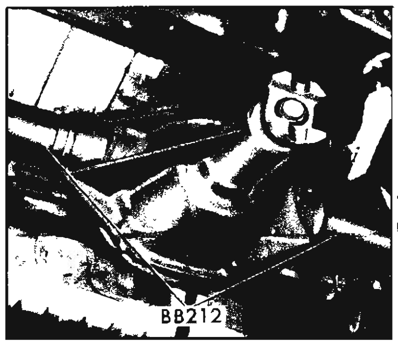


Fig. 8—Rear Axle Serial Number Located on Right or Left Axle Tube Adjacent to Carrier

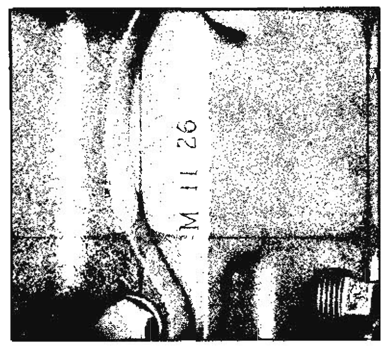


Fig. 9—3-Speed Transmission Unit Number Located on Rear Face of Case in the Upper Right Corner

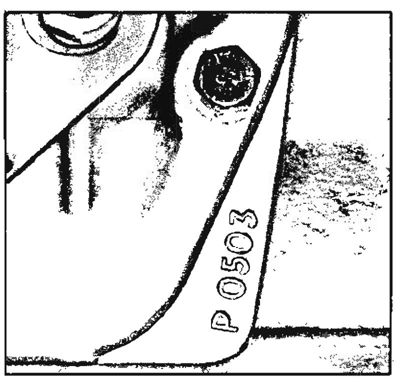


Fig. 10—4-Speed Transmission Source Data Code is Located On Left Side of Case at Lower Rear of Cover Flange

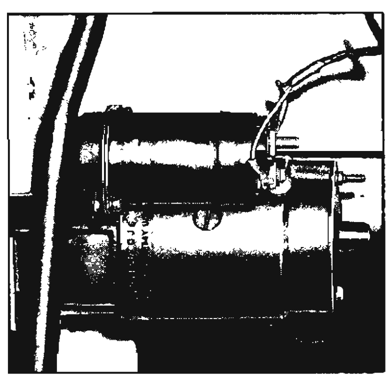


Fig. 11—Starter Serial Number and Production Date Stamped on Outer Case, Toward Rear

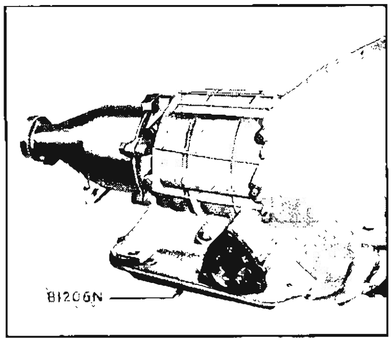


Fig. 12—Powerglide Transmission Unit Number Located on Bottom of Oil Pan

The prefixes on certain units identify the plant in which the unit was manufactured, and thereby permits proper follow-up of the plant involved to get corrections made when necessary.

Engine Number

The engine number (figs. 2 and 3) shows manufacturing plant, month and day of manufacture, and transmission type. A typical engine number would be F1210A, which would breakdown thus:

F--Manufacturing Plant (F--Flint, T--Tonawanda)
12--Month of manufacture (December)
10--Day of manufacture (tenth)
A--Transmission type

Vehicle Serial Number

A typical vehicle serial number tag (fig. 1) yields manufacturers identity, vehicle type, model year, assembly plant and production unit number when broken down as shown in the following chart.

Manufacturer Identity [1]	Body Style [2]	Model Year [3]	Assembly Plant [4]	Unit Number [5]
1	5645	5	F	100025

1. Manufacturers identity number assigned to all Chevrolet built vehicles.
2. See Model Identification in this section.
3. Last number of model year (1965)
4. F-Flint
5. Unit numbering will start at 100,001 at all plants.

KEYS AND LOCKS

Two keys are provided with each vehicle. The octagonal-end key operates the ignition switch and front door locks. The round-end key operates the locks for the glove box and rear compartment lid.

Lock cylinders are furnished for service uncoded, this necessitates the coding of all replacement lock cylinders.

The side bar type lock (fig. 14) is used for the ignition, door, and trunk lid on passenger cars. Glove compartment locks are wafer tumbler single bitted type having 4 tumblers on passenger cars. To protect owners, automobile lock manufacturers stamp the lock numbers on the lock core, shaft, etc., where they will not show until the lock is removed.

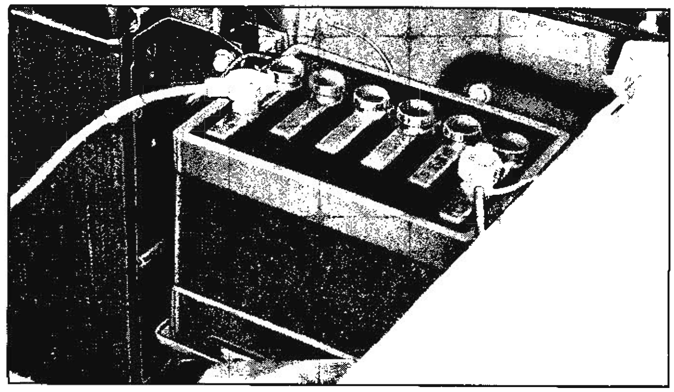


Fig. 13—Battery Code Number Located on Cell Cover Segment, Top of Battery

To obtain the code number remove the door lock, the key number may be obtained from the lock core, shaft, etc., which will be the same on all of the other locks.

In addition, when a lock cylinder requires replacement the lock code number may be obtained either from the key, if available, or from old lock cylinder which is being replaced.

Once the code number of the lock is obtained, look up this number in a key cutting book. There are two types of code booklets in general use, one which lists the cutting code by letter C, N, B and Y. Numbers or letters are always recorded from the head of the key to the end.

Numbers may be transposed to letters to numbers as follows:

Code Book-Numbers	Code Book-Letters
1	C
2	N
3	B
4	Y

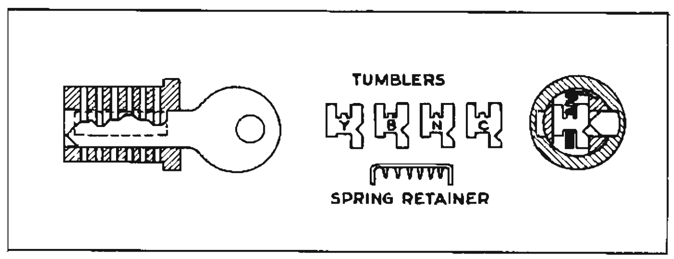


Fig. 14—Side Bar Lock

All side bar locks furnished to the field by the Parts Department are uncoded, that is, they are furnished without tumblers, springs or spring retainers; these parts are serviced separately. The tumblers come in four different depths indicated by colors "C" for copper, "N" for nickel, "B" for black and "Y" for yellow.

The side bar locks have six tumbler positions, and in looking up the cutting code, the following may be used as an example. After key code number is determined, either from key or from number stamped on lock cylinder refer to your code book and record the key cutting information as follows:

Key of lock code Number	Key cutting code Numerical	Key Cutting code Alphabetical
8109	2-3-2-1-2-4	N-B-N-C-N-Y
Cutting or Tumbler position from head of lock.	1-2-3-4-5-6	1-2-3-4-5-6

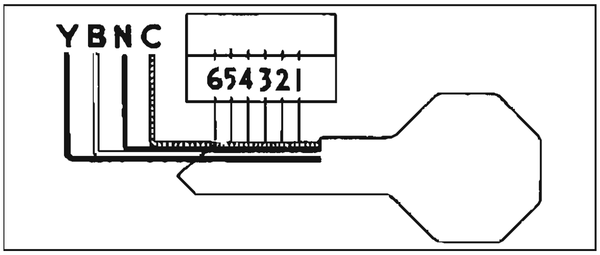


Fig. 15—Tumbler Requirement Diagram

The number or letters (depending on code book) which are written above the cutting or tumbler position indicate the different color tumblers which are to be dropped into each tumbler slot of the lock: "C"--copper, "N"--nickel, "B"-black, "Y"--yellow.

NOTE: If code book used lists the key cutting code numerically, the numbers must be transposed to letters as previously stated in order to select proper color tumblers for installation into the lock.

In cases where a code book is not available, the diagram as shown in Figure 15 may be used to determine the tumblers required to assemble as uncoded lock cylinder.

1. Lay the key on the diagram (fig. 15) with the bottom of the key flush with the edge of the drawing, head and point carefully lined up.
2. Read the code in letters C-N-B-Y from the head of key to the end from positions 1 to 6 inclusive. As each depth is determined write that letter in the blank space provided above the position numbers (1-2-3-4-5-6).
3. With the key properly lined up on the diagram, all cuts that show in the first section are to be marked "C".
4. Cuts that fall in the first black section, mark "N".
5. Cuts that fall in the White section, mark "B."
6. Cuts that fall in the second black section, mark "Y."

After the letters (C-N-B-Y) have been determined and written above the cutting positions the lock cylinder should be assembled as follows:

Lock Cylinder Assembly

1. Hold cylinder with head of cylinder away and starting at the head of the cylinder, insert the tumblers in their proper slots in the order called for by the code, ribbed side toward you and long point down (fig. 16).
2. After all tumblers are in place, check for correctness with the code. Then press tumblers down with one finger (fig. 17).
3. Insert one tumbler spring in the space provided above each tumbler (fig. 18).

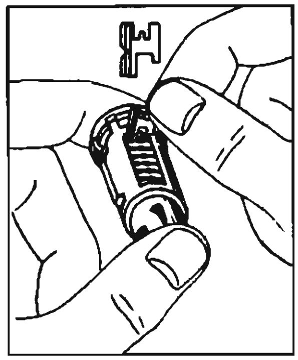


Fig. 16—Inserting Tumbler

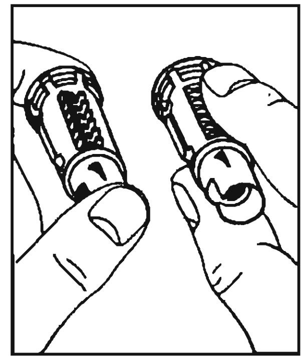


Fig. 17—Checking with Code

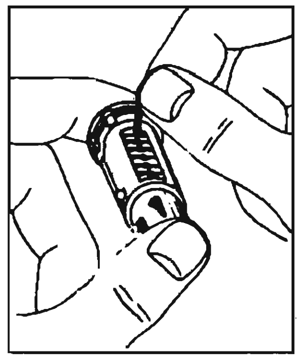


Fig. 18—Inserting Tumbler Springs

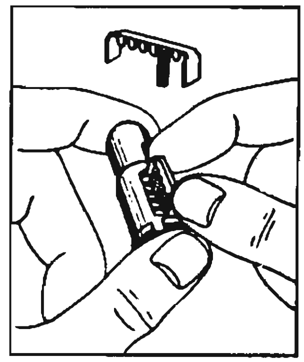


Fig. 19—Inserting Spring Retainer

CAUTION: If the springs are tangled, do not pull them apart--unscrew them.

4. Reverse the lock cylinder so that the head of the cylinder is now toward you. Insert the spring retainer so that one of its six prongs enters into each of the springs and the two large end prongs slide into the slots at either end of the cylinder (fig. 19). Press the retainer down with one finger.
5. To check, insert proper key and if tumblers are installed properly the side bar will be allowed to drop down. If bar does not drop down, remove the key, spring retainer, springs and tumblers and reassemble correctly.

NOTE: If the tumblers have not been assembled correctly and not according to the code, the tumblers can be removed from the cylinder by holding it with the tumbler slots down, pulling the side bar out with the fingers and jarring the cylinder to shake the tumblers out. This procedure is necessary because after the tumblers have been pressed down into the cylinder they are held in their slots by the cross bar.

6. If after checking it is found that the lock is assembled properly, remove key and place cylinder in a vise using leather or wood on each side to prevent damage to the cylinder.
7. Stake the retainer securely in place by staking the cylinder metal over both edges of the retainer ends

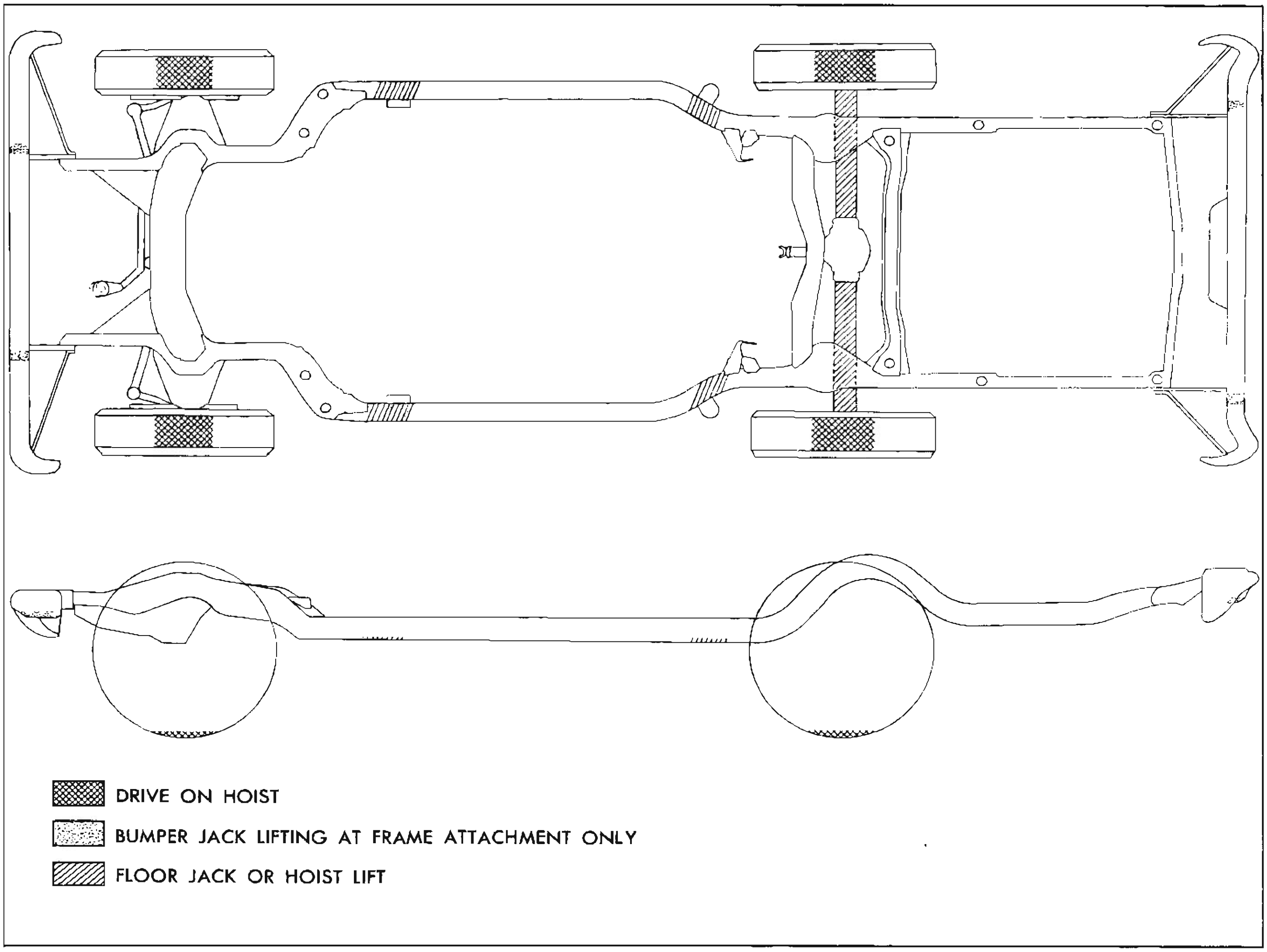


Fig. 20—Vehicle Lifting Points—Chevrolet

using a suitable staking tool at right angles to the top of the retainer and from the cast metal of the cylinder over the retainer at each corner.

PUSHING, TOWING AND LIFTING

Pushing Car To Start

NOTE: Towing car to start is not recommended due to the possibility of the disabled car accelerating into tow car.

AUTOMATIC TRANSMISSION

Turn off all electrical loads such as radio, heater and, if possible, lights until the engine starts.

With the ignition key turned ON and the transmission in N (neutral), allow the car speed to reach 25 to 30 miles per hour. Then shift the transmission to L (low) position. After the engine starts, the transmission may be operated in the normal manner. Never tow the car to start.

MANUAL TRANSMISSION

When a push start is necessary turn off all electrical loads such as heater, radio and, if possible, lights, turn on the key, depress the clutch, and place the shift lever in high gear. Release the clutch when your speed reaches 10 to 15 miles per hour.

Emergency Towing

The car may be towed safely on its rear wheels with the (selector lever in "N" (Neutral) position at speeds of 35 miles per hour or less under most conditions.

However, the drive shaft must be disconnected or the car towed on its front wheels if 1) Tow speeds in excess of 35 MPH are necessary, 2) Car must be towed for extended distances (over 50 miles) or, 3) Transmission is not operating properly. If car is towed on its front wheels, the steering wheel should be secured to maintain a straight ahead position.

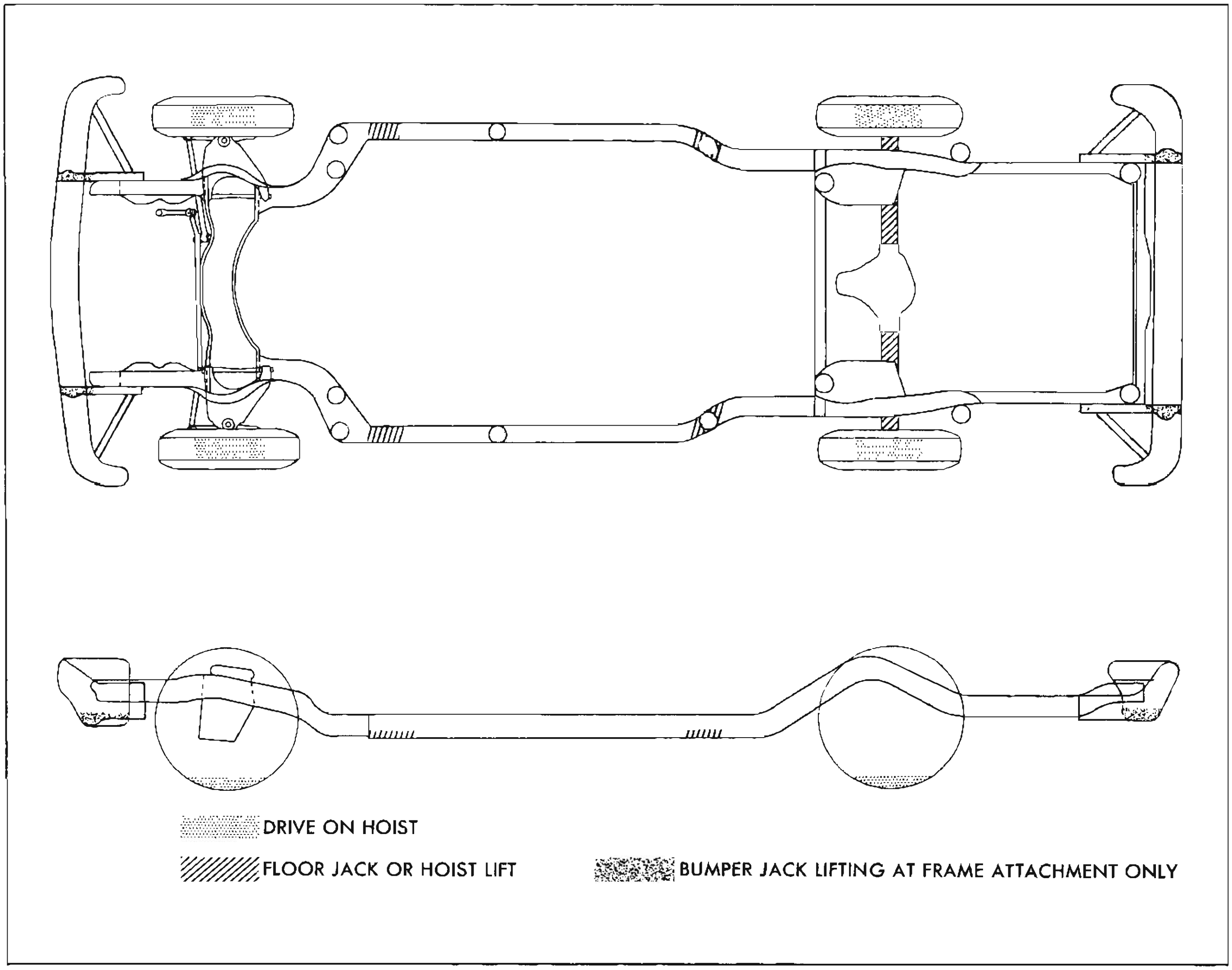


Fig. 21—Vehicle Lifting Points—Chevelle

Lifting Car With Drive-on Hoist

Many dealer service facilities and service stations are now equipped with a type of automotive hoist which must bear upon some part of the frame in order to lift the vehicle. In Figures 20, 21, 22, the shaded areas indicate areas recommended for hoist contact.

Lifting With Auto Jack

The shaded areas on both the front and the rear bumpers, as shown in Figures 20, 21, 22, are recommended auto jack lifting points. The jack load rest must locate under the bumper at these points. Be sure the load rest is positioned properly on the jack before raising the vehicle.

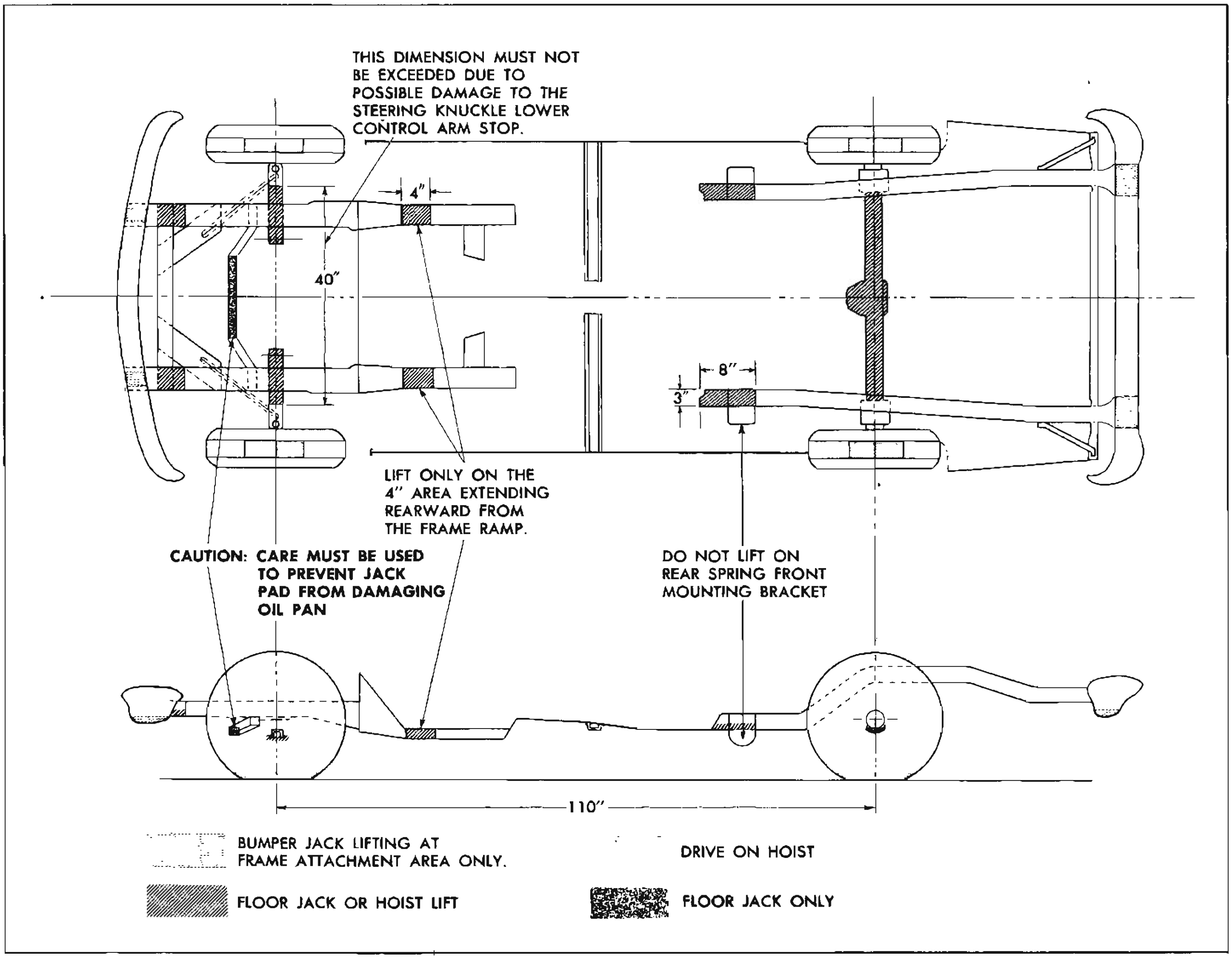


Fig. 22—Vehicle Lifting Points—Chevy II

LUBRICATION

INDEX

The selection of the proper lubricant and its correct application at regular intervals does much to increase the life and operation of all moving parts of the vehicle. Consequently, it is important that the correct grade of oil or grease, as noted in the following pages, be used.

ENGINE CRANKCASE OIL

Crankcase Capacity

4 Cylinder	3.5 qt.
6 Cylinder	4 qt.
8 Cylinder (283)	4 qt.
8 Cylinder (327)	4 qt.
8 Cylinder (409)	5 qt.

For 4 Cyl. Add .5 qt. with filter change;
1 qt. for 6 and 8 Cyl. engines.

Lubrication

Crankcase oil should be selected to give the best performance under the climatic and driving conditions in the territory in which the vehicle is driven.

During warm or hot weather, an oil which will provide adequate lubrication under high operating temperatures is required.

During the colder months of the year, an oil which will permit easy starting at the lowest atmospheric temperature likely to be encountered, should be used.

When the crankcase is drained and refilled, the crankcase oil should be selected, not on the basis of the existing temperature at the time of the change, but on the lowest temperature anticipated for the period during which the oil is to be used.

Unless the crankcase oil is selected on the basis of viscosity or fluidity of the anticipated temperature, difficulty in starting will be experienced at each sudden drop in temperature.

SAE Viscosity Oils

SAE Viscosity Numbers indicate only the viscosity or body of the oil, that is, whether an oil is a light or a heavy body oil, and do not consider or include other properties or quality factors.

The lower SAE Viscosity Numbers, such as SAE 5W and SAE 10W which represent the light body oils, are recommended for use during cold weather to provide easy starting and instant lubrication. The higher SAE Viscosity Numbers such as SAE 20 and SAE 20W, which represents heavier body oils, are recommended for use during warm or hot weather to provide improved oil economy and adequate lubrication under high operating temperatures.

Oils are available which are designed to combine the easy starting characteristics of the lower SAE Viscosity Number with the warm weather operating characteristics of the higher SAE Viscosity Number. These are termed "multi-viscosity oils," SAE 5-10W, SAE 5W-20, SAE 10W-20W, and SAE 10W-30.

The following chart will serve as a guide for the selection of the correct SAE Viscosity Number for use under different atmospheric temperature ranges, and suggests the appropriate SAE Viscosity Numbers when multi-viscosity oils are used.

Lowest Anticipated Temperature During Time Oil Will Be in Crankcase	Recommended SAE Viscosity Oils	Recommended SAE Multi-Viscosity Oils
32°F.	SAE 20 or 20W	SAE 10W-30
0°F.	SAE 10W	SAE 10W-30
Below 0°F.	SAE 5W	SAE 5W-20

SAE 30 or 10W-30 is recommended when most of the driving is at high speeds and/or at temperatures above 90°F.

SAE 5W-30 oils may be used during periods when temperatures of 32° and below are to be expected.

Types of Oils

In service, crankcase oils may form sludge and varnish and under some conditions, corrosive acids unless protected against oxidation.

To minimize the formation of these harmful products and to assure the use of oil best suited for present day operating conditions, automobile manufacturers have developed a series of sequence tests designed to evaluate the ability of any oil to properly lubricate automobile engines.

It is recommended that only those oils which are certified by their suppliers as meeting or exceeding the maximum severity requirements of these sequence tests (or GM Standard 4745-M) be used in Chevrolet engines. Certified sequence tested oils will be described as such on their containers.

Maintaining Oil Level

The oil gauge rod is marked "Full" and "Add Oil." These notations have broad arrows pointing to the level lines. The oil level should be maintained between the two lines, neither going above the "Full" line nor under the "Add Oil" line. DO NOT OVERFILL. After operating vehicle allow a few minutes for oil to return to crankcase before checking oil level.

Check the oil level frequently and add oil when necessary.

> **NOTE:** It is advisable, when taking a long trip, to recheck the oil level after the first 100 miles of the trip. This is a precautionary measure, due to the possibility of crankcase dilution which would give a false oil level reading. The diluents which are usually the result of imcomplete engine warm-up (traveling short distances) are driven out of the crankcase with high speed driving or sustained normal engine operating temperatures.

Oil and Filter Change Intervals

> **NOTE:** Under prolonged dusty driving conditions, it is recommended that these operations be performed more often.

OIL

To insure continuation of best performance, low maintenance cost and long engine life, it is necessary to change the crankcase oil whenever it becomes contaminated with harmful foreign materials. Under normal driving conditions draining the crankcase and refilling with fresh oil every 60 days or every 6000 miles whichever occurs first, is recommended.

It is always advisable to drain the crankcase only after the engine has become thoroughly warmed up or reached normal operating temperature. The benefit of draining is, to a large extent, lost if the crankcase is drained when the engine is cold, as some of the suspended foreign material will cling to the sides of the oil pan and will not drain out readily with the cold, slower moving oil.

OIL FILTER

Change engine oil filter every 6000 miles or every 6 months, whichever occurs first.

Crankcase Dilution

Probably the most serious phase of engine oil deterioration is that of crankcase dilution which is the thinning of the oil by fuel vapor leaking by pistons and rings and mixing with the oil and by condensation of water on the cylinder walls and crankcase.

Leakage of fuel, or fuel vapors, into the oil pan occurs mostly during the "warming up" period when the fuel is not thoroughly vaporized and burned. Water vapor enters the crankcase through normal engine ventilation and through exhaust gas blow-by. When the engine is not completely warmed up, these vapors condense, combine with the condensed fuel and exhaust gases and form acid compounds in the crankcase.

As long as the gases and internal walls of the crankcase are hot enough to keep water vapor from condensing, no harm will result. However, when the engine is run in low temperatures moisture will collect and unite with the gases formed by combustion resulting in an acid formation. The acid thus formed is likely to cause serious etching or pitting which will manifest itself in excessively rapid wear on piston pins, camshaft bearings and other moving parts of the engine, oftentimes causing the owner to blame the car manufacturer or the lubricating oil when in reality the trouble may be traced back to the character of fuel used, or a condition of the engine such as excessive blowby or improper carburetor adjustment.

Automatic Control Devices to Minimize Crankcase Dilution

All engines are equipped with automatic devices which aid greatly in minimizing the danger of crankcase dilution.

The thermostat, mounted in the cylinder head water outlet, restricts the flow of water to the radiator until a predetermined temperature is reached, thus minimizing the length of time required to reach efficient operating temperature, reducing the time that engine temperatures are conducive to vapor condensation.

A water by-pass is included in the cooling system, utilizing a hole in the front of the cylinder block. This allows a limited circulation of coolant, bypassing the thermostat until thermostat opening temperatures are reached. This system provides a uniform coolant temperature throughout the engine, eliminating localized hot-spots, improving exhaust valve life, provides fast warm-up of lubricating oil and fast temperature rise in the coolant which provides fast heater operation in cold weather.

A thermostatic heat control on the exhaust manifold during the warming up period, automatically directs the hot exhaust gases against the center of the intake manifold, greatly aids in proper vaporization of the fuel.

An automatic choke reduces the danger of raw or unvaporized fuel entering the combustion chamber and leaking into the oil reservoir.

An efficient crankcase ventilating system drives off fuel vapors and aids in the evaporation of the raw fuel and water which may find its way into the oil pan.

CRANKCASE BREATHER CAP

Clean and re-oil at every oil change.

CRANKCASE VENTILATION VALVE

VALVE TYPE

At every oil change, test valve and replace when necessary.

FIXED ORIFICE TYPE

Check at every oil change, if dirty or plugged clear with suitable drill. Twist drill by hand to remove any sludge or carbon formation.

FLAME ARRESTER

Remove and clean in suitable solvent every 12,000 miles. Blow dry with air hose and replace.

FUEL FILTER

The fuel filter, located in the carburetor inlet line need not be changed unless inspection proves it to be dirty or plugged or if flooding occurs.

AIR CLEANER

NOTE: Under prolonged dusty driving conditions, it is recommended that these operations be performed more often.

POLYURETHANE TYPE–

Every 12,000 miles clean element in solvent, squeeze out solvent, then soak in engine oil and squeeze out excess.

PAPER ELEMENT TYPE–

First 12,000 miles inspect or test element; if satisfactory, re-use element but recheck every 6,000 miles until replaced. Element must not be washed, oiled, tapped or cleaned with an air hose.

BATTERY TERMINAL WASHERS

Battery terminals have felt washers between top of case and cable connections to minimize corrosive action of battery acid. These felt washers should be saturated with engine oil every 6,000 miles.

DISTRIBUTOR

6-Cylinder Engine--Remove distributor cap and rotate lubricator 1/2 turn at 12,000 mile intervals. Replace at 24,000 mile intervals.

8-Cylinder Engine--Change cam lubricator end for end at 12,000 mile intervals. Replace at 24,000 mile intervals.

REAR AXLE AND 3-SPEED AND OVERDRIVE, 4-SPEED TRANSMISSIONS

The passenger car operates under the most severe lubrication conditions at high speed and reauires a hypoid lubricant which will meet this condition.

Recommended Lubricants

Standard Rear Axles--SAE 90 "Multi-Purpose" gear lubricant.

Positraction Rear Axles--Use special Positraction lubricant.

CAUTION: Straight Mineral Oil gear lubricants must not be used in hypoid rear axles.

Transmissions--SAE 90 Straight Mineral Oil gear lubricant.
--SAE 90 "Multi-Purpose" gear lubricant.

The SAE 90 viscosity grade is recommended for year round use. However, when extremely low temperatures are encountered for protracted periods during the winter months, the SAE 80 viscosity grade may be used.

"Multi-Purpose" Gear Lubricants

Gear lubricants that will satisfactorily lubricate hypoid rear axles have been developed and are commonly referred to as "Multi-Purpose" gear lubricants.

These lubricants can also be satisfactorily used in manual transmissions and steering gears requiring a fluid lubricant.

CAUTION: With Positraction rear axles use special Positraction lubricant.

"Multi-Purpose" gear lubricants must be manufactured under carefully controlled conditions and the lubricant manufacturer must be responsible for the satisfactory performance of his product. His reputation is the best indication of quality.

Lubricant Additions

The lubricant level in the axle and transmission housings should be checked periodically. (Every 6,000 miles.)

It is recommended that any additions required to bring up the lubricant level be made using the same type lubricant already in the housing.

When checking lubricant level in transmission or rear axle the unit being checked should be at operating temperature. With unit at operating temperature the lubricant should be level with bottom of the filler plug hole. If the lubricant level is checked with the unit cold the lubricant level should 1/2 inch below the filler plug hole.

Lubricant Changes

The rear axle lubricant does not require changing for the life of the vehicle. If additions are needed, or when refilling the axle after service procedures, use lubricants described above.

POWERGLIDE TRANSMISSION

Every 6,000 miles--Check fluid level on dipstick with engine idling, selector lever in neutral position, parking brake set and transmission at operating temperature. If fluid level is below full mark on dip stick, add small amount of Automatic Transmission Fluid Type "A" bearing the mark AQ-ATF followed by a number and the suffix letter "A". Recheck fluid level on dip stick and again add a small amount of fluid if needed to bring level to full mark. DO NOT OVERFILL.

Every 12,000 miles (more frequently*, depending on severity of service, if vehicle is used to pull trailers,

*Except if vehicle is equipped with transmission provided in heavy duty service options. If so equipped, drain converter and pump every 12,000 miles and add approximately seven and a half quarts of fresh fluid for Chevy II and nine quarts for Chevrolet and Chevelle.

carry full loads during high ambient temperatures, operate in mountainous terrain or operate under other severe conditions--Remove fluid from the transmission sump and add one and a half quarts of fresh fluid for Chevy II and two quarts for Chevrolet and Chevelle. Operate transmission through all ranges and check fluid level as described above.

FRONT WHEEL BEARINGS

It is necessary to remove the wheel and hub assembly to lubricate the bearings. The bearing assemblies should be cleaned before repacking with lubricant. Do not pack the hub between the inner and outer bearing assemblies or the hub caps, as this excessive lubrication results in the lubricant working out into the brake drums and linings.

Front wheels of all passenger car models are equipped with tapered roller bearings and should be packed with a high melting point water resistant front wheel bearing lubricant whenever brake drums are removed.

CAUTION: "Long fibre" or "viscous" type lubricant should not be used. Do not mix wheel bearing lubricants. Be sure to thoroughly clean bearings and hubs of all old lubricant before repacking.

The proper adjustment of front wheel bearings is one of the important service operations that has a definite bearing on safety. A car with improperly adjusted front wheel bearings lacks steering stability, has a tendency to wander or shimmy and may have increased tire wear. The adjustment of these bearings is very critical. The procedure is covered in Section 3 of this manual under Front Wheel Bearings--Adjust.

MANUAL STEERING GEAR

Check lubricant level every 36,000 miles. If required, add EP Chassis Lubricant.

POWER STEERING

On models equipped with power steering gear, check fluid at operating temperature in pump reservoir. Add GM Power Steering Fluid, or, if this is not available, use Automatic Transmission Fluid "Type A" bearing an AQ-ATF mark to bring level to full mark on dip stick.

AIR CONDITIONING

After the first 6,000 miles, check all hose clamp connections for proper tightness.

Every 6,000 miles check sight glass under the hood, after the system has been in operation for several minutes. Sight glass should be clear but may, during milder weather, show traces of bubbles. Foam or dirt indicate a leak which should be repair immediately.

Every week--during winter months--run the system for 10 to 15 minutes to insure proper lubrication of the seals and moving parts.

BRAKE MASTER CYLINDER

Check level every 6,000 miles and maintain 1/4" below filler opening with GM Hydraulic Brake Fluid Supreme No. 11.

PARKING BRAKE

Every 6,000 miles, apply water resistant lube to parking brake cable, cable guides and at all operating links and levers.

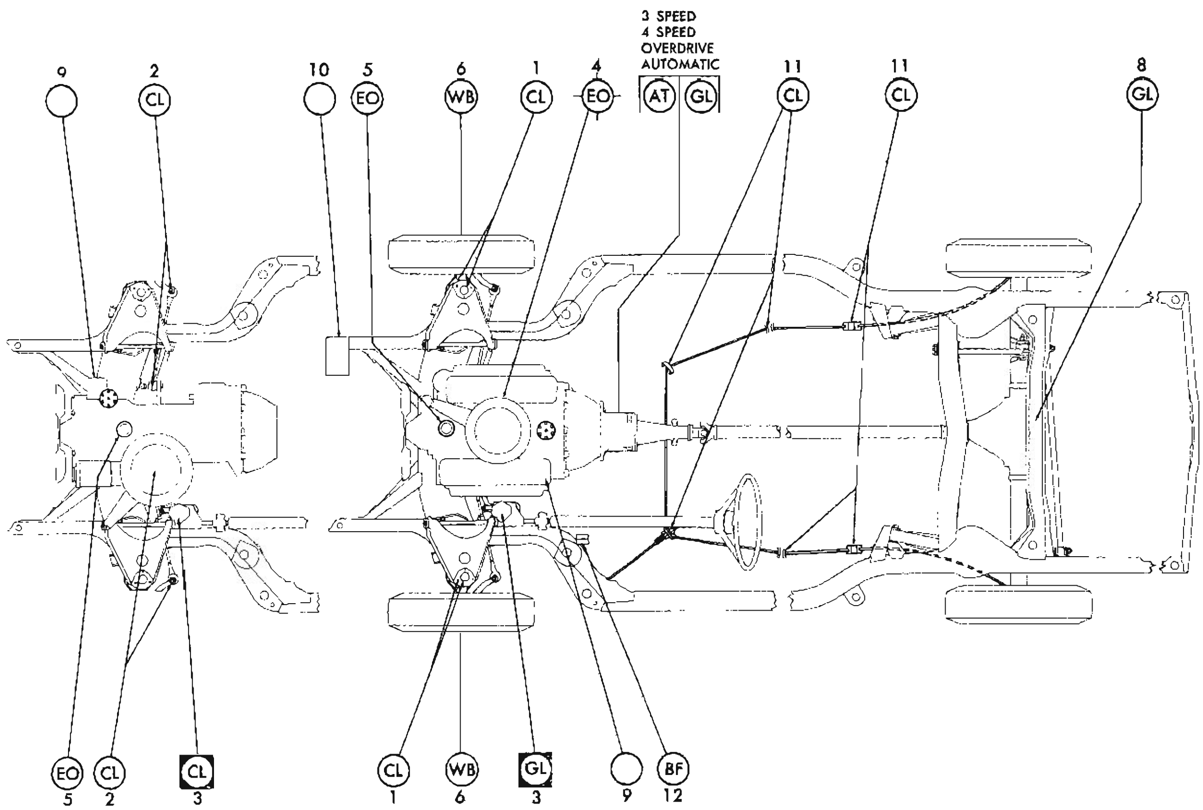
CLUTCH CROSS-SHAFT

Periodic lubrication of the clutch cross shaft is not required. At 36,000 miles or sooner, if necessary; remove plug, install lube fitting and apply CHASSIS LUBRICANT.

CHASSIS LUBRICATION

For chassis lubrication, consult the lubrication chart. It shows the points to be lubricated and how often the lubricant should be applied.

The term "chassis lubricant" as used in this manual, describes a water resistant EP chassis grease designed for application by commercial pressure gun equipment.



LUBRICATE EVERY 6,000 MILES

LUBRICATE EVERY 12,000 MILES

LUBRICATE EVERY 36,000 MILES

*Refill Positraction Rear Axle with Special Lubricant Only.

GL—Multi-purpose or Universal Gear Lubricant*

WB—Wheel Bearing Lubricant (Whenever Brakes are serviced)

CL—Chassis Lubricant

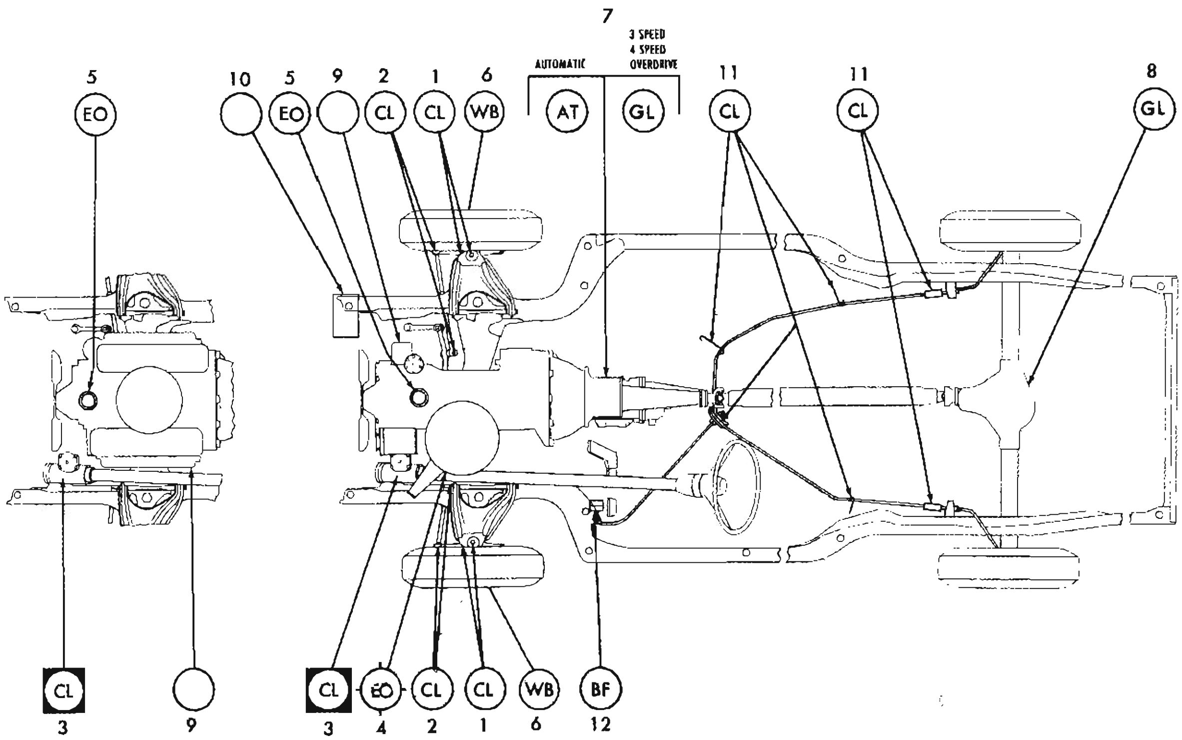
EO—Engine Oil

AT—Automatic Transmission Fluid (Type A)

BF—Brake Fluid

Fig. 23—Lubrication Diagram—Chevrolet

1. Front Suspension
2. Steering Linkage
3. Steering Gear
4. Air Cleaner
5. Crankcase Breather Cap
6. Front Wheel Bearings
7. Transmission
8. Rear Axle
9. Oil Filter
10. Battery
11. Parking Brake
12. Brake Master Cylinder



LUBRICATE EVERY 6000 MILES

LUBRICATE EVERY 12000 MILES

LUBRICATE EVERY 36000 MILES

GL —Multi-purpose Gear Lubricant*
WB—Wheel Bearing Lubricant (Whenever Brakes are serviced)
CL —Chassis Lubricant
EO —Engine Oil

AT —Automatic Transmission Fluid (Type A)
SL —Steering Gear Lubricant
BF —Hydraulic Brake Fluid

*Refill Positraction Rear Axle with Special Positraction Rear Axle Lubricant Only.

Fig. 24—Lubrication Diagram—Chevelle

1. Front Suspension
2. Steering Linkage
3. Steering Gear
4. Air Cleaner
5. Crankcase Breather Cap
6. Front Wheel Bearings
7. Transmission
8. Rear Axle
9. Oil Filter
10. Battery
11. Parking Brake
12. Brake Master Cylinder

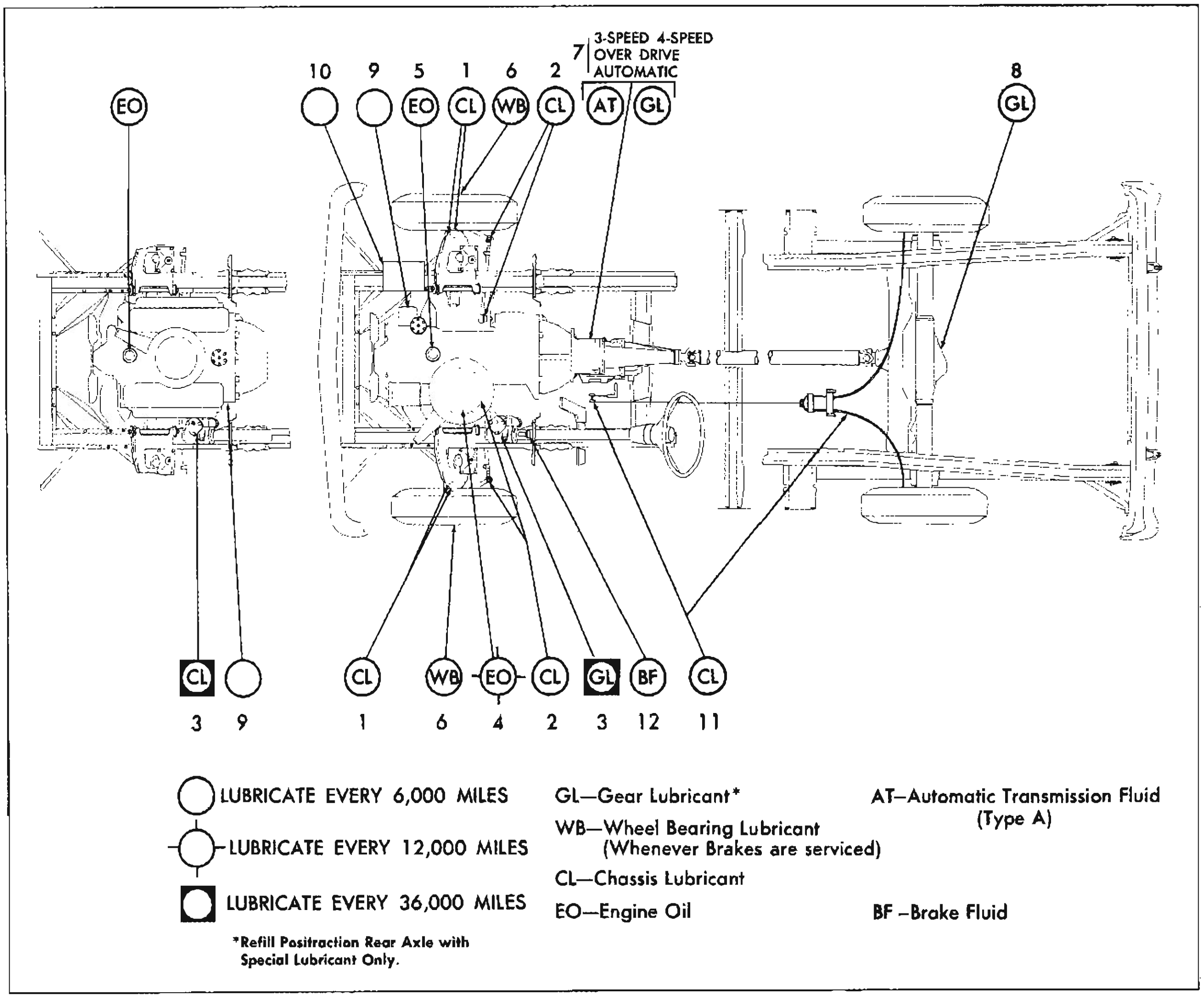


Fig. 25—Lubrication Diagram - Chevy II

1. Front Suspension
2. Steering Linkage
3. Steering Gear
4. Air Cleaner
5. Crankcase Breather Cap
6. Front Wheel Bearings
7. Transmission
8. Rear Axle
9. Oil Filter
10. Battery
11. Parking Brake
12. Brake Master Cylinder

BODY LUBRICATION

See Body Service Manual for Body Lubrication

SECTION 2
FRAME

INDEX

GENERAL DESCRIPTION

Frames used on Chevrolet and Chevelle lines are basically the same, consisting of full length right and left side members joined laterally by crossmembers. Several different frames are used in each line to meet the various vehicle size and function requirements but the basic shape for each line remains the same. Differences between frames in a given line exist only in metal gauge, part size and numbers of parts necessary to meet the particular structural requirements of the models involved.

REPAIR PROCEDURES

CHECKING FRAME ALIGNMENT

Vehicles involved in an accident of any nature which might result in a "swayed" or "sprung" frame should always be checked for proper frame alignment in addition to steering geometry and wheel alignment.

CAR PREPARATION

Preparing the car for the frame alignment check involves the following:

1. Place the car on level surface.
2. The weight of the car should be supported at the wheel locations.
3. A visual damage inspection should be made to eliminate needless measuring. Obviously damaged or misaligned areas can often be located by sight.

TRAMMING SEQUENCE

When checking a frame for alignment in case of damage, the first step is horizontal "X" checking with a tram from similar given points on opposite side of the frame.

Frame alignment checks on all models should be made with the tram points set at the center of each locating point indicated and the cross bar level to insure accuracy.

When "X" checking any section of the frame, the measurements should agree within 3/16". If they do not, it means that corrections will have to be made.

If a tram gauge is not available, the "plumb bob" method of checking may be used. To assure any degree of accuracy when using this method, the vehicle should be on a level floor.

By using this method, it is only necessary to have a piece of cord attached to an ordinary surveyor's plumb bob. When measuring the distance between two points, the free end of the cord should be placed on the reference point allowing the plumb bob to hang on the floor. A check mark should be made on the floor just under the tip of the plumb bob. This operation should be repeated at all reference points. With these points located on the floor, they may easily be measured with a rule.

The second step is checking the vertical dimensions from the datum plane to the points to be trammed. As an example Figure 2 indicates that the measurement (calculated on a horizontal plane) between reference points of a dimension line, running from the front upper edge of the frame side rail to the top edge of the rear crossmember, is from the datum plane a vertical height difference of 0.17 inch between the forward location (15.93) and the rearward location (16.10). This means the vertical pointer used at the rearward location should be positioned so as to extend 0.17 inch further from the tram bar than the pointer used at the forward location. With the proper settings the tram bar will be on a plane parallel to that of the frame. The exception to this would be when one of the reference locations is included in the misaligned area; then the parallel plane between the frame and the tram bar may not prevail. After completion of the repairs, the tram gauge should be set at the specified dimension to check the accuracy of the repair operation.

ALIGNMENT REFERENCE POINT DIMENSIONS

Dimensions to holes are measured to dead center of the holes and flush to the adjacent surface metal.

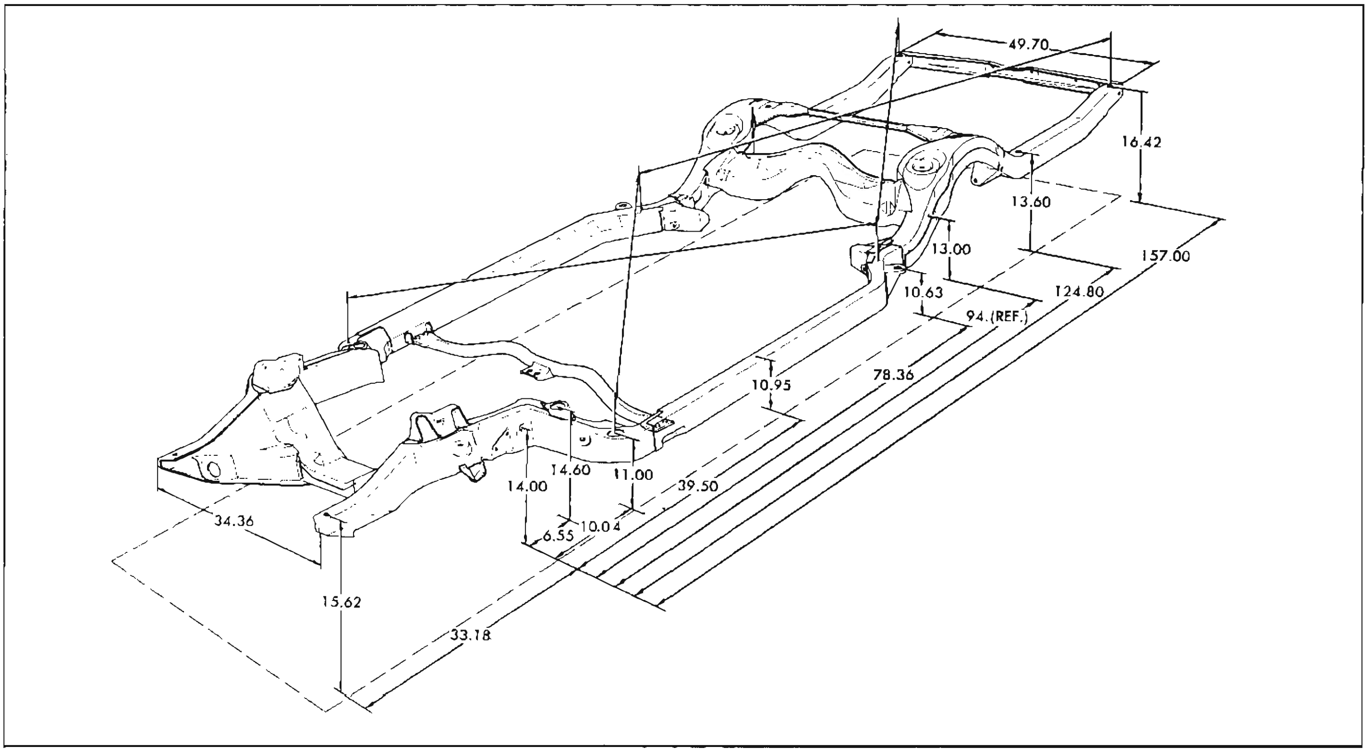


Fig. 1—Frame Dimensions (Chevrolet)

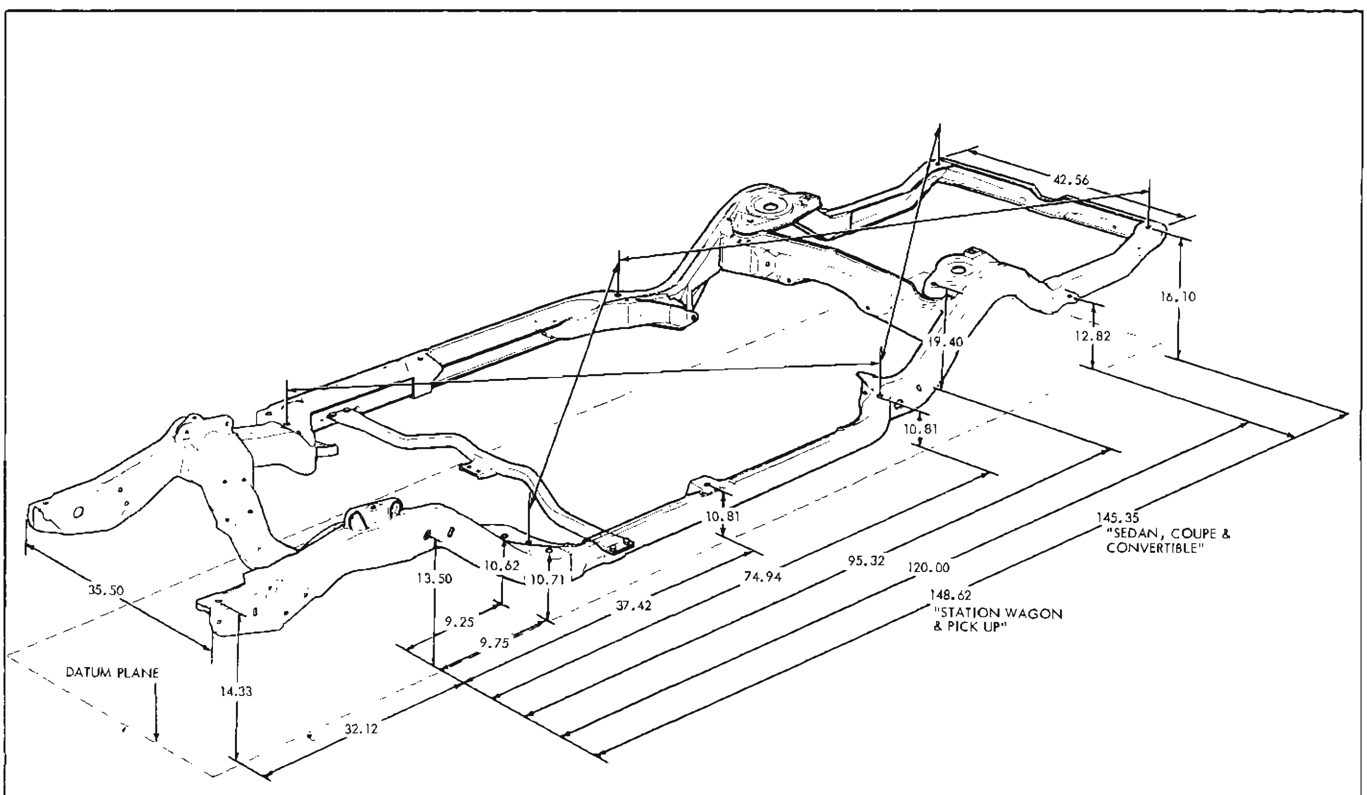


Fig. 2—Frame Dimensions—Chevelle

SECTION 3

FRONT SUSPENSION

INDEX

GENERAL DESCRIPTION

The 1965 Chevrolet, Chevelle and Chevy II front suspension systems are basically similar, being of the S.L.A. (short-long arm) type with independent coil springs. In the Chevrolet and Chevelle the springs ride on the lower control arms; in the Chevy II the springs ride on the upper control arms. Spherical joints connect the upper and lower arms to the steering knuckle. Tapered roller wheel bearings are used.

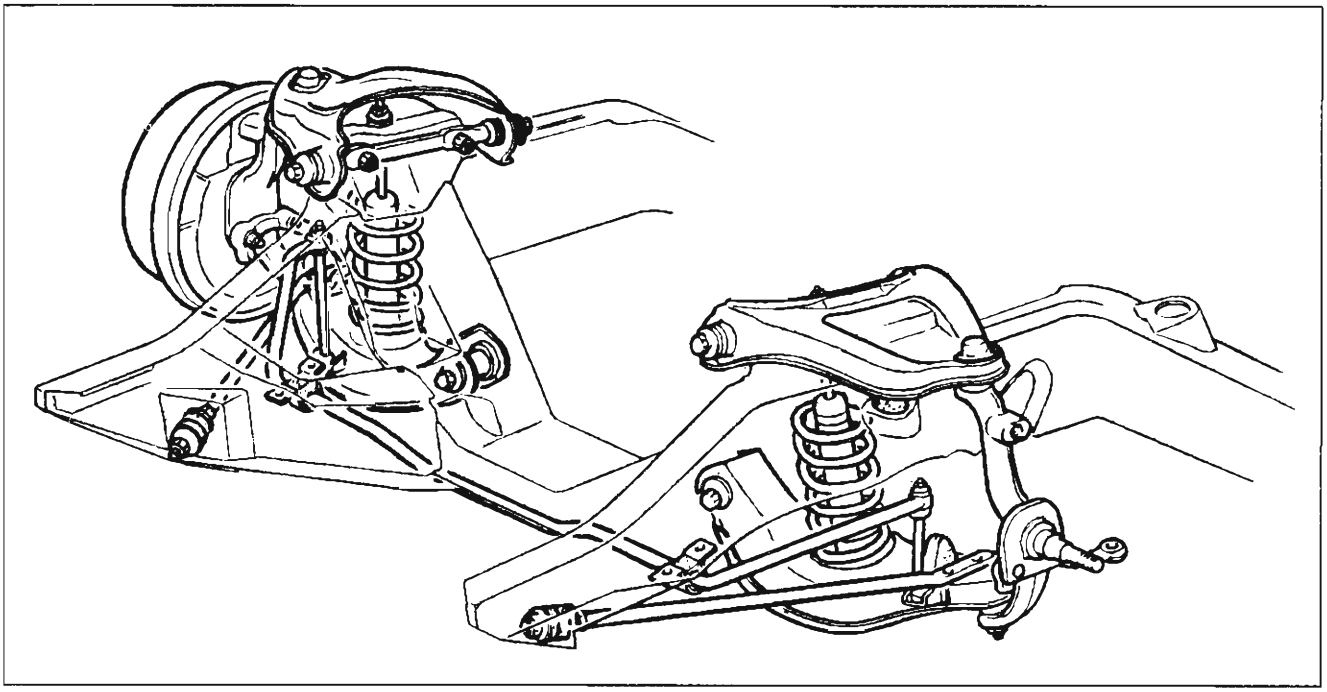


Fig. 1—Front Suspension—Chevrolet

Camber angle is adjusted, on the Chevrolet and Chevy II by means of a lower control arm inner pivot cam; on the Chevelle by means of upper control arm inner support shaft shims.

Caster angle is adjusted, on the Chevrolet and Chevy II by means of a strut rod which runs from the lower control arm forward to a frame brace; on the Chevelle by means of upper control arm inner support shaft shims.

A stabilizer bar is used on all Chevelle models and on Chevrolet and Chevy II station wagons.

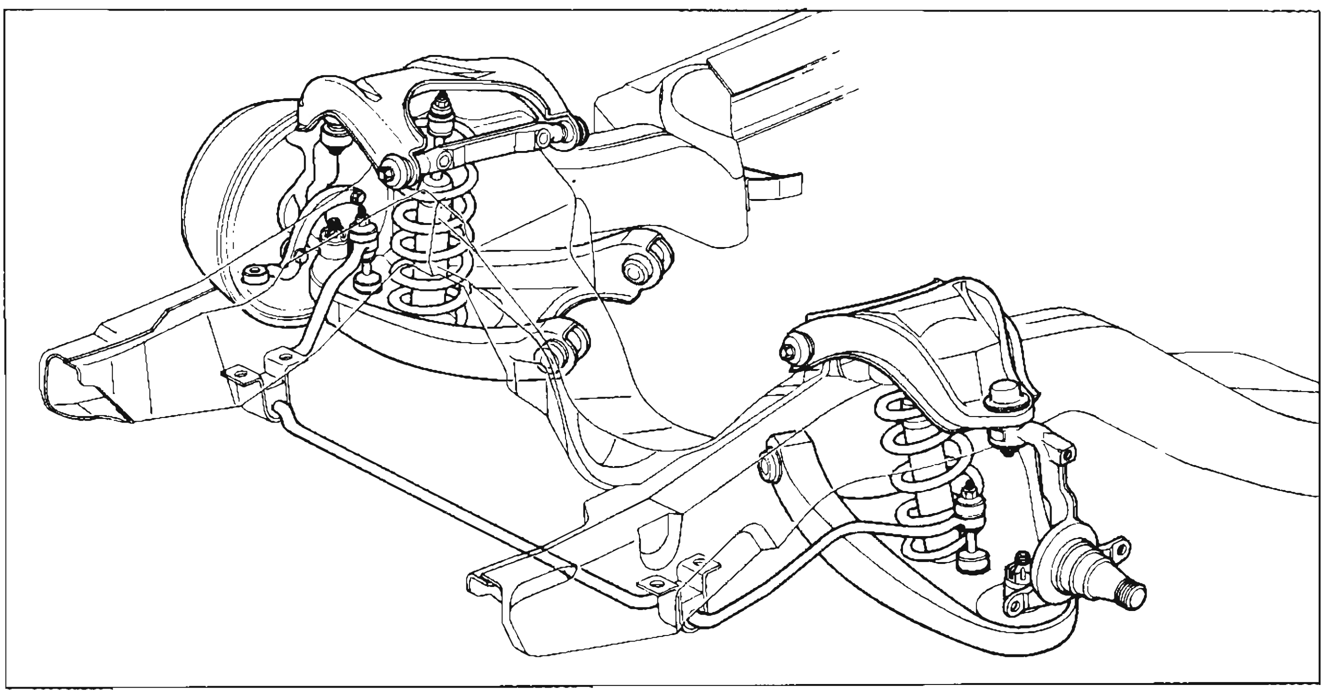


Fig. 2—Front Suspension—Chevelle

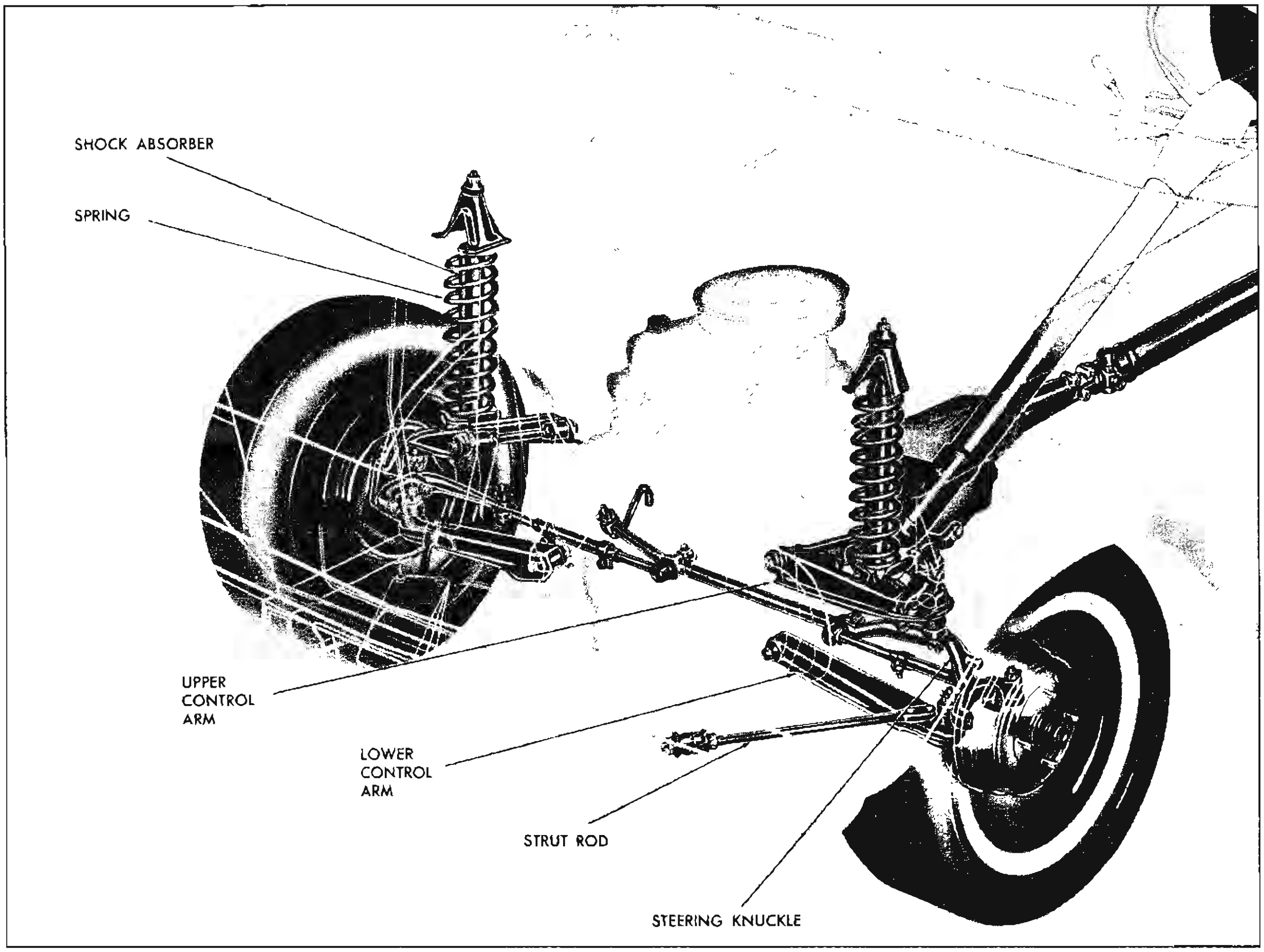


Fig. 3—Front Suspension—Chevy II

MAINTENANCE AND ADJUSTMENTS

Maintenance intervals recommended for lubrication of front suspension components have been fully covered in Section 0 of this manual. Only actual adjustment procedures will be covered here.

NOTE: Unless otherwise indicated all procedures will apply to all three vehicles covered in this manual.

FRONT WHEEL BEARING ADJUSTMENT

Proper front wheel bearing adjustment has a definite bearing on the safe operation of a vehicle. Improperly adjusted front wheel bearings will result in a lack of steering stability causing wheel wander, shimmy and excessive tire wear. Very accurate adjustment is possible because the spindles are drilled both vertically and horizontally and the adjusting nuts are slotted in all six sides.

NOTE: Wheel bearings should not be repacked or adjusted as a part of "New Car Conditioning".

1. With wheel raised, remove hub cap and dust cap and then remove the cotter pin from the end of the spindle.
2. While rotating wheel, tighten spindle nut to 15 lbs. ft. torque for Chevrolet and Chevelle; 9 lbs. ft. for Chevy II.
3. Back off adjusting nut one flat and insert cotter pin. If slot and pin hole do not line up, back off the adjusting nut an additional 1/2 flat or less as required to insert cotter pin.
4. Spin the wheel to check that it rolls freely and then lock the cotter pin by spreading the end and bending it around.

   NOTE: Bearings should have zero preload and .000" to .007" end movement when properly adjusted on Chevrolet and Chevelle; .000" to .004" on Chevy II.

5. Install dust cap, hub cap or wheel disc and lower wheel.
6. Perform the same operation on each front wheel.

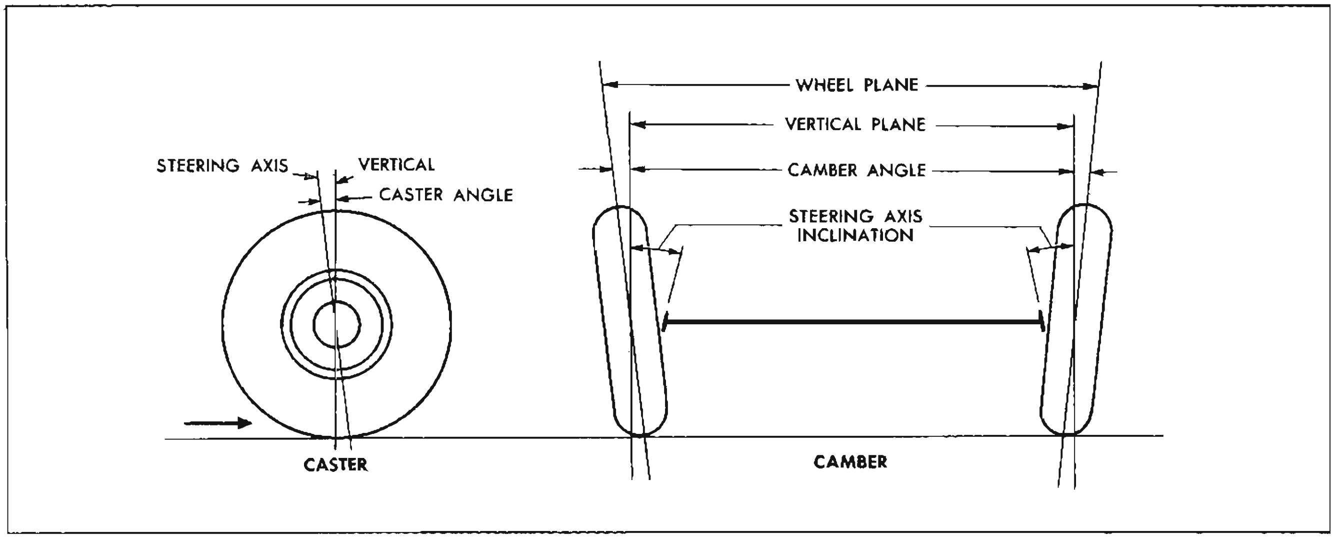


Fig. 4—Caster and Camber

FRONT END ALIGNMENT

Front end alignment, that is alignment of the inter-related steering components of the front suspension system, must be correctly maintained to assure ease and stability of steering and satisfactory tire life.

Alignment Preliminary Steps

Several different types of machines are available for checking all the factors of front end alignment. The instructions furnished with each particular machine should be followed. In all cases, however, checks should be made with the vehicle level and at curb weight.

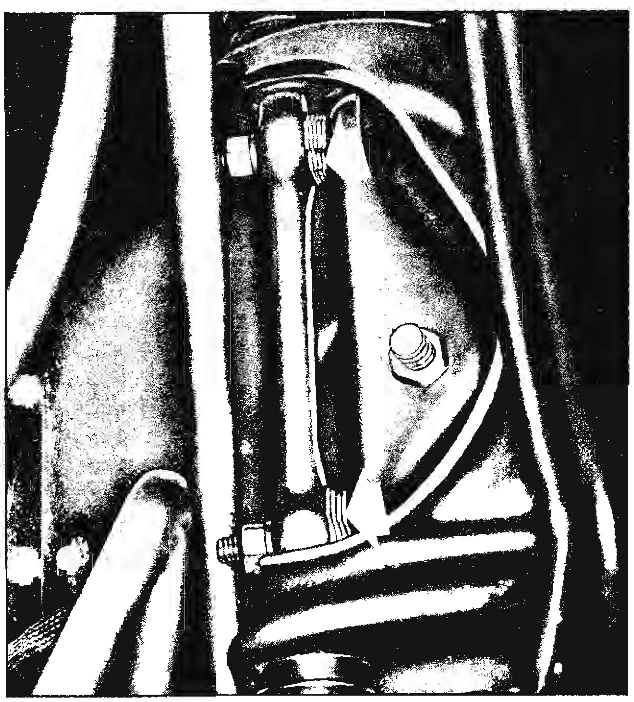


Fig. 5—Caster and Camber Adjustment—Chevelle

Since steering complaints are not always the result of improper alignment a check should be made to see if any of the following conditions exist. Any such conditions should be corrected before proceeding further.

1. Steering gear loose or improperly adjusted.
2. Steering gear housing loose at frame.
3. Excessive wear or play in spherical joints or steering shaft coupling.
4. Tie rod or steering connections loose.
5. Improper front spring heights.
6. Unbalanced or underinflated tires.
7. Improperly adjusted wheel bearings.
8. Shock absorbers not operating properly.

Caster and Camber Adjustment

NOTE: Before adjusting caster and camber angles after complaint of excessive tire wear or poor handling, the front bumper should be raised and quickly released to allow car to return to its normal height.

Chevelle

Caster and camber adjustments are made by means of shims inserted between the upper control arm inner support shaft and the support bracket attached to the frame (fig. 5). Shims may be added to change the readings as follows:

1. Caster - change shims at either the front or rear of the shaft.

   The addition of shims at the front bolt or removal of shims at the rear bolt will decrease positive caster. One shim (1/32") will change caster (approx.) 1/4°.

2. Camber - change shims at both the front and rear of the shaft.

   Adding an equal number of shims at both front and rear of the support shaft will decrease positive camber. One shim (1/32") at each location will move camber (approx.) 1/5%.

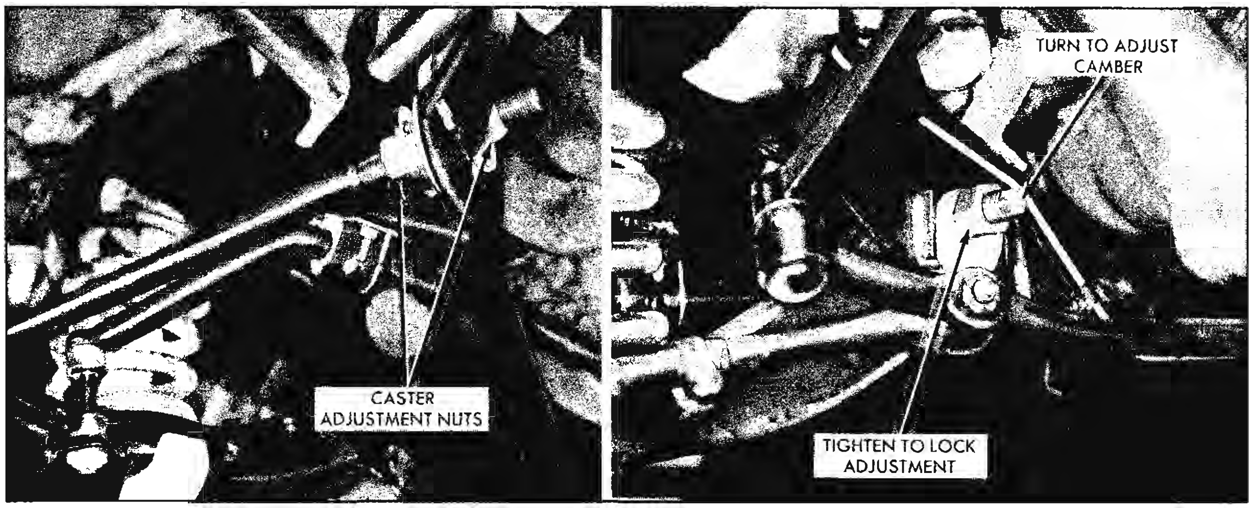


Fig. 6—Caster and Camber Adjustment Points—Chevrolet

To adjust for caster and camber, loosen the upper support shaft to crossmember nuts, add or subtract shims as required and retighten nuts.

NOTE: Caster and camber can be adjusted in one operation.

Caster and camber specifications will be found in the last section of this book.

Chevrolet and Chevy II

The caster angle is adjusted by turning the two nuts at the front of the lower control arm strut rod (figs 6 and 7). Shortening this rod will increase caster. Lengthening will decrease caster.

Camber angle is adjusted by loosening the lower control arm pivot bolt and rotating the cam located on this pivot (figs. 6 and 7). This eccentric cam action will move lower control arm in or out, thereby varying camber.

Steering Axis Inclination Adjustment

"Camber" is the outward tilt of the wheel and "steering axis inclination" is the inward tilt of the knuckle. Camber cannot be changed without changing steering axis inclination. Correct specifications will be found at the end of this section. If, with the camber correctly adjusted, the steering axis inclination does not fall within the specified limits the knuckle is bent and should be replaced.

If a new knuckle is installed, caster, camber and toe-in must be readjusted.

Toe-In Adjustment

Toe-in, the inward pointing of both front wheels, is checked with the wheels in the straight ahead position. It is the difference of the distance measured between the extreme front and the distance measured between the extreme rear of both front wheels. Correct toe-in specifications will be found at the end of this section.

A. If the equipment being used measures the toe-in of each wheel individually:

1. Set the steering gear on the high point, mark 12 o'clock position on the steering shaft and position the steering wheel for straight ahead driving.

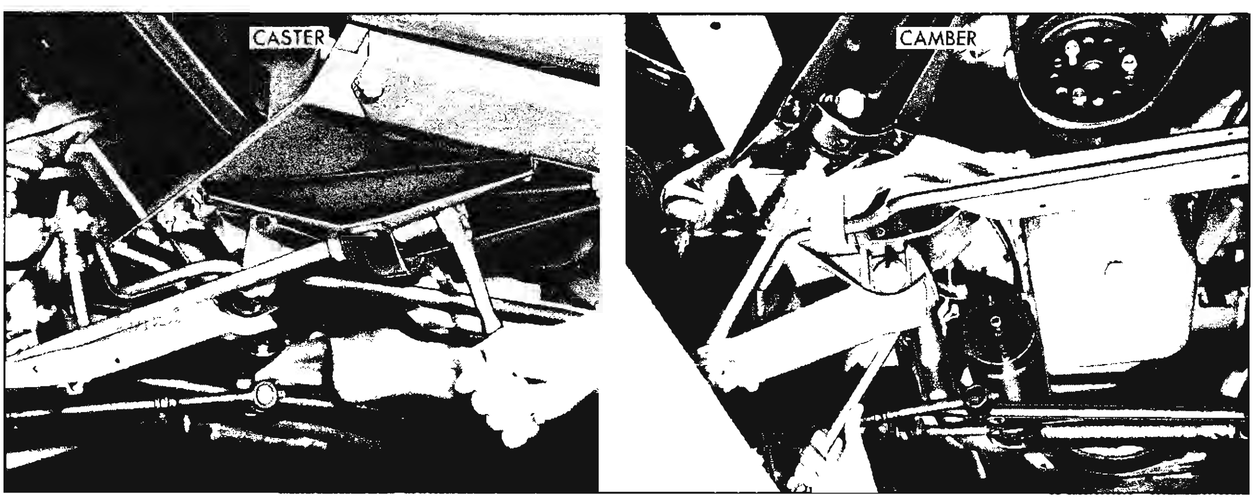


Fig. 7—Caster and Camber Adjustments—Chevy II

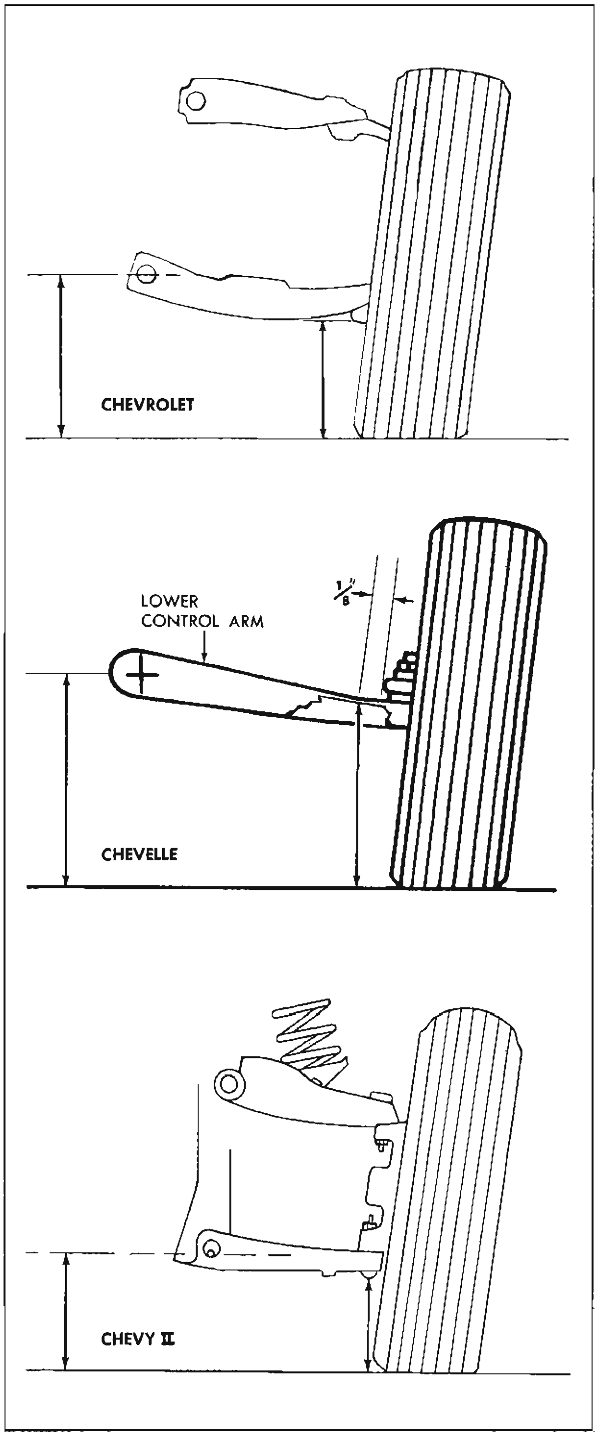


Fig. 8—Checking Riding Height

2. Loosen the clamp bolt at each end of each tie rod and adjust to the total toe-in as given in the specifications at the end of this book.

B. If a tram gauge is being used, proceed as follows:
1. Set the front wheels in the straight ahead position.
2. Loosen the clamp bolts on one tie rod and adjust for the proper toe-in as given in the specifications at the end of this book.
3. Loosen the clamp bolts on the other tie rod. Turn both rods the same amount and in the same direction to place the steering gear on its high point and position the steering wheel in its straight ahead position.

C. After the adjustment has been made:
1. a. Chevelle and Chevy II. Position the tie rod clamp bosses forward and not more than 45° up or down from horizontal to avoid interference.
   b. Chevrolet. Position inner tie rod clamp bosses forward to 90° down to avoid stabilizer link bolt interference.

Cornering Wheel Relationship

Cornering Wheel Relationship, or toe-out on turns, is determined by the angle of the steering arms. If, when checking, toe-out does not fall within the limits given in the specifications, it will be necessary to replace the steering arm on the wheel side that does not come within limits.

RIDING HEIGHT AND COIL SPRING SAG

The following check will quickly determine whether or not the vehicle riding height is correct.

1. Place the vehicle on a smooth, level floor and bounce and rock the front end several times. Raise vehicle, then allow it to settle to a normal height.
2. Measure the following two distances (fig. 8):
   a. From the floor to the center of the inner pivot of the lower control arm. (On the Chevrolet, this measurement must be made at the rear end of the pivot.)
   b. Chevrolet—Measure the distance from the floor to the lower face of the lower steering knuckle boss for the spherical joint on the same side of the vehicle.
   Chevelle—From the floor to the outer pivot which is located 1/8" (.12) inboard from the ball stud boss at the lower surface of the arm.
   Chevy II—Measure the distance from the floor to the lower ball joint seat.
3. The difference between these two measurements should be as outlined in the Specifications given at the end of the book with the vehicle at curb weight (full tank of gas, spare tire and jack in trunk, no passengers).
4. Measure the opposite side of the vehicle in the same manner. The measurements for both sides should differ no more than 1/2".
5. To correct the height, springs must be replaced. These springs do not have flat ends and shims should not be used.

REPAIR PROCEDURES

Unless otherwise indicated all repair procedures will apply to all three vehicles covered in this manual.

CAUTION: During any operations which include breaking the ball stud loose from the knuckle boss extreme care must be used to assure that the ball stud seal is not damaged or cut. A recommended way to loosen the stud is to place a flat bar stock against the knuckle boss and strike the bar rather than the knuckle.

FRONT BRAKE DRUM

Removal

1. Remove hub caps, partially loosen wheel nuts and raise vehicle from floor. Remove wheel nuts and wheel.
2. Remove brake drum. In some cases it may be necessary to back off brake adjustment because of scored drum or unevenly worn brake linings.
3. Check brake drum for concentricity, damaged pilot diameter or scored braking surface. Lightly sand braking surface and wipe clean.

Installation

1. Install drum over hub bolts making sure alignment dowel on drum web indexes with hole in wheel hub. This will assure proper drum alignment with hub bolts and hub pilot diameter.
2. Install wheel and partially tighten wheel nuts.
3. Re-adjust brake shoes to original setting. It may be necessary to re-adjust brake shoes on both front and/or rear wheels to assure balanced brake adjustment. See Section 5 for brake adjustment procedure.
4. Lower vehicle to floor, tighten hub wheel nuts and install hub cap.

FRONT WHEEL HUB

Replacement

1. Remove hub caps, break loose the wheel stud nuts and raise vehicle. Remove wheel nuts, wheel and tire and brake drum.
2. Pry out hub grease cap, cotter pin, spindle nut and washer, and remove hub. Do not drop wheel bearings.
3. Reverse this procedure to install.

Replacement of Wheel Hub Bolts

It may be necessary to replace damaged wheel hub bolts. In this case, service the hub in the following manner:

1. Remove the hub bolts with a press or hammer. These bolts are not peened into the hub. Do not damage wheel mounting surface on hub flange.
2. Install new serrated bolt into hole in hub. Tap lightly with a hammer to start bolt serrations in hole, making sure that bolt is square with hub flange.

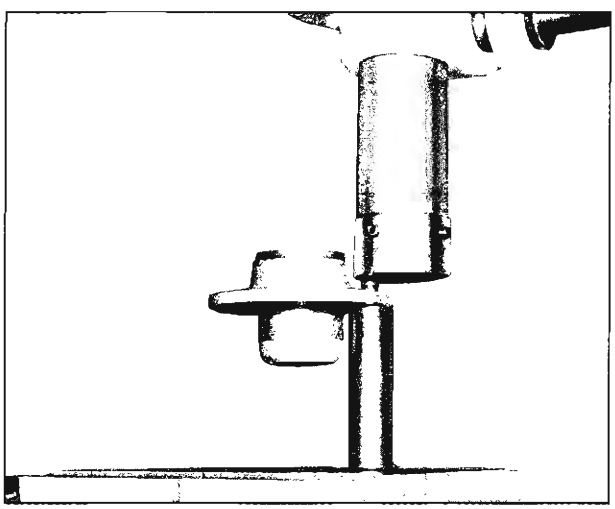


Fig. 9—Pressing Front Hub Bolts

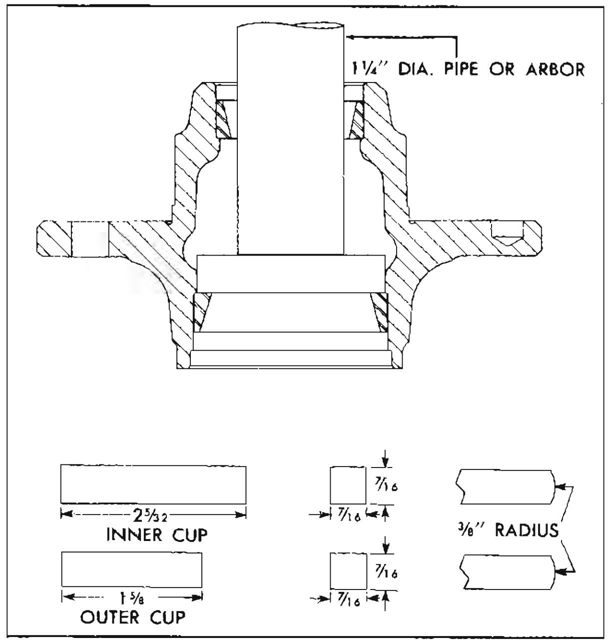


Fig. 10—Front Wheel Bearing Cup Removers

3. Press bolt into flange until head is fully seated against hub flange (fig. 9).

FRONT WHEEL BEARINGS

Removal

1. Remove wheel, brake drum and wheel hub.

   NOTE: Discard cotter pin if badly bent or weakened from repeated bending.

2. Remove outer roller bearing assembly from hub with fingers. The inner bearing assembly will remain in the hub and may be removed after prying out the inner bearing felt seal assembly. Discard seal.
3. Wash all parts thoroughly in cleaning solvent and blow dry.

Inspection

1. Check bearings for cracked separators or worn or pitted rollers and races.
2. Check brake drum for out-of-round or scoring.
3. Check fit of bearing outer cups in hub.

Repairs

Replacement of Bearing Cups

1. Using steel bar stock, make press-out tools shown in Figure 10.
2. Insert removers through hub, indexing ends into slots in hub shoulder behind bearing cup.
3. Using a suitable extension pipe or rod, press bearing cups from hub.
4. Install new bearing cup in hub using Tool J-8849 on the outer and Tool J-8850 on the inner cup (fig. 11). Use Driver Handle J-8092 with the installers. Make sure that the bearing cups are not cocked and are fully seated against shoulder in hub.

Installation

1. Pack both inner and outer bearings using a high melting point wheel bearing lubricant.

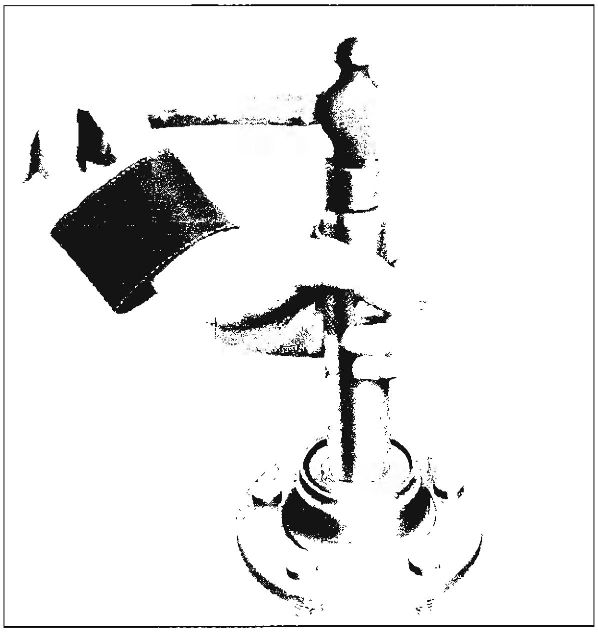


Fig. 11—Installing Front Hub Inner Bearing

2. Place inner bearing in hub, then install a new inner bearing felt seal assembly. Seal flange should face bearing cup.
3. Carefully install wheel hub over steering spindle.
4. Install outer bearing, pressing it firmly into the hub by hand.
5. Install spindle washer and adjusting nut. Draw up tight and adjust wheel bearings as outlined under "Front Wheel Bearing Adjustment".

STEERING KNUCKLE

Chevrolet and Chevelle—It is recommended that vehicle be raised and supported on a twin-post hoist so that the front coil spring remains compressed, yet the wheel and steering knuckle assembly remain accessible. If a frame hoist is used, support lower control arm with an adjustable jackstand to safely retain spring in its curb height position.

Chevy II—While vehicle weight is still on front wheels, position support between upper control arm and frame side rail (fig. 12), then raise vehicle and position adjustable jackstand under lower control arm.

Removal

1. Raise vehicle and support lower control arm as noted above.
2. Remove hub cap, wheel hub dust cover, cotter pin, adjusting nut and washer. Withdraw wheel and tire, brake drum, and wheel hub and bearing assembly from steering knuckle spindle.
3. Remove brake shoes from backing plate, (See Section 5 - Brakes.) and clamp wheel cylinder.

   CAUTION: Keep brake shoes clean and dry.

4. Remove brake anchor pin and two bolts securing brake backing plate and steering arm to steering knuckle.
5. Withdraw steering arm and brake backing plate from steering knuckle. Wire backing plate to frame. Do not disconnect brake line.

   NOTE: Refer to Section 9 - Steering Service Operation entitled Steering Linkage - Tie Rod, for further steering arm service operations.

6. Remove upper and lower ball stud cotter pins and remove ball stud nuts. Free steering knuckle from ball studs by rapping steering knuckle bosses. Withdraw steering knuckle.

Installation

1. Place steering knuckle in position and insert upper and lower ball studs into knuckle bosses.
2. Install ball stud nuts and tighten nut as shown in the specifications at the end of this section.

   NOTE: If necessary, tighten one more notch to insert cotter pins.

3. Place brake backing plate and wheel cylinder in position on steering knuckle and insert anchor pin.
4. Place steering arm in position on back of steering knuckle and insert two bolts through backing plate, steering knuckle and steering arm. Install locknuts and tighten (See Specifications).
5. Torque brake anchor pin (See Specifications).
6. Install brake shoes. (See Section 5 - Brakes.)
7. Install wheel hub, brake drum, wheel and tire assembly over spindle.
8. Insert outer wheel bearing race and roller assembly, washer and nut. Adjust front wheel bearing as shown under Maintenance and Adjustments in this section. Install new cotter pin, dust cap and hub cap.
9. Lower vehicle, recheck and readjust wheel alignment where necessary.

SHOCK ABSORBER

Chevrolet and Chevelle (Fig. 13)

Removal

1. With an open end wrench hold the shock absorber upper stem from turning, and then remove the upper stem retaining nut, retainer and rubber grommet.

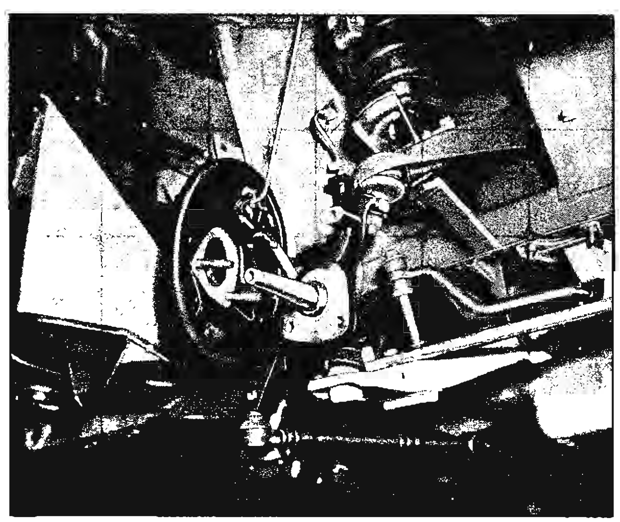


Fig. 12—Backing Plate Removed—Chevy II

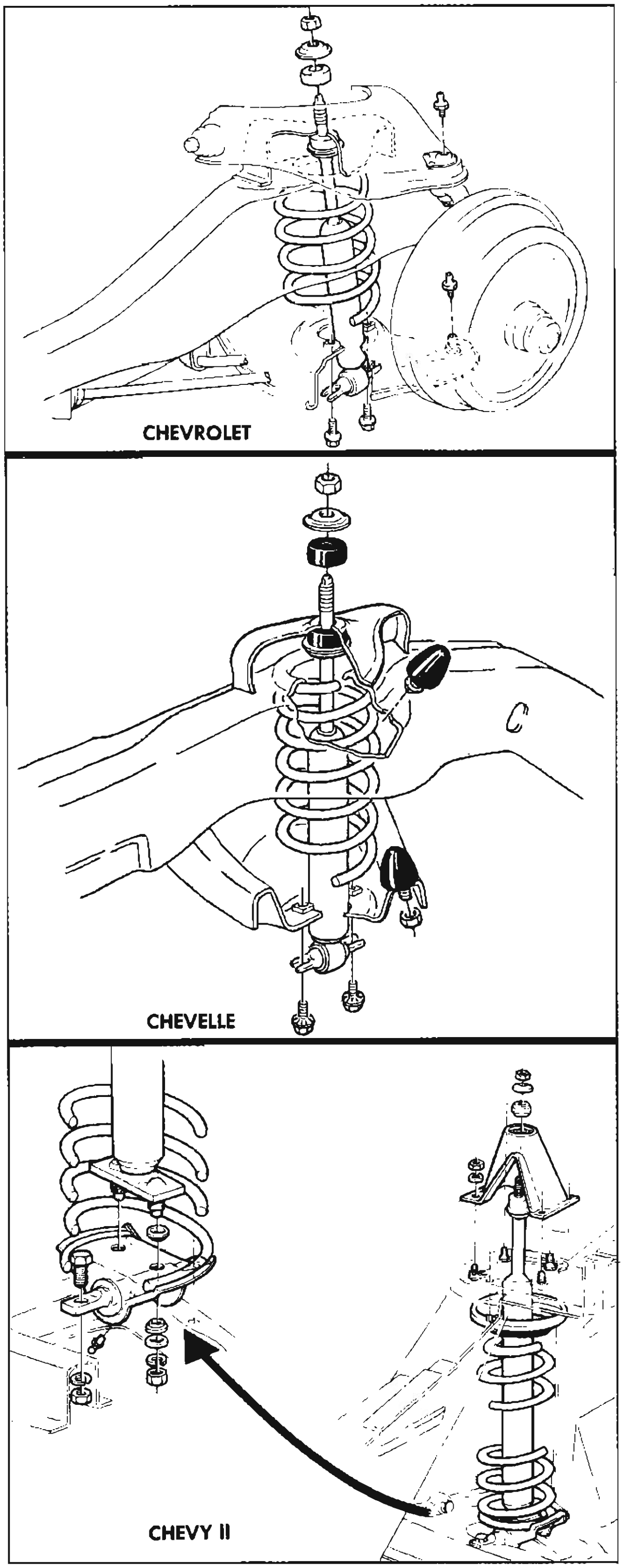


Fig. 13—Shock Absorber

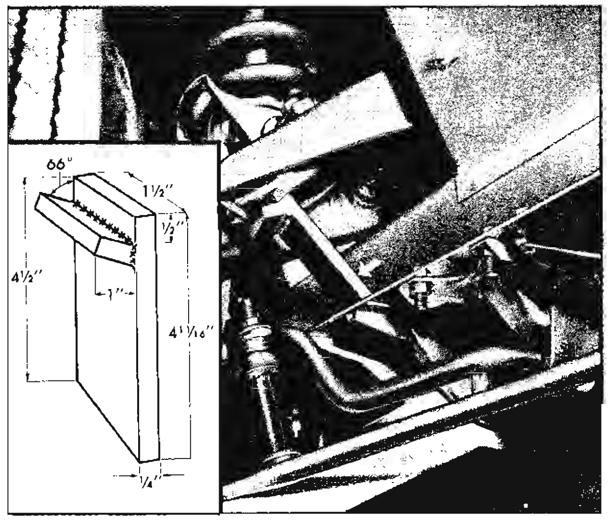


Fig. 14—Upper Control Arm Support Installed—Chevy II

2. Remove the two bolts retaining the lower shock absorber pivot to the lower control arm and pull the shock absorber assembly out from the bottom.

Installation

1. With the retainer and rubber grommet in place over the upper stem, install the shock absorber (fully extended) up through the lower control arm and spring so that the upper stem passes through the mounting hole in the upper support arm.
2. Install the rubber grommet, retainer and attaching nut over the shock absorber upper stem.
3. With an open end wrench, hold the upper stem from turning and tighten the retaining nut. (See Specifications)
4. Install the two bolts attaching the shock absorber lower pivot to the lower control arm and tighten. (See Specifications)

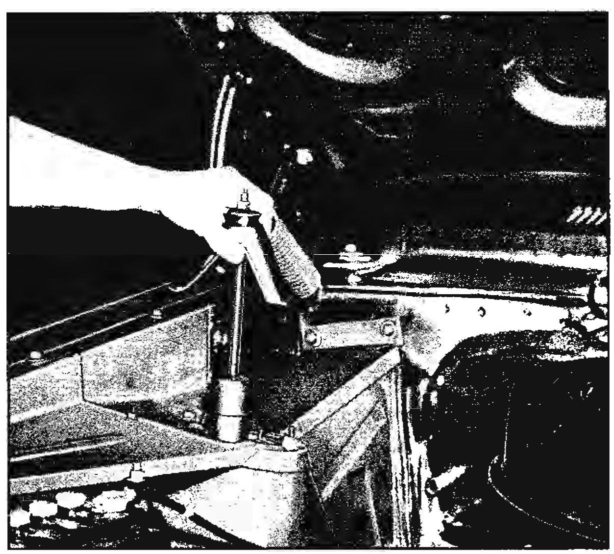


Fig. 15—Removing Shock Absorber and Bracket—Chevy II

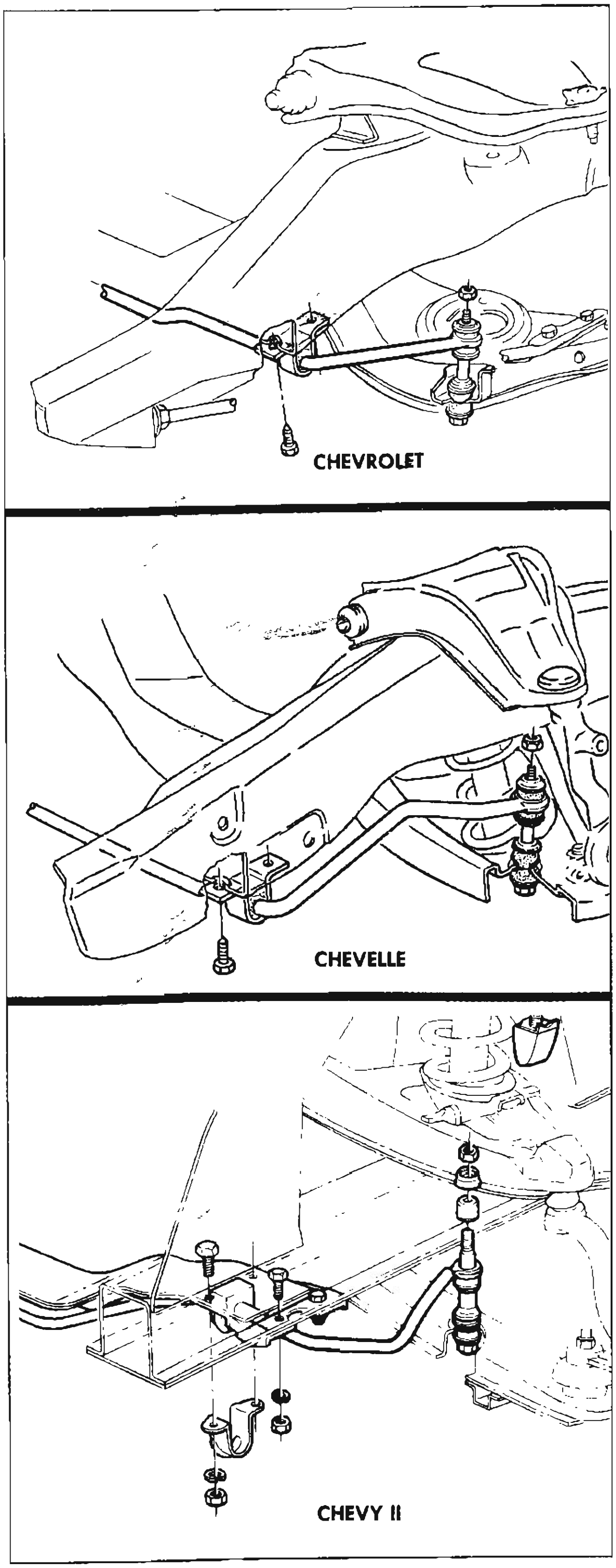


Fig. 16—Stabilizer—Exploded View

Chevy II

Removal

1. While vehicle weight is still on front wheels, position support between upper control arm and frame side rail (fig. 14).

   NOTE: Right side control arm support bracket is illustrated in Figure 14. For left side, angled support should be welded to reverse side of plate.

2. Raise vehicle and remove wheel and tire.
3. Disconnect lower shock absorber mounting nuts, lock washers and rubber washers from lower spring seat.
4. Remove shock absorber upper mounting bracket bolts. Lift bracket and shock absorber assembly from vehicle (fig. 15).
5. Remove shock absorber from upper mounting bracket and remove rubber bushings and washers.

Installation

1. Assemble upper washer and rubber bushing to shock absorber rod (refer to Figure 13).
2. Assemble upper mounting bracket, bushing, washer and nut to rod. Torque according to Specifications at the end of this book.
3. Install rubber washers to shock absorber lower seat studs and insert shock absorber and upper bracket assembly into shock absorber access hole, and position to the lower spring seat. Install washers, nuts and torque according to Specifications at the end of this book.

   NOTE: Shock absorber seat upper washers must correctly pilot into spring seat.

4. Install upper mounting bracket to spring tower and torque nuts according to Specifications at the end of this book.

STABILIZER BAR (FIG. 16)

Removal

1. Raise vehicle and support both front wheels.
2. Disconnect stabilizer bar from lower control arm (fig. 16). Remove stabilizer bar brackets from the frame (Chevrolet and Chevelle) or from the front crossmember (Chevy II) and remove stabilizer.
3. Disconnect stabilizer link bolts, spacers and rubber bushings from lower control arms.
4. Inspect rubber stabilizer link bushings and stabilizer insulator bushings for aging. Replace if necessary.

Installation

1. If new insulators are necessary, coat stabilizer with recommended rubber lubricant and slide insulators into position.
2. Insert stabilizer brackets over insulators and connect to frame. Do not torque at this point. Connect stabilizer ends to link bolts on lower control arms. Torque bracket bolts and link nuts as shown in the Specifications.

STRUT ROD (FIG. 17)

Chevrolet and Chevy II

Removal

1. Raise vehicle to provide sufficient working clearance.

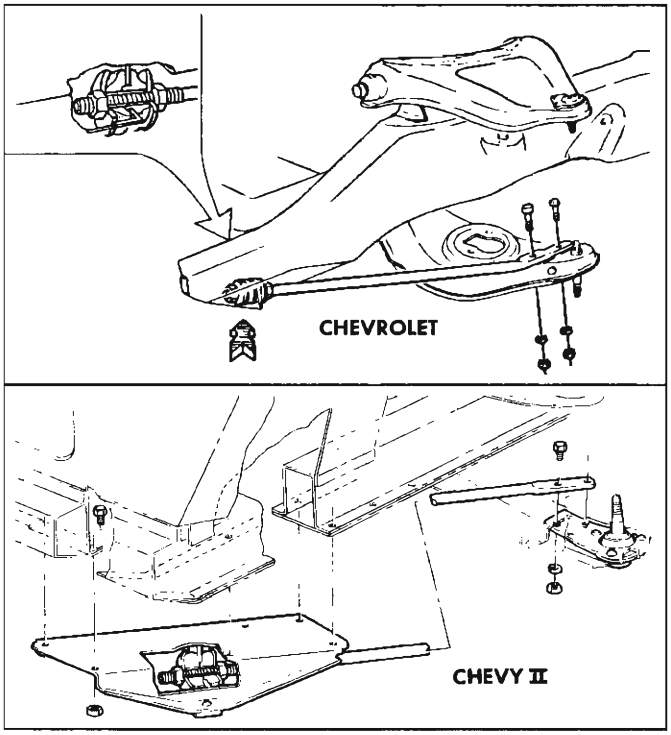


Fig. 17—Strut Rod

2. Remove forward nut, retainer and rubber bushing from front end of strut rod (fig. 19).
3. Remove two nuts from strut rod to lower control arm bolts and remove bolts and washers (fig. 18).
4. Withdraw strut rod from bracket.
5. Remove remaining rubber bushing, retainer, sleeve and nut from strut rod.
6. Inspect rubber bushings for aging and replace if necessary.

Installation

1. Screw rear nut on forward end of rod and position it approximately 3/4" from end of threads. Install rear retainer, sleeve and bushing on rod so raised pilot diameter faces forward.
2. Insert strut rod in bracket so pilot diameter on bushing pilots in hole in bracket. Install forward bushing on sleeve so raised pilot diameter faces rear to enter hole in bracket, then install forward retainer and nut on rod.
3. Attach strut rod to top of lower control arm with two bolts, washers and nuts.
4. Lower vehicle to floor, check caster and camber angles and adjust where necessary. Torque nuts as shown in Specifications.

FRONT SPRING

Chevrolet

Removal

1. With an open end wrench hold the shock absorber upper stem from turning, and then remove the upper stem retaining nut, retainer and rubber grommet.
2. With the car supported by the frame so that the control arms hang free, remove the wheel and tire assembly (replace one wheel nut to retain the brake

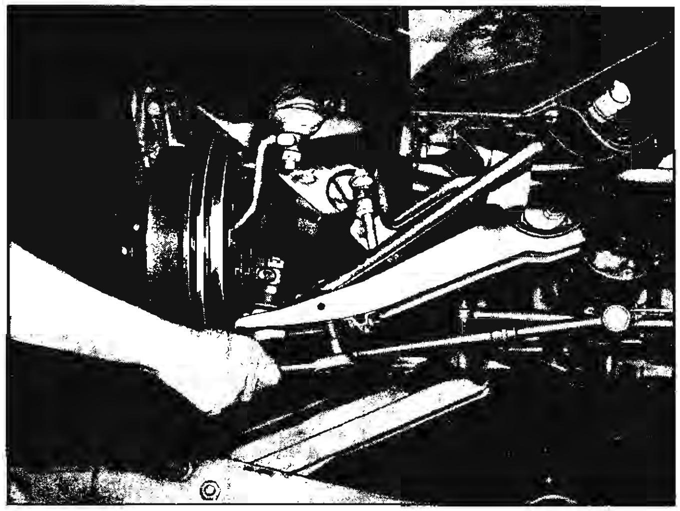


Fig. 18—Disconnecting Strut Rod Rear Mounting Studs—Chevy II Shown

drum), shock absorber, stabilizer bar to lower control arm link, strut rod to lower control arm attaching nuts, bolts and lock washers and tie rod end.
3. Scribe the position of the inner pivot camber adjusting cam bolt and then remove the nut, lock washer and outer cam.
4. Install a steel bar (fabricated as shown in Figure 20) through the shock absorber mounting hole in the lower control arm so that the notch seats over the bottom spring coil and the bar extends inboard and under the inner bushing. Fit a 5" wood block (See Figure 20) between the bar and the bushing as shown in Figure 21.
5. With suitable jack or hoist, lift up slightly on the end of the bar to remove the tension from the inner pivot cam bolt, which can then be removed.
6. Carefully lower the inner end of the control arm. Tension on the spring will be removed before the spring can be removed from the vehicle.

Fig. 19—Removing Strut Rod Front Mounting Nut—Chevy II Shown

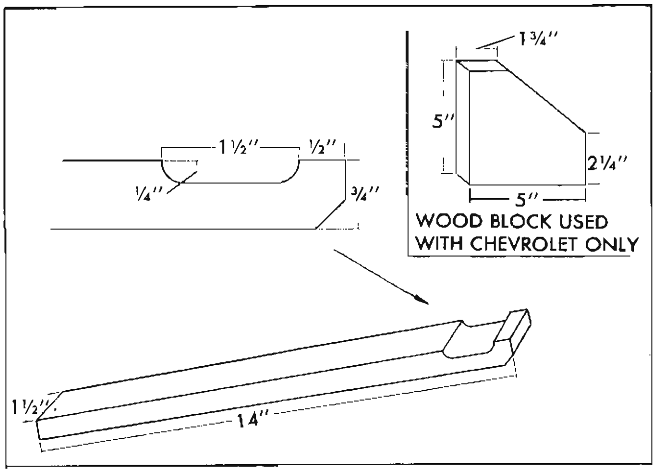


Fig. 20—Spring Removal Tools—Chevrolet and Chevelle

7. Remove the spring.

Installation

1. With the suspension set up as in Step 2 of the disassembly procedure, insert a block of wood between the upper control arm and the spring tower to keep the arm up out of the way.
2. Set the spring in place on the crossmember after checking on proper positioning necessary.
3. Install the steel bar and wood block as shown in Figure 21 and lift the control arm up until the inner pivot cam bolt can be installed.
4. Install the outer cam and loosely install the lock washer and nut.
5. Set the cam bolt on the mark scribed during the removal procedure and hold in this position while tightening the nut (See specifications at the end of this book).
6. Replace the strut rod to lower control arm nuts, bolts and lock washers, the stabilizer bar link, the shock absorber, the tie rod end, and the wheel and tire.
7. Lower vehicle to floor and install the shock absorber upper stem retaining nut retainer and grommet.
8. Check the camber adjustment.

Chevelle

Removal

1. With an open end wrench hold the shock absorber upper stem from turning, and then remove the upper stem retaining nut, retainer and rubber grommet.
2. With the car supported by the frame so that the control arms hang free, remove the wheel and tire assembly (replace one wheel nut to retain the brake drum), shock absorber, and stabilizer bar to lower control arm link.
3. Place a steel bar (fabricated as shown in Figure 20) through the shock absorber mounting hole in the lower control arm so that the notch seats over the bottom spring coil and the bar extends outboard beyond the end of the control arm and slightly toward the front of the car.
4. Remove the lower ball stud cotter pin and attaching nut and remove the ball stud from the knuckle.

   CAUTION: Use extreme care not to damage the seal during this operation.

5. Lower control arm as shown in Figure 22, until spring can be removed.

Installation

1. Properly position the spring on the arm and with the steel bar in place, as shown in Figure 22, lift the arm up until the ball stud may be installed in the knuckle. Install the nut and cotter pin.

   NOTE: A block of wood between the upper control arm and the frame will simplify this operation.

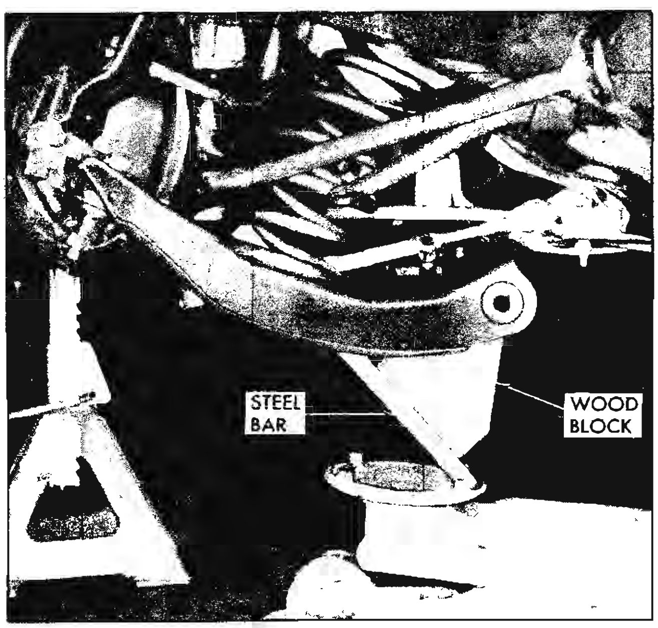


Fig. 21—Front Spring Removal—Chevrolet

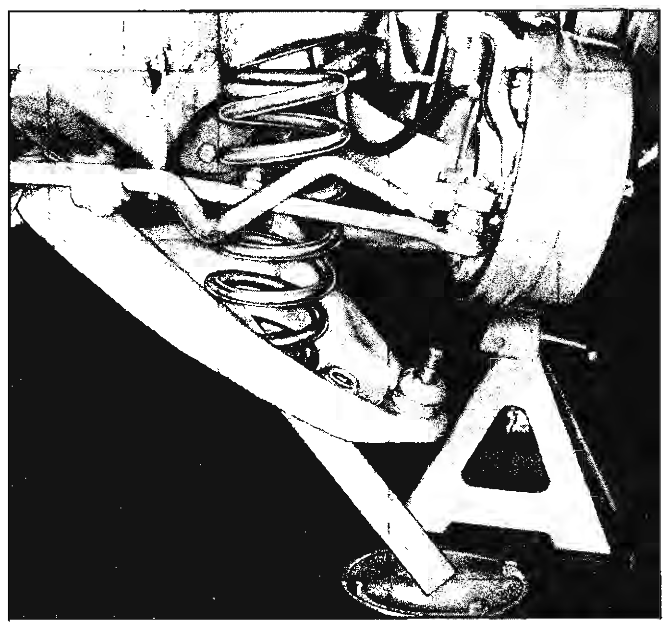


Fig. 22—Front Spring Removal—Chevelle

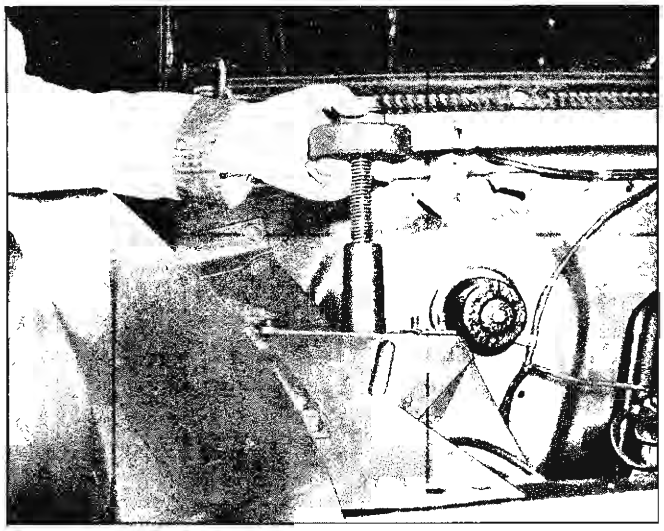


Fig. 23—Installing Spring Compressor—Chevy II

2. Replace the stabilizer bar link, shock absorber and wheel and tire.
3. Lower vehicle to floor and install the shock absorber upper stem retaining nut retainer and grommet.

Chevy II

Removal

1. Raise vehicle and remove wheel and tire.
2. Support lower control arm with adjustable jackstand and raise slightly from full rebound position.
3. Remove shock absorber as outlined under Shock Absorber — Removal in this section (delete Step 1).
4. Insert Spring Compressor J-6874-4-5 with Adapters J-6874-8-9 into upper spring tower so that lower U-bolt fits into shock absorber mounting holes in spring seat (fig. 23). Secure the two lower studs to the spring seat with nuts.
5. Fit the tool upper pilot to top of spring and compress spring by tightening upper nut (fig. 24). Compress spring until screw is bottomed out.

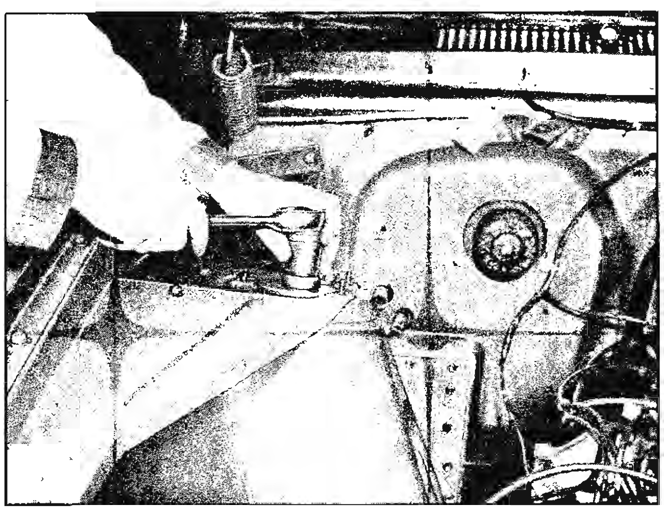


Fig. 24—Compressing Front Spring—Chevy II

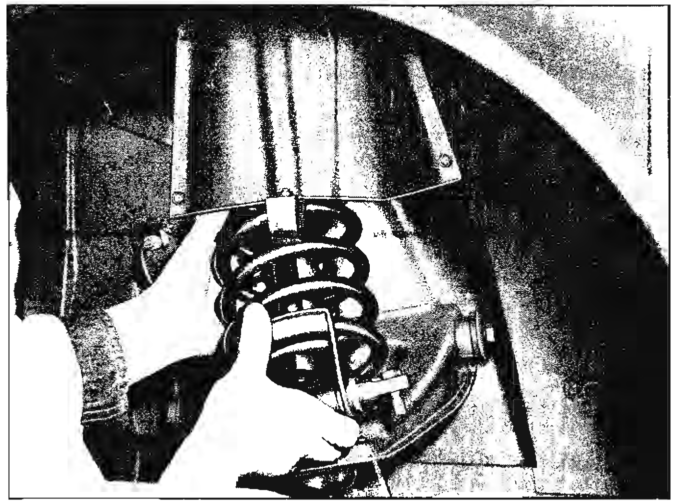


Fig. 25—Removing Spring and Seat Assembly—Chevy II

6. Remove lower spring seat retaining nuts, lift spring and seat assembly from control arm and guide it down and out through fender skirt (fig. 25).

Spring Seat Disassembly and Assembly (Fig. 26)

1. Release spring tension and disconnect spring compressor from spring seat.

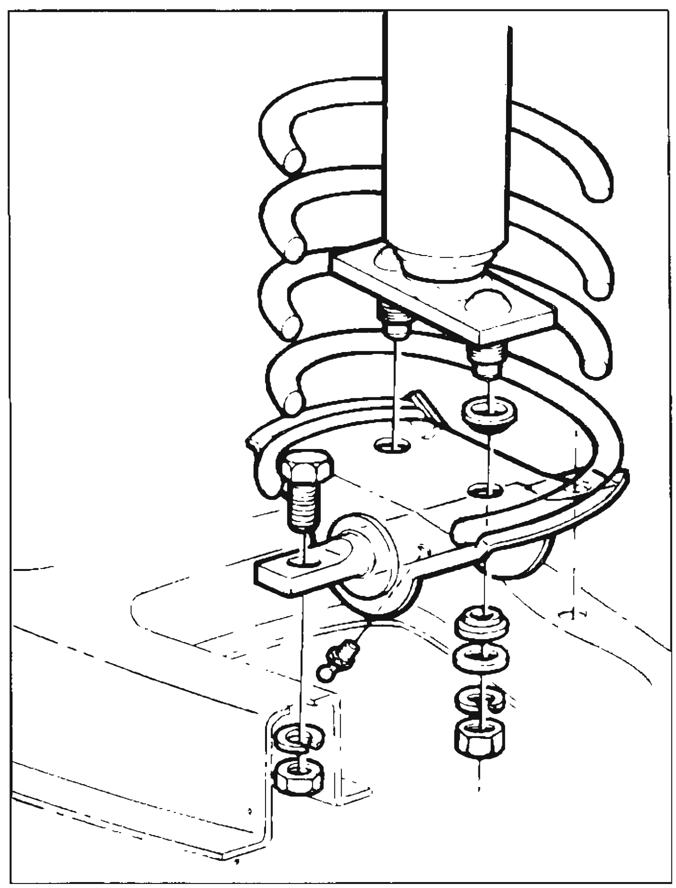


Fig. 26—Spring Seat—Exploded View—Chevy II

2. Tap one bolt out of pivot shaft and remove rubber boots.
3. Unscrew pivot shaft, drawing free end of shaft through threaded sleeve (fig. 27).
4. Inspect pivot shaft and sleeve for damage to threads or distortion. Inspect rubber shaft boots for aging and replace if necessary.
5. Screw pivot shaft into spring seat sleeve until bolt hole centerlines are equal distance from spring seat within .05" (fig. 28).
6. Insert lip of rubber boot into groove in seat sleeve.
7. Insert bolt into pivot shaft and grease spring seat assembly through lube fitting.
8. Install spring seat to spring compressor.

Installation

1. If spring is to be replaced, install new spring into tool and compress spring until screw is bottomed out.

   NOTE: Spring coil ends must be against spring stops in upper and lower seats.

2. Lift spring and tool assembly into place and position so that the upper spring stop is inboard.

   NOTE: Locating tab on upper spring seat may be flattened before reinstalling spring.

3. Install lower spring seat to control arm and torque nuts as shown in the Specifications.
4. Loosen spring compressor until spring is properly seated in upper spring tower and remove.
5. Install shock absorber as outlined under Shock Absorber—Installation in this section.

LOWER CONTROL ARM SPHERICAL JOINT

Chevrolet and Chevelle

Inspection

The lower control arm spherical joint should be replaced whenever wear is indicated in the upper joint inspection.

NOTE: The lower control arm spherical joint is a loose fit in the assembly when not connected to the steering knuckle.

Only if inspection of each upper joint indicates them both to be within limits, inspect each lower joint for excessive wear as follows:

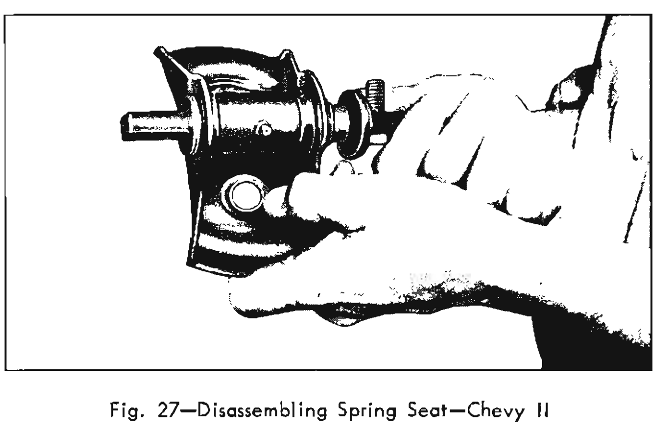


Fig. 27—Disassembling Spring Seat—Chevy II

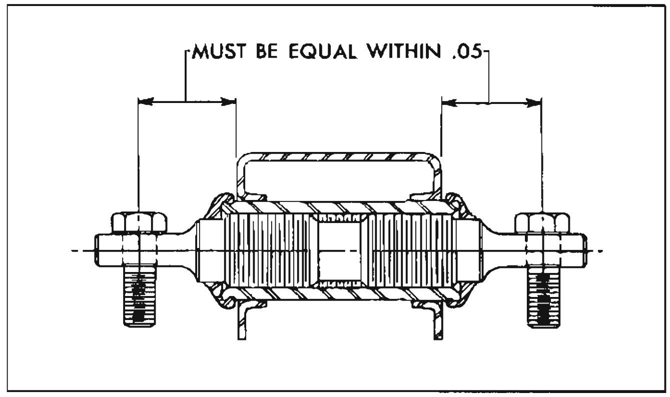


Fig. 28—Installing Pivot Shaft—Chevy II

1. After reconnecting upper joints to steering knuckles, support vehicle weight on wheels or wheel hubs.
2. With outside micrometer or caliper, measure distance from top of lubrication fitting to bottom of ball stud, and record the dimensions for each side.
3. Then support vehicle weight at outer end of each lower control arm, so that wheels or wheel hubs are free, then repeat Step 2.
4. If the difference in dimensions on either side is greater than 1/16" (.0625"), the joint is excessively worn and both lower joints should be replaced.

If inspection of lower spherical joints does not indicate excessive wear, inspect further as follows:

5. On Chevrolet Only—Examine lubrication hole in each joint assembly after cleaning out hole. Look for evidence of the liner partially or fully blocking lubrication opening. Such evidence indicates that liner is disintegrating and that both lower spherical points should be replaced.

Another indication of lower spherical joint excessive wear is indicated when difficulty is experienced when lubricating the joint. If the liner has worn to the point where the lubrication grooves in the liner have worn away, then abnormal pressure is required to force lubricant through the joint. This is another reason to recommend replacement of both lower joints.

If the above inspections do not indicate any reason for spherical joint replacements, test the torque tightness of the lower ball stud in the knuckle on each side as follows:

1. Wire-brush off nut and cotter pin attaching spherical joint ball stud to steering knuckle and examine for evidence of looseness of stud in knuckle.
2. If no evidence of looseness, remove cotter pin and with prick punch or equivalent, mark nut stud and knuckle to identify relative location.
3. Tighten nut as installed and observe torque reading. If less than 45 ft. lbs., stud may have been loose in steering knuckle and replacement of both lower spherical joints may be recommended.
4. Check to see if torque of 60-94 ft. lbs. can be obtained without bottoming stud or ball joint against knuckle. If bottoming occurs, replace ball joint or steering knuckle.

Chevrolet

Removal

1. Support lower control arm at outer end on floor jack, with hoist or jack pad clear of lower ball stud nut.

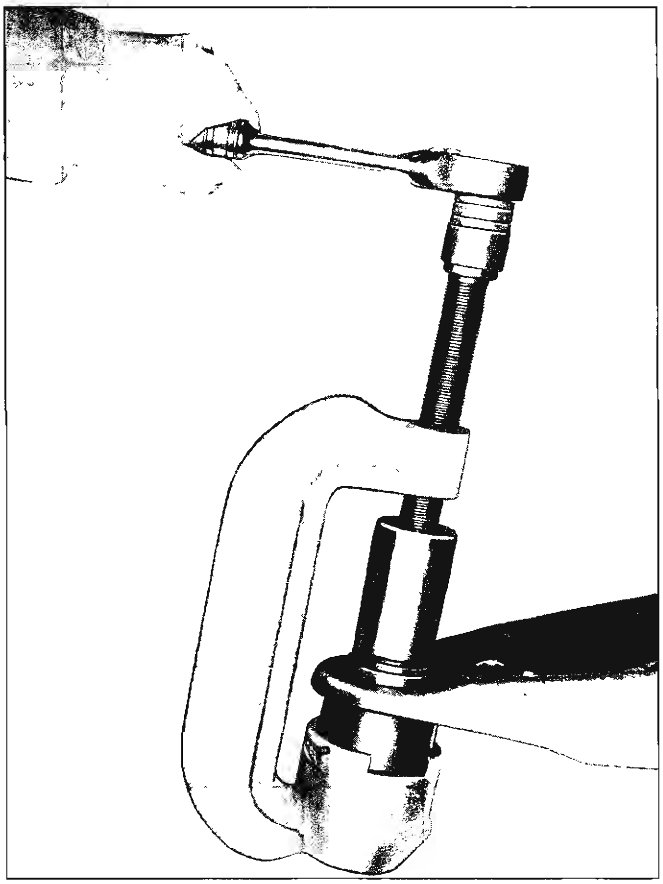


Fig. 29—Removing Lower Ball Joint—Chevelle

2. Remove upper and lower ball stud nuts, free ball studs from steering knuckle and wire knuckle and brake drum assembly up to fender skirt to preclude interference while performing next step.
3. Being careful not to enlarge the holes in control arm, cut off rivets.

Installation

NOTE: The service part will be in three pieces. The metal inner seal is to be carefully pressed in place on the joint housing. The rubber outer seal should then be placed over the inner seal.

1. Install new joint against underside of control arm and retain in place with special bolts and nuts supplied with new joint.

   CAUTION: Use only alloy bolts supplied for this operation. The special thick headed bolt must be installed in the forward side of the control arm.

2. Tighten bolts and nut on ball stud forging to Specification shown at the end of this book.

Chevelle

Removal

1. Support lower control arm at outer end of floor jack, with hoist or jack pad clear of lower ball stud and remove the wheel.
2. Remove the upper and lower ball stud nuts, free the ball studs from the steering knuckle and wire the knuckle and brake drum assembly out of the way to preclude interference while completing the lower ball stud removal procedure.
3. Use a screw driver to pry off the seal and retainer. Install Tools J-9519-10, J-9519-17 and J-9519-7 as shown in Figure 29 and turn down on the hex head screw until the ball stud is pushed out.

Installation

1. Start the replacement ball stud into the control arm and install Tools J-9519-10, J-9519-16 and J-9519-17 as shown in Figure 30.
2. Turn down on the hex head screw until the ball stud is seated properly in the control arm.
3. Install the stud into the steering knuckle, secure in place with the attaching nut and install the cotter pin.
4. Replace the wheel and tire.
5. Lower the vehicle.

Chevy II

Inspection

1. With upper control arm support in position as in Figure 14, disconnect the lower ball stud from steering knuckle.
2. Assemble nut to lower ball stud and check rotating torque with torque wrench. Specifications for new joints are 4-8 ft. lbs. If torque readings are excessively high or low, replace ball joint.

Removal

1. While vehicle weight is still on front wheels, position support between upper control arm and frame side rail (fig. 14).
2. Raise vehicle and remove cotter pin and nut from lower ball joint stud (fig. 31).

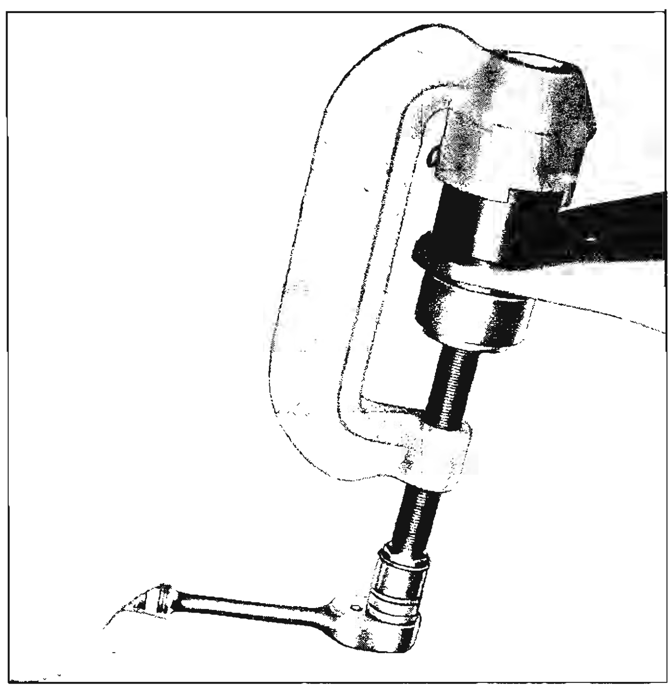


Fig. 30—Installing Lower Ball Joint—Chevelle

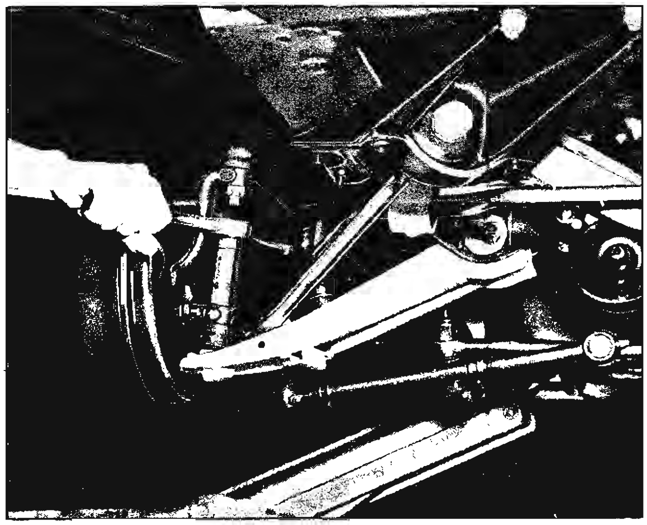


Fig. 31—Disassembling Lower Ball Stud—Chevy II

3. Disconnect stabilizer at upper link. Break loose the lower ball stud. Drop lower control arm until lower ball joint is easily accessible.

   CAUTION: Use extreme care when breaking the ball stud loose so that seal is not damaged.

4. Using a large chisel, cut off the three ball joint retaining plate rivet heads. It may be necessary to drill out rivet heads before chiseling.

   NOTE: Additional support to lower control arm will be necessary to perform this operation.

5. Remove ball joint from arm and clean arm.
6. Inspect ball joint seat and rivet holes for evidence of fatigue such as cracking or bending. If defects are evident, replace lower control arm as outlined later in this section.

Installation

1. Install ball joint in arm using special bolts furnished with replacement kit.

   NOTE: Use only special hardened bolts furnished with this replacement kit. Do not attempt to use other non-hardened bolts and do not attempt to rivet replacement ball joint to arm.

2. Raise lower control arm and insert ball stud into steering knuckle lower boss. Install nut and insert new cotter pin. Install stabilizer linkage.

Lube Fittings

Special self threading type lube fittings are used in the spherical joint assemblies. If it is necessary to replace a fitting a standard threaded type may be used. However, replacement spherical joint assemblies are supplied less the lube fitting. Therefore it will be necessary to install a self threading type fitting into the untapped hole provided when replacing the entire assembly.

LOWER CONTROL ARM

Chevrolet (Fig. 32)

Removal

1. Remove the coil spring as outlined previously.
2. Remove lower control arm ball stud cotter pin and loosen nut. Loosen the ball stud, then remove nut and lower control arm.

   CAUTION: Use extreme care not to damage the seal during this operation.

Installation

1. Insert lower control arm ball stud into the steering boss, install the nut and insert new cotter pin.
2. Install the coil spring as outlined previously.

Chevelle (Fig. 33)

Removal

1. Remove the front coil spring as outlined previously.
2. Remove the two control arm to frame and cross-member bracket attaching bolts and lock washers.
3. Remove the lower control arm assembly.

Installation

1. With the control arm in place in frame and cross-member brackets, install the front and rear attaching bolts, nuts and lock washers.
2. Install the coil spring as outlined under "Front Coil Spring - Installation".
3. Tighten the nuts.

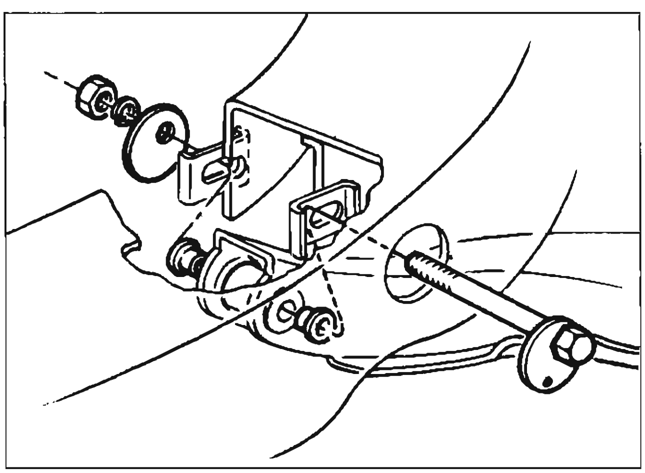


Fig. 32—Lower Control Arm Attachment—Chevrolet

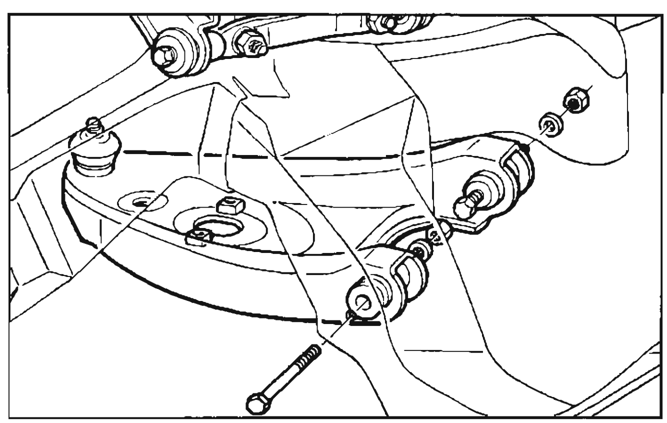


Fig. 33—Lower Control Arm Attachment—Chevelle

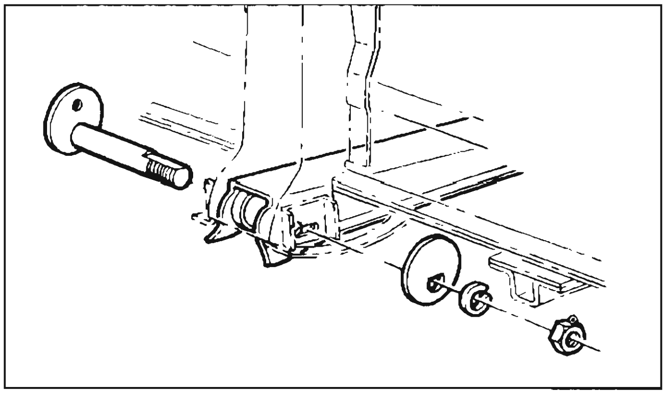


Fig. 34—Lower Control Arm Pivot Bolt—Chevy II

Chevy II (Fig. 34)

Removal

1. With vehicle weight still on front wheels, install spacer between upper control arm and frame side rail (fig. 14). Raise vehicle.
2. Remove lower control arm ball stud cotter pin and loosen nut.
3. Loosen ball stud and remove nut. Drop lower control arm.

   CAUTION: Use extreme care not to damage the seal during this operation.

4. Mark lower control arm pivot bolt and adjusting cam for realignment. Remove nut securing pivot bolt and cam assembly. Remove pivot bolt and cam. Remove lower control arm.

Installation

1. Insert lower control arm into its support bracket, index pivot bolt and cams, pivot nut and tighten.
2. Raise lower control arm ball stud into steering knuckle boss and install nut. Tighten nut and insert new cotter pin.
3. Grease ball joint and install wheel and tire.
4. Lower vehicle and remove upper control arm to frame support. Check caster and camber and re-adjust where necessary.

LOWER CONTROL ARM BUSHING

Chevrolet

Removal

1. Remove the lower control arm.
2. Install Tools J-21058-8, J-21058-15, J-21830-7, J-9519-17, J-21474-8, special thrust washer and a flat washer as shown in Figure 35. Use J-21878 as shown to prevent collapse of the control arm.
3. Turn down on the puller screw nut to remove the bushing from the control arm.

Installation

1. With Spacer J-21878 in place to prevent collapse of the control arm, install Tools J-21058-8, J-21058-15, J-21830-7, J-9519-17, J-21474-2 special thrust washer and flat washer as shown in Figure 35.
2. Turn down on the puller screw nut to install the bushing in the control arm.

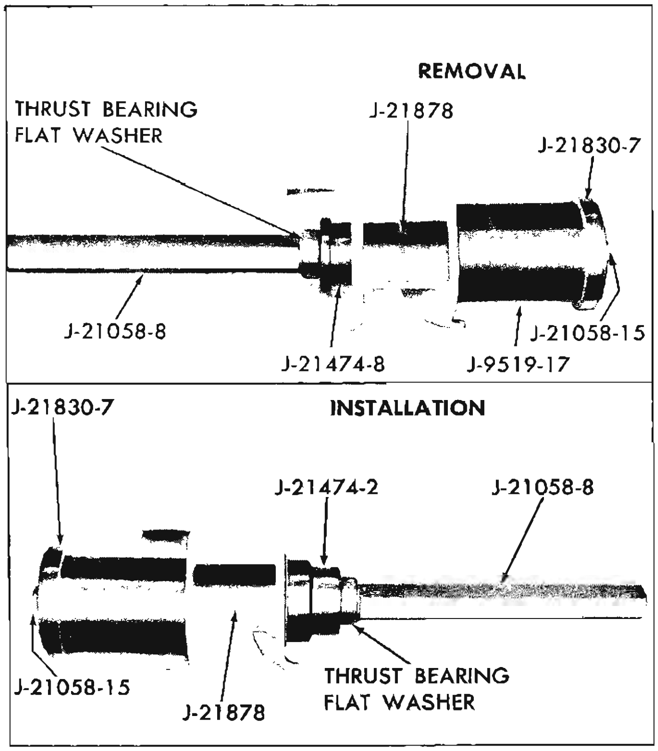


Fig. 35—Lower Control Arm Bushing—Chevrolet

Chevelle

Removal

1. Remove the lower control arm.
2. Install Tools J-21058, J-21474-5 and J-21474-8 (small end) over the control arm front bushing, as shown in Figure 36. Tool J-21474-12 prevents collapse of the control arm.
3. Turn down on the hex head screw of J-21058 until the bushing is pushed out.
4. Perform the same operation on the control arm rear bushing, using the large end of J-21474-8 and installing the various tools as shown in Figure 36.
5. Remove the bushing as in Step 3.
6. Discard both bushings.

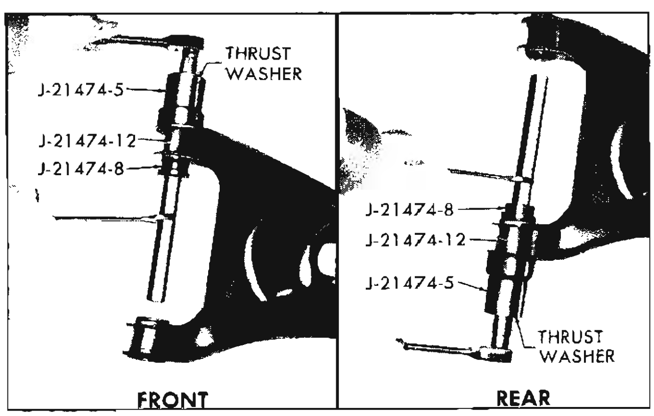


Fig. 36—Lower Control Arm Bushing Removal—Chevelle

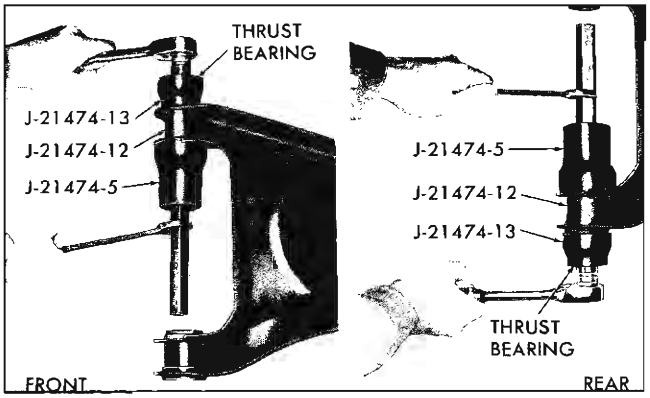


Fig. 37—Lower Control Arm Bushing Installation—Chevelle

Installation

1. The front and rear bushings are pressed into place individually using Tools J-21058, J-21474-5, J-21474-12 and J-21474-13.
2. Hand start the front bushing into the control arm.
3. Install the tools as shown in Figure 37. Use the small end of J-21474-13.
4. Turn down on the hex head screw of J-21058 until the bushing flange contacts the control arm.
5. Perform the same operation to install the control arm rear bushing, using the large end of J-21474-13. Install the tools as shown in Figure 37.
6. Replace the control arm.

Chevy II

Removal

1. Support control arm on Tool J-7574-4 and insert Spacer J-9514 (fig. 38).
2. Press bushing out with Tool J-9226 and Handle J-7079-2 (fig. 38).

Installation

With Spacer J-9514 still in control arm, invert control arm and press in new bushing with Tool J-7474-2 and Handle J-7079-2 until bushing is fully seated.

CAUTION: It should be noted that control arm bushing diameters are unequal and bushing must be pressed into position through larger diameter only.

UPPER CONTROL ARM SPHERICAL JOINT

Chevrolet and Chevelle

Inspection

The upper spherical joint is checked for wear by checking the torque required to rotate the ball stud in the assembly. Install a stud nut on the stud and measure the torque required to turn the stud in the assembly with a torque wrench. This should be a minimum of 2 lbs. ft. for Chevrolet; 12 lb. in. for Chevelle. If excessive wear is indicated in upper joint, both upper and lower joints should be replaced. If a tight joint is suspected, 15 lbs. ft. is the maximum allowable torque for Chevrolet; 100 lb. in. for Chevelle, with joint well lubricated.

NOTE: This inspection does not necessitate upper control arm removal.

Replacement

1. Support the vehicle weight at the outer end of the lower control arm.
2. Remove the wheel and tire assembly.
3. Remove cotter pin and nut from upper control arm ball stud.
4. Remove the stud from knuckle.
5. Cut off the ball joint rivets with a chisel.
6. Install new joint and retain in place with the special nuts and bolts supplied.
7. Reassemble ball stud to the steering knuckle.

Chevy II

Inspection

The following on-the-vehicle check is to determine ball joint wear.

NOTE: The upper ball joint is a loose fit when not connected to the steering knuckle. Wear may be checked without disassembling the ball stud by using the following procedure:

1. While vehicle weight is still on front wheels, insert upper control arm support as shown in Figure 14.
2. Raise vehicle and allow wheel and tire to hang free.
3. Measure distance from tip of ball stud to top surface of control arm.
4. Place adjustable jackstand under tire and raise slightly to take up ball joint looseness.
5. Repeat Step 3 and if the difference in measurements exceeds 3/32", the joint is excessively worn and should be replaced.

Replacement

1. With vehicle weight still on front wheels, install spacer between upper control arm and frame side rail (fig. 14). Raise vehicle.
2. Remove wheel and tire.
3. Disconnect stabilizer link (if present) and strut rod at lower control arm.
4. Remove cotter pin and nut from upper ball joint stud.

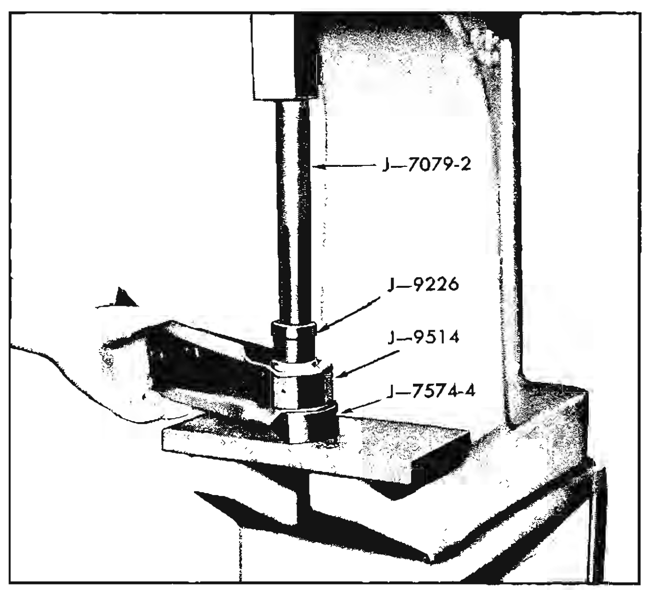


Fig. 38—Removing Lower Control Arm Pivot Bushing—Chevy II

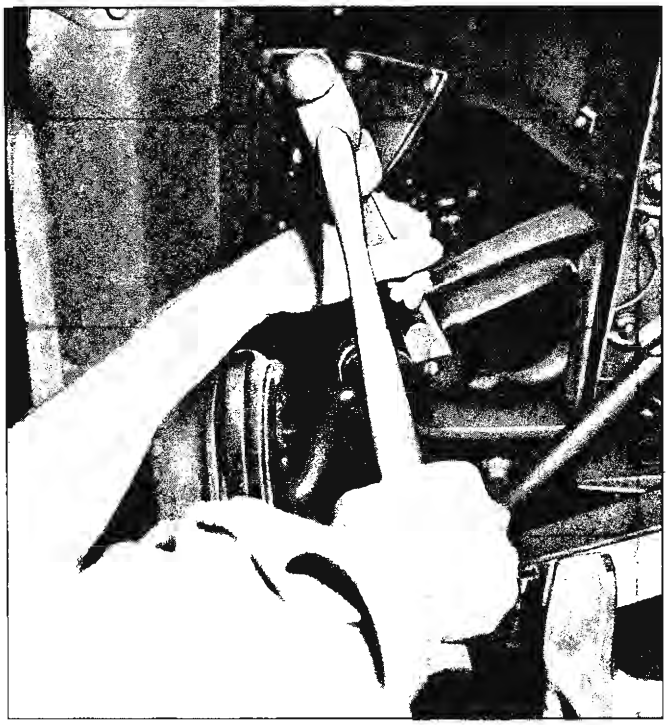


Fig. 39—Cutting Upper Ball Joint Rivet Heads—Chevy II

5. Break ball stud loose. Drop lower control arm, steering knuckle and brake assembly with an adjustable jackstand until upper control arm ball joint is easily accessible.
6. Using a large chisel, cut off the three ball joint retaining plate rivet heads (fig. 39). It may be necessary to drill out rivet heads before chiseling.

NOTE: Additional support to upper control arm may be necessary while chiseling.

7. Clean ball joint seat in arm and inspect for cracking or other evidence of fatigue. If cracks are present at the rivet holes or ball joint opening, replace arm as outlined later in this section.
8. Attach replacement ball joint assembly to the control arm, using special bolts furnished with replacement kit.

NOTE: Use only special hardened bolts furnished with this replacement kit. Do not attempt to use other non-hardened bolts and do not attempt to rivet replacement ball joint to arm.

9. Raise lower control arm and steering knuckle assembly into position, insert upper ball stud into upper steering knuckle and install stud nut. Torque nut as shown in the specifications and insert new cotter pin. Install stabilizer and strut rod.
10. Lubricate ball joint, install wheel and tire and remove adjustable jackstand.
11. Lower vehicle and remove upper control arm spacer.
12. Check and readjust caster and camber angles where necessary.

Lube Fittings

Special self threading type lube fittings are used in the spherical joint assemblies. If it is necessary to replace a fitting a standard threaded type may be used. However, replacement spherical joint assemblies are supplied less the lube fitting. Therefore it will be necessary to install a self threading type fitting into the untapped hole provided when replacing the entire assembly.

UPPER CONTROL ARM

Chevrolet and Chevelle

Removal

1. Support vehicle weight at outer end of lower control arm.
2. Remove wheel and tire assembly.
3. Remove cotter pin and nut from upper control arm ball stud.
4. Remove the stud from knuckle.
5. Remove two nuts retaining upper control arm shaft to front crossmember. (Chevelle Only—Note number of shims at each bolt.)
6. Remove the bolts attaching the control arm to the frame to allow proper clearance for control arm removal.
7. Remove upper control arm from vehicle.

Installation

1. Install upper control arm in vehicle.
2. Install nuts, bolts and lock washers retaining upper control arm shaft to frame. (Chevelle Only—Install same number of shims as removed at each bolt.)

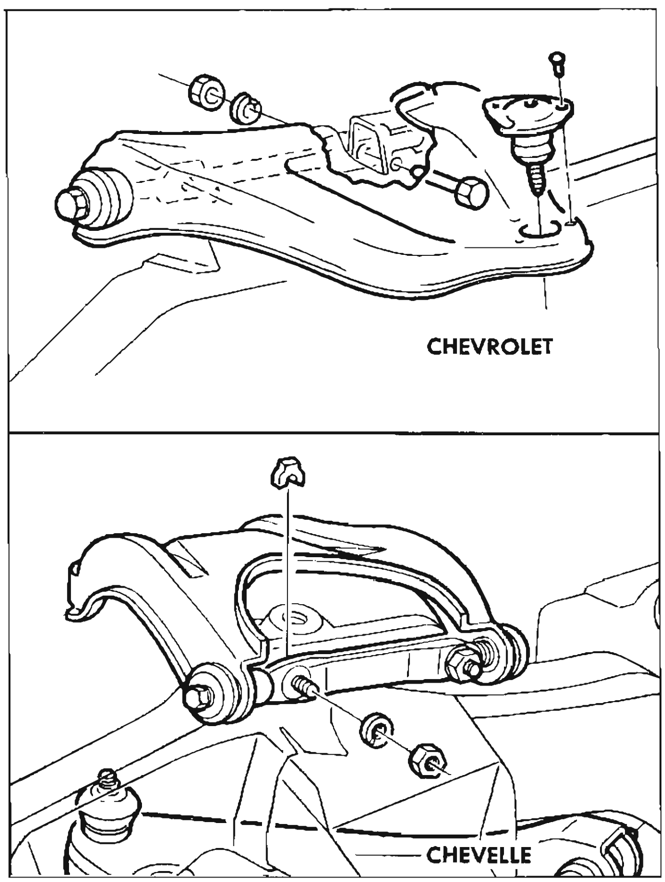


Fig. 40—Upper Control Arm Attachment

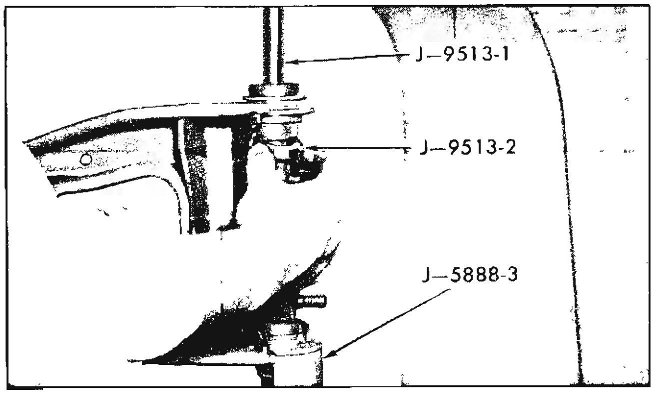


Fig. 41—Upper Control Arm—Chevy II

3. Torque nuts as shown in the Specifications at the end of this book.
4. Install ball stud through knuckle, install nut, tighten and install cotter pin.
5. Install wheel and tire assembly.
6. Lower vehicle to floor.
7. Bounce front end of vehicle to centralize bushings and tighten bushing collar bolts as shown in the Specifications.

Chevy II

Removal

1. Remove spring and shock absorber as outlined above.
2. Position adjustable jackstand under lower control arm.
3. Remove cotter pin and nut from upper ball joint stud and strike steering knuckle boss to loosen stud.
4. Drop lower control arm and steering knuckle assembly.
5. Remove upper control arm pivot shaft stud nuts from fender skirt and remove upper control arm.
6. Inspect upper control arm for cracks or bending and replace if necessary.

Installation

1. Insert upper control arm pivot shaft studs into reinforced fender skirt openings, install lock washers and nuts and torque as indicated in the specifications.
2. Raise lower control arm and steering knuckle assembly into position, insert upper ball joint stud into

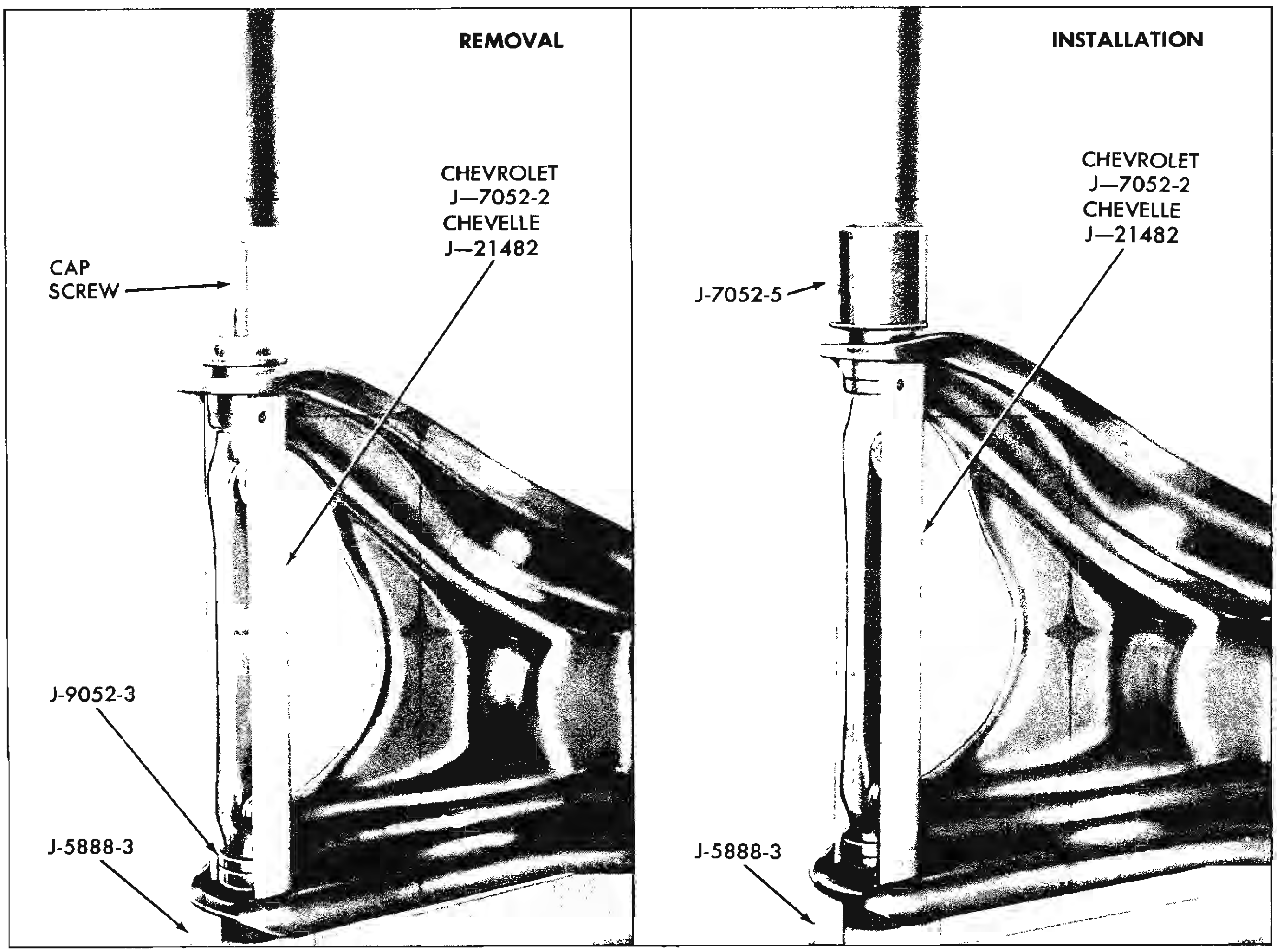


Fig. 42—Removal and Installation of Upper Control Arm Bushings—(Chevelle shown as typical)

steering knuckle and install ball stud nut and insert new cotter pin.

3. Install spring and shock absorber as outlined earlier in this section.
4. Lubricate ball joint and lower vehicle. Check caster and camber angles and adjust where necessary.

UPPER CONTROL ARM CROSS SHAFT AND/OR BUSHINGS

Chevrolet and Chevelle

Removal

1. Remove cap screws, lock washers and collars from both ends of cross shaft.
2. Install a 3/8-24 cap screw in one end of cross shaft.
3. Support control arm in an arbor press on Tool J-5888-3 as shown in Figure 42.

   NOTE: Be certain flange of bushing does not contact support.

4. Press out bushing, invert control arm and repeat process on other bushing. Discard bushings.
5. Remove cap screw from cross shaft.

   NOTE: If bushing rubber id deteriorated to the extent that the bushing sleeve cannot be pushed out, release the press, install J-9502-3 as shown in Figure 42 and press out the sleeve.

Installation

1. Install arm in arbor press with Tool J-7052-2 (Chevrolet) or J-21482 (Chevelle) in place and press in one bushing using J-7052-5 as shown while supported on Tool J-5888-3 as shown in Figure 42.
2. Install cross shaft in arm, invert in press, and press in second bushing as above.
3. Cross shaft should be able to be turned by hand.
4. Install collar, lock washer and cap screw in ends of cross shaft. Do not tighten.

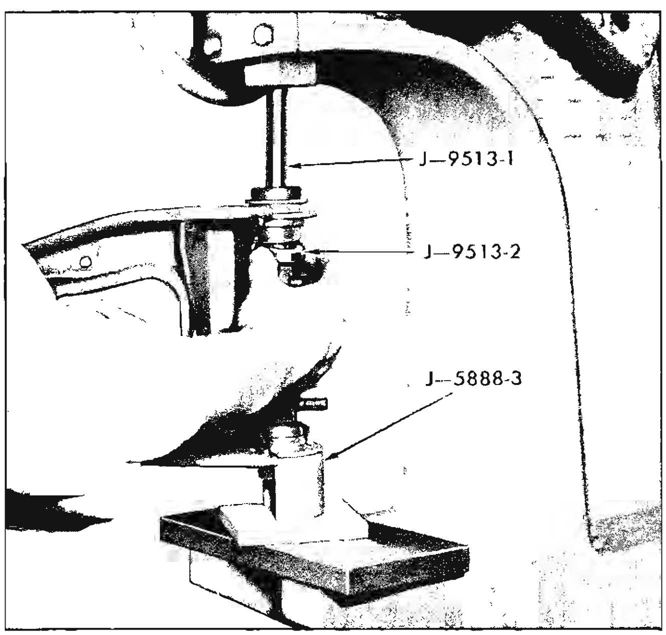


Fig. 43—Installing Bushing Remover J-9513-2—Chevy II

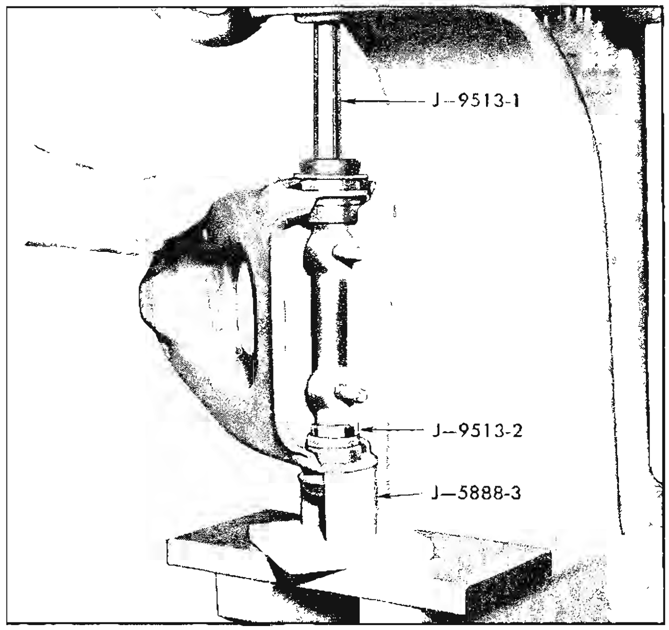


Fig. 44—Removing Pivot Shaft Bushing—Chevy II

Chevy II

Removal

If a new pivot shaft is to be installed, always replace both pivot shaft bushings.

1. Remove nut, lock washer and metal spacer from pivot shaft end.
2. Stand control arm and pivot shaft assembly on Support J-5888-3.
3. Insert J-9513-1 over threaded end of pivot shaft.
4. Press pivot shaft down until upper bushing diameter is visible for approximately 5/16", then insert J-9513-2 over journal (fig. 43). Release tension on pivot shaft.

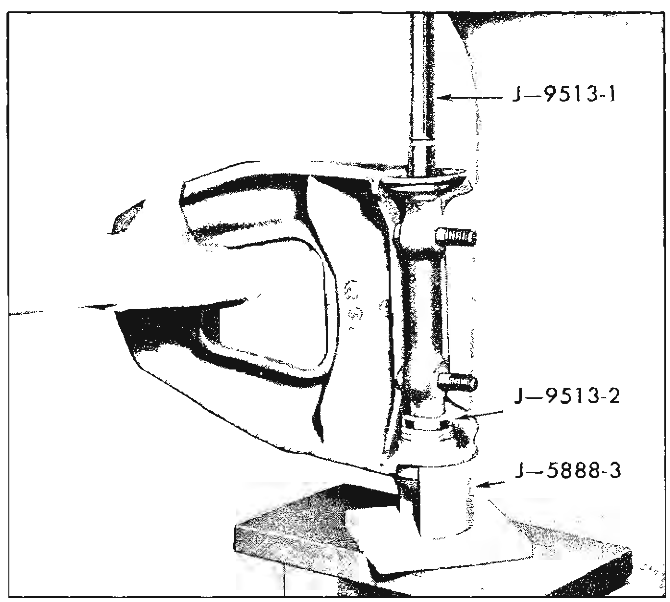


Fig. 45—Removing Remaining Pivot Shaft Bushing—Chevy II

5. Invert control arm, support on J-5888-3 and press out bushing with J-9513-1 (fig. 44).
6. Press remaining bushing out in the same manner (fig. 45).

Installation

1. Insert new bushing in control arm and over pivot shaft.
2. Support arm on J-5888-3 and insert Spacer J-8345-1.
3. Press bushing into place with Installer J-9513-3 (fig. 46).
4. Invert arm and press remaining bushing in place with J-9513-3 (fig. 47).
5. Install bushing spacers, lock washers and nuts to pivot shaft ends. Torque as indicated in Specifications.

NOTE: Pivot shaft bolts must be in horizontal position (toward center line of vehicle) before torquing nuts.

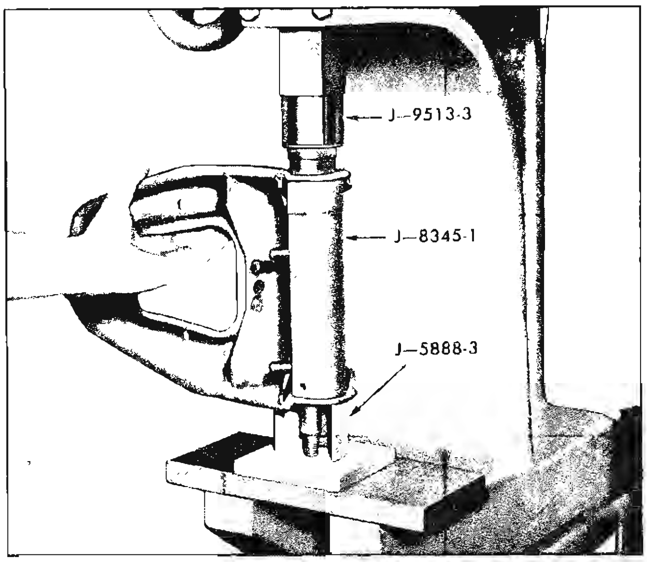


Fig. 46—Installing Pivot Shaft Bushing—Chevy II

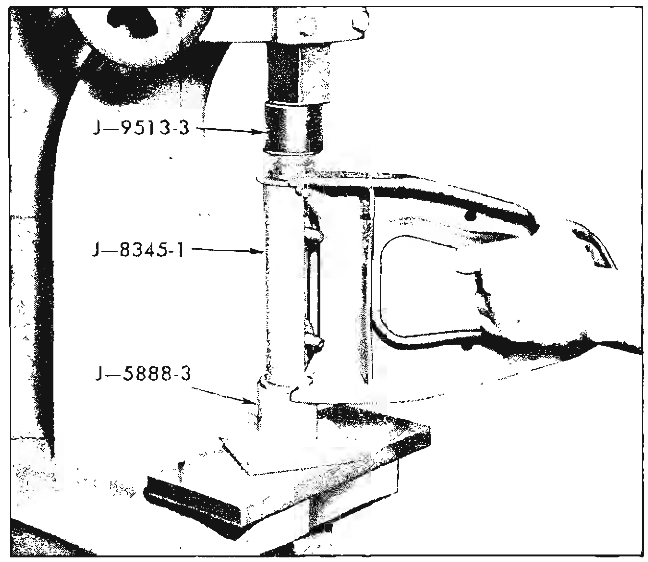


Fig. 47—Installing Remaining Pivot Shaft Bushing—Chevy II

SPECIAL TOOLS

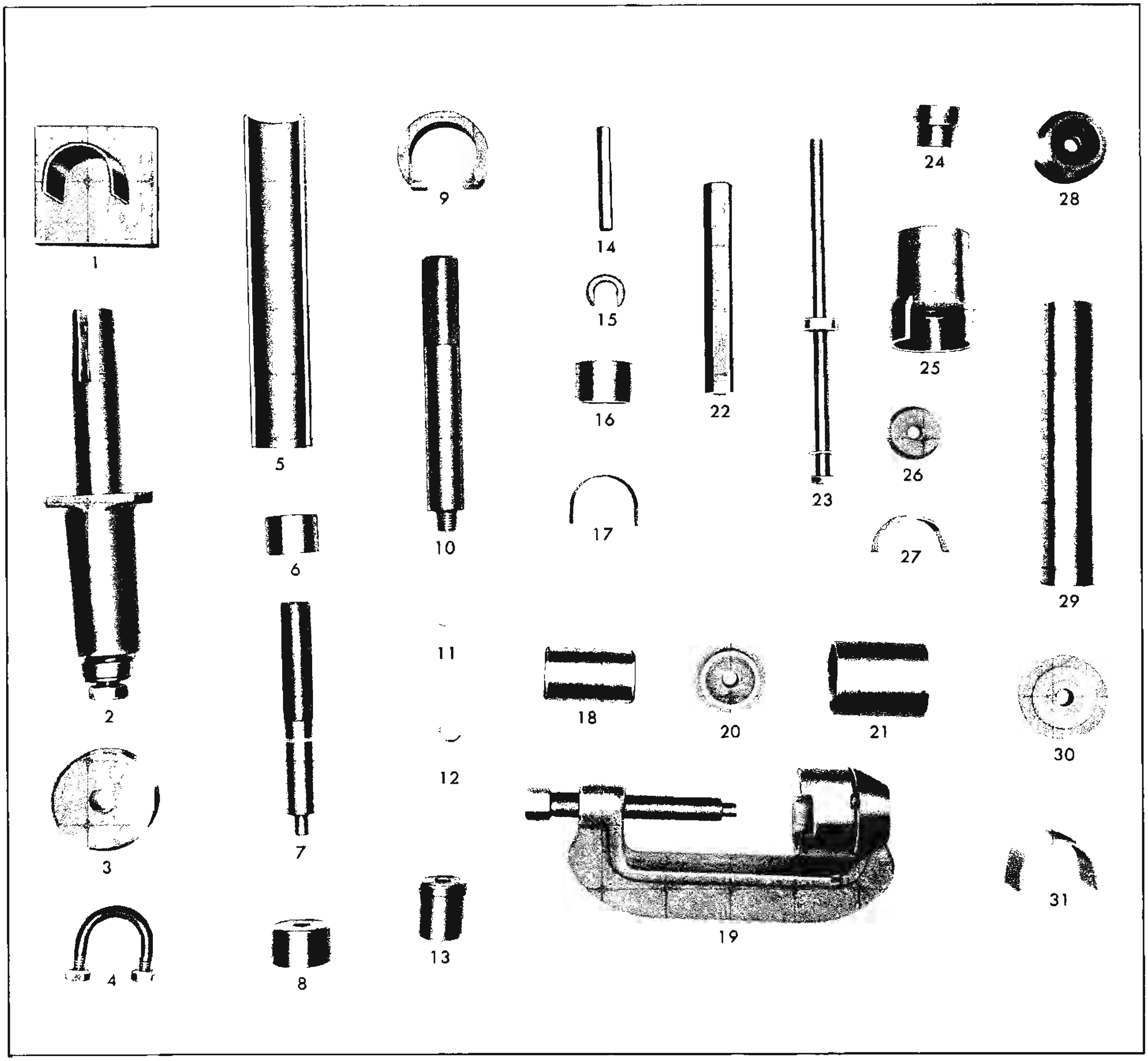


Fig. 48—Front Suspension Special Tools

1. J-5888-3 Support
2. J-6874-5 Spring Compressor
3. J-6874-8 Adapter for J-6874-5
4. J-6874-9 Adapter for J-6874-5
5. J-7052-2 Spacer
6. J-7052-5 Installer
7. J-7079-2 Driver Handle
8. J-7574-2 Installer
9. J-7574-4 Support
10. J-8092 Driver Handle
11. J-8849 Installer
12. J-8850 Installer
13. J-9226 Remover
14. J-9513-1 Remover
15. J-9513-2 Remover
16. J-9513-3 Installer
17. J-9514 Spacer
18. J-9519-7 Remover
19. J-9519-10 Clamp
20. J-9519-16 Installer
21. J-9519-17 Receiver
22. J-21058-8 Nut
23. J-21058-15 Screw
24. J-21474-2 Installer
25. J-21474-5 Receiver
26. J-21474-8 Remover
27. J-21474-12 Spacer
28. J-21474-13 Installer
29. J-21482 Spacer
30. J-21830-7 Receiver Bridge
31. J-21878 Spacer

SECTION 4
REAR SUSPENSION AND DRIVE LINE
CONTENTS OF THIS SECTION

REAR SUSPENSION
INDEX

GENERAL DESCRIPTION

CHEVROLET

The link-type rear suspension (fig. 1) has two lower control arms which maintain proper axle to frame relationship and also take the acceleration, drive and braking forces. A single upper control arm on light-duty models (or two upper control arms on heavy-duty models) limits axle rotation when drive, acceleration or braking forces are applied. Lateral movement of the axle is restricted by the axle-to-frame tie rod. Two full coil springs and two direct, double acting shock absorbers are provided for additional ride control.

CHEVELLE

The rear suspension (fig. 2) is of the four-link design utilizing axle mounted, full coil springs and direct, double-acting shock absorbers.

Two rubber-bushed lower control arms, stretching slightly outboard from axle-mounted brackets to frame side member mounted brackets, maintain fore and aft relationship of the axle assembly to the vehicle proper. These lower control arm axle brackets also mount the axle rebound bumpers and provide for lower attachment of the shock absorber. Upper attachment of the shock absorber is a platform mount to the rear of the coil spring frame bracket. The coil springs are attached to axle housing mounted brackets by a bolt secured retainer.

Sideways movement of the axle assembly is controlled by two angularly mounted, rubber-bushed upper control arms. Projecting ears, cast as part of the differential carrier, provide for rear attachment and frame cross-member mounted brackets retain them at the forward end.

CHEVY II

The rear suspension (fig. 3) consists of two uniformly stressed rear springs and two shock absorbers mounted to the spring lower seats. The springs are rubber mounted at both axle and frame attaching points, thus insuring uniform spring loading, minimizing transmittal of road vibration to passenger compartment, and providing a pivot point to absorb axle wind-up. The springs are positioned to the axle spring seats by locating pins butt welded to the spring leaf.

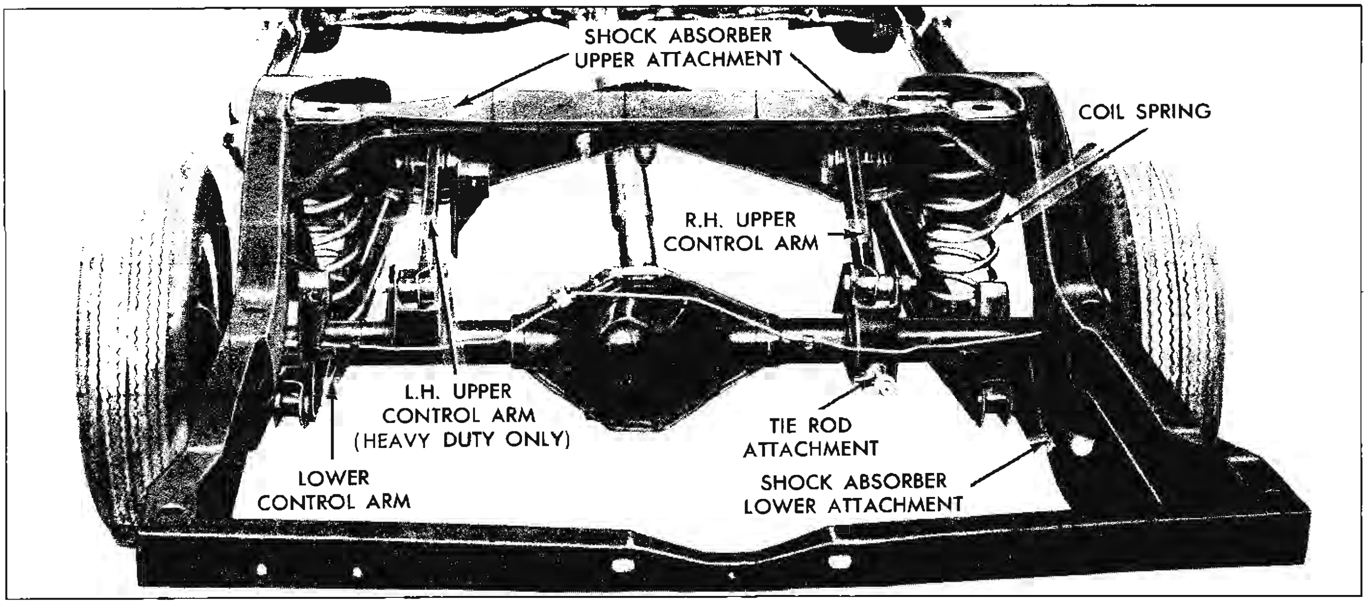


Fig. 1—Chevrolet Rear Suspension Components

MAINTENANCE AND ADJUSTMENTS

Periodic maintenance and adjustments are not required for the rear suspension components. The suspension system should be checked for shock absorber action, condition of suspension bushings, tightness of suspension attaching bolts and an overall visual inspection of components for defects.

RIDING HEIGHT CHECK AND SPECIFICATIONS

In case of vehicle riding height complaints, a spring height check will show if the rear suspension is at the right height.

1. Position car on smooth level floor.
2. Vehicle must be at curb weight (full gas tank, no passengers, spare and jack in trunk). Car should be raised up a few times to allow suspension to settle with car weight to eliminate friction at arm pivots.
3. On Chevrolet and Chevelle models, measure riding height as the distance from the top of the axle housing to frame kick-up (fig. 4).
4. On Chevy II models, measure riding height as the distance from lower surface of bumper support bracket to top of axle housing (fig. 5).
5. Riding heights vary between models. Refer to appropriate chart for vehicle and model application.

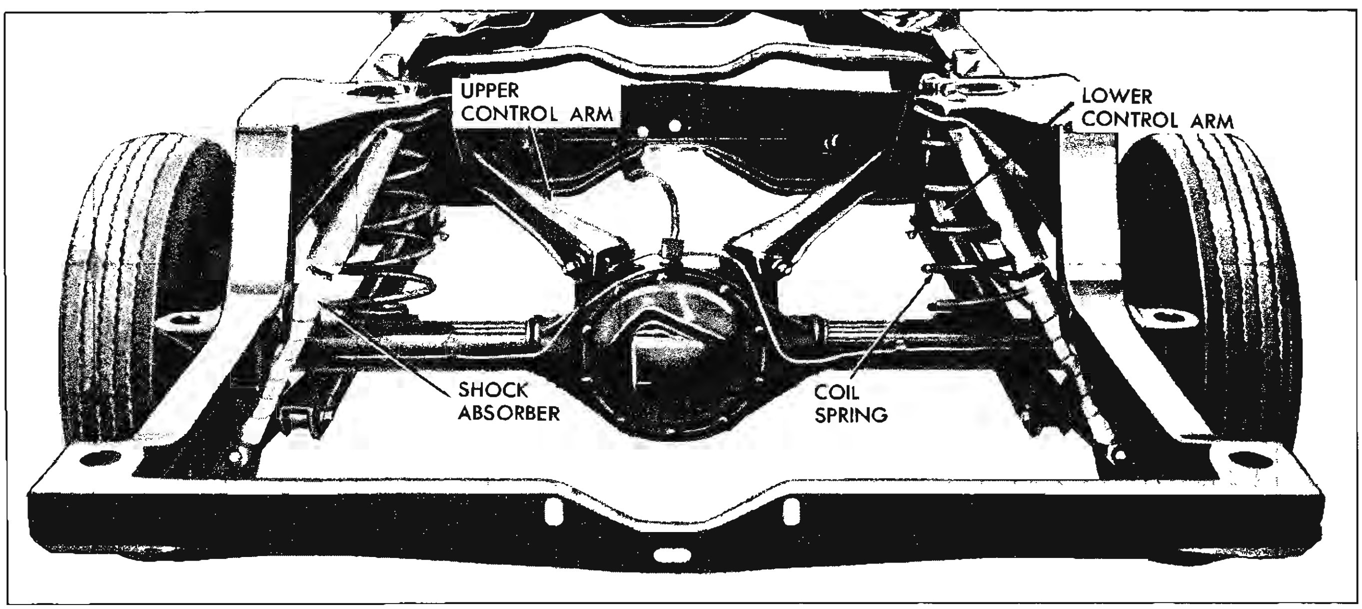


Fig. 2—Chevelle Rear Suspension Components

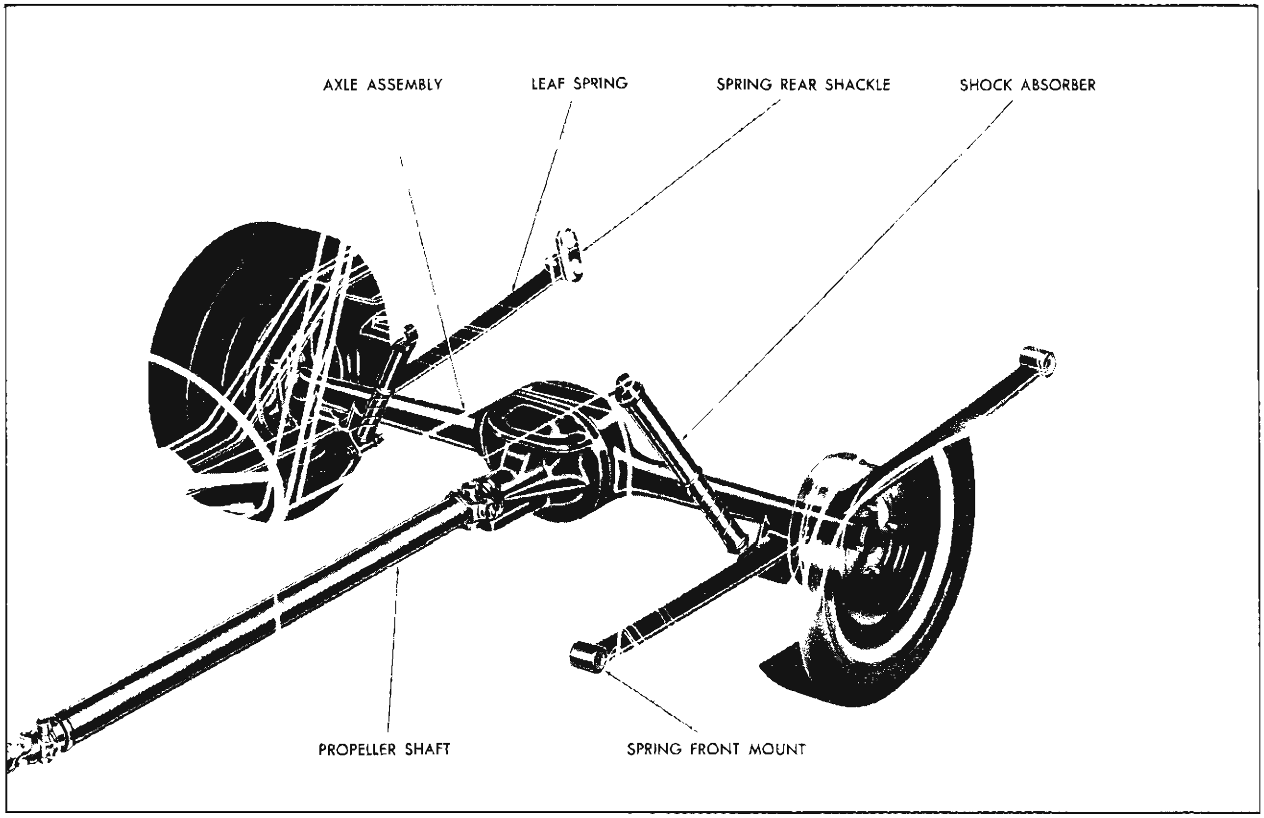


Fig. 3—Chevy II Rear Suspension Components

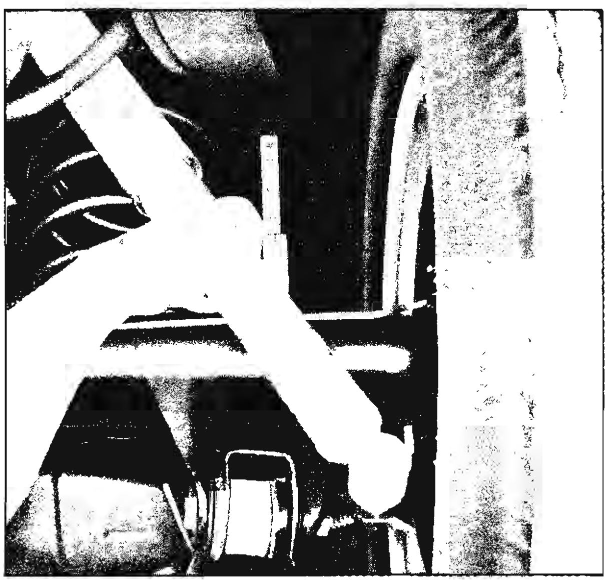


Fig. 4—Measuring Rear Riding Height (Chevrolet and Chevelle)

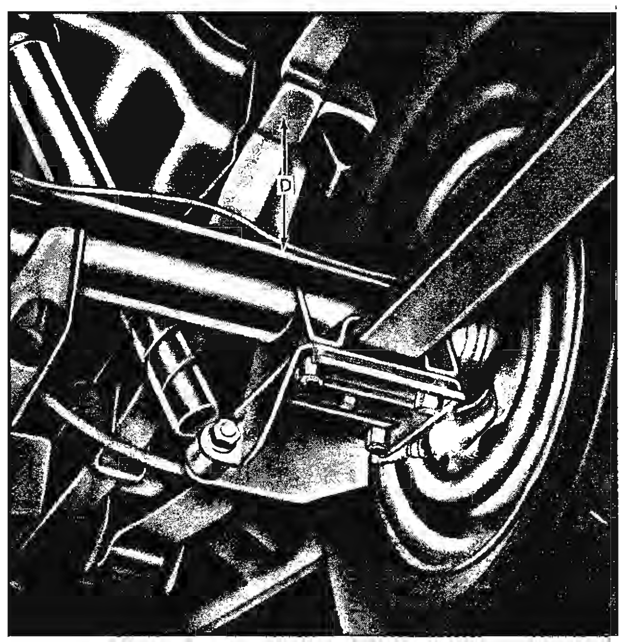


Fig. 5—Rear Riding Height

Chevrolet Models	Riding Height
2 Dr. Sedan	6" ± 1/4"
4 Dr. Sedan	6-1/4" + 1/4"
Convertible	5-1/2" ± 1/4"
Station Wagon (All)	6-5/8" ± 1/4"

Chevelle Models	Riding Height
Super Sport	4-13/16" ± 1/4"
Station Wagons	6-5/8" ± 1/4"
Sport Coupe and Convertibles	4-15/16" ± 1/4"
Sedans	5-3/8" ± 1/4"
Sedan Pickup	6-5/8" ± 1/4"

Chevy II Models	Riding Height (Dimension "D" Fig. 5)
2 Door Sedans	6-1/8" ± 1/4"
4 Door Sedans	6-1/16" ± 1/4"
Station Wagons	5-13/16" ± 1/4"
Sport Coupes	4-15/16" ± 1/4"

COMPONENT PARTS REPLACEMENT

COIL SPRING

Chevrolet

Removal

To remove either or both rear coil springs proceed as follows.

1. Raise vehicle to a height that will allow axle assembly to hang freely; position supports under both frame side rails.
2. Support axle assembly with an adjustable lifting device, and disconnect shock absorber at one end. Shock absorber on opposite side need not be disconnected if only one spring is being removed.
3. Disconnect suspension tie rod at one end and remove rod from stud so that axle will hang freely.
4. Disconnect propeller shaft from differential and tie shaft out of the way. Tape bearings to trunnion to prevent bearing from falling off.
5. Lower the axle housing until the suspension components limit axle travel. Loosen and remove the spring-to-lower control arm retaining bolt. The spring clamp and spring seat are also retained by the spring bolt.
6. Slide coil spring from the control arm and remove from its seat in the side rail seat (fig. 6).

Installation

1. Position upper end of coil into spring seat so that coil end is indexed against spring stop. The end of the top coil must be 3/8" ± 1/8" from end of stop.

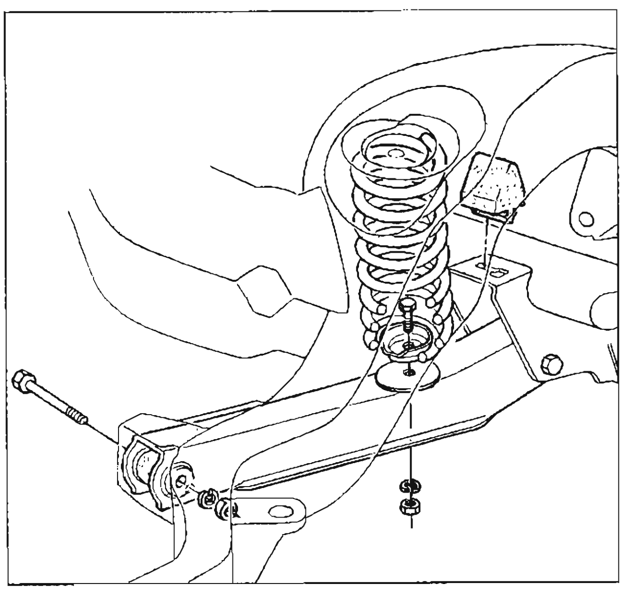


Fig. 6—Coil Spring Installation (Chevrolet)

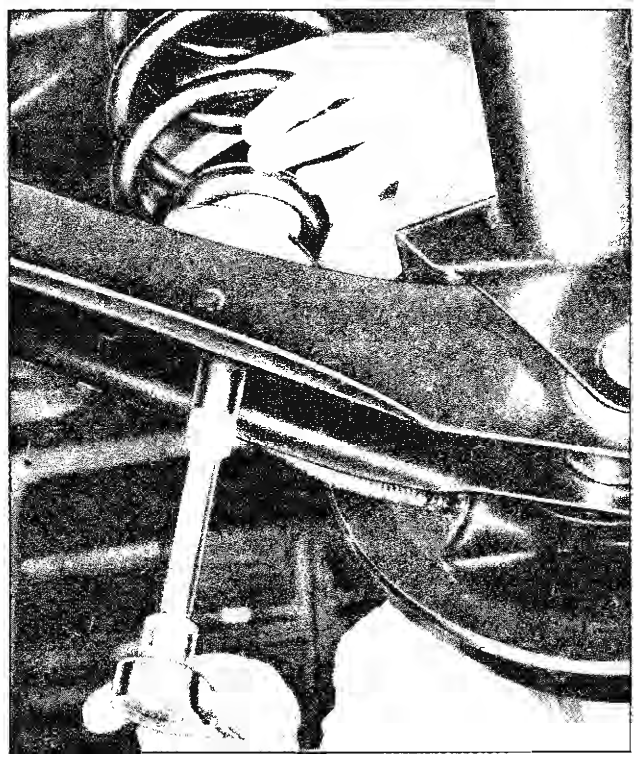


Fig. 7—Installing Coil Spring to Lower Control Arm

2. Position clamp inside lower coil, then install spring seat between spring and lower control arm. Align spring seat and clamp with control arm then install retaining bolt and nut (fig. 7).
3. Alternately tighten nut and raise axle until spring is properly seated on control arm. Do not attempt to seat spring by tightening bolt only to draw spring into position.
4. After spring is securely retained to lower control arm, raise axle assembly sufficiently to allow shock absorber and suspension tie rod installation.
5. Install propeller shaft to differential.
6. Position vehicle so that weight is on suspension components and torque all affected parts to specifications.

Chevelle

Removal

The following procedure may be utilized to replace either or both rear coil springs.

1. Raise vehicle to a height that will allow axle assembly to hang freely, and position supports under both frame side rails.
2. Support axle assembly with an adjustable lifting device, and disconnect shock absorber at axle bracket. Shock absorber on side opposite need not be disconnected if only one spring is being removed. Refer to Shock Absorber Removal procedures outlined in this section.
3. Lower axle assembly until suspension reaches end of travel; then disconnect spring retainer and withdraw spring from vehicle.

Installation

1. Position coil spring in upper seat so that end of spring is indexed in seat (fig. 8).
2. Install lower end of spring on axle bracket and secure by installing retainer and bolt. Install lock washer and retainer nut - torque nut to specifications.
3. Raise axle to allow shock absorber installation. Position shock absorber in axle bracket. Torque nut as outlined in Shock Absorber Installation procedures.
4. Lower vehicle and check rear riding height.

Chevy II

Rear Spring, Spring Seat Pads, Spring Eye Bushings (Figure 9)

Removal

1. Raise vehicle and support rear axle assembly.
2. Pull emergency brake cable out of lower spring pad mounting bracket clamp and disconnect cable above axle housing. Remove four nuts securing lower spring pad mounting bracket to axle spring seat (fig. 10). Drop lower bracket and remove rubber spring pad.
3. Loosen and drive out front spring eye bolt. Lower spring and remove front rubber eye bushing (fig. 11).
4. Remove nuts from rear spring shackle (fig. 12), spread shackle to separate it from spring eye and support bracket and remove spring. Remove rear spring eye bushings.
5. Remove upper spring pad cushion.

Installation

1. Inspect spring eye bushings and spring pads for excessive wear or aging and replace as necessary. Inspect spring rear shackles, front spring bracket and eye bolt for bending or cracking and correct where needed.
2. Assemble spring rear shackle as follows:
   a. All except Station Wagons (fig. 13).
      1. Insert inboard rubber spring eye bushings into rear spring eye and outboard shackle bushings into shackle mounting bracket.
      2. Position spring and install shackle to spring and mounting bracket with top nut toward outboard of vehicle and bottom nut toward vehicle centerline.
      3. Tighten nuts but do not torque at this point.
   b. Station Wagon (fig. 14):
      When installing shackle as in Step 2 above, top nut should be toward center line of vehicle and bottom nut toward outboard of vehicle.
3. Insert inboard rubber bushing into front spring eye.

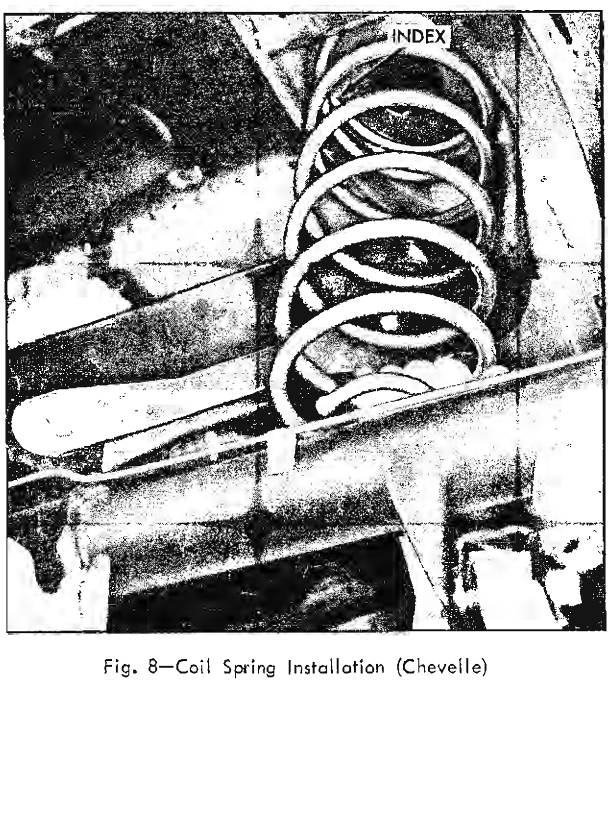


Fig. 8—Coil Spring Installation (Chevelle)

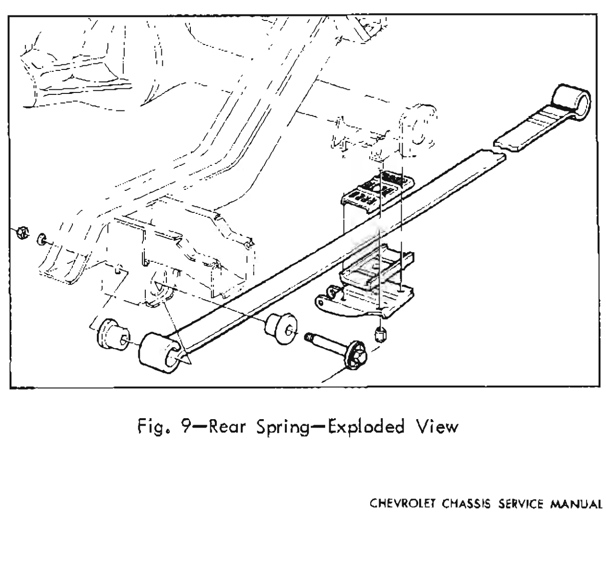


Fig. 9—Rear Spring—Exploded View

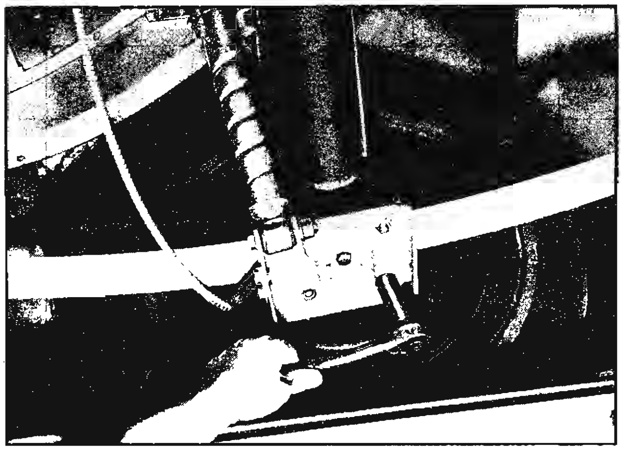


Fig. 10—Removing Lower Pad Bracket

4. Place upper spring pad cushion on spring. Raise spring, making sure spring cushion ribs index with locating ribs in axle housing spring seat, and insert spring front eye and bushing in frame bracket. Install spring eye bolt, bushing, retainer, lock washer and nut. Do not torque at this point.
5. Place lower spring pad cushion on spring, indexing it over locating dowel.

   NOTE: Upper pad correctly installed when aligned with lower pad.

6. Place lower mounting plate into position over locating dowel on spring pad, install four locknuts and insert shock absorber lower eye bolt.
7. Remove adjustable jackstands, lower vehicle to floor and bounce several times. Torque all affected parts to specifications. Incorrect bushing preload may result if spring eye bolts are torqued prior to lowering vehicle.

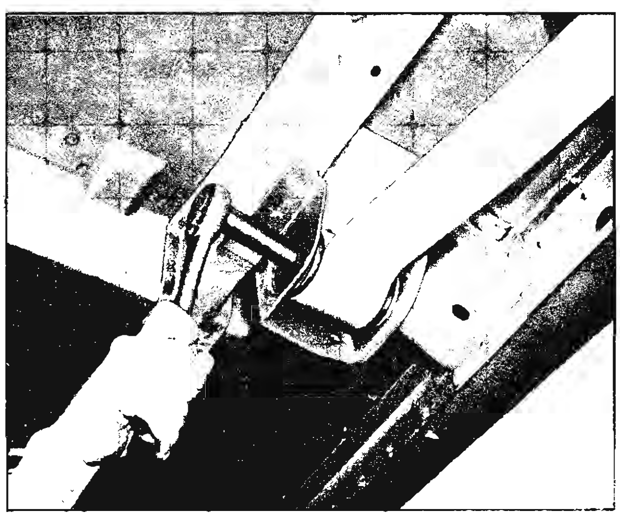


Fig. 11—Removing Front Eye Bushings

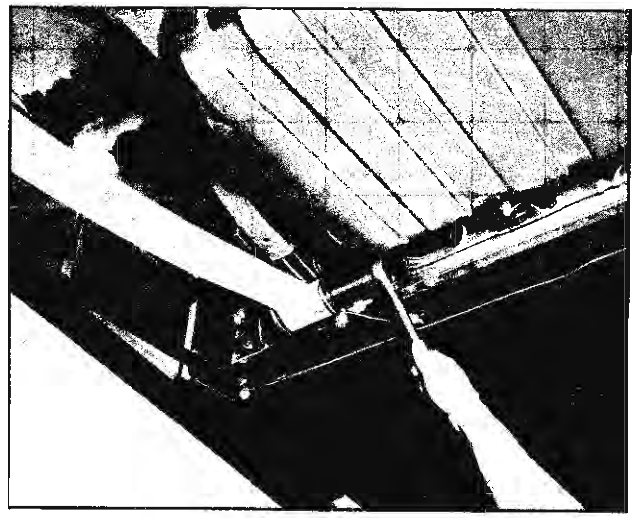


Fig. 12—Disassembling Rear Spring Shackle

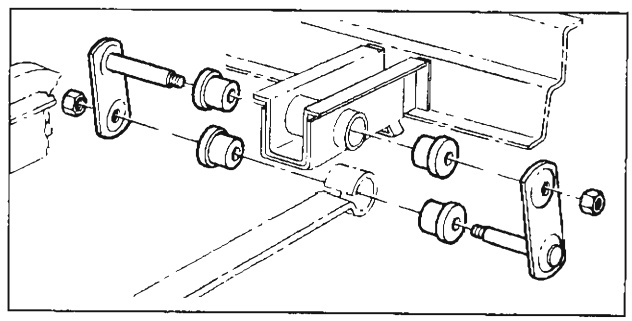


Fig. 13—Rear Spring Shackle Exploded View—All Except Station Wagon

SHOCK ABSORBER

Chevrolet and Chevelle

Removal

1. Raise rear of vehicle and support rear axle assembly.

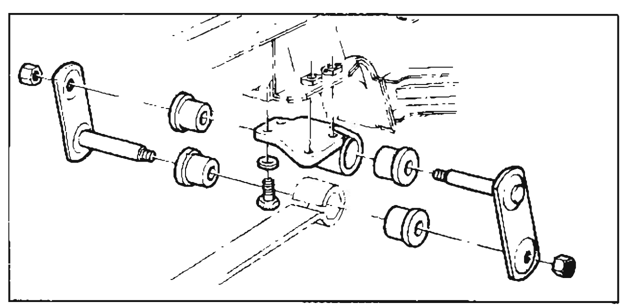


Fig. 14—Rear Spring Shackle Exploded View—Station Wagon

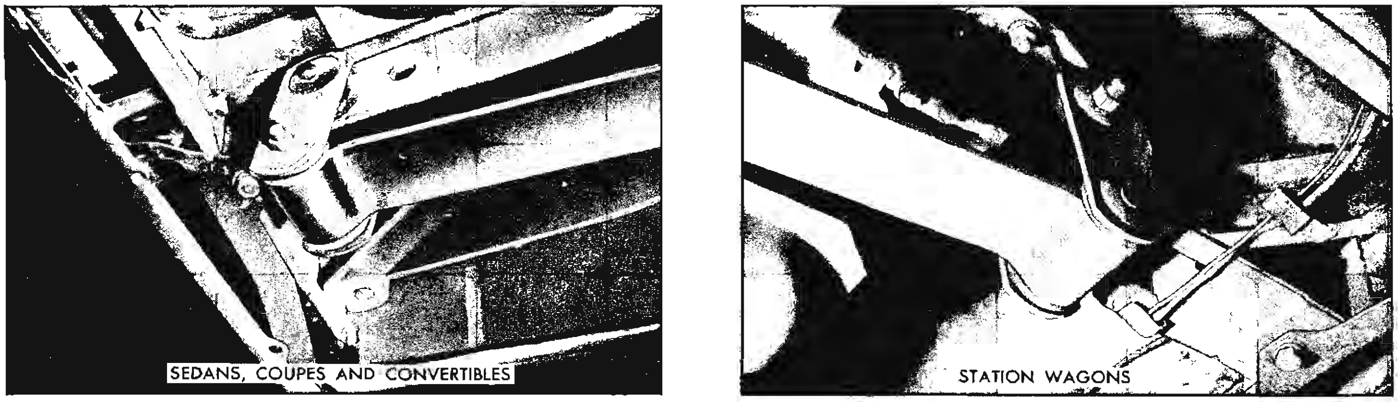


Fig. 15—Rear Spring Shackles Installed

2. Disconnect shock absorber at upper mounting bracket by removing the two retaining bolts. Refer to Figure 16 for shock absorber mounting details. (Chevelle components shown as typical.)
3. Disconnect shock absorber at lower attaching bracket and remove shock.

NOTE: When performing any service operations that requires removal or loosening of the lower attaching nut, it is essential that the stud be prevented from turning. A hex is located on the stud between the axle bracket and shock absorber in order that a wrench may be used for this purpose. Failure to hold the stud in this manner will result in damage to the mechanical bond between the shock absorber bushing and the mounting stud.

Installation

1. Loosely install the two shock absorber upper attaching bolts.
2. Position lower attaching stud in axle bracket and loosely install lock washer and nut.

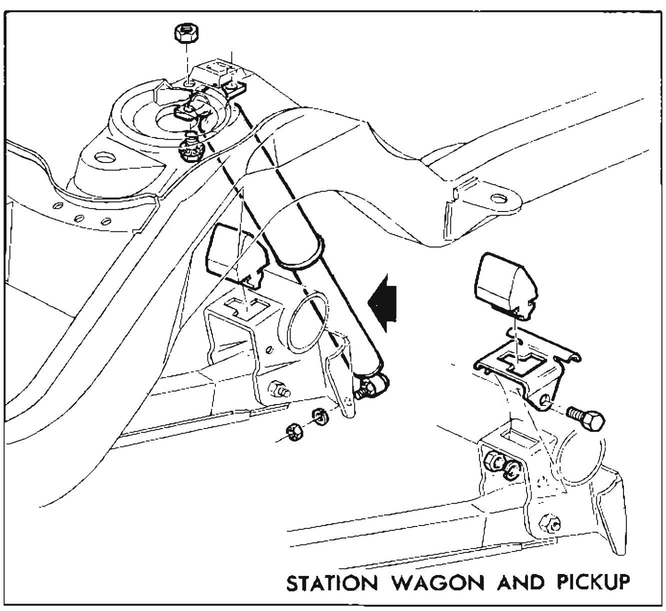


Fig. 16—Shock Absorber Mounting—Exploded View

3. Torque upper attaching bolts to specifications.
4. Torque lower attaching nut to specifications, observing procedure outlined in Removal procedure.
5. Lower vehicle and check shock absorber action.

Chevy II

Removal

1. Raise vehicle and support axle housing with adjustable jackstand.
2. Loosen and remove shock absorber lower mounting bolt from shock absorber eye (fig. 8).
3. Remove shock absorber upper mounting bracket bolts and withdraw shock absorber and bracket (fig. 19).

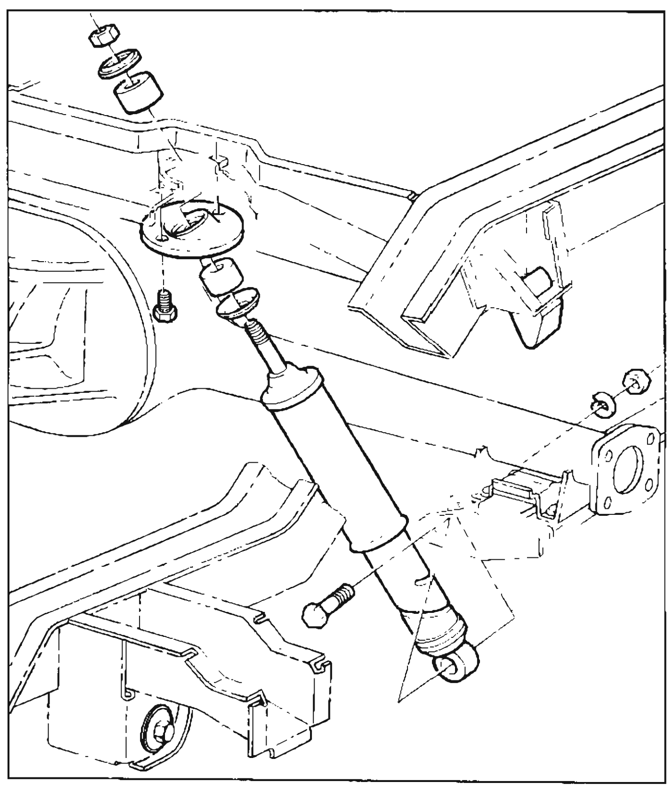


Fig. 17—Shock Absorber—Exploded View

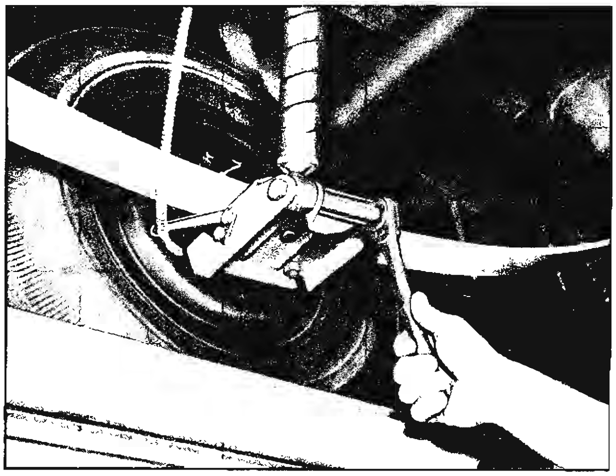


Fig. 18—Removing Shock Absorber Eye Bolt

4. Remove nut, washer, bushing and upper mounting bracket from shock absorber. Inspect rubber bushings for aging or damage and replace where necessary.

Installation

1. Assemble nut, washer, rubber bushings, bracket and upper bushing to shock absorber. Torque nut to specifications.
2. Install shock absorber with upper bracket to floor pan and torque to specifications.
3. Insert shock absorber eye into lower bracket, install bolt with nut to rear and torque to specifications.
4. Lower vehicle and test shock absorber action.

CONTROL ARM

Chevrolet Upper

Removal

1. Using a suitable hoist that will support the rear axle housing or wheels (such as a twin post or drive on ramp type), remove the rear pivot bushing bolt at the rear axle housing (fig. 20).

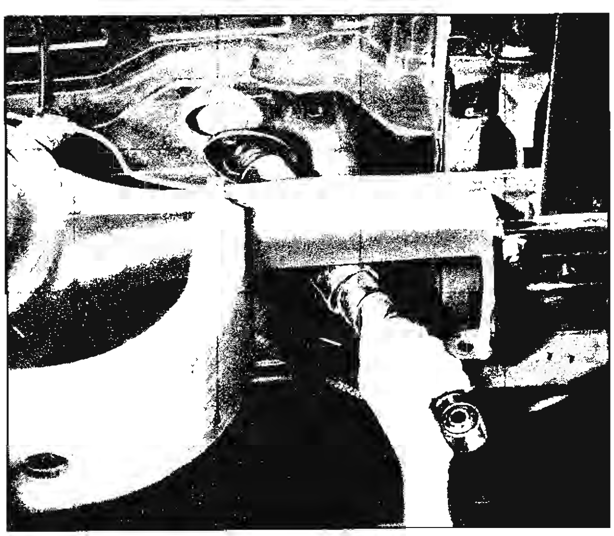


Fig. 19—Removing Shock Absorber

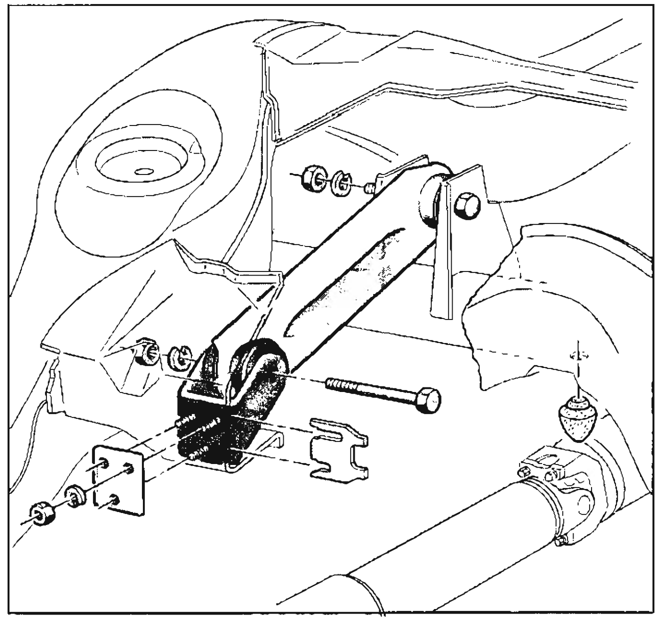


Fig. 20—Rear Suspension Upper Control Arm Attaching Points

NOTE: The rear axle must be supported in such a way as to prevent the axle housing from rotating about the lower control arm rear pivot, and to also relieve load on the pivot bushing.

2. Remove the three bolts, lock washers and nuts attaching the upper control arm bracket to the crossmember.
3. Separate the control arm bracket from the crossmember. Note the number of shims removed as

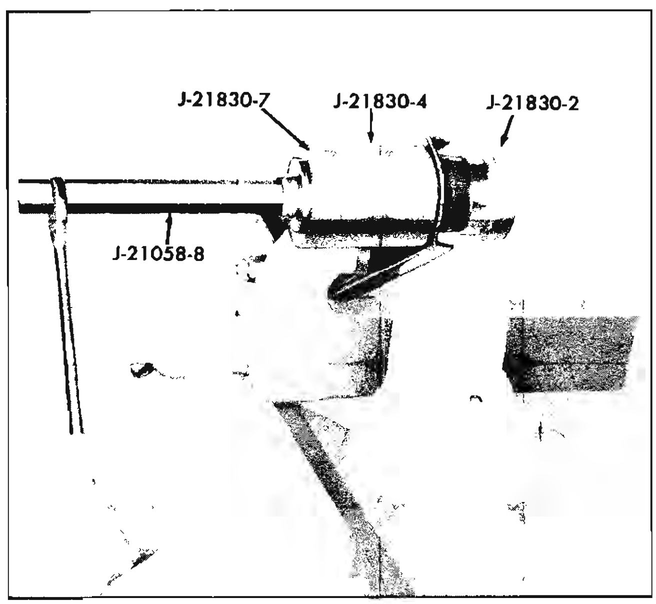


Fig. 21—Upper Control Arm Bushing Removal

these control the driveline angles. Remove the arm from under vehicle.

4. Remove the bolt, nut and washer attaching the upper control arm to the bracket. Separate the control arm from the bracket.

Bushing Replacement

1. Clamp control arm securely in a vise and remove bracket from forward end of arm.
2. Place Puller Screw J-21058-15 through Puller Adapter J-21830-2. Position puller screw through small end of bushing then install Receiver J-21830-4 and Bridge J-21830-7 over opposite end of bushing. Center receiver and bridge over flanged end of bushing then position thrust bearing and Nut J-21058-8 on puller screw. Refer to Figure 21 for installation of removal tools.
3. Turn Nut J-21058-8 to withdraw bushing, making sure Remover Adapter J-21830-2 is centered and will clear hole in control arm.
4. Disassemble puller tools and position Installer Adapter J-21830-2 on flanged end of new bushing. Install Spacer J-21830-6 over small end of bushing so that it makes contact with J-21830-2.
5. Position Puller Screw J-21058-15 through J-21830-2 and bushing so that head of screw rests against J-21830-2. Position this assembly in control arm as shown in Figure 22.
6. Install receiver, bridge, thrust bearing and nut to complete installation as shown in Figure 22.
7. Turn Nut J-21058-8 to pull bushing into control arm. Check position of bushing when installing to make sure bushing is properly aligned. When bushing is properly installed, Spacer J-21830-6 will stop against control arm.
8. Disassemble bushing installation tools and reinstall attaching bracket to control arm. Install bracket pivot bolt so that nut will be on outboard side of arm.

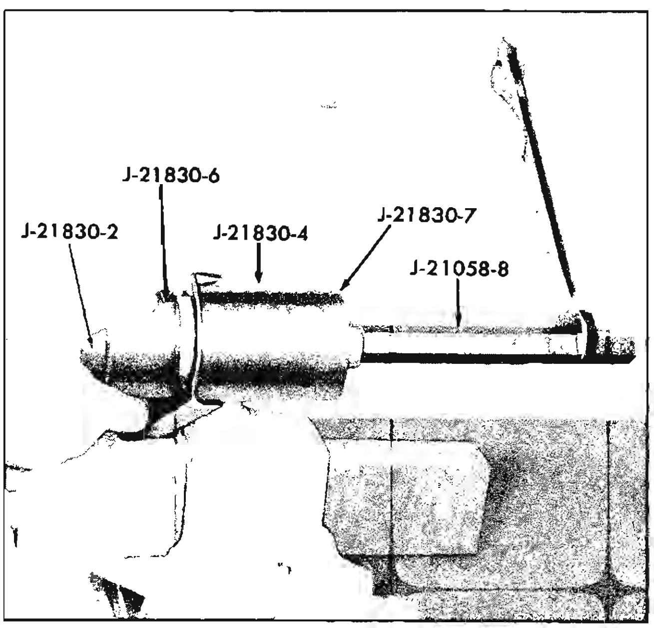


Fig. 22—Upper Control Arm Bushing Installation

Installation

1. Position rear of control arm into axle bracket and loosely install the pivot bolt.
2. Align the forward end of the control arm with the rear crossmember and install front bracket bolts through holes. Raise or lower nose of carrier as required to help align bracket and crossmember.
3. Install spacers between bracket and crossmember then install crossmember reinforcement plate, lock washers and nuts to retain spacers in place.
4. Position vehicle so that weight is on suspension components and torque all affected parts to specifications.
5. If a new control arm was installed check drive line angle as outlined in this section.

Chevrolet Lower

Removal

1. Raise vehicle and remove shock absorber and spring as outlined in this section.

   NOTE: If both rear suspension lower control arms are to be removed, support the rear axle in such a manner to prevent damage to brake lines and to prevent assembly from falling.

2. Disconnect control arm at forward and rearward attaching points and remove assembly from vehicle.

Bushing Replacement

Lower control arm front and rear bushing assemblies are not interchangeable and require separate removal and installation procedures.

1. Replace the front bushing as follows.
   a. Center Receiver J-7574-4 over flanged end of bushing and position Spacer J-7574-3 over bushing and between sides of control arm. Using Remover J-7574-1 against small end of bushing, press bushing from control arm. Refer to Figure 23 for installed view of tools.
   b. Position bushing in control arm making sure of correct installation. Small end of bushing will pass through one side without any interference.

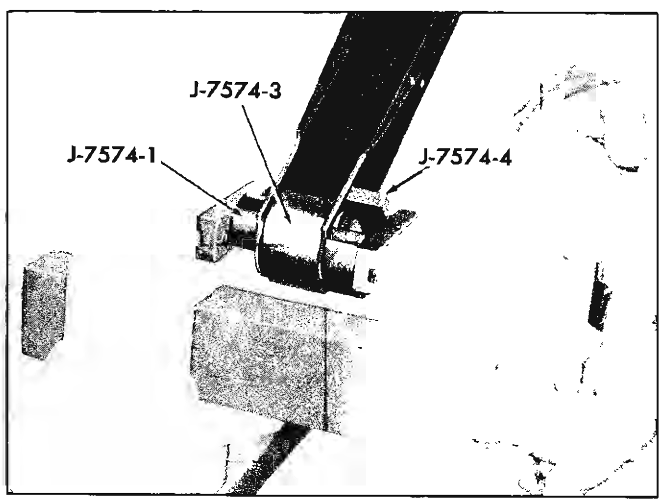


Fig. 23—Lower Control Arm Front Bushing Removal

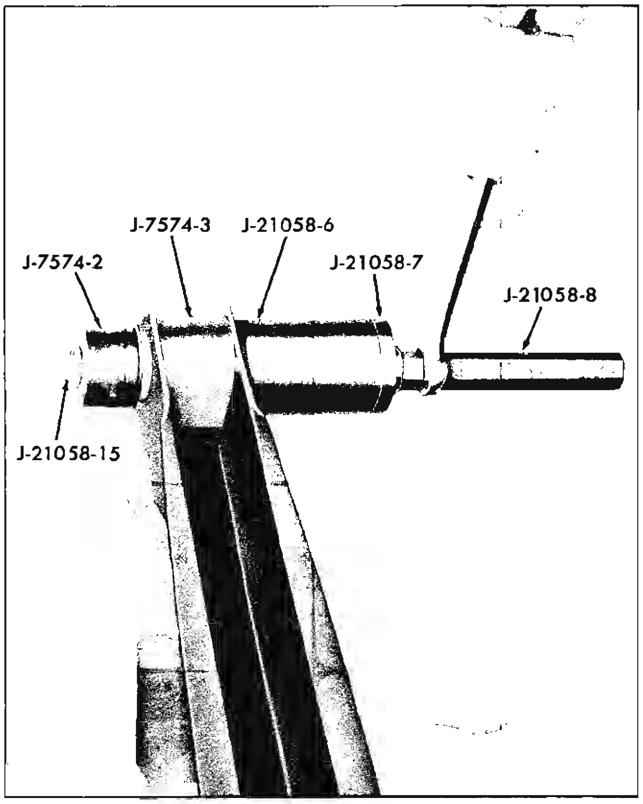


Fig. 24—Lower Control Arm Front Bushing Installation

c. Position Puller Screw J-21058-15 through Installer Adapter J-7574-2 — head of puller screw should rest against flat side of adapter.
d. Install adapter and screw through bushing with adapter resting against flange portion of bushing. Install Receiver J-21058-6 and Bridge J-21058-7 on opposite side of control arm (fig. 24).
e. Install thrust bearing and Nut J-21058-8. Screw nut against J-21058-7 to maintain proper relationship of parts, then install Spacer J-7574-3 over the partially installed bushing and between the sides of the control arm.
f. Continue to tighten J-21058-8 until bushing is pulled flush against control arm. Do not exert undue force against control arm after bushing is installed. Overtightening of J-21058-8 will cause damage to walls of control arm.
g. Disassemble tools and inspect bushing for proper installation.

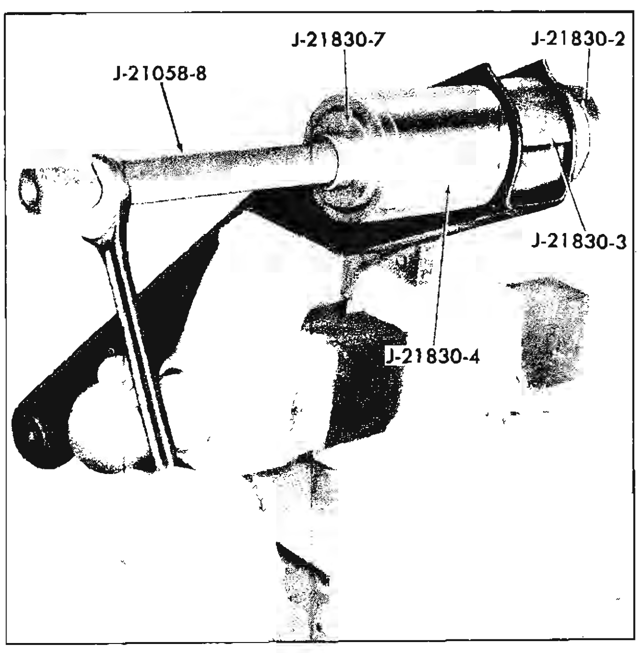


Fig. 25—Lower Control Arm Rear Bushing Removal

2. Replace the rear bushing as follows:
   a. Position Puller Screw J-21058-8 through Remover Adapter J-21830-2 so that head of screw is opposite button end of remover. Install this assembly, threaded end of screw first, through bushing to be removed.
   b. Install Receiver J-21830-4 and Bridge J-21830-7 over screw and against control arm. Position thrust bearing against J-21830-7 and screw J-21058-8 snugly against bearing. Install Spacer J-21830-3 between sides of control arm and over bushing.
   c. Check tool installation for proper alignment and tighten J-21058-8 to withdraw bushing from control arm. Refer to Figure 25 for installed view of tools.
   d. Disassemble tools and position Installer adapter J-21830-2 on flanged end of new bushing. Position bushing in control arm making sure of correct installation. Small end of bushing will pass through one side of arm without any interference.
   e. Install J-21830-4, J-21830-7, thrust bearing and J-21058-8 on threaded end of J-21058-15 as shown in Figure 26. Tighten J-21058 to maintain proper relationship of parts; then position Spacer J-21830-3 over bushing and between sides of control arm.
   f. Tighten J-21058-8 until bushing is fully seated against side of control arm. Do not apply undue pressure to J-21058 after bushing is seated – to

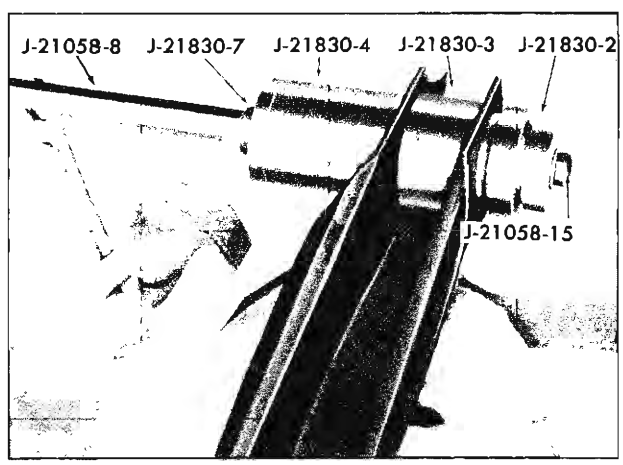


Fig. 26—Lower Control Arm Rear Bushing Installation

do so may cause permanent distortion to control arm.

g. Disassemble tools and check bushing for proper installation.

Installation

1. Position the control arm between the mounting brackets and loosely install the pivot bolt retaining nuts in the proper position.
2. Install spring and shock absorber as outlined in this section.
3. Lower vehicle so that weight is placed on suspension components and torque all affected parts to specifications.
4. If control arm was replaced, check drive line angle as outlined in this section.

Chevelle Upper and Lower

Removal

NOTE: If both upper control arms and both lower control arms are to be removed at the same time, remove both coil springs as outlined under "Coil Spring Removal".

1. Raise vehicle to a height that will allow axle assembly to hang freely and position supports under both frame side rails.
2. Support axle assembly with an adjustable lifting device and raise rear axle assembly until tension is relieved in control arm being removed.
3. Disconnect control arm at forward and rearward attaching points and remove from vehicle.

Bushing Replacement

The upper arm front bushing and carrier ear bushings are of the same part number and are interchangeable. However, the lower control arm bushings are of a different rubber material and are not interchangeable with the upper bushings. Replacement procedures are indicated below.

1. Replace the control arm installed bushings as follows:
   a. Position control arm in a vise, or other suitable holding device, so that clamping action is against closed section of control arm.
   b. Place Puller Screw J-21058-15 through Puller Adapter J-21474-2. Position puller screw through small end of bushing then install Receiver J-21474-5, Thrust Bearing and Nut J-21058-8 (in that order) onto puller screw. Install Spacer J-21474-1 between sides of control arm and over bushing so that spacer follows contour of bushing. Refer to Figure 27 for installation of removal tools.
   c. Turn Nut J-21058-8 to withdraw bushing, making sure Remover Adapter J-21474-2 is centered and will clear hole in control arm.
   d. Disassemble puller tools and position Installer Adapter J-21474-2 on flanged end of new bushing. Position Puller Screw J-21058-15 through installer adapter and bushing; then place assembly through hole in control arm.

   NOTE: Bushings are installed in one direction only - flanged end of bushing seats against rolled cutout side of control arm.

   e. Install Receiver J-21474-5, Thrust Bearing, and Nut J-21058-8 (in that order) onto puller screw. Install Spacer J-21474-1 between sides of control arm and over bushing so that spacer follows contour of bushing. Refer to Figure 28 for installed view of tools.
   f. Turn Nut J-21058-8 to pull bushing into control arm. Check position of bushing when installing to make sure bushing is properly aligned. Seat flanged end of bushing firmly against control arm, but do not apply unnecessary force after bushing is seated - to do so will distort control arm.
2. Replace the carrier mounted, upper control arm rear bushing using the following procedure.

Light Duty Carrier

a. Position Puller Adapter J-21474-2 on Puller Screw J-21058-15 then place puller screw through small end of bushing.
b. Install Receiver J-21830-4, Bridge J-21830-7, Thrust Bearing, and Nut J-21058-8 (in that order) onto puller screw. Refer to Figure 29 for installed view of tools.
c. Turn Nut J-21058-8 to remove bushing from carrier ear, making sure Remover Adapter J-21474-2 is centered and will clear hole in carrier ear.
d. Disassemble puller tools and position Installer Adapter J-21474-2 on flanged end of bushing. Install

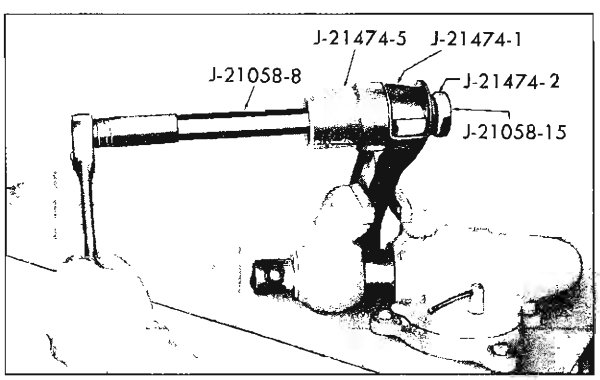


Fig. 27—Control Arm Bushing Removal (Chevelle)

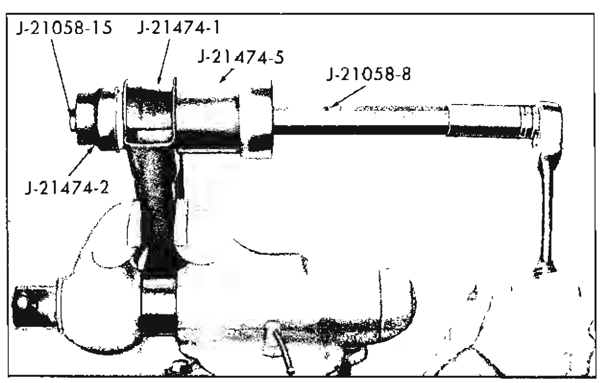


Fig. 28—Control Arm Bushing Installation (Chevelle)

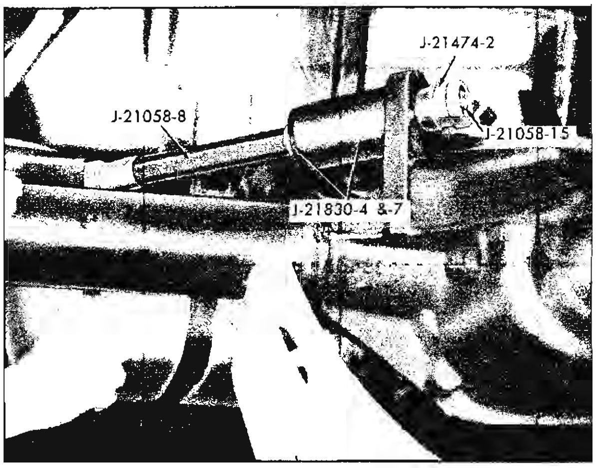


Fig. 29—Carrier Mounted Suspension Bushing Removal (Light-Duty)

Puller Screw J-21058-15 through receiver so that screw head is seated against receiver. Position this assembly through inboard side of carrier ear.

e. Position bushing and Installer Adapter J-21474-2 onto puller screw with small end of bushing toward carrier ear. Refer to Figure 30 for installed view of tools.
f. Install Thrust Bearing and Nut J-21058-8 onto puller screw. Turn nut to pull bushing into carrier ear. Check position of bushing when installing to make sure bushing is properly aligned.

Heavy-Duty Carrier

a. Install a 1/2 x 20 nut on Puller Screw J-21058-15, install thrust bearing against nut. Position puller screw through Bridge and Receiver J-21830-4 and 7.
b. Position puller screw through flanged end of bushing then install Remover Adapter J-21991 on threaded end of puller screw.
c. Align tools on carrier ear and center remover adapter on bushing. Hold head of puller screw and turn 1/2 x 20 nut to withdraw bushing from carrier ear. Refer to Figure 31 for installed view of removal tools.

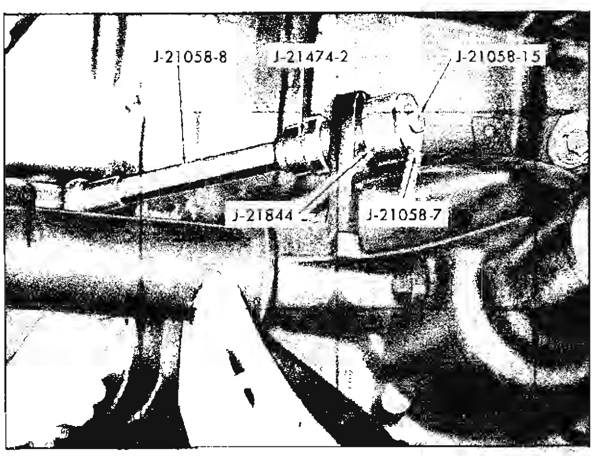


Fig. 30—Carrier Mounted Suspension Bushing Installation (Light-Duty)

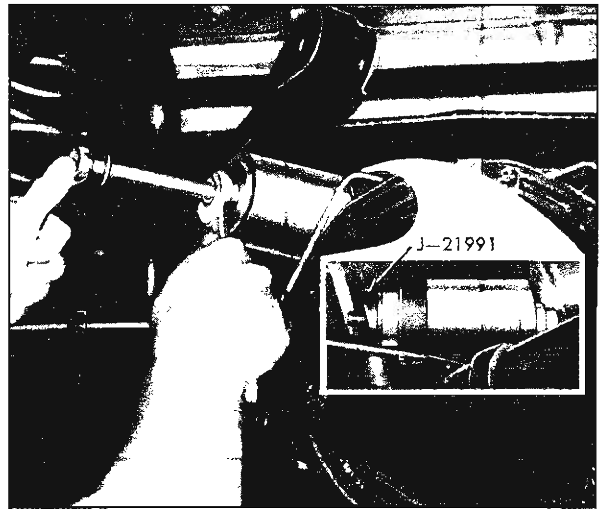


Fig. 31—Carrier Mounted Suspension Bushing Removal (Heavy-Duty)

d. Position Installer J-21474-2 on flanged end of new bushing and install Driver Handle J-7079-2 to opposite end of installer.
e. Position bushing in carrier ear and drive bushing until it seats against carrier. Bushing is properly seated when shoulder on bushing contacts carrier. Refer to Figure 32 for installation.

NOTE: Do not attempt to seat flange of bushing against ear of carrier. Bushing is properly installed when shoulder on bushing seats against chamfer on carrier ear.

Installation

1. Place control arm into position between the forward and rearward mounting brackets and install retaining bolts. Refer to Figure 33 for installation view of control arms.

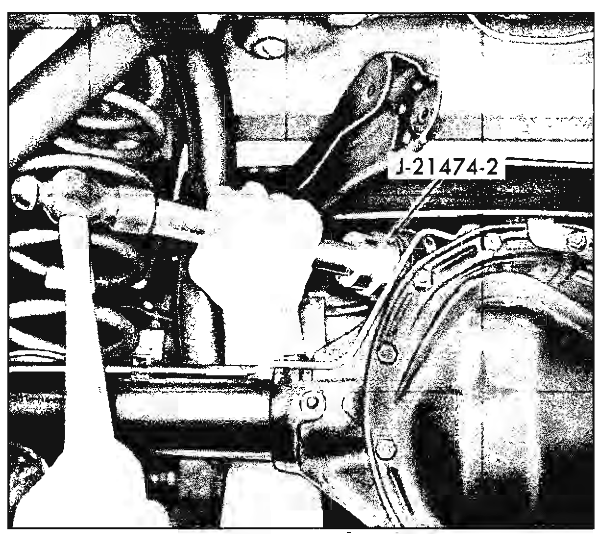


Fig. 32—Carrier Mounted Suspension Bushing Installation (Heavy-Duty)

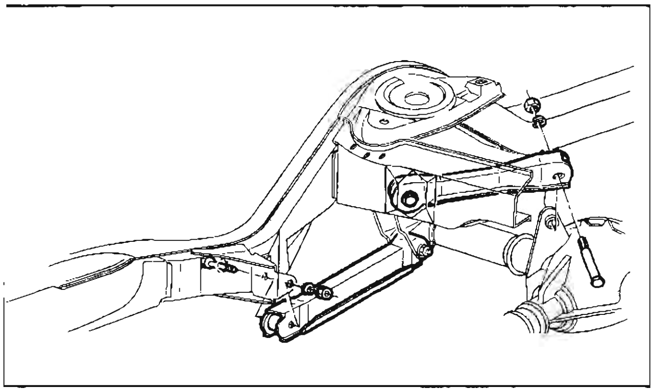


Fig. 33—Upper and Lower Control Arm Assembly

2. Support vehicle at axle and remove supports from beneath the frame side rails.
3. Install lock washer and nut to retaining bolts and torque to specifications.

REAR SUSPENSION TIE ROD—CHEVROLET

Removal

1. Remove the nut, washer and bolt from the left hand side and the nut and washer from the stud on the right side that secure the tie rod to the brackets (fig. 34). Withdraw the rod from under the vehicle. An external shell service bushing is available for replacement.

   NOTE: The above operations need not be performed on a hoist. However, to provide ample working space, the use of a hoist or proper jack stand is recommended.

Bushing Replacement

1. With tie rod bushing centered over Tool J-7877-2 and with tie rod supported horizontally, press or drive bushing from rod, using Tools J-7877-1 and J-7079-2 as shown in Figure 35.
2. With tie rod centered over Tool J-7877-2 and rod supported horizontally, press or drive bushing into arm using Tools J-7877-3 and J-7079-2 as shown in Figure 35. Tool J-7877-3 should bottom on tie rod when bushing is fully installed.

Installation

1. Mount the tie rod to the right hand stud. Install nut and special washer but do not tighten.
2. Install the bolt, lock washer and nut to the left hand bracket (fig. 34). Do not tighten.

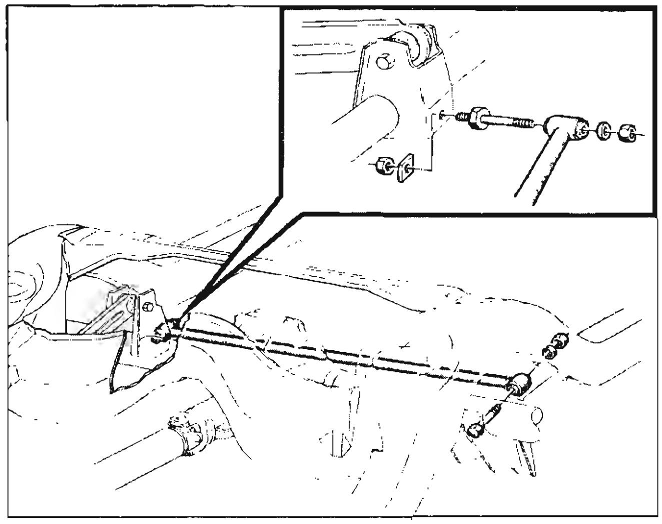


Fig. 34—Rear Suspension Tie Rod Attaching Points

   NOTE: Bolt may be installed from either direction.

3. Lower vehicle to floor (if raised) and bounce rear end several times to settle bushings. Tighten affected parts to specifications.

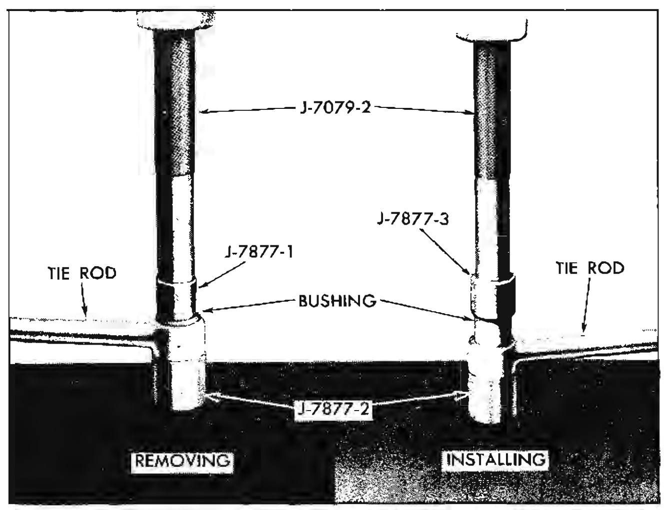


Fig. 35—Tie Rod Bushing Replacement

DRIVE LINE
REAR AXLE

INDEX

GENERAL DESCRIPTION

The rear axle (fig. 36) is a semifloating type consisting of a cast carrier with large bosses on each end into which two welded steel tubes are fitted. The carrier contains an overhung hypoid pinion and ring gear. The differential is a two pinion arrangement.

The axle housing is made up of two steel welded tubes pressed into the crossbore of the cast carrier - each tube is puddle welded at three places to the differential carrier. Welded-on brackets provide attachment points for Chevelle springs, shock absorbers, and lower control arms. Chevrolet models have welded-on brackets for control arms, tie rod, and shock absorbers. The housing on Chevy II has welded brackets for mounting lower spring pad and shock absorber. A welded flange is provided for brake flange plate attachment.

The overhung hypoid drive pinion is mounted on two preloaded tapered roller bearings. The pinion shaft is sealed by means of a molded, spring loaded, rubber seal. The seal is mounted on the pinion shaft flange which is splined and bolted to the hypoid pinion shaft.

The hypoid ring gear is bolted to a one-piece differential case which is mounted on two preloaded tapered roller bearings.

MAINTENANCE AND ADJUSTMENTS

LUBRICANT

The lubricant level should be periodically checked and maintained at level of filler plug with a warm axle. See the lubrication section of this manual for lubricant recommendations.

Lubricant Leaks

Lubricant leaks should be checked for at the pinion flange oil seal, axle wheel bearing seals, lubricant filler plug, and carrier cover. Correction of these leaks consists of replacing the defective seals or gaskets involved as described in this section.

AXLE BOLTS AND WHEEL NUTS

From a safety standpoint, axle housing to rear spring bolts, wheel nuts and control arm attaching bolts should be periodically inspected for secure installation.

REAR AXLE NOISE DIAGNOSIS

Mechanical failures of the rear axle are relatively simple to locate and correct. Noise in a rear axle is a little more difficult to diagnose and repair. One of the most essential parts of rear axle service is proper diagnosis.

One of the cardinal points of axle noise diagnosis is the fact that all rear axles are noisy to a certain degree. The action of transmitting the high engine torque through a 90° turn reducing propeller shaft speed produces noise in rear axles. This point establishes the need for a line between normal and abnormal or unacceptable axle noises.

Slight axle noise heard only at a certain speed or under remote conditions must be considered normal. Axle noise tends to "peak" at varying speeds and the noise is in no way indicative of trouble in the axle.

If noise is present in an objectionable form, loud or at all speeds, an effort should be made to isolate the noise as being in one particular unit of the vehicle. Axle noise is often confused with other noises such as tire noise, transmission noise, propeller shaft vibration and universal joint noise. Isolation of the noise as in any one unit requires skill and experience. An attempt to eliminate a slight noise may baffle even the best of diagnosticians. Such practices as raising tire pressure to eliminate tire noise, listening for the noise at varying speeds and on drive, float and coast, and under proper highway conditions, turning the steering wheel from left to right to detect wheel bearing noise, will aid even the beginner in detecting alleged axle noises. Axle noises fall into two categories: gear noise and bearing noise.

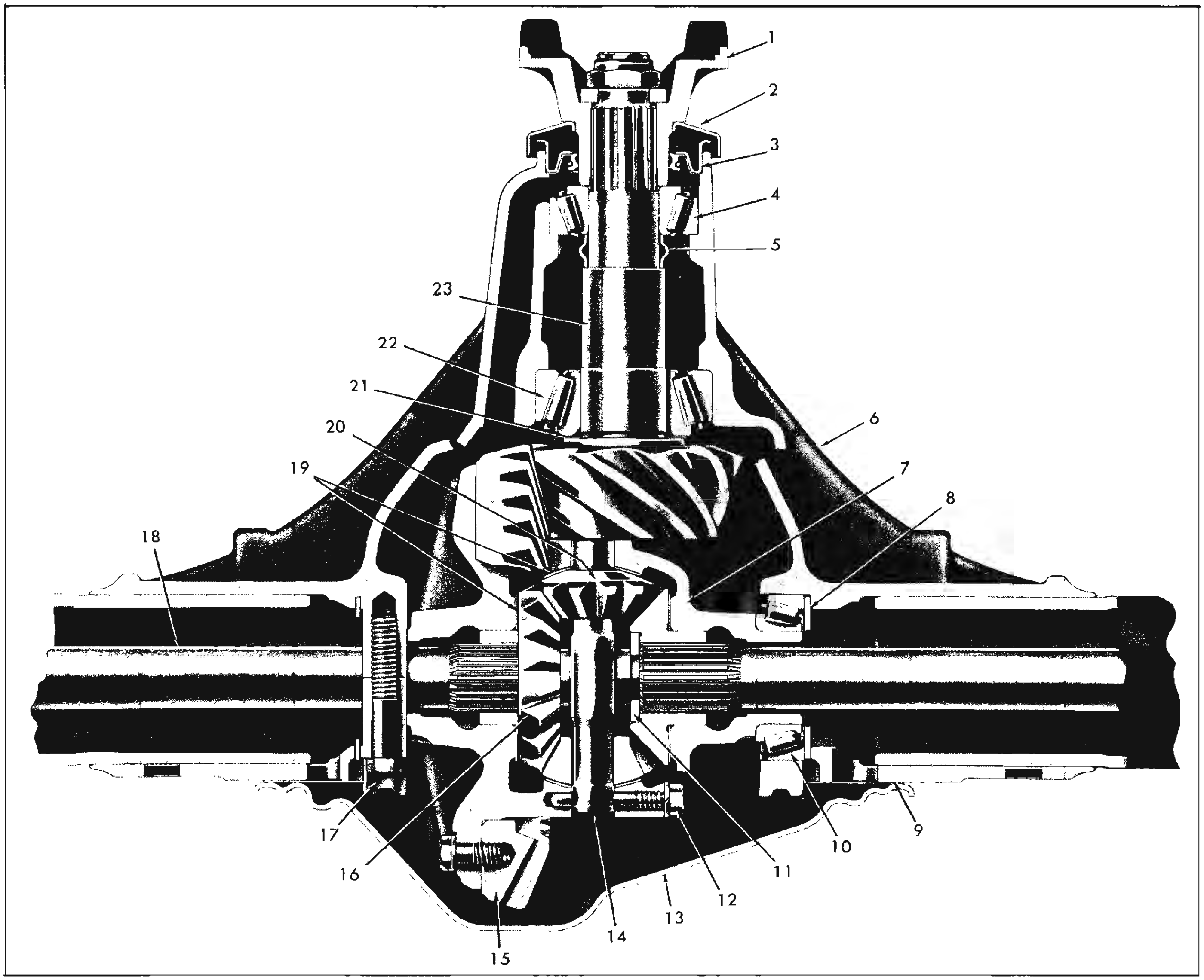


Fig. 36—Rear Axle Cross Section

1. Companion Flange
2. Deflector
3. Pinion Oil Seal
4. Pinion Front Bearing
5. Pinion Bearing Spacer
6. Differential Carrier
7. Differential Case
8. Shim
9. Gasket
10. Differential Bearing
11. "C" Lock
12. Pinion Shaft Lock Bolt
13. Cover
14. Pinion Shaft
15. Ring Gear
16. Side Gear
17. Bearing Cap
18. Axle Shaft
19. Thrust Washer
20. Differential Pinion
21. Shim
22. Pinion Rear Bearing
23. Drive Pinion

GEAR NOISE

Abnormal gear noise can be recognized since it produces a cycling pitch and will be very pronounced in the speed range at which it occurs, appearing under either "drive," "float" or "coast" conditions. Gear noise tends to peak in a narrow speed range or ranges, while bearing noise will tend to remain constant in pitch. Abnormal gear noise is rare and usually originates from the scoring of the ring gear and pinion teeth as a result of insufficient or improper lubrication in new assemblies. Side gears rarely give trouble as they are used only when the rear wheels travel at different speeds.

BEARING NOISE

Defective bearings will always produce a whine that is constant in pitch and varies with vehicle speed. This fact will allow you to distinguish between bearing noise and gear noise.

1. Pinion bearing noise resulting from a bearing failure can be identified by a constant rough sound. Pinion bearings are rotating at a higher speed than differential side bearings or axle shaft bearings. This particular noise can be picked up best by testing the car on a smooth road (black top). However, care

should be taken not to confuse tire noise with bearing or gear noise. If any doubt exists, tire treads should be examined for irregularities that would produce such noise.

2. Wheel bearing noise may be confused with rear axle noise. To differentiate between wheel bearings and rear axle, drive the vehicle on a smooth road at medium-low speed. With traffic permitting, turn the vehicle sharply right and left. If noise is caused by wheel bearings, it will increase in the turns because of the side loading. If noise cannot be isolated to front or rear wheel bearings, inspection will be necessary.
3. Side bearings will produce a constant rough noise of a slower nature than pinion bearings. Side bearing noise will not fluctuate in the above wheel bearing test.

Failure Analysis

The most common types of rear axle failures are hypoid gear tooth scoring and fracture, differential gear fracture and/or differential bearing failure, and axle shaft bearing failure.

Hypoid Gears

Hypoid gear tooth scoring (fig. 37) is caused generally by improper break-in, insufficient gear backlash or improper ring/pinion gear alignment. The scoring will progressively lead to complete erosion of the gear tooth, or gear tooth pitting and eventual fracture with possible attendant damage to bearings, if the initial scoring condition is not diagnosed in time and corrected. Hypoid gear scoring is easily recognized by its characteristic loud whine in either drive, coast or under both conditions.

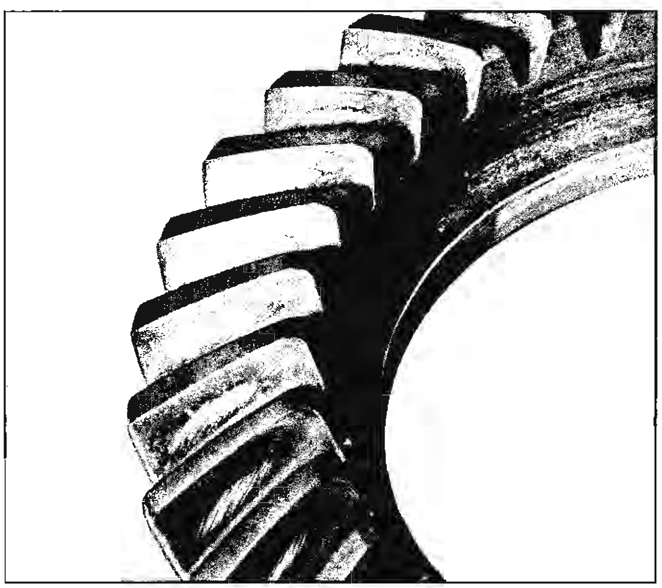


Fig. 37—Scored Hypoid Ring Gear

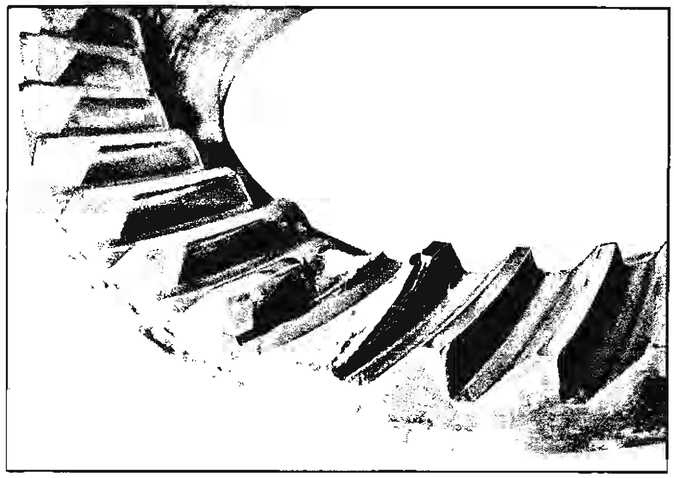


Fig. 38—Cracked Hypoid Ring Gear

Another cause of hypoid tooth fracture (fig. 38) is extended overloading of the gear set which will produce fatigue fracture, or shock loading which will result in sudden failure.

Differential Gears

Common causes of differential gear failure are shock loading, extended overloading leading to fatigue failure, and overheating of gear thrust surfaces resulting from excessive wheel spin and consequent lubrication breakdown. Overheating will lead to seizing of thrust surfaces or tooth failure (fig. 39).

Bearings

Failure of axle tapered roller bearings is due primarily to excessive wear caused by long service or foreign materials in the oil. The second most common cause of bearing failure is too tight or too loose preload adjustment leading to spalling and eventaul failure. This failure may also lead to hypoid gear scoring due to the resultant misalignment of the hypoid gear set.

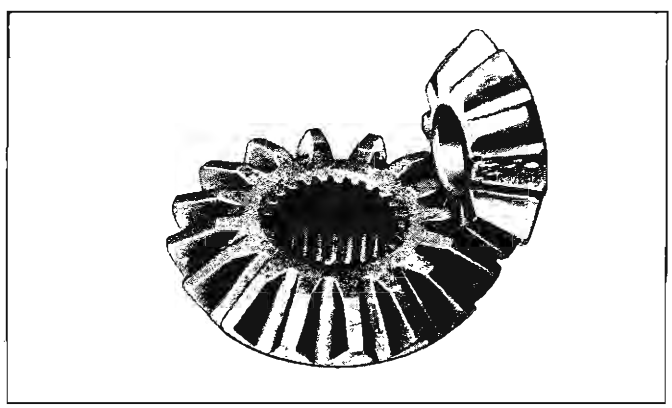


Fig. 39—Differential Gear Failure

COMPONENT PARTS REPLACEMENT

AXLE ASSEMBLY

Removal

1. Raise vehicle to a height that will permit axle assembly to hang freely and position supports under both frame side rails.
2. Disconnect wheel cylinder inlet lines. Disconnect and remove brake hose and brake line retaining bracket

by removing retaining bolt from carrier cover.
3. Loosen parking brake equalizer adjusting nut and disconnect both rear cables at frame bracket and at control arms. See Section 5 for detail of parking brake cable removal.
4. Remove two trunnion bearing U-bolts from the rear yoke and separate rear universal joint. Wire propeller shaft to frame side rail and tape trunnion bearing cups.
5. Support and secure axle assembly with an adjustable lifting device. On Chevrolet and Chevelle models, loosen upper and lower control arm attaching bolts at axle housing. (On Chevrolet models, disconnect tie rod at axle bracket.)
6. Disconnect shock absorbers at axle brackets. Refer to Shock Absorber Removal procedures outlined in this section.
7. On Chevrolet and Chevelle models, lower axle assembly until suspension reaches end of travel, then disconnect spring retainers and withdraw springs from vehicle.
8. On Chevy II models, remove four nuts securing lower spring seat to axle housing, then remove front spring eye bolts and swing spring to rear so that it does not interfere with axle.
9. On Chevrolet and Chevelle models, disconnect upper and lower control arm attaching bolts at axle housing.
10. Lower axle assembly and remove from under vehicle.

Installation

1. Place axle assembly under vehicle and raise into position.
2. On Chevrolet and Chevelle models, install, but do not tighten, upper and lower control arm attaching bolts at axle housing.
3. On Chevrolet and Chevelle models, position coil springs in upper seats so that end of spring is indexed in seat.
4. On Chevrolet and Chevelle models, install lower end of spring on axle bracket or control arm and secure by installing retainer and bolt. Install lock washer and retainer nut.
5. On Chevy II models, install spring seat pads and swing springs up into spring seats on axle housing, making sure upper seat pads are aligned in axle housing bracket.
6. Install spring front eye bolt and tighten, then install

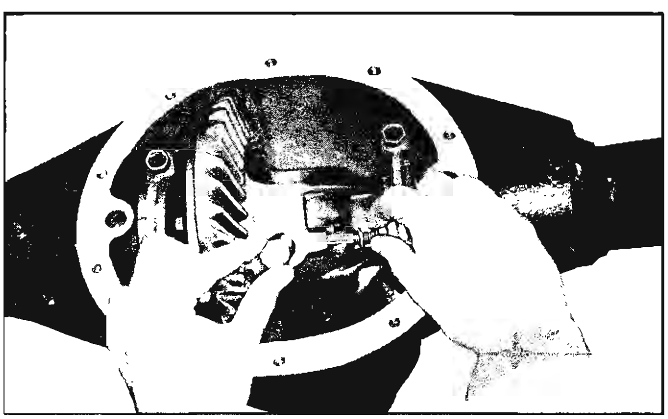


Fig. 40—Differential Pinion Shaft Removal

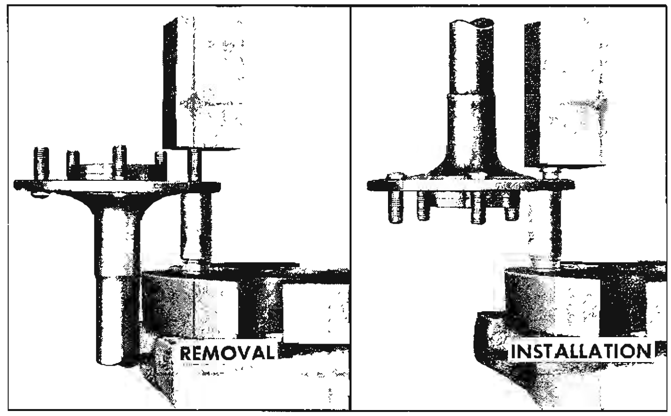


Fig. 41—Wheel Bolt Replacement

spring seat lower mounting bracket and retaining nuts.
7. Raise axle assembly to allow shock absorber and tie rod installation. Position shock absorber in axle bracket. Torque nut as outlined in Shock Absorber Installation procedures.
8. Install brake hose and brake line retaining bracket to carrier and connect wheel cylinder inlet lines. Connect parking brake cable to frame bracket and at control arm. Adjust parking brake and bleed brakes as outlined in Section 5.
9. Reassemble rear universal joint to companion flange.
10. Support vehicle at axle and remove supports from beneath the frame side rails.
11. Remove supports and lower vehicle to floor. Torque all affected parts to specifications.

AXLE SHAFT

Removal

1. Raise vehicle to desired working height and remove wheel and tire assembly and brake drum.
2. Clean all dirt from area of carrier cover.
3. Drain lubricant from carrier by removing cover.
4. Remove the differential pinion shaft lock screw and the differential pinion shaft (fig. 40).
5. Push flanged end of axle shaft toward center of vehicle and remove "C" lock from button end of shaft.
6. Remove axle shaft from housing, being careful not to damage oil seal.

Wheel Bolt Replacement

Press bolts out of axle shaft flange (as illustrated in Figure 41) and press new bolts into place, making sure that they are tight and square with flange.

Oil Seal and/or Bearing Replacement

1. Insert Tool J-8119 into bore and position it behind bearing so that tangs on tool engage bearing outer race. Remove oil seal and bearing, using slide hammer as shown in Figure 42. Figure 43 shows a detail of axle housing outer end.
2. Lubricate new bearing with wheel bearing lubricant, and install bearing so that it bottoms against shoulder (fig. 44). To install bearing use Tool J-21491 for the light-duty axle and Tool J-21051 for the heavy-duty axle.

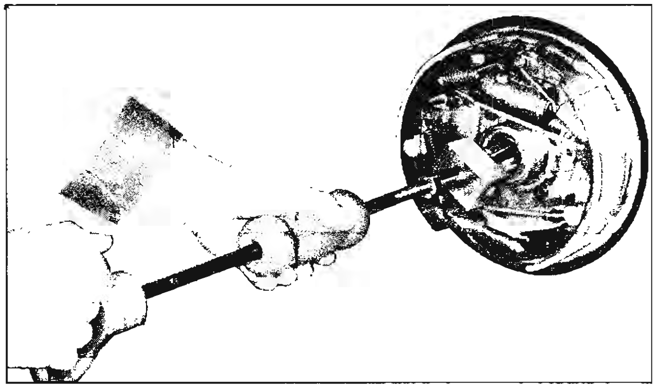


Fig. 42—Wheel Bearing and Oil Seal Removal

3. Pack cavity between the seal lips with a high melting point wheel bearing lubricant; position seal on tool (Use J-21491 for light-duty axle and J-21051 for heavy-duty axle) and position seal in axle housing bore, tap seal into place so that it bottoms against bearing (fig. 44).

Brake Flange Plate Replacement

1. Remove brake line at wheel cylinder inlet and disassemble brake components from flange plate. Refer to Section 5 for brake disassembly procedure.
2. Remove 4 nuts securing flange plate to axle housing.
3. Install new flange plate to axle housing and torque nuts to specifications.
4. Install brake components on flange and connect hydraulic line to wheel cylinder inlet. See Section 5 for brake assembly procedure.
5. Install axle shaft, brake drum and wheel and tire assembly.
6. Bleed and adjust brakes as outlined in Section 5.

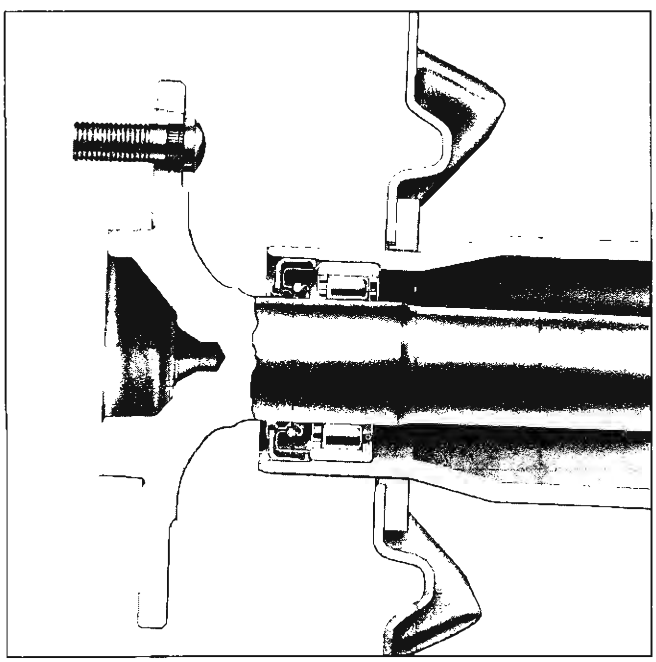


Fig. 43—Axle Housing Detail

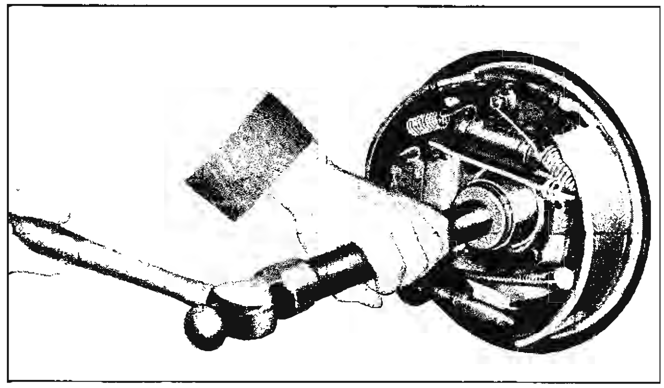


Fig. 44—Wheel Bearing and/or Oil Seal Installation

Installation

1. Slide axle shaft into place.

   CAUTION: Exercise care that splines on end of shaft do not damage oil seal and that they engage with splines of differential side gear.

2. Install axle shaft "C" lock on button end of axle shaft and push shaft outward so that shaft lock seats in counterbore of differential side gear.
3. Position differential pinion shaft through case and pinions, aligning hole in shaft with lock screw hole. Install lock screw and torque to specifications.
4. Using a new gasket, install carrier cover and torque bolts to specifications.

   CAUTION: Make sure both gasket surfaces on carrier and cover are clean before installing new gasket. Torque carrier cover bolts in a crosswise pattern to ensure uniform draw on cover gasket.

5. Fill axle with lubricant to a level even with bottom of filler hole. See Section 0 for proper lubricant.
6. Install brake drum and wheel and tire assembly.
7. Lower vehicle and test operation of axle.

PINION FLANGE, DUST DEFLECTOR AND/OR OIL SEAL

Replacement

1. Raise rear of vehicle and place stand jacks under frame side rails so that axle hangs freely to allow sufficient working room.
2. Check wheels for freedom of rotation.
3. Separate rear universal joint, tape trunnion bearings to joint, position propeller shaft to one side and tie it to frame side rail.
4. Using Tool J-5853 with Adapter J-5810 and a suitable socket on the pinion flange nut, rotate the pinion through several complete revolutions and record the torque required to keep the pinion turning (fig. 45). If flange is to be reused, mark pinion and flange for reassembly in the same relative position.
5. Install Tool J-8614-1 on pinion flange and remove pinion flange nut and washer (fig. 46). (Position J-8614-1 on flange so that the four notches are toward flange.) Discard nut and use a new one upon reassembly.

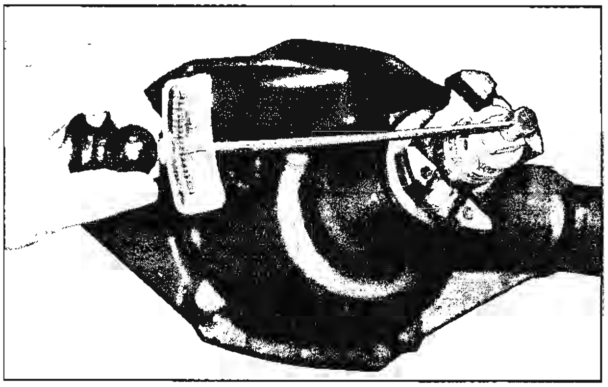


Fig. 45—Measuring Drive Pinion Bearing Preload

6. Thread pilot end of Tool J-8614-3 into small OD end of J-8614-2. Then with J-8614-1 installed as in Step 4, insert J-8614-2 into J-8614-1 and turn it 45 degrees to locked position. Remove flange by turning J-8614-3 while holding J-8614-1 (fig. 47).
7. Pry old seal out of bore, using a screw driver or a hammer and chisel.
8. Inspect pinion flange for smooth oil seal surface, worn drive splines, damaged ears, and for smoothness of bearing contact surface. Replace if necessary.
9. If deflector requires replacement, remove by tapping from flange, clean up stake points; install new deflector, and stake deflector at three new equally spaced positions.

NOTE: Staking operation must be performed in such a manner that the seal operating surface is not damaged.

10. Pack the cavity between the seal lips of the pinion flange oil seal with a lithium-base extreme pressure lubricant, position seal in bore, then using Tools J-21468 and J-9458, for light-duty axle and Tool J-21057 for heavy-duty axle, press seal into bore until it seats against shoulder (figs. 48 and 49).

CAUTION: Pinion oil seal flange must not bottom against carrier. Press seal into carrier bore until it seats against internal shoulder - do not apply unnecessary pressure after seal is seated. To do so will destroy rubber seat and distort seal.

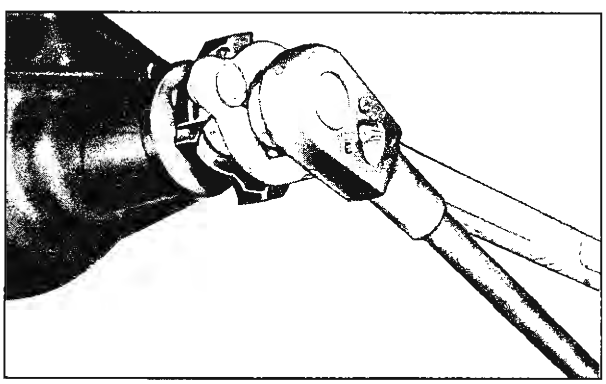


Fig. 46—Drive Pinion Nut Removal

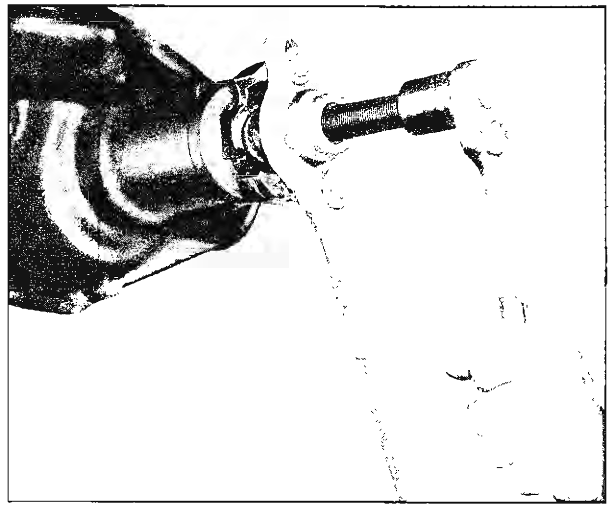


Fig. 47—Drive Pinion Flange Removal

11. Position and align pinion flange on pinion shaft using Tools J-9458 and J-8614-1. Tool J-9458-1 is threaded onto pinion shaft and nut tightened against J-9458-2 to pull flange on shaft (fig. 50). Remove J-9458 after flange is seated.

CAUTION: Do not attempt to hammer flange onto pinion shaft. To do so will damage ring gear and pinion.

12. Pack the cavity between end of pinion splines and pinion flange with a non-hardening sealer (such as Permatex Type A) prior to installing washer and nut on pinion.
13. Install washer and a new self-locking nut on pinion shaft. Tighten nut to remove end play and continue

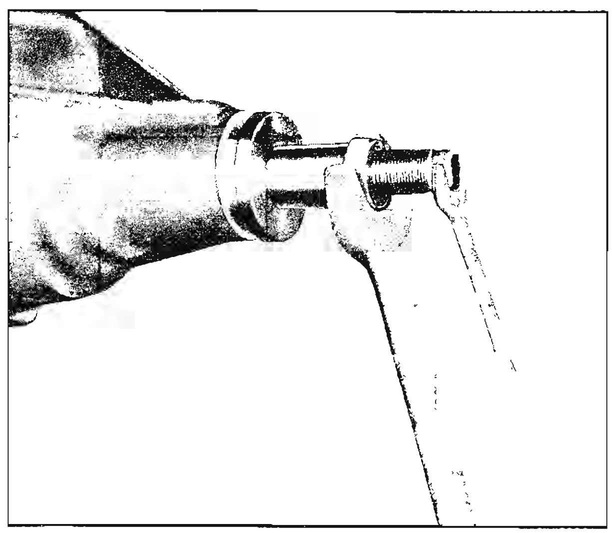


Fig. 48—Drive Pinion Flange Oil Seal Installation (Light-Duty)

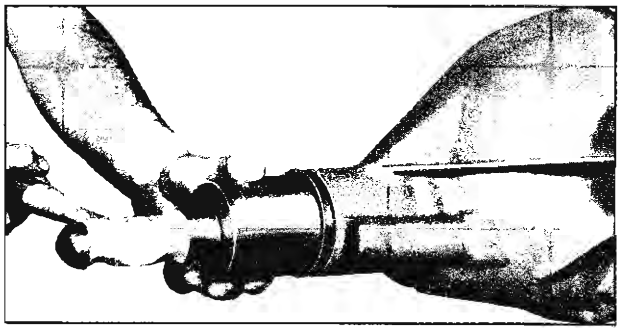


Fig. 49—Drive Pinion Flange Oil Seal Installation (Heavy-Duty)

alternately tightening in small increments and checking preload with torque wrench until it is the same as that recorded in Step 4.

NOTE: The position of the pinion and flange was previously marked so that reinstallation may be made with flange and pinion in same relative position.

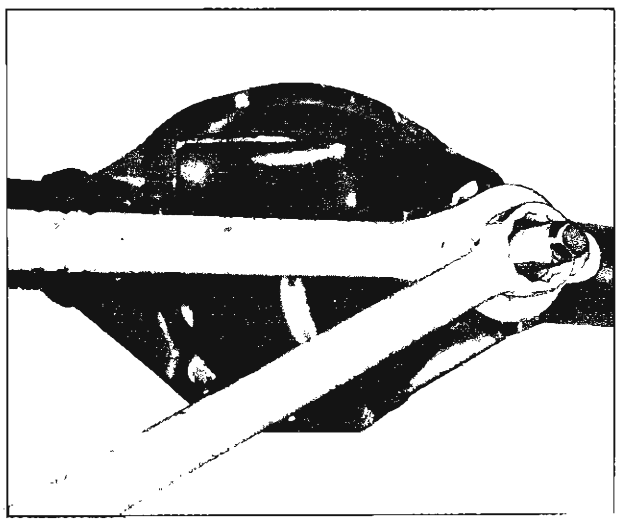


Fig. 50—Drive Pinion Flange Installation

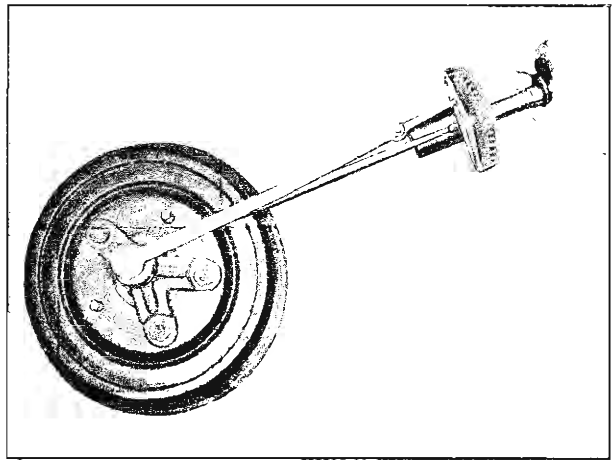


Fig. 51—Measuring Positraction Rotating Torque

14. Reassemble the rear universal joint, and torque "U" bolt nuts to specifications.
15. Lower vehicle to floor and road test for leaks.

POSITRACTION DIFFERENTIAL UNIT

The optionally available Positraction differential unit is installed in the conventional carrier to replace the standard differential unit.

Service procedures for the Positraction equipped axle are the same as on a conventional axle except for the operations listed below.

On the Vehicle Check

If vehicle is equipped with a manual transmission, shift transmission into neutral.

1. Raise rear of vehicle until wheels are off the ground, remove one wheel and tire assembly.
2. Attach Adapter J-5748 to axle shaft flange and install a 1/2-13 bolt into adapter (fig. 51).
3. With wheel and tire assembly still on vehicle held firmly to prevent turning, measure torque required to rotate opposite axle shaft with a 0-150# torque wrench attached to J-5748. Torque should be 70 lb. ft. minimum new, and no less than 40 lb. ft. if used.

PROPELLER SHAFT AND UNIVERSAL JOINTS

INDEX

GENERAL DESCRIPTION

The one-piece, exposed-type, tubular propeller shaft is used on all models. Powerglide equipped Chevrolets use a propeller shaft tube which incorporates rubber insulators for quieter operation. These insulators, which are bonded to the smaller tube, press fit to the larger tube for a length of approximately 12-1/2 inches. Two cardon-type universal joints are of the lube-for-life design and do not require periodic maintenance. A splined front yoke on the front end of the propeller shaft extends into a splined coupling on the transmission output shaft. This slip joint permits slight lengthening and shortening of the propeller shaft to compensate for up and down movement of the rear axle assembly.

MAINTENANCE AND ADJUSTMENTS

PROPELLER SHAFT FRONT AND REAR JOINT ANGLES

When torque is transmitted through any ordinary universal joint, the driven yoke fluctuates slightly in speed. Although the driving yoke rotates at a constant speed, the driven yoke speeds up and slows down twice per revolution. This fluctuation of the driven yoke is in direct proportion to the angle through which the universal joint is operating; the greater the angle, the greater the fluctuation.

When two universal joints are used, the angles through which they operate must be very nearly the same. This allows the alternate acceleration and deacceleration of one joint to be offset by the alternate acceleration and deacceleration of the second joint. When the two joints do not run at the same angle, operation is rough and an objectionable vibration is produced.

In addition, universal joints are designed to operate safely and efficiently within certain angles. If the designed angle is exceeded, the joint may be broken or otherwise damaged.

The front universal joint angle is actually the angle between the engine-transmission centerline and the propeller shaft centerline. This angle is not likely to change with use, and checking should not be necessary unless engine or transmission mounts are replaced, excessive vibration is encountered, or interference to floor pan occurs. On Chevrolet models, the front angle can be altered by shimming or bending crossmember.

On Chevrolet models the rear universal joint angle is adjusted with shims between the upper control arm and crossmember (fig. 20). This adjustment rotates the axle assembly thereby changing the position of the pinion shaft centerline in relation to the propeller shaft centerline.

Drive line angles are not adjustable on Chevy II models, as the pinion angle is determined by the spring pad location on the axle housing. There is no provision for propshaft angle adjustment on Chevelle.

Chevrolet

Adjustment

1. Raise vehicle so that vehicle weight is supported on axle.
2. Check propeller shaft and spring condition and make sure riding height is satisfactory.
3. Measure the distance from the top of the axle housing to frame kick-up as outlined in the Riding Height Check procedure in this section (fig. 4). Record this measurement for future reference.
4. Using a bubble protractor, obtain propeller shaft angle (fig. 52).

   NOTE: All angles are measured in relation to a horizontal or level plane as indicated by the bubble in the protractor.

5. Rotate the propeller shaft until one of the four machined surfaces of the pinion shaft drive flange is parallel to the floor. Measure the pinion shaft angle by positioning the protractor on the machined surface (fig. 53).
6. Add the rear propeller shaft angle (Step 4) and the pinion shaft angle (Step 5). This sum is the propeller shaft rear joint angle.

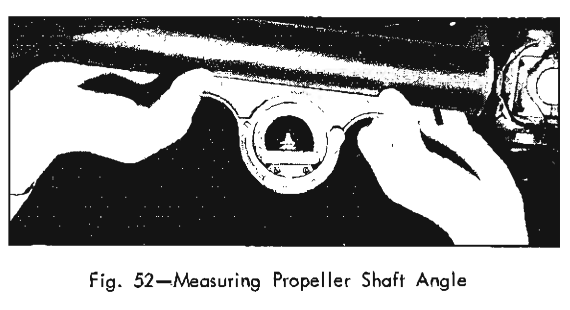


Fig. 52—Measuring Propeller Shaft Angle

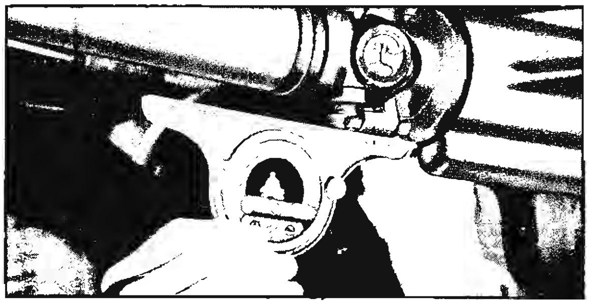


Fig. 53—Measuring Pinion Angle

7. Refer to the "Front and Rear Joint Angle Curve", Figure 55, and select the rear joint angle applicable to the axle to frame dimension recorded in Step 3.

8. If the rear joint angle is not the same (± 1/2°) as the angle shown on Figure 55, adjust pinion shaft as follows:

   a. Loosen the three upper control arm bracket nuts, located on forward side of the rear crossmember.

   b. Add or remove shim(s) between the control arm bracket and crossmember as required.

   c. Tighten control arm bracket nuts to specifications and recheck propeller shaft angle and pinion angle. Compare the sum of these two angles with Figure 55, as outlined in Step 7. Readjust if necessary. Check front joint angle as outlined in Step 9 and 10.

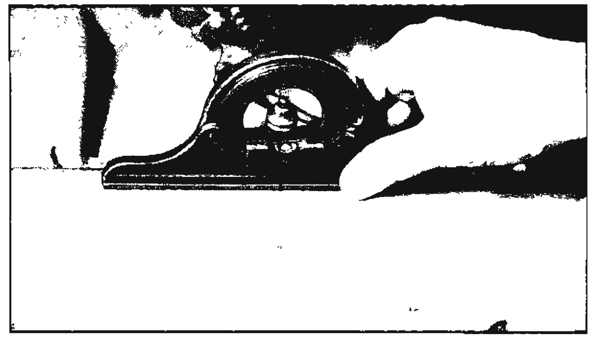


Fig. 54—Measuring Engine Angle

NOTE: On models with two upper control arms, make sure equal shim packs are used on both sides to maintain correct suspension to frame relationship.

9. Measure the engine angle, placing protractor on valve rocker cover flange surface (fig. 54).
10. Subtract the front propeller shaft angle from the engine angle to obtain the front joint angle.
11. If the result obtained in Step 10 is not the same (± 1/2°) as the front joint angle shown on Figure 55, adjust by shimming at the transmission support or by bending the support.

NOTE: If the front angle is too large, a shim should be inserted under the transmission support. If the rear angle is too small a shim should be removed from the rear suspension upper control arm front attachment.

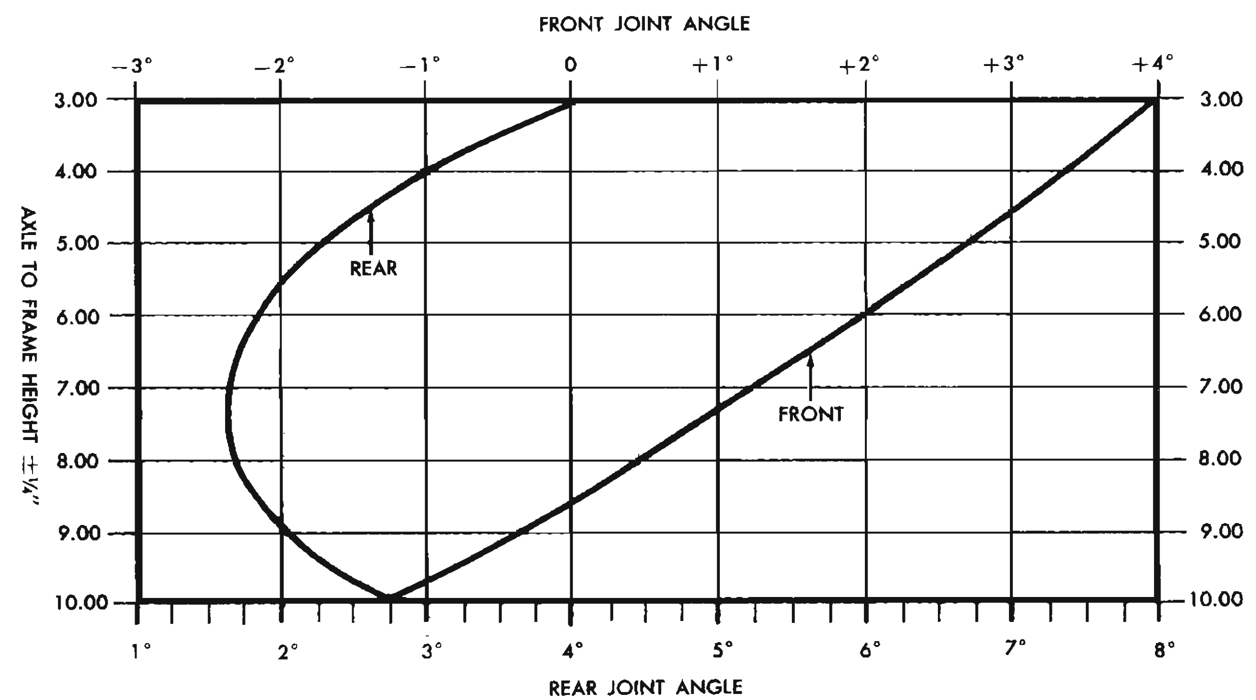


Fig. 55—Front and Rear Joint Angle Curve

12. If proper joint angles cannot be obtained, inspect engine mounts, transmission support and drive line to determine faulty part or parts. Replace parts as required and readjust front angle and pinion angle as necessary.

COMPONENT PARTS REPLACEMENT

PROPELLER SHAFT

REMOVAL

1. Raise vehicle and disconnect the rear universal joint by removing trunnion bearing U-bolts. Tape bearing cups to trunnion to prevent dropping and loss of bearing rollers.
2. Withdraw propeller shaft front yoke from transmission by moving shaft rearward, passing it under the axle housing. Watch for oil leakage from transmission output shaft housing.

Repairs

NOTE: The universal joints are of the lube-for-life design and do not require periodic inspection or lubrication; however, when these joints are disassembled, repack bearings with high melting point wheel bearing lubricant and replace the dust seals.

1. Remove bearing lockrings from trunnion yoke.
2. Support trunnion yoke on a piece of 1-1/4" I.D. pipe on an arbor bed.

NOTE: Due to length of the propeller shaft it may be more convenient to use a bench vise, for removal and installation, instead of an arbor press. In this case, proceed with disassembly and assembly procedure as with an arbor press.

3. Using a suitable socket or rod, press trunnion down far enough to drive bearing cup from yoke (fig. 56).
4. Remove dust seals from trunnion fingers, clean and inspect bearing rollers and trunnion. Relubricate bearings with a high melting point wheel bearing lubricant.
5. Place new dust seals on trunnion finger - cavity of seal toward end of trunnion - then position Tool J-21548 over end of trunnion and into cavity portion of seal. Press seal onto trunnion until tool bottoms against trunnion finger (fig. 57).

NOTE: Installation of seal is critical to proper sealing - use specified tool during installation to prevent seal distortion and to assure proper seating of seal on trunnion.

6. Partially install one bearing cup into yoke. Place trunnion in yoke and into bearing cup. Install other bearing cup and press both bearing cups into yoke (fig. 58) being careful to keep trunnion aligned in bearing cups.
7. Press bearing cups far enough to install lockrings, and install lockrings.

INSTALLATION

1. Inspect yoke seal in the transmission and replace, if necessary, as described in the transmission section.
2. Insert propeller shaft front yoke into transmission.
3. Connect the rear universal joint by installing U-bolt clamps over bearing trunnions - torque nuts to specifications.

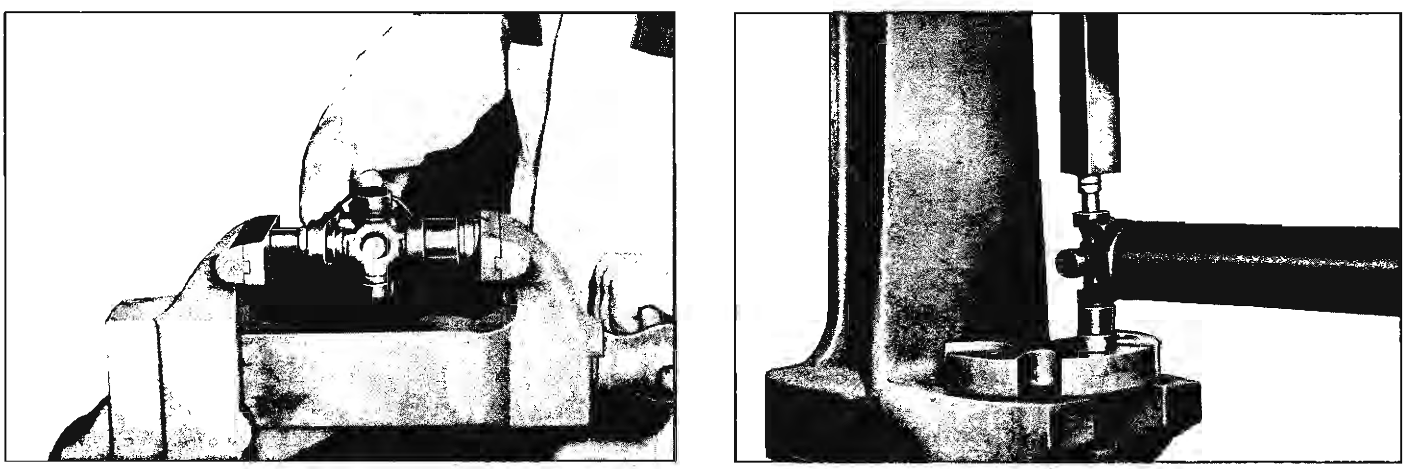


Fig. 56—Removing Bearing Caps

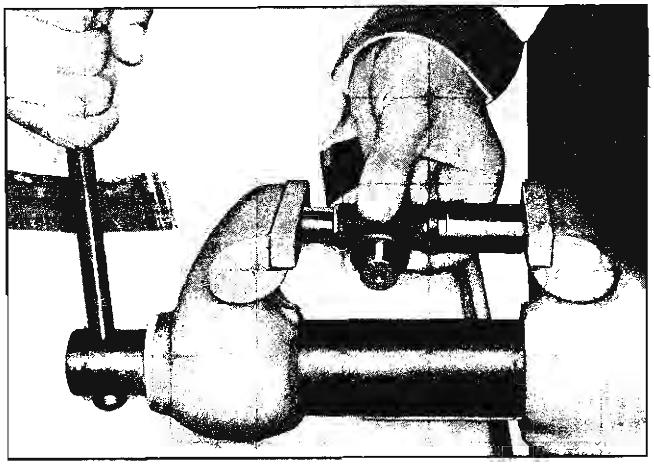


Fig. 57—"U" Joint Trunnion Seal Installation

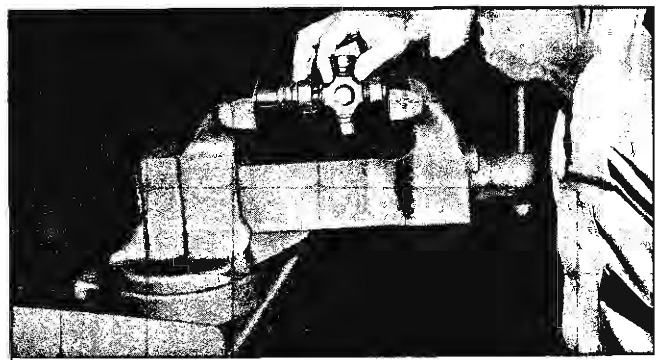


Fig. 58—Installing Bearing Cup and Trunnion

Fig. 59—Special Tools

1.	J-8614	Companion Flange Remover—Consists of J-8614-1 Holder, J-8614-2 Nut and J-8614-3 Screw.
2.	J-21057	Drive Pinion Oil Seal Installer—Heavy-Duty Axle.
3.	J-21468	Drive Pinion Oil Seal Installer—Light Duty Axle—Used with J-9458.
4.	J-5748	Positraction Torque Measuring Adapter.
5.	J-21830	Upper and Lower Control Arm Bushing Puller—Consists of J-21830-2 Adapter, J-21830-4 Receiver, J-21830-7 Bridge—Used with J-21058-6 Spacer.
6.	J-7574	Chevrolet Lower Control Arm Front Bushing Remover/Installer—Consists of J-7474-4 Receiver, J-7474-1 Remover, J-7574-2 Installer Adapter, J-7574-3 Spacer.
7.	J-7877	Chevrolet Tie Rod Bushing Remover/Installer—Consists of J-7877-1 Remover Adapter, J-7877-2 Bushing Receiver, J-7877-3 Installer Adapter—Used with J-7079-2 Handle.
8.	J-21474	Chevelle Control Arm Bushing Remover—Consists of J-21474-5 Receiver and J-21474-1 Spacer.
9.	J-21830-3	Chevrolet Lower Control Arm Rear Bushing Installer Spacer.
10.	J-9458	Drive Pinion Oil Seal Installer—Light Duty Axle—Used with J-21468.
11.	J-21051	Rear Wheel Bearing and Oil Seal Installer—Heavy Duty Axle—Used with J-7079-2.
12.	J-21491	Rear Wheel Bearing and Oil Seal Installer—Light Duty Axle—Used with J-8092.
13.	J-2619	Rear Wheel Bearing and Oil Seal Remover (Slide Hammer).
14.	J-8119	Rear Wheel Bearing and Oil Seal Remover—Used with J-2619.
15.	J-21058	Upper and Lower Control Arm Puller—Consists of J-21058-15 Screw and J-21058-8 Nut—Used with J-21830.
16.	J-8092	Driver Handle—Threaded Type.
17.	J-7079-2	Driver Handle—Insert Type.
18.	J-21548	Propeller Shaft "U" Joint Trunnion Seal Installer.
19.	J-21991	Chevelle Upper Control Arm Carrier Bushing Remover Adapter
20.	J-5853	Torque Wrench—in. lbs.
21.	J-5810	Torque Wrench Adapter
22.	J-1313	Torque Wrench—ft. lbs.

SPECIAL TOOLS

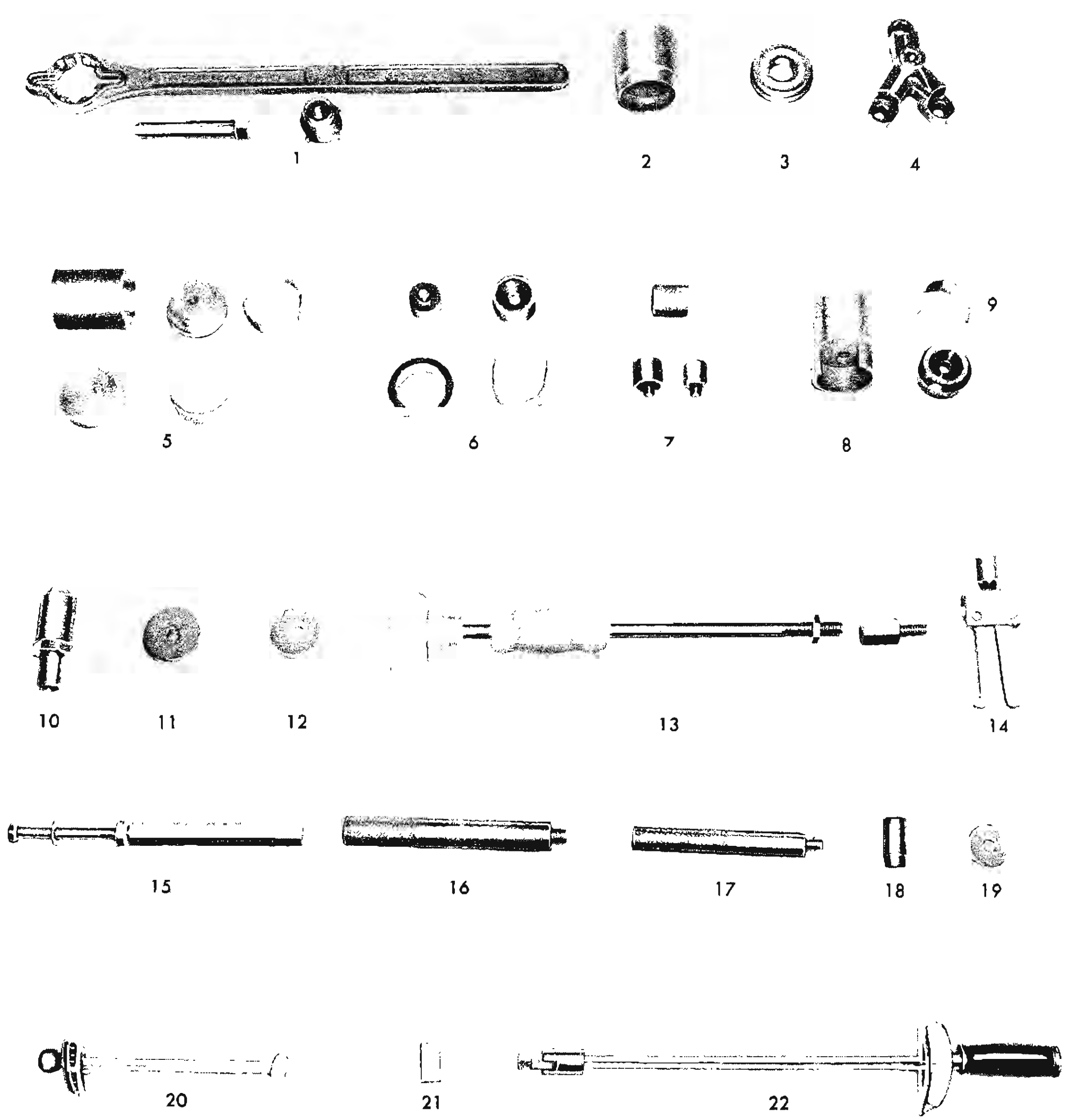


Fig. 59—Rear Suspension Special Tools

SECTION 5

BRAKES

CONTENTS OF THIS SECTION

STANDARD BRAKES

INDEX

GENERAL DESCRIPTION

The self-adjusting brakes used (fig. 1) on both front and rear of all models are the Duo-Servo single anchor type which utilize the momentum of the vehicle to assist in the brake application. This self-energizing or self-actuating force is applied to both brake shoes at each wheel in both forward and reverse motion. The brake shoe linings are bonded to the shoes.

Wheel cylinders are the double piston type permitting even distribution of pressure to each brake shoe. To keep out dust and moisture, both ends of each wheel cylinder are sealed with a rubber boot. The wheel cylinders have no adjustments.

The main cylinder (fig. 2) consists of a piston which receives mechanical pressure from the brake pedal and transmits it through the brake lines as hydraulic pressure to the wheel cylinders. The filler cap is accessible from inside the engine compartment.

The Chevrolet and Chevelle parking brake has a foot operated ratchet type pedal mounted to the left of the steering column. A cable assembly connects the pedal to an intermediate cable by means of an equalizer, where the adjustment for the parking brake is incorporated. This intermediate cable attaches to the two rear cables which operate the rear service brake.

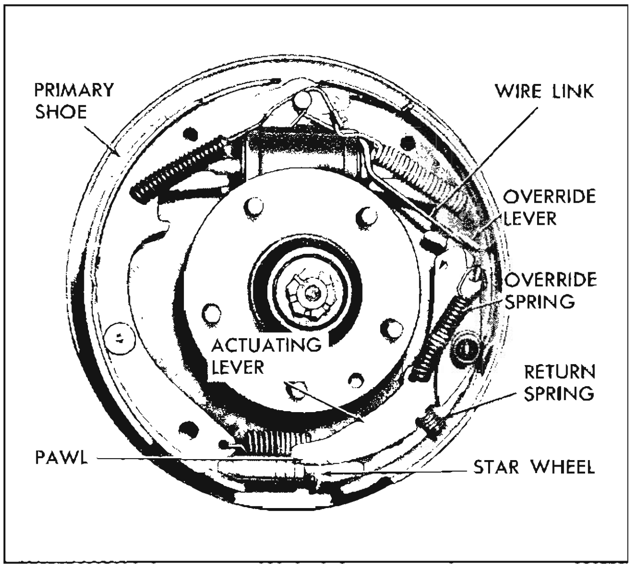


Fig. 1—Self-Adjusting Brake

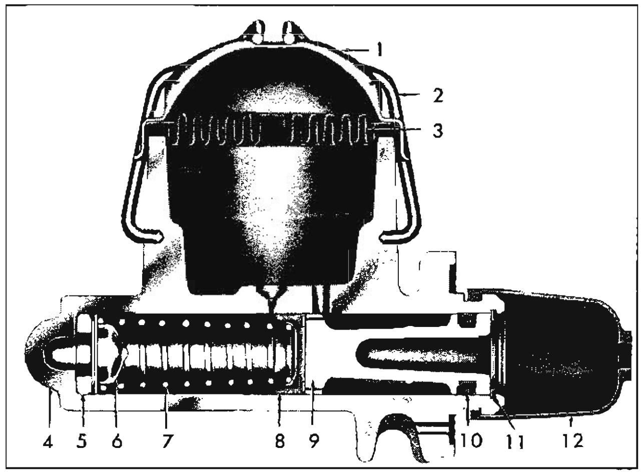


Fig. 2—Main Cylinder

1. Reservoir Cover
2. Bail Wire
3. Seal
4. Body
5. Valve Seat
6. Valve Assembly
7. Spring
8. Primary Cup
9. Piston
10. Secondary Cup
11. Lock Ring
12. Boot

The Chevy II has a single-stroke, ratchet-type parking brake actuating release lever, located to the right of the steering column, it is connected to the rear wheel brake assemblies through a two-piece cable and equalizer assembly.

A dash-mounted idler lever multiplies force applied at the parking brake lever and transmits it to the equalizer assembly by means of the front cable. The one-piece rear cable passes through the equalizer and is connected at each end to an actuating lever within the rear brake assembly.

MAINTENANCE AND ADJUSTMENTS

In any service operation it is extremely important that absolute cleanliness be observed. Any foreign matter in the hydraulic system will tend to clog the lines, ruin the rubber cups of the main and wheel cylinders and cause inefficient operation or even failure of the braking system. Dirt or grease on a brake lining may cause that brake to grab first on brake application and fade out on heavy brake application.

HYDRAULIC BRAKE FLUID

Use GM Hydraulic Brake Fluid Supreme No. 11 or equivalent when servicing brakes. This brake fluid is satisfactory for any climate and has all the qualities necessary for satisfactory operation, such as a high boiling point to prevent vapor lock and the ability to remain fluid at low temperatures.

In the event that improper fluid has entered the system, it will be necessary to:

1. Drain the entire system.
2. Thoroughly flush the system with clean alcohol, 188 proof, or a hydraulic system cleaning fluid, such as "Declene."
3. Replace all rubber parts of the system, including brake hoses.
4. Refill the system.

BLEEDING HYDRAULIC SYSTEM

The hydraulic brake system must be bled whenever any line has been disconnected or air has in some way entered the system. The system must be absolutely free of air at all times. Bleeding should be done on the longest line first and the proper sequence to follow is left rear, right rear, right front and left front (fig. 3). Bleeding of brake system may be accomplished by one of two methods: either pressure or manual.

NOTE: Fill master cylinder reservoir to within 1/4" of the reservoir rim.

Pressure Bleeding

1. Clean all dirt from top of main cylinder, and remove main cylinder cover.

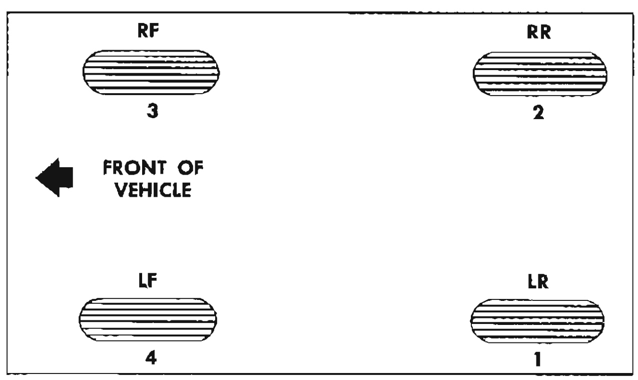


Fig. 3—Proper Bleeding Sequence

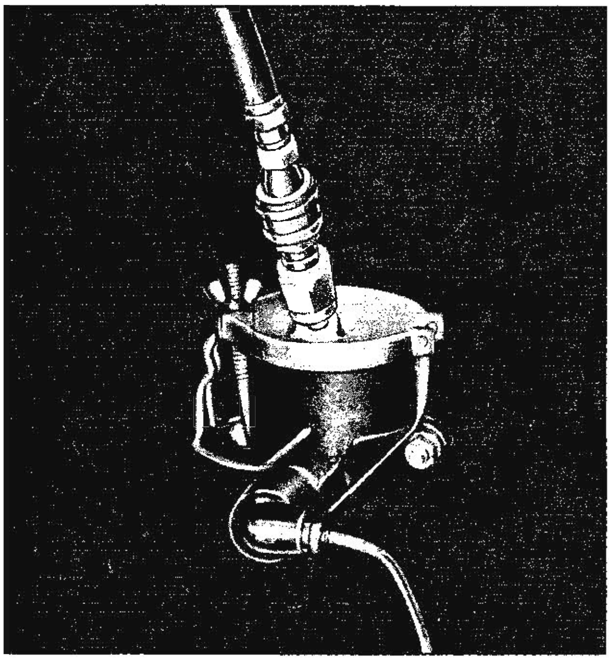


Fig. 4—Pressure Bleeding Adapter-Installed

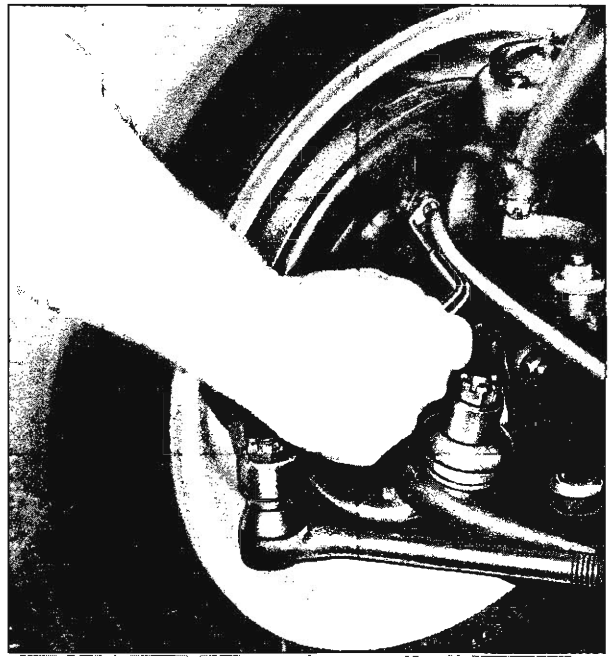


Fig. 5—Bleeding Brakes-Using Tool J-21472

2. Install Tool J-21479 (fig. 4), connect hose from bleeder equipment to Tool J-21479 and open release valve on bleeder equipment.

   NOTE: Make sure brake fluid in bleeder equipment is at operating level and that the equipment is capable of exerting 30 to 50 lbs. hydraulic pressure on the brake system.

3. Install Tool J-21472 on bleeder valve, and position one end of bleeder hose on bleeder valve (fig. 5).
4. Place loose end of bleeder hose in a transparent container. Pour a sufficient volume of brake fluid into container to ensure that end of bleeder hose will remain submerged.
5. Open wheel cylinder bleeder valve by turning Tool J-21472 counter-clockwise approximately 1/3 of a turn, and observe flow of fluid at end of bleeder hose.
6. Close bleeder valve tightly as soon as bubbles stop and brake fluid flows in a solid stream from the bleeder hose. Bleed off enough fluid to ensure that all fluid is replaced.
7. Remove Tool J-21472 and bleeder hose from wheel cylinder bleeder valve.
8. Repeat Steps 3 through 7 at the remaining wheel cylinders in the proper bleeding sequence (fig. 3). Disconnect bleeder equipment, remove Tool J-21479 and replace main cylinder cover.

Manual Bleeding

1. Clean all dirt from top of main cylinder, and remove main cylinder cover.
2. Fill main cylinder reservoir.
3. Install Tool J-21472 on bleeder valve and position one end of bleeder hose on bleeder valve (fig. 5).
4. Place loose end of bleeder hose in a transparent container. Pour a sufficient volume of brake fluid into container to ensure that end of bleeder hose will remain submerged.
5. Open wheel cylinder bleeder valve by turning Tool J-21472 counter-clockwise approximately 1/3 of a turn. Slowly depress brake pedal. When brake pedal reaches the end of its travel, close bleeder valve, and allow brake pedal to return slowly to the fully released position. Repeat this procedure until expelled brake fluid flows in a solid stream from the bleeder hose. Bleed off enough fluid to ensure that all fluid is replaced.
6. Close wheel cylinder bleeder valve tightly as soon as brake fluid flows in a solid stream from the bleeder hose.
7. Remove Tool J-21472 and bleeder hose from wheel cylinder bleeder valve.
8. Repeat Steps 2 through 7 at the remaining wheel cylinders in the proper bleeding sequence (fig. 3). Fill main cylinder and replace main cylinder cover.

   NOTE: Fill main cylinder reservoir to within 1/4" of the reservoir rim.

PUSH ROD TO MAIN CYLINDER CLEARANCE

The brake pedal has a definite stop which is permanent and not adjustable. This stop consists of a rubber bumper at the release end of pedal travel. Before adjusting push rod to main cylinder clearance, make sure pedal returns to the fully released position freely and that the pedal retracting spring has not lost its tension, then proceed as follows:

1. Loosen check nut on push rod.
2. Turn push rod as required to provide correct adjustment. Movement of pedal pad before push rod contacts main cylinder piston must be 1/16" to 1/4" (fig. 6).

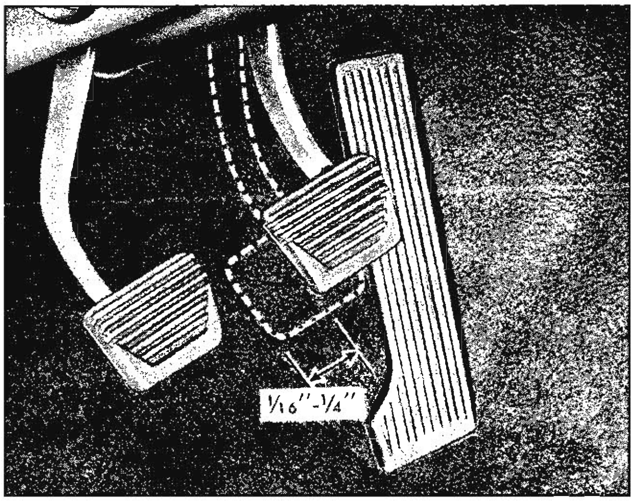


Fig. 6—Brake Pedal Free Movement

3. Tighten check nut against clevis, and recheck movement.

HYDRAULIC BRAKE LINES

Hydraulic Brake Hose

The flexible hoses which carry the hydraulic pressure from the steel lines to the wheel cylinders are carefully designed and constructed to withstand all conditions of stress and twist which they encounter during normal vehicle usage.

The hoses require no service other than periodic inspection for damage from road hazards or other like sources. Should damage occur and replacement become necessary, the following procedure is to be followed.

Removal

1. Separate hose from steel line by turning double flare connector out of hose fitting.
2. Remove "U" shaped retainer from hose fitting and withdraw hose from support bracket.
3. Turn hose fitting out of wheel cylinder inlet.

Replacement

1. Install new copper gasket on cylinder end of hose (male end).
2. Moisten threads with brake fluid and install hose in wheel cylinder inlet.
3. With weight of car on wheels and suspension in normal position (front wheels straight ahead) pass female end of hose through support bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12 point hole in support bracket in position which induces least twist to hose (fig. 7).

   NOTE: Do not twist hose unduly during this operation as its natural curvature is absolutely necessary to maintain proper hose-to-suspension clearance through full movement of the suspension and steering parts.
4. Install "U" shaped retainer to secure hose in support bracket.
5. Inspect by removing weight completely from wheel; turn wheels from lock to lock while observing hose position. Be sure that hose does not touch other parts at any time during suspension or wheel travel. If contact does occur, remove hose retainer and rotate the female hose end in the support bracket one or two points in appropriate direction, replace retainer, and re-inspect.
6. Place steel tube connector in hose fitting and tighten securely.
7. Bleed all brakes as outlined in this section.

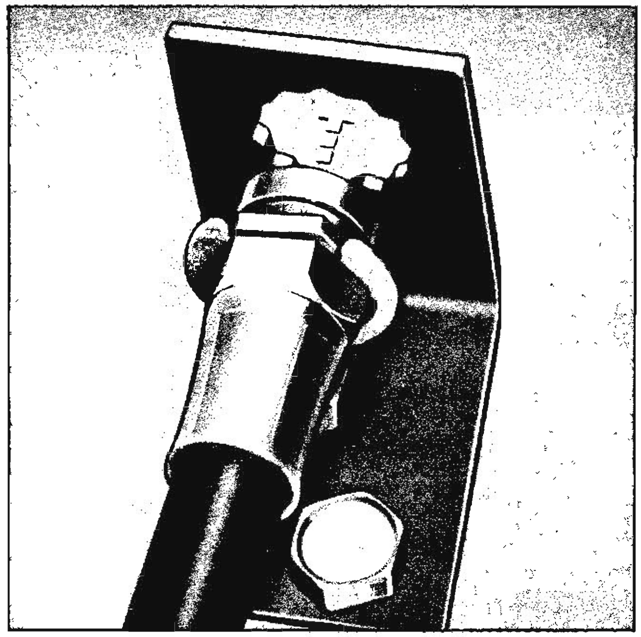


Fig. 7—Brake Line Support Bracket

Hydraulic Brake Tubing

Hydraulic brake tubing is a double layer annealed steel, copper coated and tin plated tubing which resists corrosion and has the physical strength to stand up under the high pressures which are developed when applying the brakes. In making up hydraulic brake pipes, it is important that the proper flaring tool be used to flare the ends of the tubing for the compression couplings. Unless the tubing is properly flared, the connections will leak and the brakes will become ineffective.

CAUTION: When necessary to replace brake tubing, always use special metal tubing which is designed to withstand high pressure and resist corrosion. Ordinary copper tubing is not satisfactory and should not be used.

This safety steel tubing must be double-lap flared at the ends in order to produce a strong leak-proof joint.

The brake tube flaring Tool J-8051 (fig. 8) is used to form the double-lap flare.

Figure 9 shows two pieces of tubing, one with single-lap flare "A" and the other with double-lap flare "B". It will be noted that the single-lap flare in "A" split the tubing while the one shown in "B" is well-formed and unbroken due to the reinforcement of the double wall.

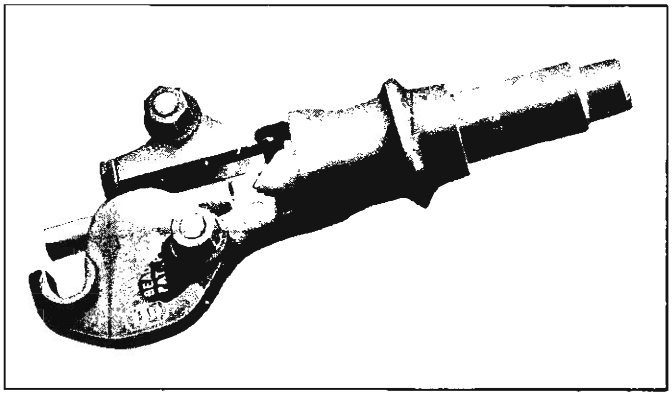


Fig. 8—Hydraulic Brake Tube Double Flaring Tool

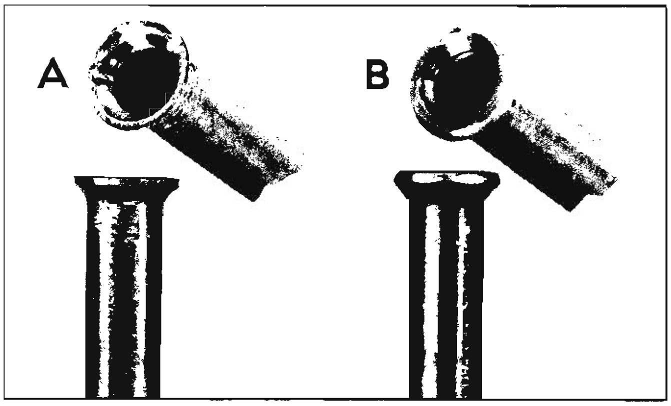


Fig. 9—Single and Double Lap Flaring

The following procedure should be followed in making up hydraulic brake pipes.

Double Lap Flaring

1. Clamp the tubing in the proper size die blocks with the flat ends of the blocks toward the end of the tubing to be cut off. Cut the end of the tubing flush and square. Using a mill file, dress tubing and square ends.
2. Remove the tubing from the die block and deburr the inside and outside edges.
3. Install compression couplings on tubing and dip end of tubing to be flared in hydraulic fluid. This lubrication results in better formation of the flare.
4. Place one-half of the die blocks in the tool body with the counterbored ends toward the ram guide. Now lay the tubing in the block with approximately 1/2" protruding beyond the end.

   Fit the other half of the block into the tool body, close the latch plate and tighten the nuts "finger-tight."
5. Select the correct size upset flare punch. One end of this punch is counterbored or hollowed out to gauge the amount of tubing necessary to form a double lap flare. Slip the punch into the tool body with the gauge end toward the die blocks. Install the ram; then tap lightly until the punch meets the die blocks and they are forced securely against the stop plate (fig. 10).

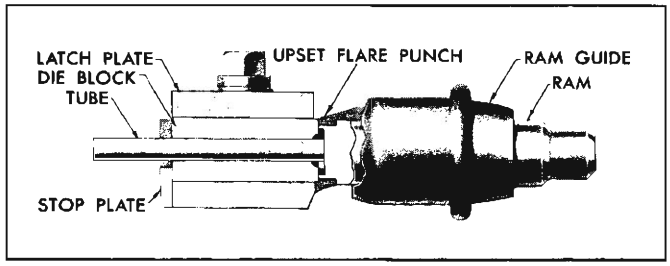


Fig. 10—Flaring Operation-Positioning Tubing

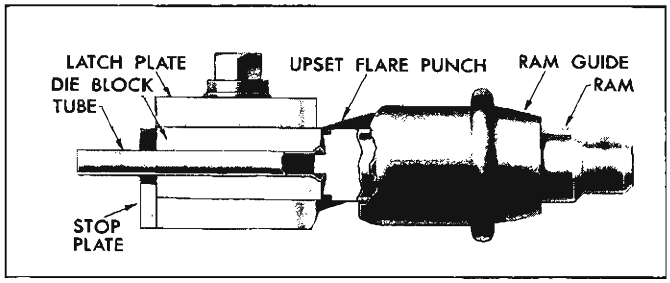


Fig. 11—Flaring Operation-First Flare

6. Using the supplied wrench, draw the latch plate nut down tight to prevent the tube from slipping. Tightening the nuts alternately (beginning with the nut at the closed hole in the plate) will prevent distortion of the plate. Remove the punch and the ram. Now reverse the punch and put it back into the tool body. Install the ram and tap it lightly until the face of the upset flare punch contacts the face of the die blocks (fig. 11). This completes the first operation. Remove the ram and the punch.
7. To complete the flare, insert the pointed finish flare punch and the ram into the tool body. Tap the ram until a good seat is formed (fig. 12).

   NOTE: The seat should be inspected at intervals during the finishing operation to avoid over-seating.

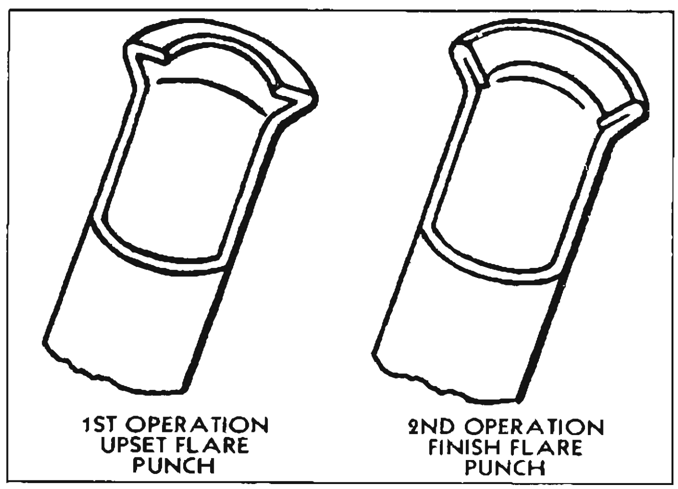


Fig. 12—Flaring Operation-First and Second Flare

BRAKE ADJUSTMENT

Service Brake

Although the brakes are self-adjusting, a preliminary or initial adjustment may be necessary after the brakes have been relined or replaced, or whenever the length of the adjusting screw has been changed. The final adjustment is made by using the self-adjusting feature.

1. With brake drum off, disengage the actuator from the star wheel and rotate the star wheel by spinning or turning with a small screw driver.
2. **Recommended**
   a. Use special Tool J-21177; Drum-to-Brake Shoe Clearance Gauge, to check the diameter of the brake drum inner surface (fig. 13).
   b. Turn the tool to the opposite side and fit over the brake shoes by turning the star wheel until the gauge just slides over the linings (fig. 14).
   c. Rotate the gauge around the brake shoe lining surface to assure proper clearance.

   Alternate
   a. Using the brake drum as an adjustment fixture turn the star wheel until the drum slides over the brake shoes with a slight drag.
   b. Turn the star wheel 1-1/4 turns to retract the shoes. This will allow sufficient lining-to-drum clearance so final adjustment may be made as described in Step 4.
3. Install the drum and wheel.

   NOTE: 1: If lanced area in brake drum was knocked out, be sure all metal has been removed from brake compartment. Install new hole cover in drum to prevent contamination of the brakes.

   NOTE: 2: Make certain when installing drums that drums are installed in the same position as when removed with the drum locating tang in line with the locating hole in the wheel hub (fig. 28).

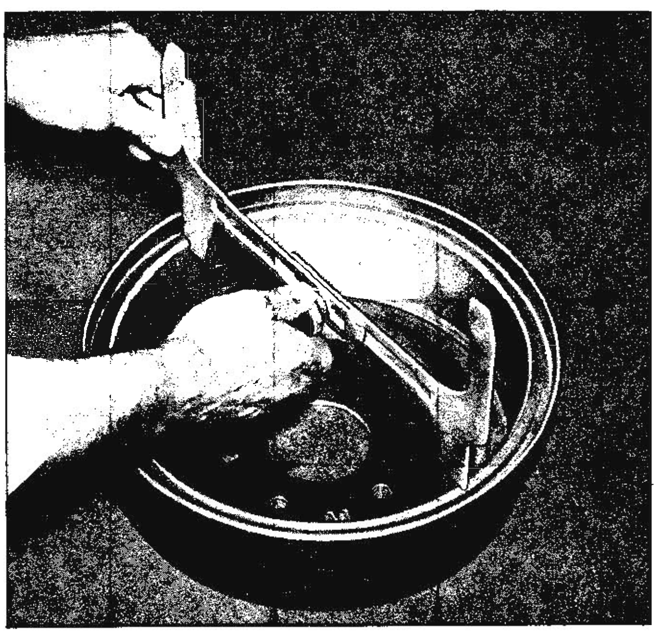


Fig. 13—Using Drum-to-Brake Shoe Clearance Gauge

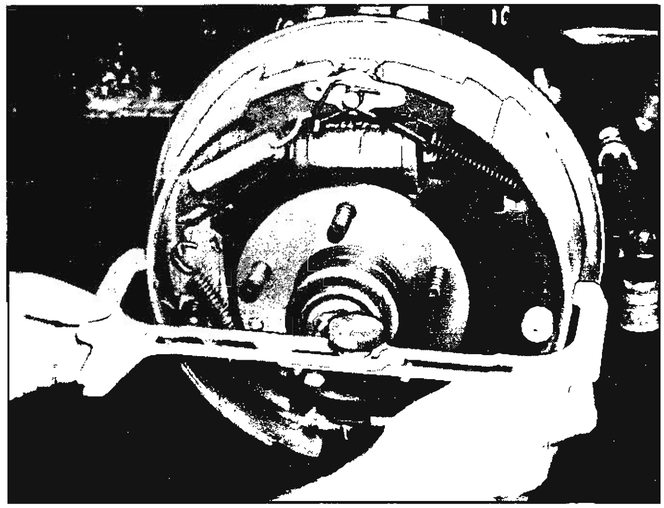


Fig. 14—Checking Brake Shoe Lining Clearance

4. Make final adjustment by making numerous forward and reverse stops, applying brakes with a firm pedal effort until a satisfactory brake pedal height results.

   NOTE: Frequent usage of an automatic transmission forward range to halt reverse vehicle motion may prevent the automatic adjusters from functioning, thereby inducing low pedal heights.

PARKING BRAKE

The rear brake assemblies serve a dual purpose in that they are utilized both as a hydraulically operated service brake and also as a mechanically operated parking brake. In view of this dual purpose, the service brake must be properly adjusted as a base for parking brake adjustment; conversely the parking brake must be properly adjusted for the service brake to function as intended.

Adjustment

1. Jack up both rear wheels.
2. Apply parking brake, two notches from fully released position.
3. Loosen the equalizer forward check nut, and tighten the rear nut until a light to moderate drag is felt when rear wheels are rotated.
4. Tighten check nuts securely.
5. Fully release parking brake and rotate rear wheels; no drag should be present.

Inspection

If complete release of the parking is not obtained, unless it is forcibly returned to its released position, or if application effort is high, check parking brake assembly for free operation. If operation is sticky or a bind is experienced, correct as follows:

1. Clean and lubricate brake cables and equalizer.
2. Inspect brake assembly for straightness and alignment (replace if necessary).
3. Clean and lubricate parking brake assembly.
4. Check routing of cables for kinks or binding.

COMPONENTS REPLACEMENT AND REPAIRS

PARKING BRAKE

CHEVROLET AND CHEVELLE (Fig. 15)

Pedal Assembly

Removal

NOTE: Remove positive cable from battery to eliminate the possibility of creating short circuits under dash.

1. Place parking brake pedal in released position.
2. Remove equalizer check nut, and separate cable stud from equalizer.
3. Remove two attaching nuts from mounting studs located in engine compartment.
4. Remove front cable ball end from pedal assembly swivel.
5. Remove pedal assembly to dash brace attaching screw.
6. Remove pedal assembly by lowering rear slightly to avoid scratching dash and pulling it out of the firewall.

Installation

1. Place pedal assembly in position with the two mounting studs protruding through the holes provided in the firewall.
2. Install and tighten pedal assembly to dash brace attaching screw.
3. Position front cable ball end into pedal assembly swivel.
4. Install and tighten two attaching nuts on mounting studs.
5. Place equalizer in position on center cable and insert front cable stud through equalizer and secure with check nut.
6. Adjust parking brake as outlined under Maintenance and Adjustments in this section.
7. Connect positive battery cable.

Front Cable

Removal

NOTE: Remove positive cable from battery to eliminate the possibility of creating short circuits under dash.

1. Place parking brake pedal in released position.
2. Remove equalizer check nut, and separate cable stud from equalizer.
3. Remove retainer from cable assembly at inner side of frame rail.
4. Remove ball end of cable from pedal assembly swivel.
5. Compress expanded conduit locking fingers at toe pan and withdraw cable from car.

Installation

1. Position cable ball and conduit tip through cutout in firewall. Make sure conduit locking fingers are fully expanded and secured in cutout, then position cable ball into pedal assembly swivel.
2. Feed stud end of cable through frame rail and secure with retainer on inner side of frame.
3. Place one check nut on cable stud and insert stud through equalizer, (make sure center cable is in position), then place second check nut on stud.
4. Adjust parking brake as outlined in this section.
5. Connect positive battery cable.

Center Cable

Removal

1. Place parking brake pedal in released position.
2. Remove equalizer check nut and remove equalizer from cable.
3. Remove three cable guides.
4. Disconnect center cable from rear cables at connectors.

Installation

1. Install cable ends into rear cable connectors.
2. Place cable through equalizer and install equalizer on to front cable stud, secure with check nut. (Do not tighten.)
3. Install three cable guides in proper position (fig. 15).
4. Adjust parking brake as outlined in this section.

Rear Cables

Removal

1. Place parking brake pedal in released position.
2. Remove equalizer check nut and remove equalizer from cable.
3. Remove rear cable from connector.
4. Remove "U" shaped retainer from rear cable at frame bracket. Pull cable out of bracket.
5. Remove rear brake drum as outlined in this section.
6. Remove rear brake shoes as outlined in this section.
7. Remove cable end from parking brake actuating lever.
8. Compress expanded conduit locking fingers at flange plate entry hole and withdraw cable.

Installation

1. Pass end of cable and conduit tip through flange plate entry hole, making sure that conduit locking fingers all expand fully.
2. Connect cable end to actuating lever.
3. Install rear brake shoes, drum and wheel as outlined in this section.
4. Pass cable through frame bracket and install "U" shaped retainer.
5. Install cable end into cable connector.
6. Position equalizer on center cable and place on front cable stud, secure with check nut.
7. Make sure all center cable guides are in place and adjust parking brake as outlined in this section.

CHEVY II (Fig. 16)

Lever Assembly

Removal

NOTE: Remove positive cable from battery to eliminate possibility of creating short circuits under dash.

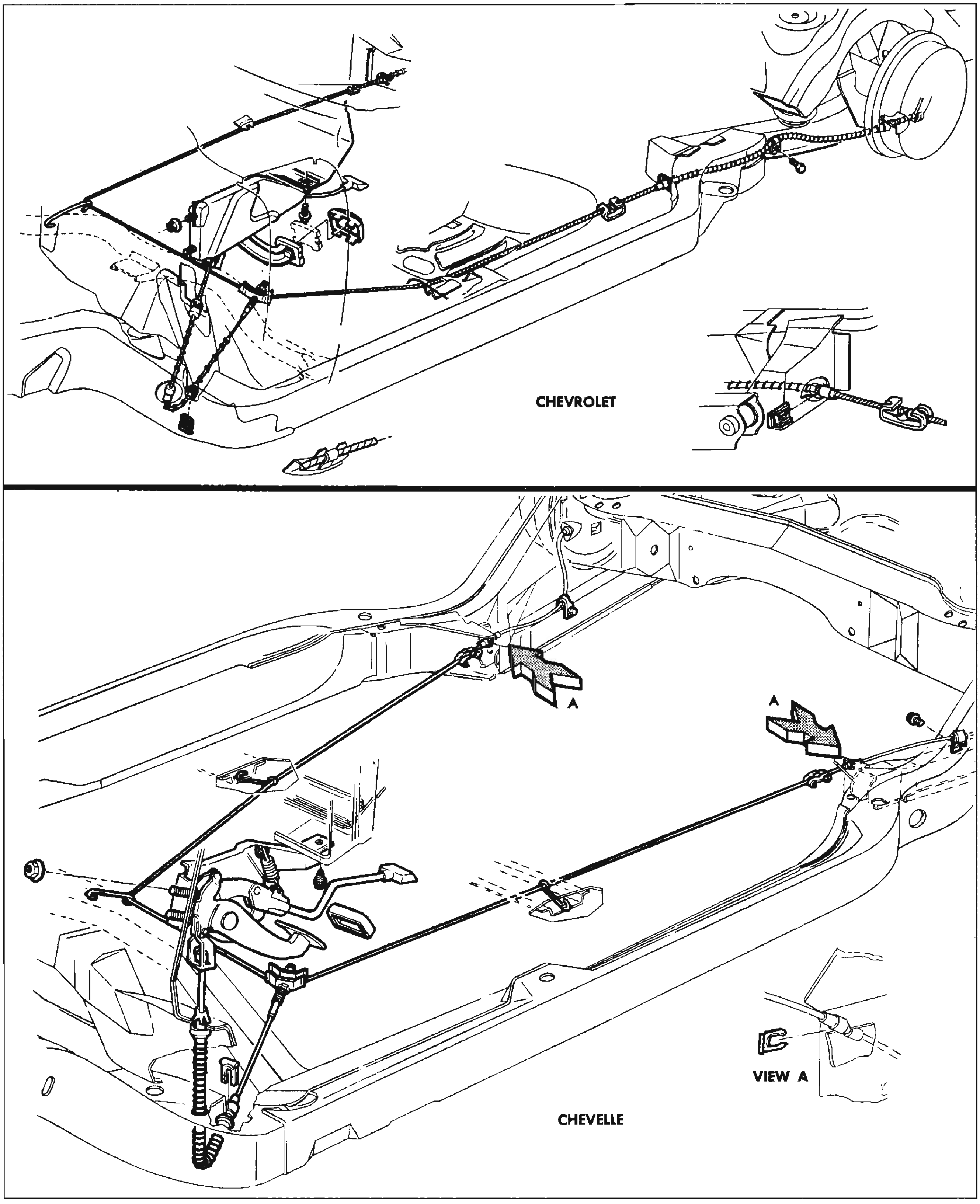


Fig. 15—Parking Brake System

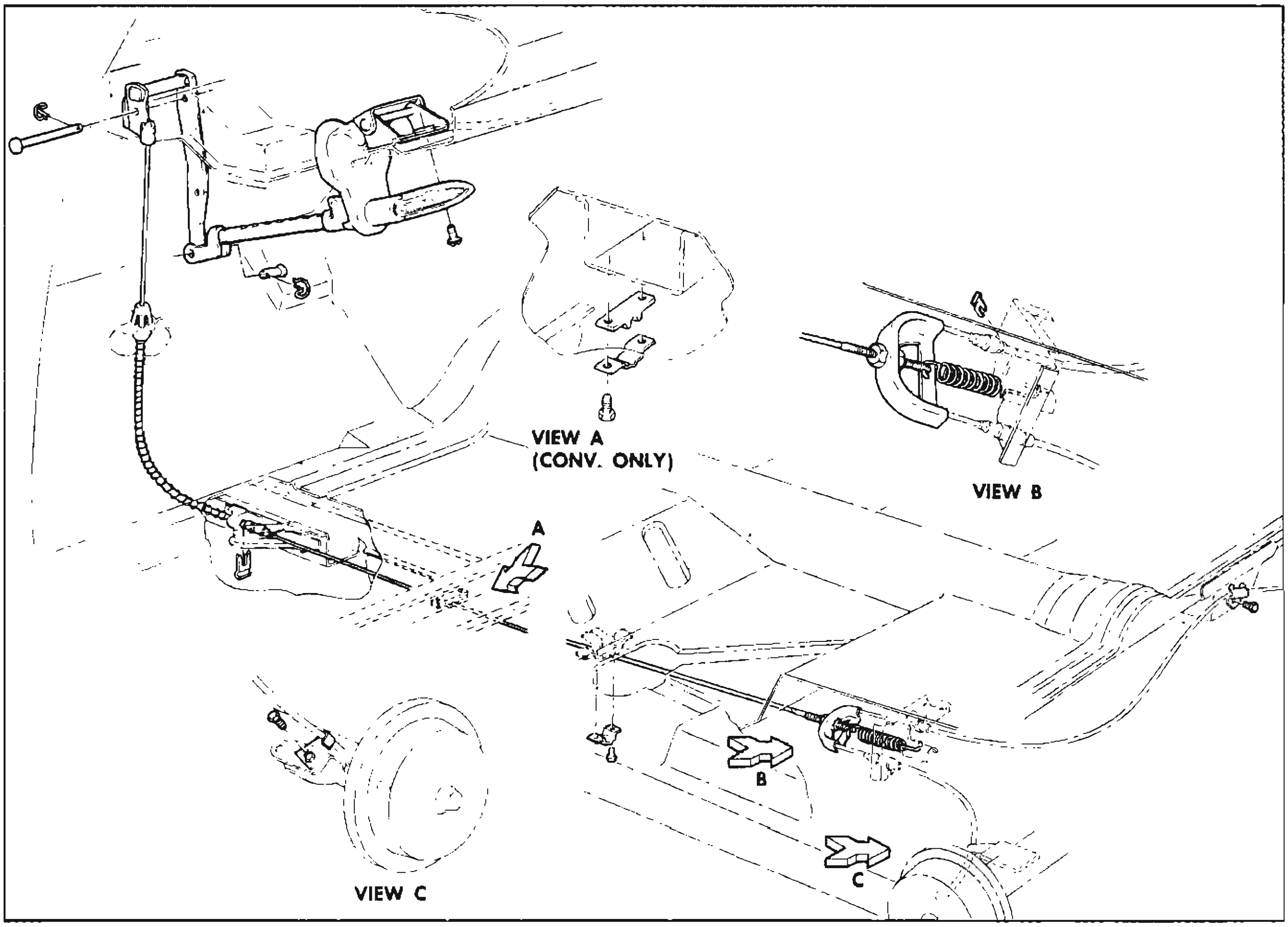


Fig. 16—Parking Brake System-Chevy II

1. Place parking brake lever in released position.
2. Remove return spring at equalizer.
3. Remove equalizer check nut, and separate cable stud from equalizer.
4. Remove clevis pin lock and pin from idler lever assembly.
5. Remove 2 lever to dash attaching screws, and remove lever assembly from vehicle.

Installation

1. Place lever assembly into position and secure with the 2 lever to dash attaching screws.
2. Place idler lever in position with lever assembly, align holes and install clevis pin and lock.
3. Position equalizer on front cable stud and secure with check nut.
4. Install return spring at equalizer.
5. Adjust parking brake as outlined under Maintenance and Adjustments in this section.
6. Connect positive battery cable.

Idler Lever

Removal

NOTE: Remove positive cable from battery to eliminate possibility of creating short circuits under dash.

1. Place parking brake lever in released position.
2. Remove return spring at equalizer.
3. Remove equalizer check nut, and separate cable stud from equalizer.
4. Remove clevis pin lock and pin from idler lever assembly.
5. Remove cable ball from idler lever.
6. Remove pivot pin lock and pivot pin, then remove idler lever from vehicle.

Installation

1. Place idler lever into position and secure with the pivot pin and lock.
2. Connect cable ball to idler lever.
3. Place idler lever in position with lever assembly, align holes and install clevis pin and lock.
4. Position equalizer on front cable stud and secure with check nut.
5. Install return spring at equalizer.
6. Adjust parking brake as outlined under Maintenance and Adjustments in this section.
7. Connect positive battery cable.

Front Cable

Removal

NOTE: Remove positive cable from battery to eliminate possibility of creating short circuits under dash.

1. Place parking brake lever in released position.
2. Remove return spring at equalizer.
3. Remove equalizer check nut, and separate cable stud from equalizer.
4. Remove clamp from underbody guide bracket. (Convertible models only, also remove clamp from guide bracket at underbody support.)
5. Remove "U" shaped cable retainer from underbody bracket.
6. Compress expanded conduit locking fingers at toe pan, remove cable ball from idler lever, and withdraw cable from car.

Installation

1. Position cable ball and conduit tip through cutout in toe pan. Make sure conduit locking fingers are fully expanded and secured in cutout, then position cable ball in idler lever clevis.
2. Preset parking brake lever to one notch.
3. Place "U" shaped retainer in conduit groove so that conduit end is secure in underbody bracket.
4. Position cable in guide bracket(s) and secure cable in bracket with clamp(s).
5. Place one check nut on cable stud and insert stud into equalizer, then place second check nut on stud.
6. Connect cable return spring.
7. Adjust parking brake as outlined in this section.
8. Connect positive battery cable.

Rear Cable

Removal

1. Place parking brake lever in released position.
2. Disconnect front cable return spring at equalizer.
3. Remove check nut from front cable stud, withdraw stud from equalizer, and remove equalizer from rear cable.
4. Remove "U" shaped retainers from grooves in rear cable conduit, and remove cable from bracket.
5. Remove cable from center body bumper bracket and spring clip at shock absorber lower mount.
6. Back off rear service brakes sufficiently to allow for drum removal.
7. Remove both rear wheels and drums.
8. Remove secondary brake shoe return spring.
9. Remove secondary brake shoe hold-down spring and pin.
10. Remove cable end from parking brake actuating lever.
11. Compress expanded conduit locking fingers at flange plate entry hole and withdraw cable.

Installation

1. Pass end of cable and conduit tip through flange plate entry hole, making sure that conduit locking fingers all expand fully.
2. Compress retaining spring and place cable end in actuating lever.
3. Install secondary shoe hold-down pin and spring.
4. Install secondary shoe return spring.
5. Install drum and wheel.
6. Snap cable conduit into spring clip at shock absorber lower mount.
7. Install cable conduit in bracket at center body bumper bracket.
8. Position cable conduit ends in cable bracket and install "U" shaped retainers in grooves.
9. Place equalizer on cable and insert forward cable stud. Install check nut and return spring.

   NOTE: To perform its intended function, equalizer must be free to slide on rear cable. Lubricate cable at equalizer with chassis grease at assembly.

10. Adjust rear service brakes and parking brake as outlined in this section.

CLUTCH AND BRAKE PEDAL

Removal

1. Disconnect clutch pedal return spring (on standard transmission models).
2. Disconnect clutch push rod at clutch pedal (fig. 17).
3. Disconnect brake pedal return spring (on Chevelle only).
4. Disconnect brake pedal from main cylinder push rod by removing retainer and clevis pin.
5. Remove retainer from right side of pedal pivot shaft.
6. Slide clutch pedal assembly to the left and remove from panel brace. Brake pedal arm and return spring will be free for removal when pivot shaft clears panel brace.
7. Withdraw brake pedal and all nylon bushings.

Inspection

1. Clean all metal parts with a good nontoxic cleaning solvent.
2. Wipe nylon bushings clean with a clean cloth.

   CAUTION: Nylon bushings should not be treated with cleansing agent of any nature.

3. Inspect all nylon bushings for wear and damage.
4. Inspect mating surface of bushings for wear and damage - replace parts as required.

Installation

1. Lubricate and install nylon bushings on pedal pivot shaft, right side of panel brace cutout and through both ends of brake pedal bore.
2. Chevy II only: Place pedal assembly in panel brace.
3. Chevrolet and Chevelle: Position brake pedal return spring on pedal arm, and place pedal assembly in panel brace (index return spring in panel brace cutout).
4. Slide pedal pivot shaft through panel brace and brake pedal bore.
5. Install retainer to right side of pedal pivot shaft.
6. Connect clutch pedal push rod to clutch pedal bracket, and install retainer (standard transmission models only).
7. Position main cylinder push rod clevis to brake pedal arm, and install clevis pin and retainer.
8. Install brake pedal return spring (Chevelle only).
9. Adjust brake pedal free play to 1/16 - 1/4 inch, and check stop light switch position - adjust if necessary so that electrical contact is made when pedal is depressed 5/8 inch.

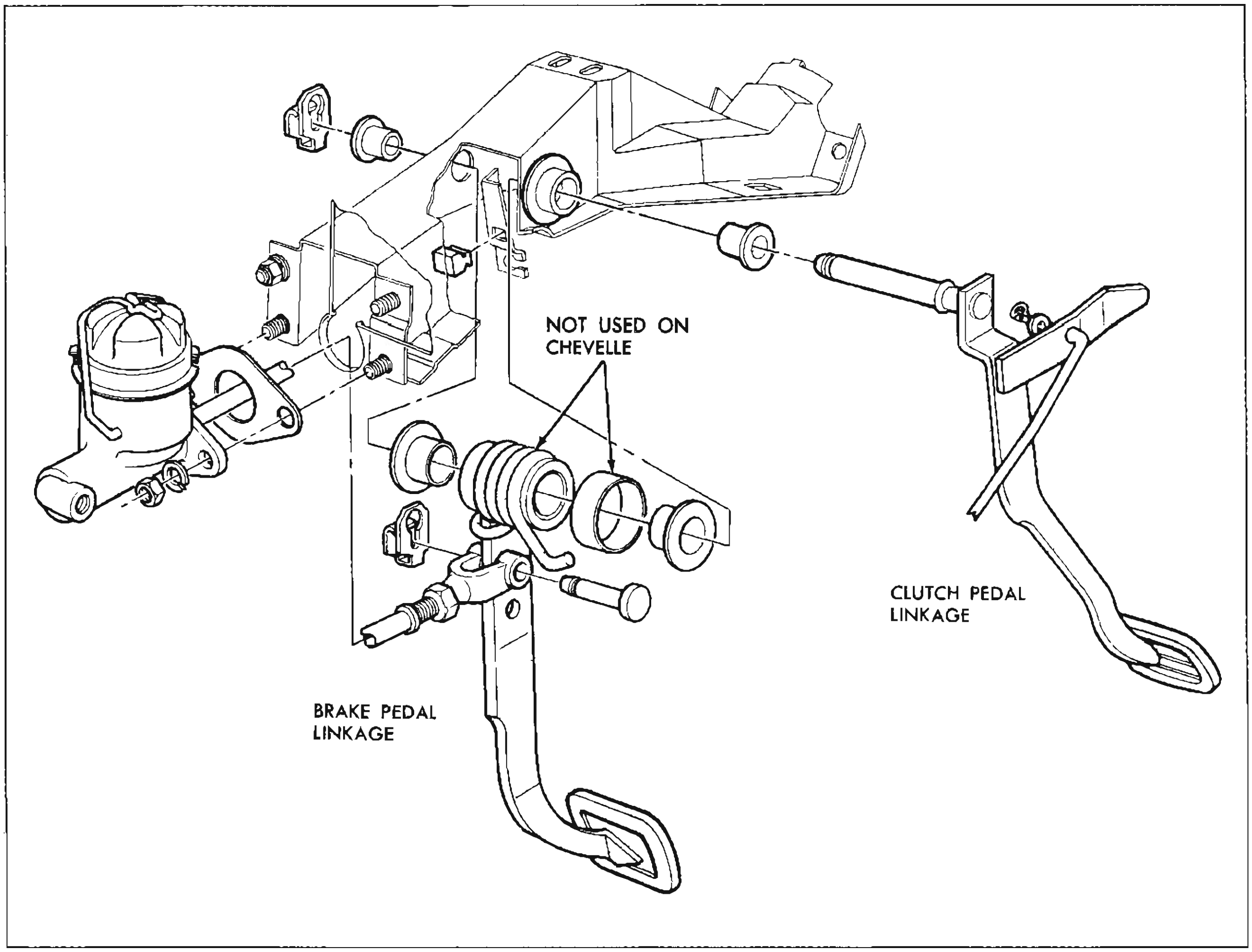


Fig. 17—Clutch and Brake Pedal Installation

10. Install clutch pedal return spring (if applicable).

SHOES AND LININGS

NOTE: If brake drums are worn severely, it may be necessary to retract the adjusting screw. To gain access to the adjusting screw star wheel, knock out the lanced area in the web of the brake drum using a chisel or similar tool. Release the actuator from the star wheel by lifting with a small screw driver and back off the star wheel with a second screw driver (press down on the handle to retract shoes).

CAUTION: After knocking out the metal, be sure to remove it from the inside of the drum and clean all metal from the brake compartment. A new hole cover must be installed when drum is reinstalled.

Removal

1. Raise the vehicle and place on jack stands.
2. Loosen check nuts at parking brake equalizer sufficiently to remove all tension from brake cable.
3. Remove brake drums.

   NOTE: Since there are wheel cylinder piston stops to prevent pistons from leaving cylinders, it is not necessary to install wheel cylinder clamps when brake shoes are removed; however, brake pedal must not be depressed while drums are removed.
4. Unhook brake shoe pull back springs from anchor pin and link end, using Tool J-8049 (fig. 18).
5. Remove the actuator return spring and link.
6. Remove hold-down pins and springs (figs. 19).
7. Remove the actuator assembly.

   NOTE: The actuator, pivot and override spring are an assembly. It is not recommended that they be disassembled for service purposes, unless they are broken. It is much easier to assemble and disassemble the brakes by leaving them intact.
8. Separate the brake shoes by removing adjusting screw and spring.
9. Remove parking brake lever from secondary brake shoe (rear only).

Inspection

1. Clean all dirt out of brake drum, using care to avoid getting dirt into front wheel bearings. Inspect drums for roughness, scoring or out-of-round. Replace or recondition drums as required.

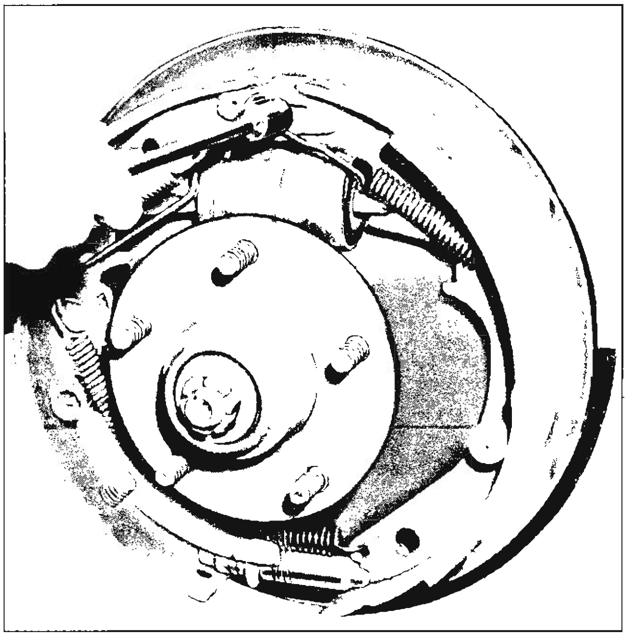


Fig. 18—Unhooking Pull Back Spring

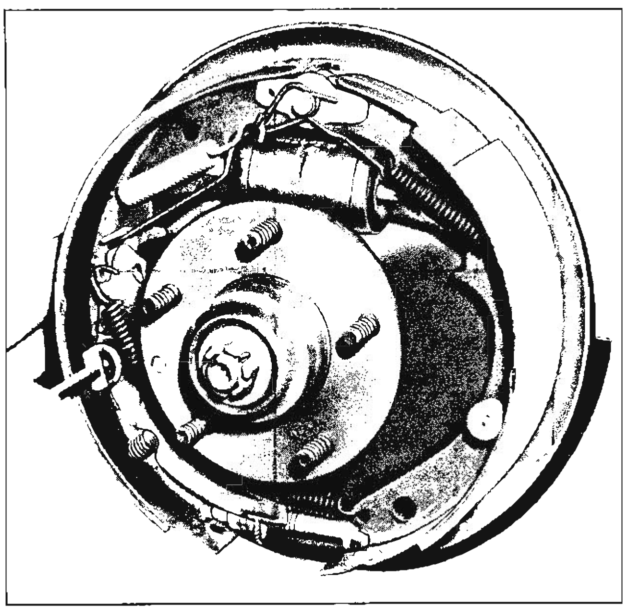


Fig. 19—Removing Hold-Down Springs and Pins

2. Inspect wheel bearings and oil seal, and replace any necessary parts.
3. On Chevrolet only: Carefully pull lower edges of wheel cylinder boots away from cylinders and note whether interior is wet with brake fluid. Excessive fluid at this point indicates leakage past piston cups and a need for wheel cylinder overhaul or replacement.

NOTE: A slight amount of fluid is nearly always present and acts as lubricant for the piston.

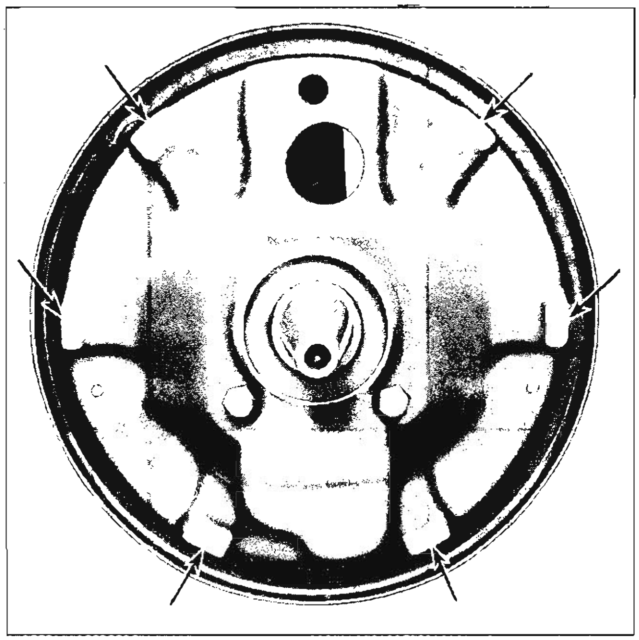


Fig. 20—Backing Plate Contact Surfaces

4. Check all brake flange plate attaching bolts to make sure that they are tight. Clean all rust and dirt from shoe contact faces on flange plate (fig. 20), using fine emery cloth.

Installation

CAUTION: Make certain to install recommended shoe and lining assemblies. Otherwise, serious fade or permanent failure may occur.

1. Inspect new linings and make certain there are no nicks or burrs on bonding material on shoe edge where contact is made with brake flange plate or on any of the contact surfaces.

   NOTE: Keep hands clean while handling brake shoes. Do not permit oil or grease to come in contact with linings.

2. If working on rear brakes, lubricate parking brake cable.
3. On rear brakes only, lubricate fulcrum end of parking brake lever and the bolt with brake lube, then attach lever to secondary shoe with bolt, spring washer, lock washer and nut. Make sure that lever moves freely.
4. Before installation, make certain the adjusting screw is clean and lubricated properly.

   NOTE: Loose adjustment may occur from an adjusting screw that is not properly operating. If the lubrication in the adjusting screw assembly is contaminated or destroyed, the adjusting screw should be thoroughly cleaned and lubricated.

5. Connect brake shoes together with adjusting screw spring, then place adjusting screw, socket and nut in position.

CAUTION: Make sure the proper adjusting screw is used ("L" for left side of vehicle, "R" for right side of vehicle). The star wheel should only be installed with the star wheel nearest to the secondary shoe and the adjusting screw spring inserted to prevent interference with the star wheel.

6. On rear wheels connect parking brake cable to lever.
7. Secure the primary brake shoe (short lining - faces forward) first with the hold-down pin and spring using a pair of pliers. Engage shoes with the wheel cylinder connecting links.
8. Install and secure the actuator assembly and secondary brake shoe with the hold-down pin and spring using a pair of needle nose pliers. On rear wheels position parking brake strut and strut spring.
9. Install guide plate over anchor pin.
10. Install the wire link.

    NOTE: Do not hook the wire link over the anchor pin stud with the regular spring hook tool. This may damage the cylinder boot seals. Fasten the wire link to the actuator assembly first, then place over the anchor pin stud by hand while holding the adjuster assembly in the full down position.

11. Install actuator return spring.

    NOTE: Do not pry actuator lever to install return spring. Ease it in place using the end of a screw driver or other suitable flat tool.

12. If old brake pull back (return) springs are nicked, distorted, or if strength is doubtful, install new springs.
13. Hook springs in shoes using Tool J-8049 by installing the primary spring from the shoe over the anchor pin and then spring from secondary shoe over the wire link end.
14. Pry shoes away from backing plate and lubricate shoe contact surfaces with a thin coating of brake lube (fig. 20).

    CAUTION: Be careful to keep lubricant off facings.

15. After completing installation, make certain the actuator lever functions easily by hand operating the self-adjusting feature (fig. 21).
16. Follow the above procedure for all wheels.
17. Adjust the service brakes as outlined under "Maintenance and Adjustments". Then adjust the parking brake.

MAIN CYLINDER

Removal

1. Disconnect hydraulic line at main cylinder.
2. Remove the two retaining nuts and lock washers holding main cylinder.
3. Remove the main cylinder, mounting gasket and rubber boot from vehicle.

Disassembly

1. Remove boot from main cylinder.
2. Place main cylinder in a vise so that the lock ring (fig. 22) can be removed from the small groove in the ID of bore.
3. Remove lock ring, main cylinder piston assembly, primary cup, spring and valve assembly and valve seat from cylinder bore.

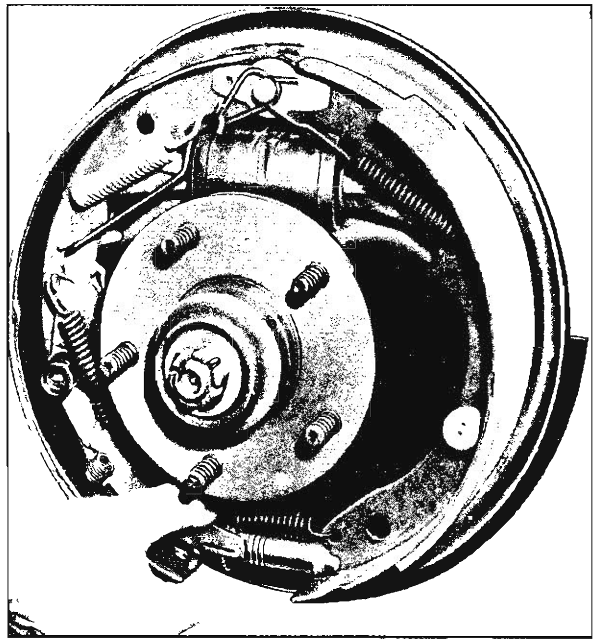


Fig. 21—Checking Operation of the Actuating Lever

4. Pry bail wire off cover with screw driver or similar tool and remove cover and seal.

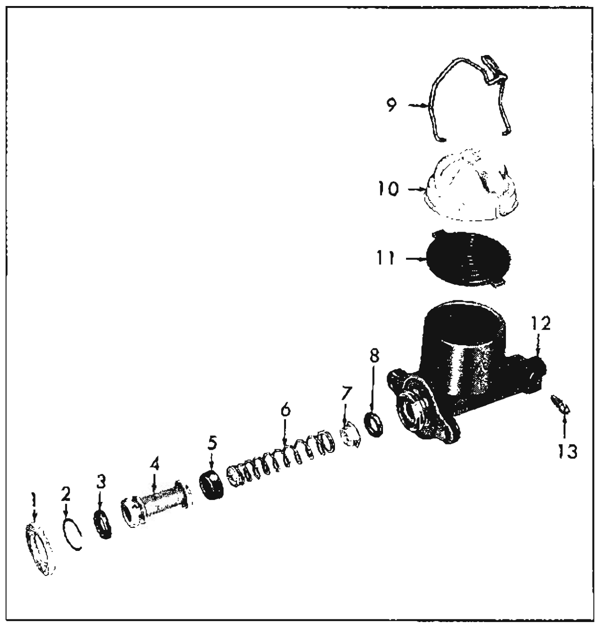


Fig. 22—Main Cylinder

1. Seal
2. Lock Ring
3. Secondary Cup
4. Piston
5. Primary Cup
6. Spring
7. Valve Assembly
8. Valve Seat
9. Bail Wire
10. Reservoir Cover
11. Seal
12. Body
13. Bleeder

Inspection

1. Wash all parts in clean alcohol. Make sure that compensating and bypass ports in main cylinder body and bypass holes in piston are clean and open.

   NOTE: Before washing parts, hands must be clean. Do not wash hands in gasoline or oil before cleaning parts. Use soap and water to clean hands.

2. Inspect cylinder bore for corrosion, pits and foreign matter.
3. Inspect primary and secondary cups, check valve and valve seat for damage and swelling. Swelling of rubber parts is due to the use of improper brake fluid or washing parts in gasoline or kerosene.
4. Check piston fit in cylinder bore (fig. 23). The clearance between piston and wall of cylinder should be 0.001-0.005 inch.

Assembly

Whenever a hydraulic brake main cylinder is overhauled, care must be taken to reassemble the check valve correctly. Improper assembly of the check valve seat will result in its distortion. When the check valve seat is distorted, there will be no check valve action and there will be a loss of brake pedal travel, also, the pedal will have to be depressed or pumped one or more times before actual car braking occurs.

1. Install valve seat in cylinder bore so that flat portion of seat rests against end of cylinder bore.
2. Position valve and spring assembly into bore.
3. Dip primary cup into clean brake fluid and install into main cylinder with the flat side toward push rod end. Make sure cup seats over end of spring.
4. Assemble the secondary seal in the groove on the piston so that the lip faces toward the end of the piston that contains the bypass holes.
5. Dip piston in clean brake fluid and place piston in cylinder bore.
6. Install piston stop ring.
7. Check clearance between the edge of the primary cup and the center of compensating port.

   NOTE: This check is made easily by using a wire and inserting it through the reservoir and into piston chamber (fig. 24).

8. Install a new seal in cover and place cover on cylinder. Secure by snapping bail wire in place.

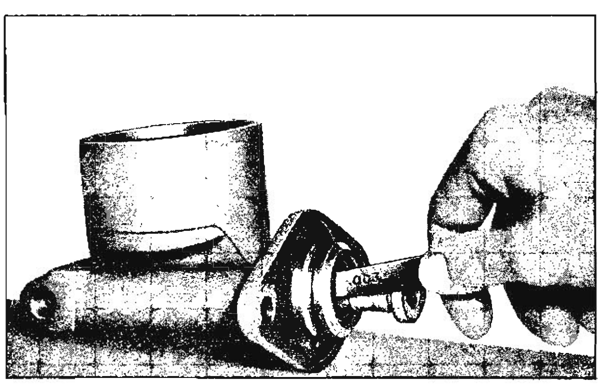


Fig. 23—Checking Main Cylinder Piston Fit

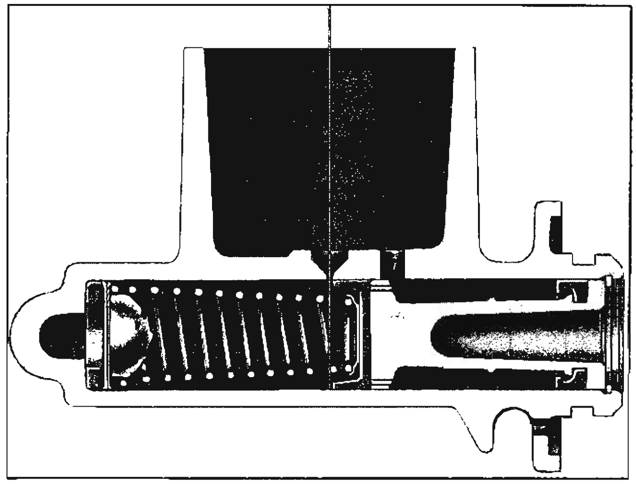


Fig. 24—Checking Compensating Port Clearance

9. Install rubber boot, making certain boot seals tightly on cylinder body. This seal must be maintained to keep water and other foreign matter from entering the main cylinder.
10. Install mounting gasket to main cylinder.

Installation

1. Position main cylinder on mounting studs and secure to dash wall. Make sure push rod goes through rubber boot and into piston.
2. Connect brake line to main cylinder.
3. Check, and if necessary, adjust brake pedal free play.
4. Bleed brakes as outlined in this section.

WHEEL CYLINDER

Removal

1. Raise vehicle and place on jack stand.
2. Remove wheel and tire assembly, back off brake adjustment (only if necessary) and remove drum.
3. Disconnect brake system hydraulic line from cylinder.
4. Remove brake shoe pull back springs.
5. Remove two cap screws that hold wheel cylinder to flange plate, disengage wheel cylinder push rods from brake shoes, and remove wheel cylinder.

   NOTE: On the Chevrolet front wheels it will be necessary to remove the anchor pin which holds front wheel cylinder to flange plate to remove front wheel cylinder.

Disassembly

1. Remove cylinder boots (on Chevelle and Chevy II the boots will have to be pulled out with pliers and discarded).
2. Remove pistons, rubber cups, cup expanders and spring.
3. Wash all parts in clean alcohol.

   NOTE: Before washing parts, hands must be clean. Do not wash hands in gasoline or oil before cleaning parts. Use soap and water to clean hands.

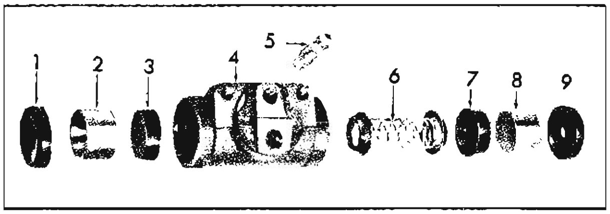


Fig. 25—Wheel Cylinder—Chevelle Shown

1. Push Rod Boot
2. Piston
3. Piston Cup
4. Housing
5. Fluid Inlet
6. Spring
7. Piston Cup
8. Piston
9. Push Rod Boot

Inspection

1. Inspect cylinder bore for smoothness. A scored or damaged cylinder must be replaced.
2. Check rubber cups for damage or swelling. Replace cups when necessary. Improper brake fluid will cause cups to swell as much as 40 per cent.
3. Check fit of piston in cylinder bore, using a feeler gauge (fig. 26). This clearance should be 0.002-0.004 inch. If clearance exceeds 0.004 inch, replace cylinder.

Assembly

CAUTION: Shake excess cleaning fluid from the cylinder. Do not use cloth to dry cylinder as the lint from the cloth will interfere with the cylinder operation.

1. Lubricate the cylinder bore with clean brake fluid and insert spring-expander assembly.
2. Install new cups with flat surface towards the outer ends of cylinder. (Be sure the cups are lint free.) Do not lubricate cups prior to assembly.
3. Install new pistons into cylinder with flat surface towards center of cylinder. Do not lubricate pistons.
4. Install new boots into cylinder by hand. Do not lubricate boots prior to assembly.

Installation

1. Position wheel cylinder to brake flange plate, install cap screws and tighten securely.

   NOTE: On Chevrolet front wheels mount front wheel cylinders to the brake flange plate by installing the threaded anchor pin through the wheel cylinder housing and tighten to 70-90 foot pounds with a torque wrench.
   To secure, peen over the flat washer on the anchor pin.

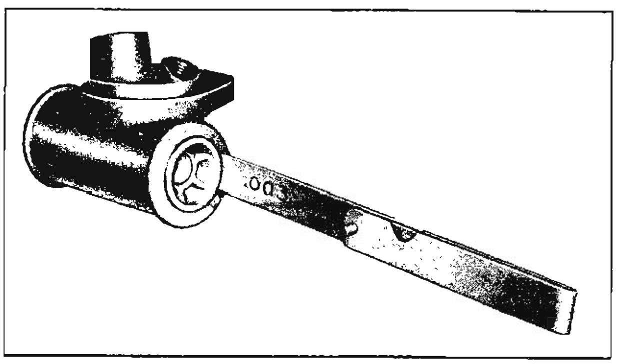


Fig. 26—Checking Wheel Cylinder Piston Fit

2. Replace all push rods and pull back springs.
3. Connect hose or line to wheel cylinder.

   NOTE: If replacing front wheel cylinder, connect hose and inspect installation as outlined in "Hydraulic Brake Hose Replacement."
4. Install drum and wheel.
5. Bleed brakes as specified in this section.

ANCHOR PIN REPLACEMENT

Front Wheel

1. Raise front of vehicle and place on jack stand.
2. Remove wheel and drum as outlined in this section.
3. Remove brake shoe pull back springs, link and guide plate.
4. Disengage anchor pin lock and remove anchor pin by turning counter-clockwise.
5. Place new lock plate on anchor pin and pass pin through the hole in flange plate and screw into tapped hole in spindle support.
6. Torque pin to 70 to 90 foot pounds and lock by peening over washer tabs.
7. Install brake shoe guide plate, link and pull back springs.
8. Adjust brakes, install drum and wheel as outlined previously in this section. Test brake operation.

Rear Wheel

Two type anchor pins are used in production for the rear wheels. The rivited type is not serviced and if failure or damge should occur to either the anchor pin or flange plate, both parts will have to be replaced and the threaded type anchor pin used.

Threaded Type

1. Raise rear of vehicle and place on jack stands.
2. Remove wheel and drum as outlined in this section.
3. Remove brake shoe pull back springs, link and guide plate.
4. Remove anchor pin retaining nut and washer and remove pin from flange plate.
5. Position anchor pin to flange plate, install lock washer and nut, and torque pin to 70 to 90 foot pounds.
6. Install brake shoe guide plate, link and pull back springs.
7. Adjust brakes and install drum and wheel as previously outlined in this section.
8. Test brake operation.

BRAKE DRUMS

Front brake drums are the demountable type; that is, they can be removed without removing the hub. Rear brake drums are demountable and may be removed without removing the axle shaft.

A lanced "knock out" area (fig. 27) is provided in the web of the brake drum for servicing purposes in the event retracting of the brake shoes is required in order to remove the drum.

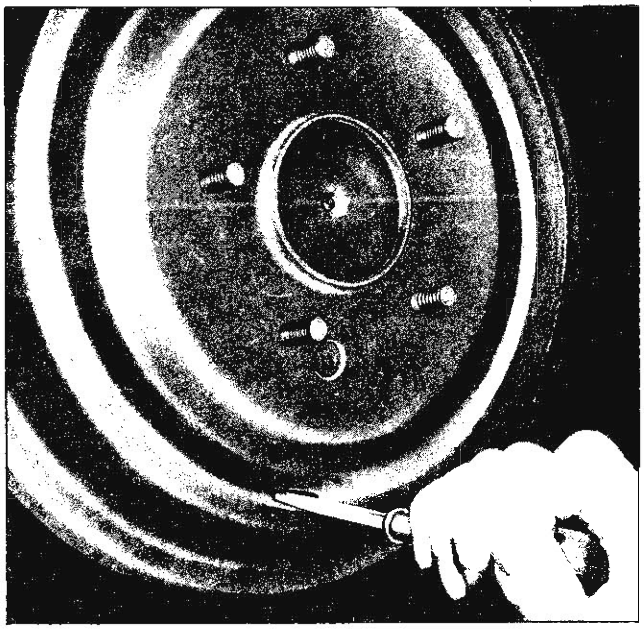


Fig. 27—Brake Drum Access Hole

Fig. 28—Aligning Drum Tang with Wheel Hub

Removal

1. Raise vehicle and place on jack stand.
2. Remove wheel and tire assembly, back off brake adjustment and remove drum.

Inspecting and Reconditioning

Whenever brake drums are removed they should be thoroughly cleaned and inspected for cracks, scores, deep grooves, and out-of-round. Any of these conditions must be corrected since they can impair the efficiency of brake operation and also can cause premature failure of other parts.

Smooth up any slight scores by polishing with fine emery cloth. Heavy or extensive scoring will cause excessive brake lining wear and it will probably be necessary to rebore in order to true up the braking surface.

An out-of-round drum makes accurate brake shoe adjustment impossible and is likely to cause excessive wear of other parts of brake mechanism due to its eccentric action.

A drum that is more than .008" out-of-round on the diameter is unfit for service and should be rebored. Out-of-round, as well as taper and wear can be accurately measured with an inside micrometer fitted with proper extension rods.

If drum is to be rebored for use with standard size brake facings which are worn very little, only enough metal should be removed to obtain a true smooth braking surface.

If drum has to be rebored more than .020" over the standard diameter, it should be rebored to .060" diameter oversize and the brake facing should be replaced with .030" oversize facings.

A brake drum must not be rebored more than .060" over the maximum standard diameter, since removal of more metal will effect dissipation of heat and may cause distortion of drum. Chevrolet brake facing is not furnished larger than .030" oversize and this will not work efficiently in drums bored more than .060" oversize.

Brake drums may be refinished either by turning or grinding. Best brake performance is obtained by turning drums with a very fine feed. To insure maximum lining life, the refinished braking surface must be smooth and free from chatter or tool marks, and run-out must not exceed .005" total indicator reading.

Cleaning

New brake drums in parts stock are given a light coating of rust proofing oil to prevent the formation of rust on the critical braking surfaces during the time that the drums are in storage.

This rust proofing oil must be carefully removed before the drum is placed in service to prevent any of this oil from getting on the brake shoe facings, which might cause an extreme brake grab condition.

It is recommended that a suitable volatile, non-toxic, greaseless type solvent be used to clean the oil from the braking surface of the new brake drums before they are placed in service to insure the cleanest possible surface.

Gasoline or kerosene should not be used as there is danger that a portion of the diluted oily substance may be left on the braking surface that may later cause difficulty.

Installation

1. Make brake adjustment as outlined in this section.
2. Install brake drum, aligning tang with wheel hub (fig. 28).
3. Install wheel and tire assembly.
4. Make final brake adjustment as outlined in this section and check brake operation.

METALLIC BRAKES

Metallic brake linings which use special heat resistant brake springs are available as an option. Service operations are the same as for standard brakes; however, when new linings are installed, the linings should be seated as described below.

NOTE: Brake shoes with metallic linings require specially finished brake drums (honed to a 20 micro-inch finish). Metallic linings are not recommended for service replacement on vehicles with standard brake drums that have not been honed to specified finish.

SEATING METALLIC LININGS

After the brakes have been adjusted, the following recommended "lining seating" is as follows:

1. Make six to eight stops from 30 mph with moderate pedal pressure to aid in seating and to modulate any tendency to dive.
2. Make six to eight complete stops from maximum legal highway speed at approximately one mile intervals to fully seat the linings.

IDENTIFICATION OF WORN LINING

The metallic shoe assembly incorporates a number of segmented pads with each pad consisting of two layers of dissimilar material. The top layer is the braking material and the lower layer is a metal bonding agent used to weld the brake facing material to the shoe proper.

During brake inspection, one can be misled easily since the bonding pad does not appear to be much different from the brake facing pad.

Close inspection of the shoes, however, will indicate the difference between a worn and satisfactory shoe. When the bonding pad begins to appear through the brake facing material a bright finish will appear. (Fig. 29).

To preclude the possibility of excessively worn shoes damaging the drum, it is recommended that metallic brake shoes be replaced whenever segment thickness becomes less than 3/32" measured at the heel or toe of the pad.

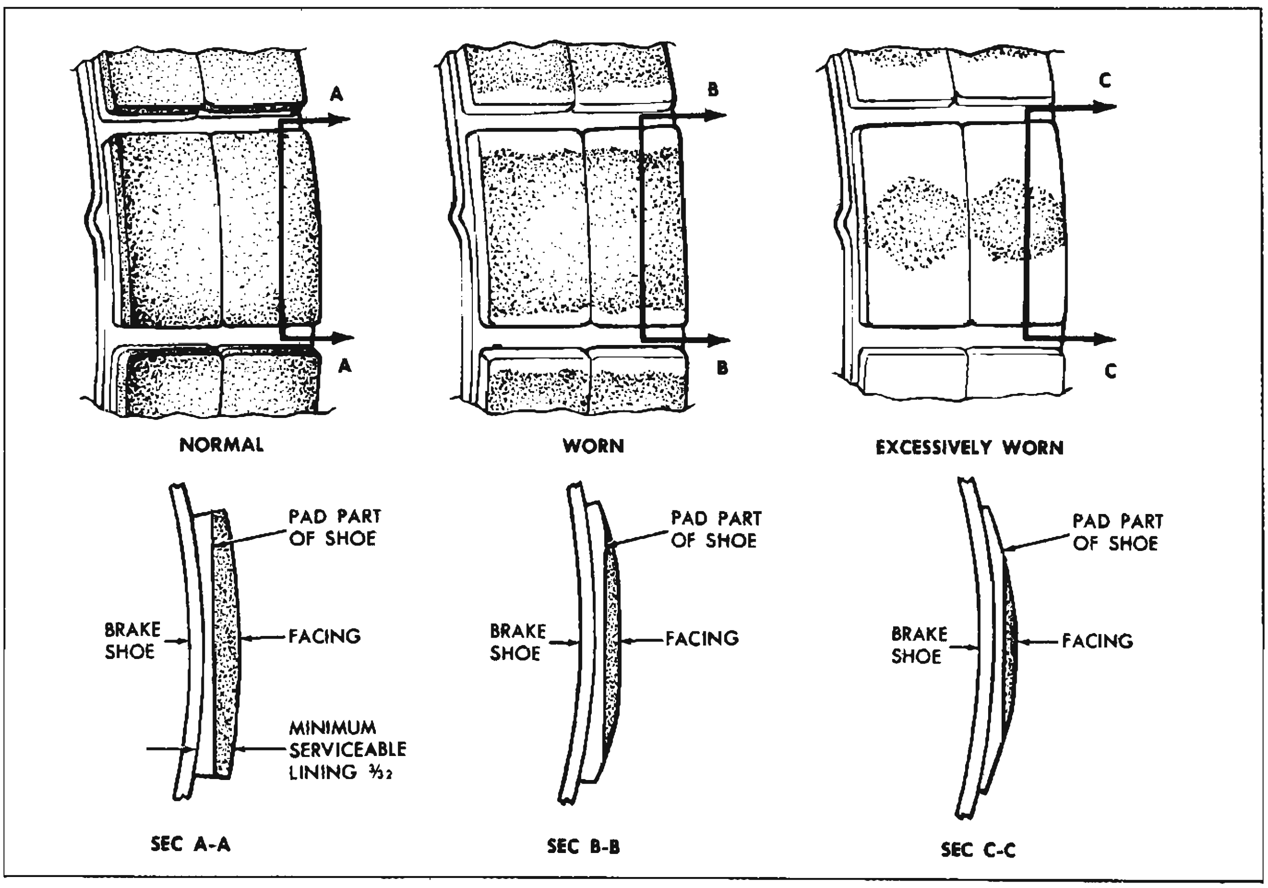


Fig. 29—Identification of Worn Metallic Brake Lining

POWER BRAKES

INDEX

GENERAL DESCRIPTION

The Power Brake Unit is a self-contained hydraulic and vacuum unit, utilizing manifold vacuum and atmosphere pressure for its power.

This unit permits the use of a low brake pedal as well as less pedal effort than is required with the conventional (nonpower) hydraulic brake system. Only two external line connections are necessary - one a vacuum connection from manifold to check valve located on front shell; the other, a hydraulic connection from the main cylinder outlet directly into the hydraulic system. The unit is mounted on the engine side of the fire wall and directly connected to the brake pedal.

MAINTENANCE AND ADJUSTMENTS

INSPECTIONS

1. Check vacuum line and vacuum line connections as well as vacuum check valve in front shell of power unit for possible vacuum loss.
2. Inspect all hydraulic lines and connections at the wheel cylinders and main cylinder for possible hydraulic leaks.
3. Check brake assemblies for scored drums, grease or brake fluid on linings, worn or glazed linings, and make necessary adjustments.
4. Check the brake fluid level in the hydraulic reservoir. The reservoir should be filled to within 1/4 inch of the reservoir rim.
5. Check for loose mounting bolts at main cylinder and at power section.
6. Check air cleaner filter in power piston extension and replace filter if necessary.
7. Check brake pedal for binding and misalignment between pedal and push rod.

LUBRICATION

The power brake unit is lubricated at assembly and needs no further lubrication other than maintaining normal reservoir fluid level. The reservoir should be filled as described in this section.

BLEEDING INSTRUCTIONS

The power system may be bled manually or with a pressure bleeder as outlined in this section. Use only GM Supreme 11 Brake Fluid or equivalent. Do not use the power assist while bleeding. The engine should not be running and the vacuum reserve should be reduced to zero by applying the brake several times before starting the bleeding procedure.

AIR CLEANER SERVICE

Servicing of the air cleaner is recommended and the element replaced when restriction becomes severe enough to affect power brake response. At any other time, if cleaning of the filter is felt necessary, it should be shaken free of dirt or washed in soap and water and thoroughly dried.

COMPONENT REPLACEMENT

POWER BRAKE CYLINDER

Removal

1. Remove vacuum hose from vacuum check valve.
2. Disconnect hydraulic line at main cylinder.
3. Disconnect push rod at brake pedal assembly.
4. Remove four nuts and lock washers securing power unit to fire wall, and remove power unit from engine compartment.

NOTE: Chevy II has a three stud attachment to fire wall.

Repair procedures for the power cylinder is outlined in the Brake Section of the Overhaul Manual - for service of the main cylinder refer to applicable portion of "Standard Brakes" in this manual.

Installation

CAUTION: After replacing the unit on the vehicle, start the engine and allow vacuum to build up before applying the brake.

1. Mount the power brake assembly in place and install the attaching nuts and lock washers.
2. Attach vacuum line to check valve.
3. Secure hydraulic line to main cylinder.
4. Attach push rod to brake pedal assembly, and check operation of stop light.
5. Bleed brakes as outlined in this section.

SPECIAL TOOLS

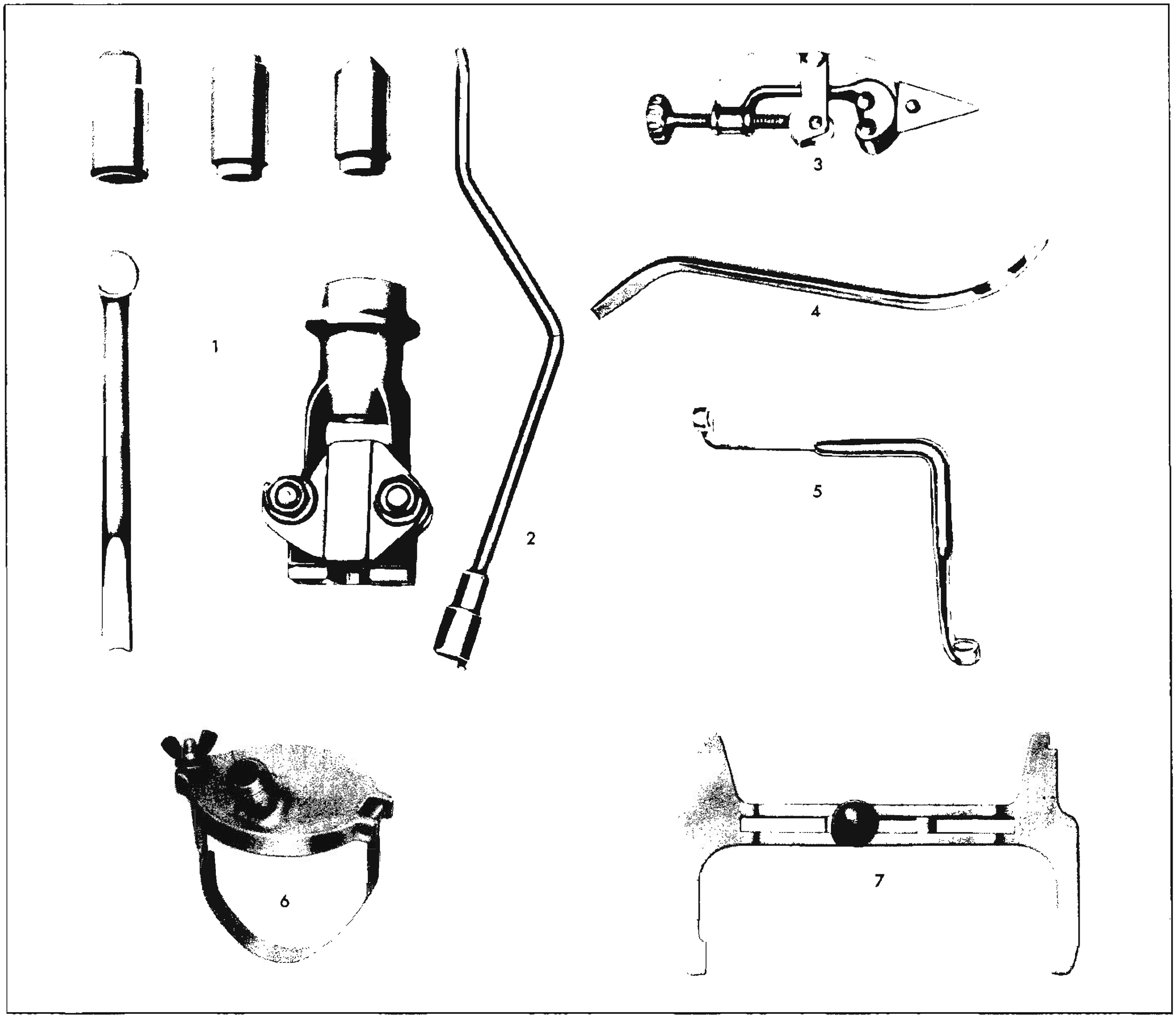


Fig. 30—Brake Special Tools

1. J-8051 Brake Tool Flaring Tool
2. J-8049 Brake Spring Remover and Installer
3. J-8113 Brake Tube Cutter
4. J-9485 Brake Adjusting Tool
5. J-21472 Brake Bleeder Wrench
6. J-21479 Pressure Bleeder Adapter
7. J-21177 Drum-to-Brake Shoe Clearance Gauge

SECTION 6
ENGINE

CONTENTS OF THIS SECTION

ENGINE TUNE UP

INDEX

GENERAL DESCRIPTION

The engine tune-up has become increasingly important to the modern automotive engine with its vastly improved power and performance. With the higher compression ratios, improved electrical systems and other advances in design, today's engines have become more sensitive to usage and operating conditions, all of which have a decided effect on power and performance.

Since the modern engine is admittedly more temperamental and sensitive to adjustments, some means must be devised to put back into the engine the standard of performance and economy of which it is capable.

Since it is seldom advisable to attempt an improvement in performance by correction of one or two items only, time will normally be saved and more lasting results assured if the serviceman will follow a definite and thorough procedure of analysis and correction of all items affecting power, performance and economy.

The tune-up will be performed in two parts. The first part will consist of visual and mechanical checks and adjustments; the second part will consist of an instrument checkout that can be performed with any one of the modern compact units of service equipment available for this purpose. Always follow the instructions provided by the manufacturer of the particular equipment to be used.

Additional checks and adjustments are included in the latter part of this section for use as required. Many of these operations would normally be used to isolate and correct trouble located during the tune-up. Where conditions are uncovered requiring major corrective action, refer to the appropriate section of this manual for detailed service information.

All operations included herein will be performed on the vehicle. Illustrations depicting bench operations have been employed for convenience only and are intended only to clarify the operations which will be performed on the vehicle. Since it is impractical to illustrate all possible installations that may be encountered, only a typical installation will be used to illustrate the point in question.

MECHANICAL CHECKS AND ADJUSTMENTS

Spark Plug Removal

1. Remove any foreign matter from around spark plugs by blowing out with compressed air, then disconnect wires and loosen each plug one turn.
2. Reconnect plug wires, start engine and accelerate to approximately 1000 rpm to blow out loose carbon (fig. 1).

NOTE: Cleaning carbon in this manner prevents chips from lodging under valves and giving a false compression reading or damaging valves.

3. Stop engine, disconnect wires and remove plugs.

Test Compression

1. Remove air cleaner and block throttle and choke in wide open position.

ENGINE TUNE-UP CHART

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<tr><td rowspan="2">TAPPET ADJUSTMENT</td><td colspan="2">Inlet</td><td colspan="8">Hydraulic 1 Turn Down From Zero Lash</td><td>.030"</td><td>Hyd.</td><td>* .025"</td></tr>
<tr><td colspan="2">Exhaust</td><td colspan="8">Hydraulic 1 Turn Down From Zero Lash</td><td>.030"</td><td>Hyd.</td><td>* .025"</td></tr>
<tr><td rowspan="2">IGNITION TIMING B.T.D.C. (Note 3)</td><td colspan="2">Nominal</td><td>4°</td><td>8°</td><td colspan="4">4°</td><td colspan="2">8°</td><td>10°</td><td>6°</td><td>12°</td></tr>
<tr><td colspan="2">Range</td><td>4°-8°</td><td>6°-14°</td><td colspan="4">4°-8°</td><td colspan="2">6°-12°</td><td>8°-14°</td><td>4°-8°</td><td>10°-14°</td></tr>
<tr><td rowspan="2">ENGINE IDLE RPM</td><td colspan="2">Synchromesh</td><td colspan="7">450 - 500</td><td>650 - 750</td><td>750 - 850</td><td>450 - 500</td><td>750 - 850</td></tr>
<tr><td colspan="2">Automatic</td><td colspan="11">Note 4</td></tr>
<tr><td rowspan="2">FUEL PUMP</td><td colspan="2">Pressure</td><td colspan="4">3 1/4 - 4 1/2</td><td colspan="3">5 1/4 - 6 1/2</td><td colspan="2">6 - 7 1/2</td><td colspan="2">7 1/4 - 8 1/2</td></tr>
<tr><td colspan="2">Volume</td><td colspan="11">One Pint In 30 - 45 Seconds</td></tr>
<tr><td colspan="3">COOLING SYSTEM PSI</td><td colspan="11">13 (15 Air Conditioning)</td></tr>
<tr><td rowspan="2">VENT VALVE</td><td colspan="2">Positive</td><td colspan="7">Check Valve Every 6,000 Miles</td><td colspan="4"></td></tr>
<tr><td colspan="2">Closed Positive</td><td colspan="11">Clean Orifice and Flame Arrestor every 12,000 Miles</td></tr>
</table>

NOTE 1: At cranking speed, throttle wide open -- Maximum Variation 20 pounds between cylinders.
NOTE 2: PAPER ELEMENT -- Service at 12,000 miles initially -- Check every 6,000 miles thereafter.
POLYURETHANE -- Service every 12,000 miles.
OIL BATH -- Change oil at regular engine oil change intervals.
NOTE 3: At idle speed with vacuum advance line disconnected and plugged.
NOTE 4: Idle speed on engines with automatic transmission should be set as low as possible to obtain smooth idle and prevent creep in drive or harsh shifts during transmission operation.
*For sustained high speed - Inlet .030" - Exhuast .030".

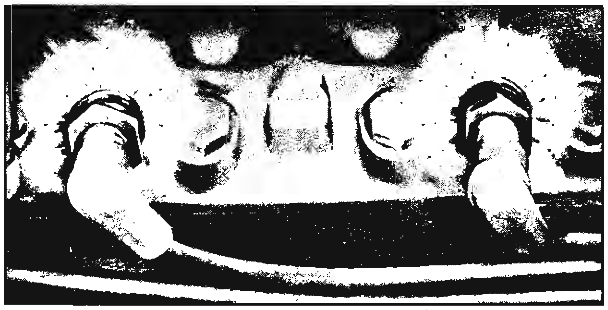


Fig. 1—Blowing Out Carbon

2. Hook up starter remote control cable and insert compression gauge firmly in spark plug port (fig. 2).

CAUTION: Whenever the engine is cranked remotely at the starter, with a special jumper cable or other means, the primary distributor lead must be disconnected from the negative post on the coil and the ignition switch must be in the "ON" position. Failure to do this will result in a damaged grounding circuit in the ignition switch.

3. Crank engine through at least four compression strokes to obtain highest possible reading.
4. Check and record compression of each cylinder.
5. If one or more cylinders read low or uneven, inject about a tablespoon of engine oil on top of pistons in low reading cylinders through spark plug port. Crank engine several times and recheck compression.
   - If compression comes up but does not necessarily reach normal, rings are worn.
   - If compression does not improve, valves are sticking or seating properly,
   - If two adjacent cylinders indicate low compression and injecting oil does not increase compression, the cause may be a head gasket leak between the cylinders. Engine coolant and/or oil in cylinders could result from this defect.

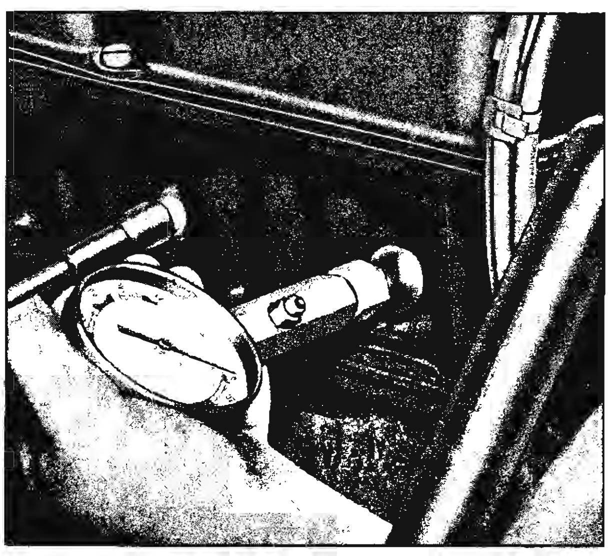


Fig. 2—Checking Compression

The compression check is important because an engine with low or uneven compression cannot be tuned successfully to give peak performance. Therefore, it is essential that improper compression be corrected before proceeding with an engine tune-up.

NOTE: If a weak cylinder cannot be located with the compression check, see "Cylinder Balance Test" under "Additional Checks and Adjustments" in this section.

Service and Install Spark Plugs

1. Inspect each plug individually for badly worn electrodes, glazed, broken or blistered porcelains and replace plugs where necessary (fig. 3). Refer to spark plug diagnosis information presented in "Engine Electrical," Section 6Y for an analysis of plug conditions.
2. Clean serviceable spark plugs thoroughly, using an abrasive-type cleaner such as sand blast. File the center electrode flat.
3. Inspect each spark plug for make and heat range. All plugs must be of the same make and number or heat range.
4. Adjust spark plug gaps to specifications using a round feeler gauge.

CAUTION: Never bend the center electrode to adjust gap. Always adjust by bending ground or side electrode.

5. If available, test plugs with a spark plug tester.
6. Inspect spark plug hole threads and clean before installing plugs. Corrosion deposits can be removed with a 14 mm. x 1.25 SAE spark plug tap (available through local jobbers) or by using a small wire brush in an electric drill. Use plenty of grease on tap to catch any chips.

CAUTION: Use extreme care when using tap to prevent cross threading. Also crank engine several times to blow out any material dislodged during cleaning operation.

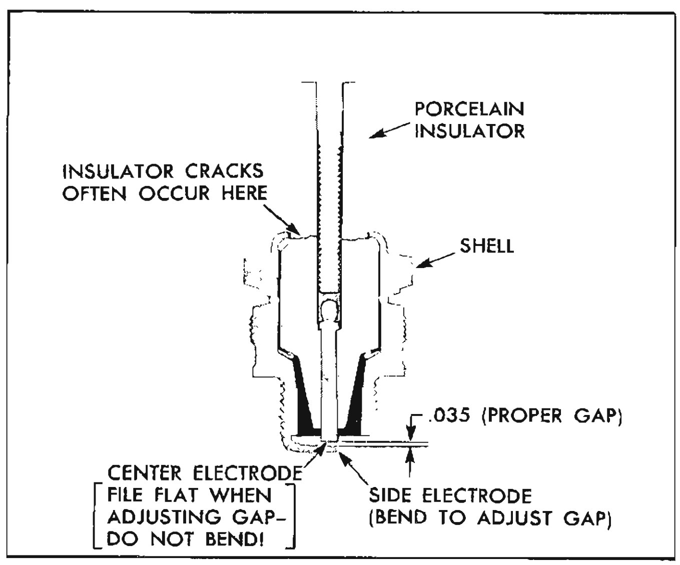


Fig. 3—Spark Plug Detail

7. Install spark plugs with new gaskets and torque to specifications.

   NOTE: Improper installations is one of the greatest single causes of unsatisfactory spark plug performance. Improper installation is the result of one or more of the following practices:

   - Installation of plugs with insufficient torque to fully seat the gasket.
   - Installation of the plugs using excessive torque which changes gap settings.
   - Installation of plugs on dirty gasket seal.
   - Installation of plugs to corroded spark plug hole threads.
8. Connect spark plug wiring.

Service Ignition System

1. Remove air cleaner (V-8).
2. Replace brittle or damaged spark plug wires. Install all wires to proper spark plug. Proper positioning of spark plug wires in supports is important on V-8 engines to prevent cross-firing (see "Engine Electrical," Section 6Y).
3. Tighten all ignition system connections.
4. Replace or repair any wires that are frayed, loose or damaged.
5. Remove distributor cap, clean cap and inspect for cracks, carbon tracks and burned or corroded terminals. Replace cap where necessary.
6. Clean rotor and inspect for damage or deterioration. Replace rotor where necessary.
7. Check the distributor centrifugal advance mechanism by turning the distributor rotor in a clockwise direction as far as possible, then releasing the rotor to see if the springs return it to its retarded position. If the rotor does not return readily, the distributor must be disassembled and the cause of the trouble corrected.

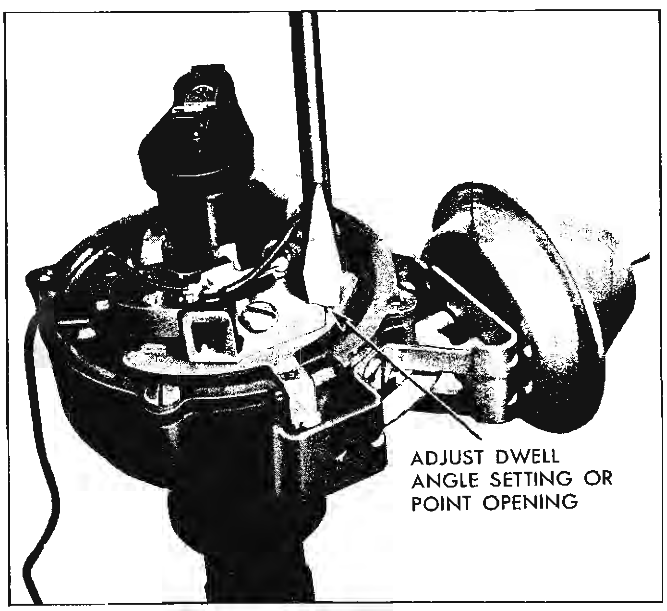


Fig. 4—In-Line Distributor

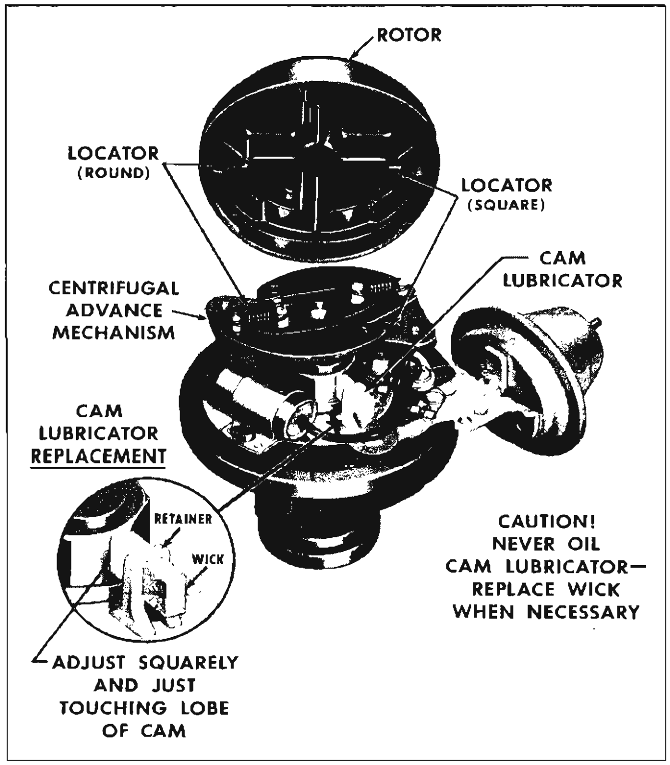


Fig. 5—V-8 Distributor

8. Check to see that the vacuum spark control operates freely by turning the movable breaker plate counterclockwise to see if the spring returns to its retarded position. Any stiffness in the operation of the spark control will affect the ignition timing. Correct any interference or binding condition noted.
9. Examine distributor points and clean or replace if necessary (figs. 4, 5 and 6).
   - Contact points with an overall gray color and only slight roughness or pitting need not be replaced.
   - Dirty points should be cleaned with a clean point file.

     Use only a few strokes of a clean, fine-cut contact file. The file should not be used on other metals

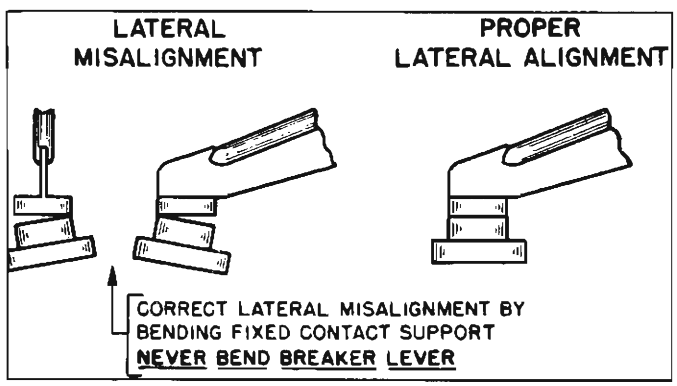


Fig. 6—Point Alignment

and should not be allowed to become greasy or dirty. Never use emery cloth or sandpaper to clean contact points since particles will embed and cause arcing and rapid burning of points. Do not attempt to remove all roughness nor dress the point surfaces down smooth. Merely remove scale or dirt.

- Clean cam lobe with cleaning solvent, lubricate cam lobe with "Delco Remy Cam and Ball Bearing Lubricant" or its equivalent and rotate cam lubricator wick 1/2 turn.
- Replace points that are burned or badly pitted.

NOTE: Where prematurely burned or badly pitted points are encountered, the ignition system and engine should be checked to determine the cause of trouble so it can be eliminated. Unless the condition causing point burning or pitting is corrected, new points will provide no better service than the old points. Refer to Section 6Y for an analysis of point burning or pitting.

- Adjust distributor contact point gap to .019" (new points) or .016 (used points), using a feeler gauge or dial indicator. Breaker arm rubbing block should be on high point of lobe during adjustment.

NOTE: If contact points have been in service, they should be cleaned before adjusting with a feeler gauge.

- Check distributor point spring tension (contact point pressure) with a spring gauge hooked to breaker lever at the contact and pull exerted at 90 degrees to the breaker lever. The points should be closed (cam follower between lobes) and the reading taken just as the points separate. Spring tension should be 19-23 ounces. If not within limits, replace.

  Excessive point pressure will cause excessive wear on the points, cam and rubbing block while weak point pressure permits bouncing or chattering, resulting in arcing and burning of the points and an ignition miss at high speed.

10. Install rotor and distributor cap. Press all wires firmly into cap towers.

Service Battery and Battery Cables

1. Measure the specific gravity of the electrolyte in each cell (fig. 7). If it is below 1.230 (corrected to 80°F.) recharge with a slow rate charger, or if desired, further check battery.
2. Connect a voltmeter across the battery terminals and measure the terminal voltage of the battery during cranking (remove the coil secondary lead during this check to prevent engine from firing). If the terminal voltage is less than 9.0 volts at room temperature, approx. 80° ± 20°F., the battery should be further checked. See Section 6Y for further tests.
3. Inspect for signs of corrosion on battery, cables and surrounding area, loose or broken carriers, cracked or bulged cases, dirt and acid, electrolyte leakage and low electrolyte level. Fill cells to proper level with distilled water or water passed through a "demineralizer."

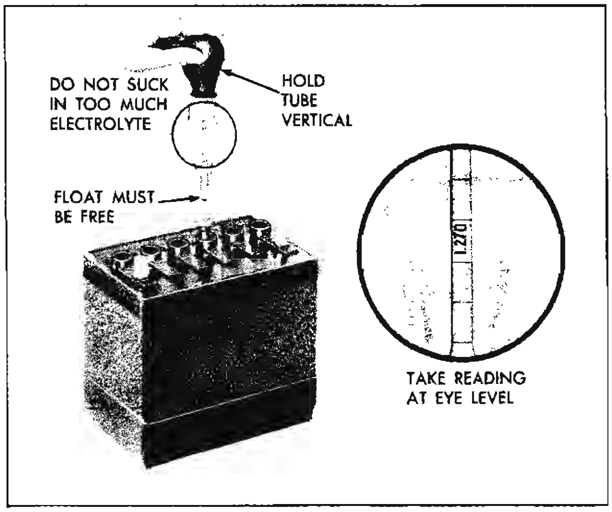


Fig. 7—Testing Specific Gravity of Battery

The top of the battery should be clean and the battery hold-down bolts properly tightened. Particular care should be taken to see that the top of the battery is kept clean of acid film and dirt because of the high voltage between the battery terminals. For best results when cleaning batteries, wash first with a dilute ammonia or soda solution to neutralize any acid present and then flush off with clean water. Care must be taken to keep vent plugs tight so that the neutralizing solution does not enter the cell. The holddown bolts should be kept tight enough to prevent the battery from shaking around in its holder, but they should not be tightened to the point where the battery case will be placed under a severe strain.

To insure good contact, the battery cables should be tight on the battery posts. Oil battery terminal felt washer. If the battery posts or cable terminals are corroded, the cables should be cleaned separately with a soda solution and a wire brush. After cleaning and before installing clamps, apply a thin coating of petrolatum to the posts and cable clamps to help retard corrosion.

If the battery has remained undercharged, check for loose or defective fan belt, defective Delcotron, high resistance in the charging circuit, oxidized regulator contact points, or a low voltage setting.

If the battery has been using too much water, the voltage output is too high.

Service Delcotron and Regulator

The Delcotron and regulator tests during tune-up consist of the above battery tests; the condition of the battery indicating further tests and adjustments as outlined in Section 6Y, "Engine Electrical."

Service Fan Belt

Inspect fan belt condition.

Check and adjust if necessary for correct tension of belt, as follows:

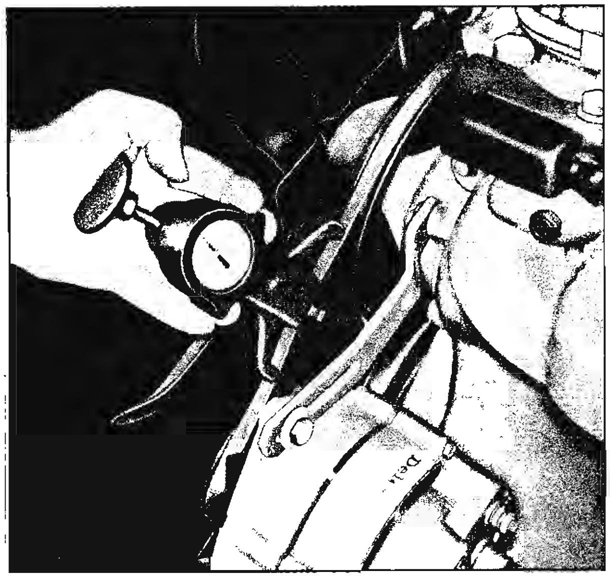


Fig. 8—Checking Fan Belt Tension

- Using a strand tension gauge, check the fan belt midway between the water pump pulley and Delcotron pulley (fig. 8).
- Adjust Delcotron on its mounting bracket until the specified tension is reached. (See Tune-Up Chart)

Service Manifold Heat Valve

Check manifold heat control valve (figs. 9 and 10) for freedom of operation. If shaft is sticking, free it up with GM Manifold Heat Control Solvent or its equivalent.

NOTE: Tap shaft end to end to help free it up.

Tighten Manifold

Tighten all manifold bolts to specification in the sequence outlined under a manifold replacement. A slight leak at the manifold destroys engine performance and economy.

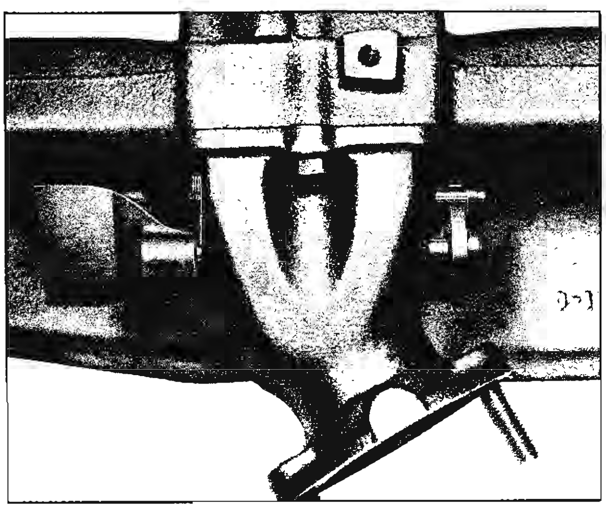


Fig. 9—Manifold Heat Control Valve (In-Line)

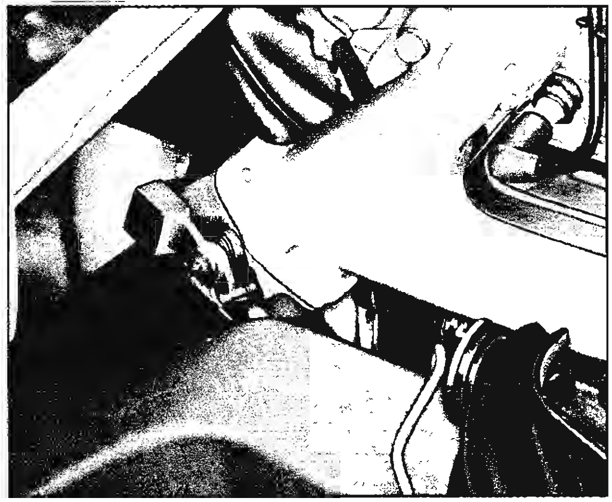


Fig. 10—Manifold Heat Control Valve (V-8 Typical)

Service Fuel Lines and Fuel Filter

1. Inspect fuel lines for kinks, bends or leaks and correct any defects found.
2. If equipped with fuel filter, clean filter.

NOTE: If a complaint of poor high speed performance exists on the vehicle, fuel pump tests described in Section 6M should be performed.

Service Cooling System

1. Inspect cooling system for leaks, weak hoses, loose hose clamps and correct coolant level, and service as required.

NOTE: A cooling system pressure test, as described in "Additional Checks and Adjustments" in this section, may be performed to detect internal or external leaks within the cooling system.

Check and Adjust Accelerator Linkage

1. Disconnect accelerator rod at carburetor throttle lever (fig. 11).

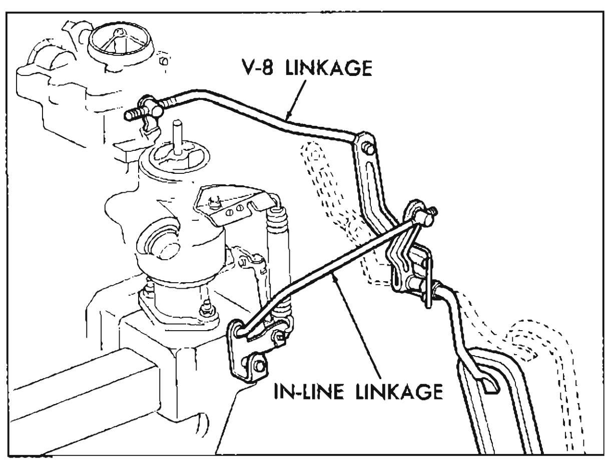


Fig. 11—Accelerator Linkage

2. Hold carburetor throttle lever in wide position.
3. Pull accelerator rod to wide open position, (on vehicles equipped with automatic transmission, pull through detent).
4. Adjust accelerator rod to freely enter hole in carburetor throttle lever.

   NOTE: Accelerator linkage is outlined in detail in Section 6M.

5. Connect accelerator rod at throttle lever.

Service Crankcase Ventilation (Figs. 12, 13 and 14)

All engines have either "Positive" or "Closed Positive" ventilation systems utilizing manifold vacuum to draw fumes and contaminating vapors into the combustion chamber where they are burned. Since it affects every part of the engine, crankcase ventilation is an important function and should be understood and serviced properly.

In both "Positive" and "Closed Positive" ventilation, air in drawn through the engine, through a regulating valve and into the manifold, drawing crankcase vapors and fumes with it to be burned. "Positive" ventilation uses a vented-meshed oil filler cap for clean air intake to the engine, while "Closed Positive" ventilation system draws the clean air from the carburetor air cleaner and has a nonvented oil filler cap.

Positive Ventilation Maintenance

1. Positive ventilation valve may be checked as outlined under "Additional Checks and Adjustments".
2. Inspect for deteriorated or plugged hoses.
3. Inspect all hose connections.

Closed Positive Ventilation Maintenance

1. Disconnect hose and clean metered orifice, by inserting a suitable drill and twisting by hand.
2. Inspect for deteriorated or plugged hoses.
3. Remove flame arrestor and wash in solvent then dry with compressed air.
4. Connect hose and inspect all connections.

Choke Adjustment

L-4 Engines

1. Remove air cleaner.
2. Push hand choke knob in to within 1/8" of instrument panel.
3. Loosen choke cable clamp at carburetor bracket and adjust cable through the clip until the choke valve is wide open.
4. Tighten cable clamp at carburetor bracket and check operation of choke valve to ensure full closed and wide open positions.

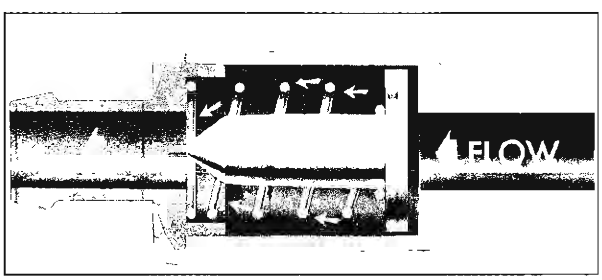


Fig. 12—Ventilation Valve

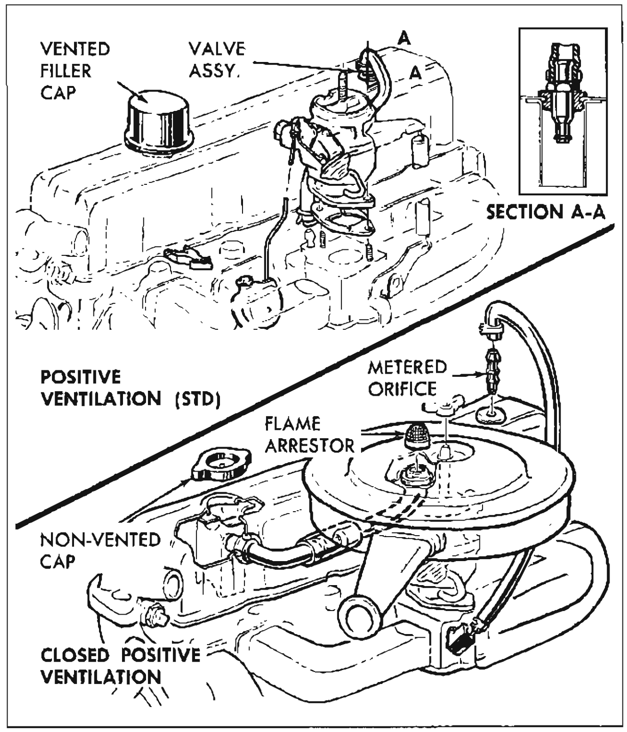


Fig. 13—Crankcase Ventilation System (In-Line)

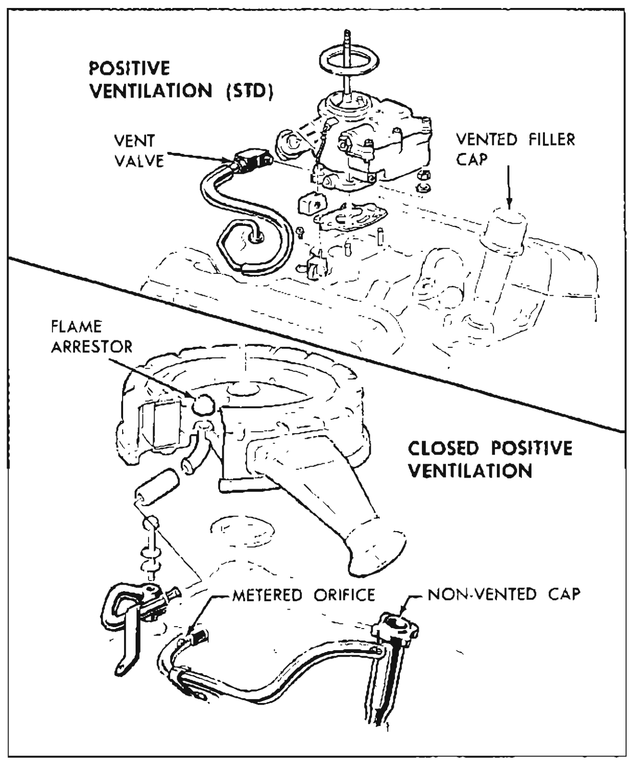


Fig. 14—Crankcase Ventilation System (V-8)

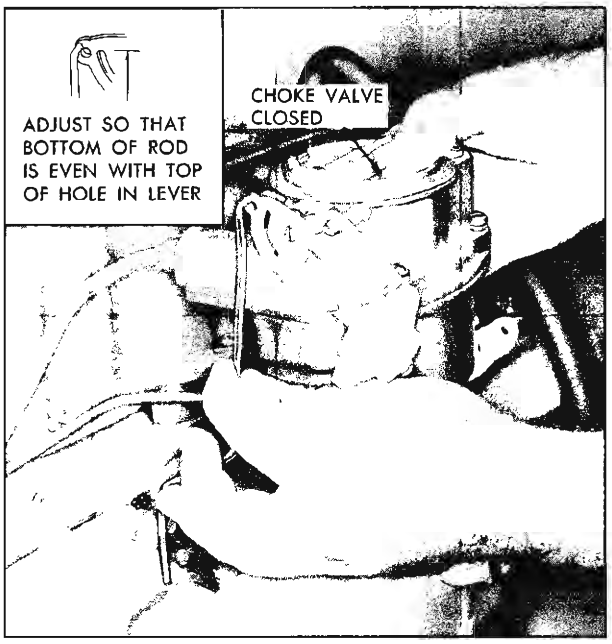


Fig. 15—Choke Adjustment (Rochester BV)

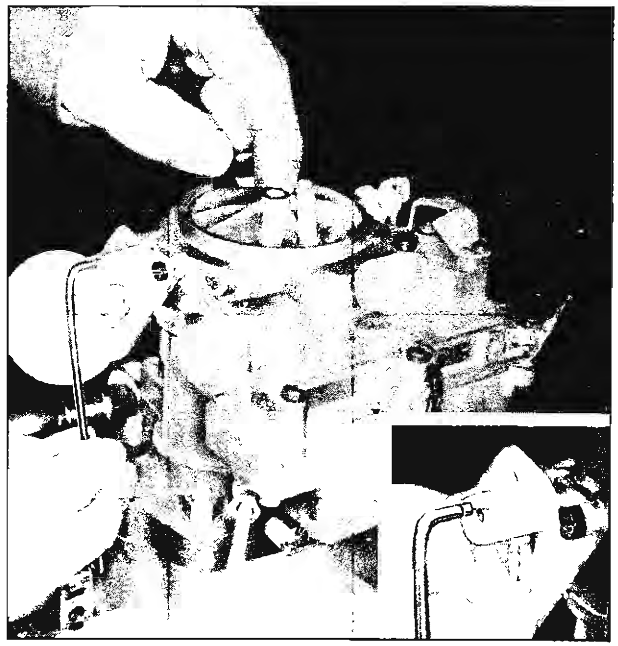


Fig. 16—Choke Adjustment (Rochester 2GV)

5. Install air cleaner.

L-6 Engines (Fig. 15)

1. Remove air cleaner and check to see that choke choke lever at carburetor.
2. Hold choke valve closed and pull choke rod up against stop in thermostat housing, while checking and adjusting rod length as follows:
   a. Nominal (Index) setting is provided when the bottom edge of the choke rod end aligns with the top edge of the hole in the choke lever (equivalent to one rod diameter above the hole).
   b. Leaner settings, if desired, can be made by bending the choke rod in the offset area to decrease rod effective length. At the maximum allowable lean setting, AT LEAST the upper quarter of the rod end should overlap the top edge of the lever hole.

      NOTE: After making any change in choke rod length, check for free operation as interferences may exist at the manifold end of the rod. If a lean adjustment is made, make sure that it is possible for the choke valve to fully close at the new setting.

   c. To adjust for a choke setting equivalent to "2 notches" rich, the choke rod should be bent at the rod offset area to effectively length the rod and bring the rod end 2 rod diameters above the hole in the choke lever.

V-8 Engines (283 cu. in. Fig. 16)

1. Remove air cleaner and check to see that choke valve and rod move freely.
2. Disconnect choke rod at choke lever.
3. Hold choke valve closed and pull rod up against stop in thermostat housing. The top of choke rod end should be approximately 1/2 rod diameter above top of hole in choke valve lever as shown to assure choke valve closing.
4. If necessary, adjust rod length by bending rod at offset bend. (Bend must be such that rod enters choke lever hole freely and squarely.)
5. Connect rod at choke lever and install air cleaner.

V-8 Engines (327 and 409 cu. in. Fig. 17)

Normal setting of the choke is such that the index mark on the cover is lined up with the molded center mark on the choke housing.

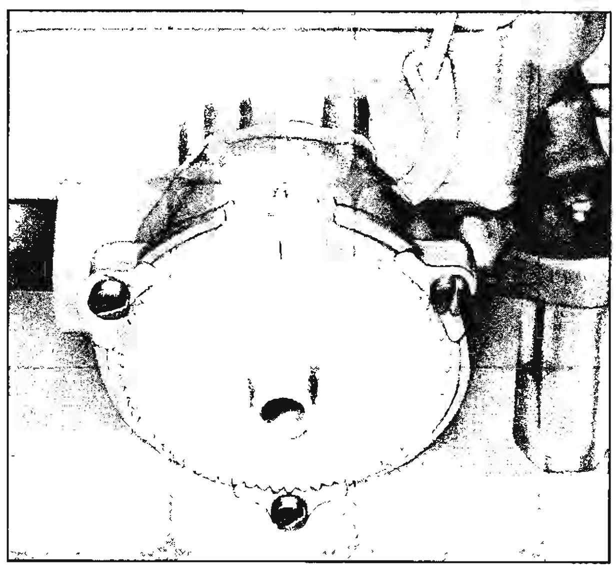


Fig. 17—Choke Adjustment (Rochester 4GC)

Service Air Cleaner

Clean or service air cleaner as outlined in Section 6M.

INSTRUMENT CHECK-OUT

Instrument Hook Up

Connect vacuum gauge, dwell meter, tachometer and timing light.

Check and Adjust Dwell

1. Start engine then check and adjust ignition dwell.
2. On In-Line engines; if dwell is not within specifications, recheck point gap, check for wrong point assembly, defective or misaligned point, worn rubbing block or worn distributor cam.
3. On V-8 engines; if dwell is not within specifications, adjust dwell as follows:
   - With engine running at idle, raise the adjustment screw window and insert an Allen wrench in the socket of the adjusting screw (fig. 18).
   - With a dwell meter connected, turn the adjusting screw as required until a dwell reading of 30 degrees is obtained. A 2-degree variation is allowable for wear. If a dwell meter is not available, turn adjusting screw clockwise until engine starts to misfire, then turn screw one-half turn in the opposite direction to complete adjustment.
   - Close access cover fully to prevent the entry of dirt into the distributor.

Check Dwell Variation

Slowly accelerate engine to 1500 rpm and note dwell reading. Return engine to idle and note dwell reading. If dwell variation exceeds specifications, check for worn distributor shaft, worn distributor shaft bushing or loose breaker plate.

Check and Adjust Ignition Timing

1. Disconnect the distributor spark advance hose (where applicable) and plug the vacuum source opening.
2. Start engine and run at idle speed (see tune-up chart).
3. Aim timing light at timing tab near harmonic balancer (fig. 19).

   NOTE: The markings on the tabs are in 2° increments (the greatest number of markings on the "A" side of the "O"). The "O" marking is TDC and all BTDC settings fall on the "A" (advance) side of "O".

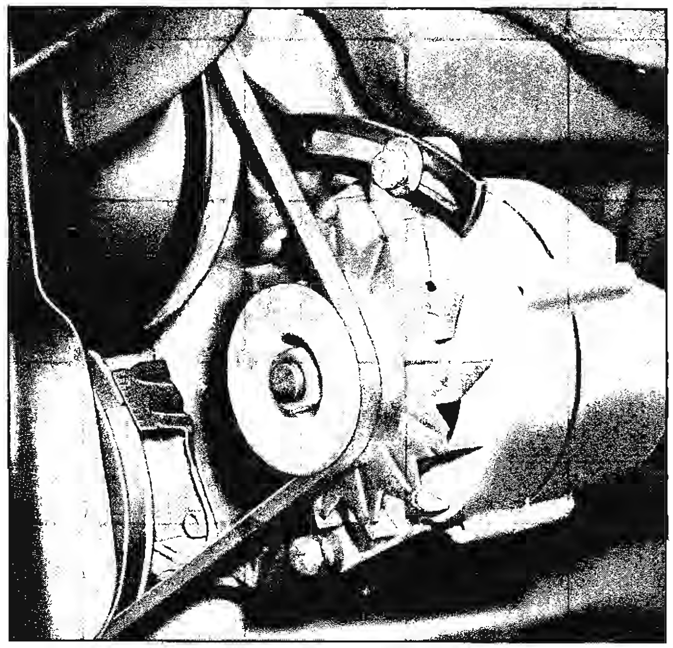


Fig. 19—Ignition Timing Marks (Typical)

4. Adjust the timing by loosening the distributor clamp and rotating the distributor body as required, then tighten the clamp.
5. Stop engine and remove timing light and reconnect the spark advance hose.

   NOTE: Timing should be advanced as far as possible (within specifications) unless detonation (spark knock) occurs.

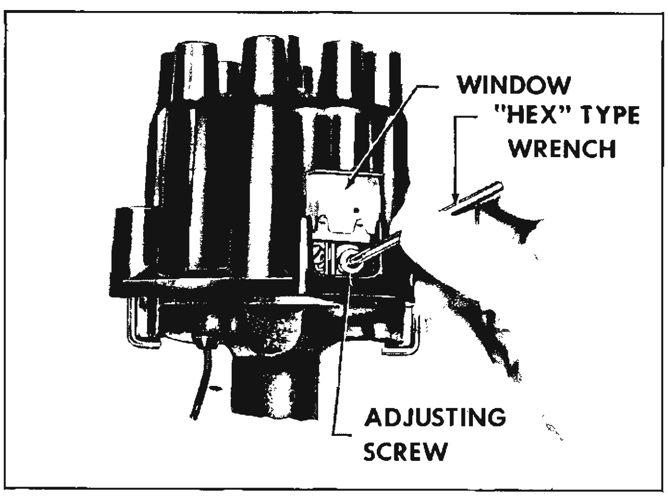


Fig. 18—Setting V-8 Dwell

Adjust Idle Speed and Mixture (Fig. 20)

1. As a preliminary adjustment, turn idle mixture screws lightly to seat and back out 1-1/2 turns.

   CAUTION: Do not turn idle mixture screw tightly against seat or damage may result.

2. With engine running (choke wide open) adjust idle speed screw to bring idle speed to specified rpm (Powerglide in drive, manual transmission in neutral).
3. Adjust idle mixture screw to obtain highest steady vacuum at idle speed.

   NOTE: On air conditioned vehicles, hold idle compressor closed during adjustment.

4. Repeat Steps 4 and 5 as needed for final adjustment.
5. Shut down the engine, remove gauges and install air cleaner.

ADDITIONAL CHECKS AND ADJUSTMENTS

Testing Positive Ventilation Valve

1. Connect tachometer and vacuum gauge as for idle speed and mixture adjustment.
2. Set parking brake, start engine and adjust idle speed and mixture.

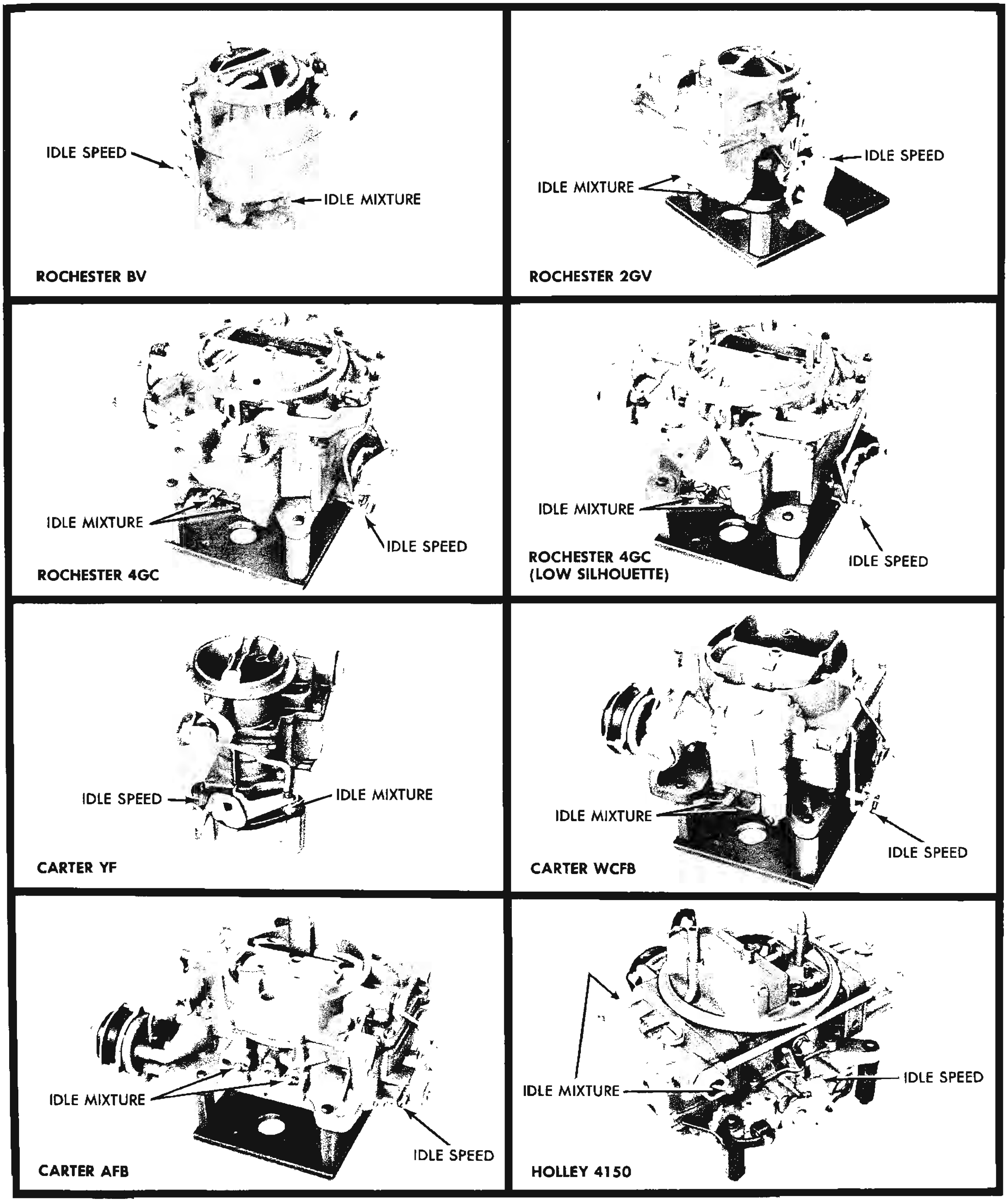


Fig. 20—Idle Speed and Mixture Screws

3. a. (In Line Engine)--Remove valve from rocker arm cover (with hose still connected), plug the open end of the valve and read engine rpm change.
   b. (8 Cylinder Engine)--Disconnect ventilation hose at valve on carburetor base, block opening of valve and read engine rpm change
4. A change of less than 50 rpm indicates a plugged ventilation valve metering hole--replace the valve.

Test Cranking Voltage (Fig. 21)

1. Ground coil primary lead at the coil to prevent engine from firing during cranking.
2. Connect voltmeter between primary terminal of coil (resistance wire side) and ground.
3. Operate starting motor.
   a. If voltage is 9 volts or more and cranking speed is satisfactory, the battery, starter, cables, starter switch and ignition circuit to coil (bypassing resistance wire) are in good condition.
   b. If below 9 volts, check circuit until difficulty is located.

   Meter reading below specification--Weak battery; defective cables, connections, switch or starter; defective ignition circuit to coil.

   Cranking speed below normal--Excessive resistance in cables or starting motor; excessive mechanical drag in engine.

   Uneven cranking speed--Uneven compression, defective starter or starter drive.

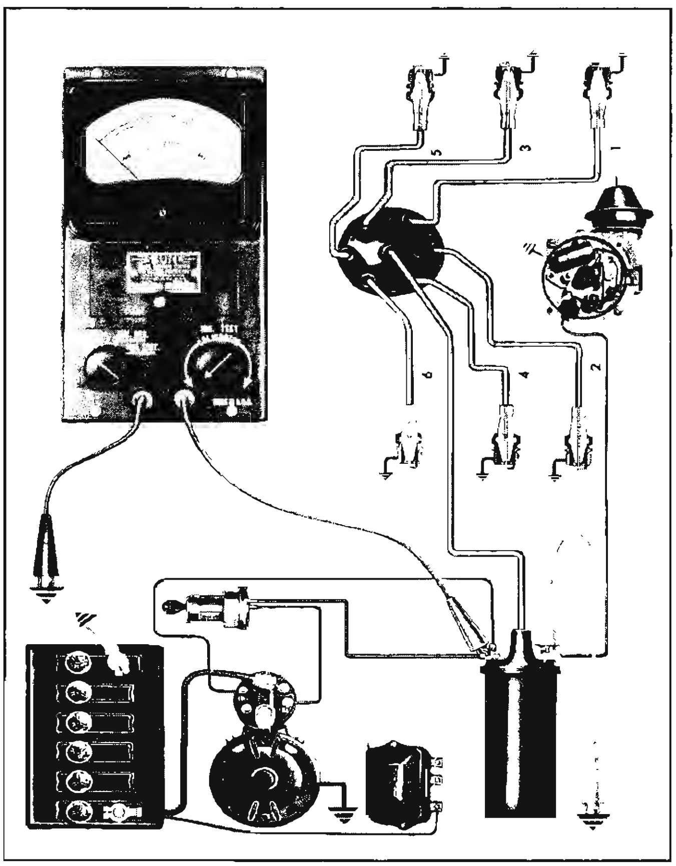


Fig. 21—Testing Cranking Voltage

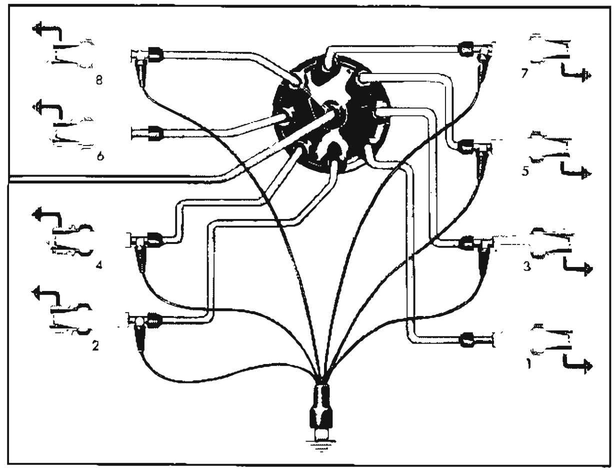


Fig. 22—Cylinder Balance Test

Cylinder Balance Test

It is often difficult to locate a weak cylinder. A compression test, for example, will not locate a leaky intake manifold, a valve not opening properly due to a worn camshaft, or a defective spark plug.

With the cylinder balance test, the power output of one cylinder may be checked against another, using a set of grounding leads. When the power output of each cylinder is not equal, the engine will lose power and run roughly.

Perform a cylinder balance test as follows:

1. Connect the tachometer and vacuum gauge.
2. Start engine and run at 1500 rpm.
3. Ground large clip of grounding leads and connect individual leads to all spark plugs except the pair being tested (fig. 22).

Divide the firing order in half and arrange one half over the other. The cylinders to be tested together appear one over the other: i.e.

L-4 Firing Order

1-3-4-2 = 1-3 = 1-4, 3-2
          4-2

L-6 Firing Order

1-5-3-6-2-4 = 1-5-3 = 1-6, 5-2, 3-4
              6-2-4

V-8 Firing Order

1-8-4-3-6-5-7-2 = 1-8-4-3 = 1-6, 8-5, 4-7, 3-2
                  6-5-7-2

4. Operate engine on each pair of cylinders in turn and note engine rpm and manifold vacuum for each pair. A variation of more than 1 inch of vacuum or 40 rpm between pairs of cylinders being tested indicates that the cylinders are off balance.

Battery

Two battery checks should be made to determine the condition of the battery in a minimum amount of time.

1. Hydrometer Test
2. Light Load Test

NOTE: If a battery failure is encountered, the cause may be outside the battery itself. Do not be satisfied merely to recharge or replace it. Find the cause of failure and prevent recurrence of trouble.

See "Engine Electrical," Section 6Y for a description of above tests.

Ignition

The following additional ignition checks may be made with any of several pieces of equipment available for uncovering the source of engine difficulties. The specific operating instructions of the equipment manufacturer should be followed:

- Cranking voltage
- Ignition switch
- Distributor resistance
- Secondary resistance
- Ignition output and secondary leakage

Ignition Switch

With voltmeter connected as described for the Cranking Voltage Test, turn ignition switch to ON. Voltage should drop to 5 to 7 volts as current is now passing through high resistance wire connected between ignition switch and (+) positive terminal of coil. If battery voltage of 12 volts is obtained, the starter solenoid is by-passing the high resistance wire connected between ignition switch and (+) positive terminal of coil, thus the starter solenoid is not functioning properly to bypass the ignition resistance wire or the ignition circuit is incorrectly wired.

Remove jumper lead from distributor primary terminal of coil and ground.

Distributor Resistance

Use equipment as directed by manufacturer. Excessive resistance in primary circuit must be eliminated before continuing with test procedure.

Secondary Resistance

Use equipment as directed by manufacturer.

- Uniform "normal readings" as specified by manufacturer indicate all secondary circuit components are in good condition.
- If all readings are "below normal," check for corroded coil tower terminal, pgorly connected or broken coil wire, center cap electrode or rotor tip burned, or an open secondary in coil.
- If readings are "higher than normal" at two or more plugs adjacent in firing order, cross firing is occurring in distributor cap or between spark plug cables concerned.
- If meter reads off scale to left, the coil polarity is reversed. Check for reversed coil primary wires, wrong coil or reversed vehicle battery connections.

Ignition Output and Secondary Leakage

Use equipment as directed by manufacturer.

- GOOD readings indicate both ignition output and secondary insulation are good.
- If all readings are BAD or if ignition test calibrator cannot be adjusted to Set Line, check for high resistance in primary circuit, defective distributor points, coil or condenser.
- If readings are BAD when certain plug wires are lifted off, check for cracks or carbon tracks in distributor cap or defective insulation on those plug wires being lifted off.

Carburetor

Refer to Section 6M to perform additional indicated adjustments such as idle vent, float level, float drop, pump rod and secondary valve.

Fuel Pump

If the owner has complained of poor high speed performance, the fuel pump may be at fault. Too low a pump pressure or volume will cause a high speed "miss" because of lack of fuel delivered to the carburetor, while too high a pressure will cause carburetor flooding. Check fuel pump as outlined in Section 6M.

Cooling System

The following test may be performed with pressure testing equipment available commercially for this purpose. This test provides an excellent means of detecting internal or external leaks within the cooling system.

1. Remove radiator cap.
2. Apply a test pressure of 3 pounds higher than the radiator cap (fig. 23). i.e. 12 pounds for a 9 pound cap.
3. If the pressure will not hold, there is either an internal or external leak within the system.

Cylinder Head Torque and Valve Adjustment

Retorquing the cylinder head bolts is not necessary unless a gasket has been replaced, or a leak is suspected. Valve lash must always be adjusted after the head has been torqued. Refer to "Repair Procedures" for torque sequence of cylinder heads.

Before adjusting the valve stem to rocker arm clearance, it is extremely important that the engine be thoroughly warmed up to normalize the expansion of all parts. This is very important because during the warm-up period, the valve clearances will change considerably. To adjust the valves during or before this warm-up period will produce clearances which will be far from

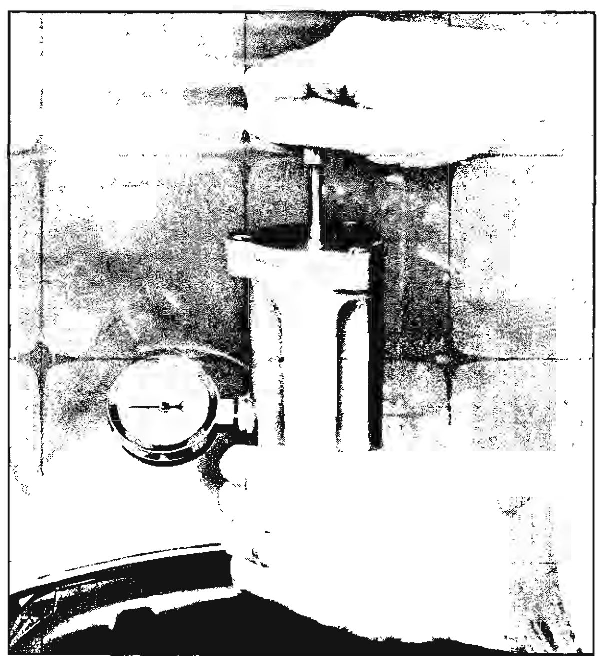


Fig. 23—Cooling System Pressure Test (Typical)

correct after the engine reaches normal operating temperature.

Tests have shown that valve clearances will vary as much as .005" from a cold check through the normalizing range: consequently the engine should be run 20-30 minutes to properly normalize all parts.

Covering the radiator will not materially hasten this normalizing process because even with the water temperature quickly raised, it does not change the rate at which the oil temperature increases or the engine parts become normalized.

The actual temperature of the oil is not as important as stabilizing the oil temperature. The expansion or contraction of the valves, rocker arm supports, push rods, cylinder head and cylinder block are relative to this oil temperature. Therefore, only after the oil temperature is stabilized, do these parts stop expanding and valve clearance changes cease to take place.

NOTE: Oil deflector clips are commercially available (fig. 24).

Hydraulic

1. After the engine has been normalized, remove valve cover and install a new valve cover gasket on cylinder head to prevent oil from running out.
2. With the engine running at idle, back off valve rocker arm nut until the valve rocker arm starts to clatter.
3. Turn rocker arm nut down slowly until the clatter just stops. This is the zero lash position.
4. Turn nut down 1/4 additional turn and pause 10 seconds until engine runs smoothly. Repeat additional 1/4 turns, pausing 10 seconds each time, until nut has been turned down 1 full turn from the zero lash position.

NOTE: This 1 turn preload adjustment must be done slowly to allow the lifter to adjust itself to prevent the possibility of interference, between the inlet valve head and top of piston, which might result in internal damage and/or bent push rods. Noisy lifters should be replaced.

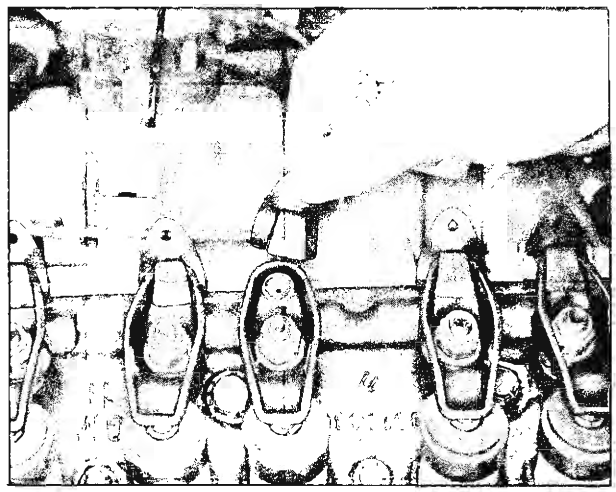


Fig. 24—Oil Deflector Clips Installed

5. Repeat Steps 2, 3 and 4 to adjust the rest of the valves.
6. Install valve cover, using new gasket.

Mechanical

1. Normalize the engine.
2. Remove rocker arm covers and gaskets.
3. Use a socket wrench on self-locking rocker arm stud nut and adjust as needed to obtain valve lash (see tune-up chart) measured between rocker arm and valve stem with a leaf type feeler gauge.
4. Stop engine and install rocker covers with new gaskets.

IN-LINE ENGINES

(153 CU. IN. L-4 AND 194 AND 230 230 CU. L-6)

INDEX

GENERAL DESCRIPTION

The In-Line engines (figs. 1L and 2L) covered in this section are the 153 cu. in. L-4 engines used in Chevy II, the 194 cu. in. L-6 engines used in Chevelle and Chevy II and the 230 cu. in. engines used in Chevrolet, Chevelle and Chevy II.

This section covers the removal and installation of engine assemblies, the removal and installation of engine components and some maintenance procedures. For all service to engine components (after removal) and removal of some subassemblies, refer to Section 6 of the Overhaul Manual.

COMPONENT REPLACEMENT

ENGINE ASSEMBLIES

Chevrolet, Chevelle and Chevy II

Removal

1. Drain cooling system and engine oil.
2. Remove air cleaner and disconnect battery cables at battery.
3. Scribe around hinges, then remove hood.
4. Remove radiator, radiator shroud fan belt fan blade and pulley.
5. Disconnect wires at:
   - Starter Solenoid
   - Delcotron
   - Temperature Switch
   - Oil Pressure Switch
   - Coil
6. Disconnect:
   - Accelerator linkage at manifold bellcrank.
   - Exhaust pipe at manifold flange.
   - Fuel line (from tank) at fuel pump.
   - Vacuum line to power brake unit at manifold (if so equipped)
   - Power steering pump lines at pump end (if so equipped)
7. Raise vehicle and place on jack stands.
8. If plug for drive shaft opening in transmission is not available, drain transmission.
9. Remove drive shaft.
10. Disconnect:
    - Shift linkage at transmission.
    - Speedometer cable at transmission.
11. On synchromesh equipped vehicles, disconnect clutch linkage at cross-shaft then remove cross-shaft engine bracket.

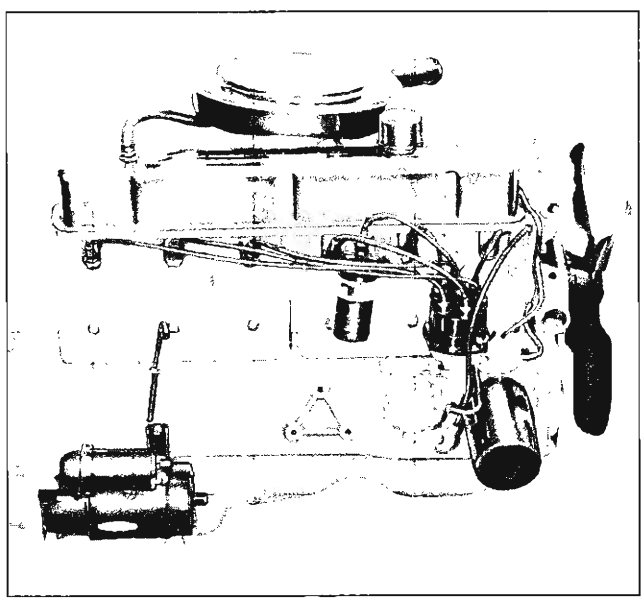


Fig. 1L—L-6 Engine

12. Remove valve rocker arm cover and attach lifting device.
13. Remove front mount through bolts.
14. Raise engine to take weight off front mounts, then remove rear mount bolts.
15. Raise engine to take weight off rear mount, then remove crossmember.

NOTE: On Chevrolet vehicles it will be necessary to remove mount from transmission before crossmember can be removed.

16. Remove engine-transmission assembly from vehicle as a unit.
17. Remove transmission (and clutch):

Synchromesh Transmission

a. Remove clutch housing cover plate screws.
b. Remove bolts attaching the clutch housing to engine block then remove transmission and clutch housing as a unit.

NOTE: Support the transmission, as the last mounting bolt is removed, and as it is being pulled away from the engine, to prevent damage to clutch disc.

c. Remove starter and clutch housing cover plate.
d. Loosen clutch mounting bolts a turn at a time (to prevent distortion of clutch cover) until the spring pressure is released. Remove all bolts, clutch disc and pressure plate assembly.

Automatic Transmission

a. Lower engine, secured by the hoist, and support engine on blocks.
b. Remove starter and converter housing under pan.
c. Remove flywheel-to-converter attaching bolts.
d. Support transmission on blocks.
e. Remove transmission-to-engine mounting bolts.
f. With the hoist attached, remove blocks from the engine only and slowly guide the engine from the transmission.

18. Mount engine in stand.

Installation

1. Attach lifting device to engine and remove engine from engine stand.
2. Install transmission (and clutch):

Synchromesh Transmission

a. Install the clutch on flywheel as outlined in Section 7.
b. Install clutch housing cover and starter.
c. Install transmission and clutch housing as outlined in Section 7.
d. Install clutch housing cover screws and tighten securely.

Automatic Transmission

a. Position engine adjacent to the transmission and align the convertor with the flywheel.
b. Bolt transmission to engine, then raise engine and transmission assembly and install flywheel to convertor attaching bolts.
c. Install convertor housing under pan and starter.

3. Tilt and lower engine and transmission assembly into the chassis as a unit, guiding engine to align front mounts with frame supports.

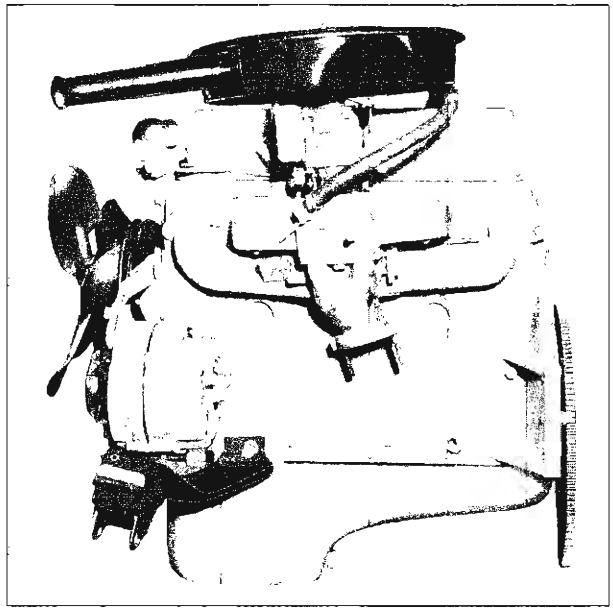


Fig. 2L—L-4 Engine

4. Install front mount through bolts and tighten securely.
5. Raise engine enough to install rear crossmember, then install crossmember; install rear mount, lower engine and tighten rear mount securely.
6. Remove lifting device and install rocker arm cover with a new gasket.
7. On synchromesh equipped vehicles, install clutch cross shaft engine bracket, then adjust and connect clutch as outlined in Section 7.
8. Connect:
   - Speedometer cable.
   - Shift linkage at transmission.
9. Install drive shaft.
10. Remove jack stands and lower vehicle.
11. Connect:
    - Power steering pump lines (if disconnected).
    - Vacuum line to power brake unit (if disconnected).
    - Fuel line at fuel pump.
    - Exhaust pipe at manifold flange.
    - Accelerator linkage at manifold bellcrank.
12. Connect wires at:
    - Coil.
    - Oil pressure switch.
    - Temperature switch.
    - Delcotron.
    - Starter solenoid.
13. Install pulley, fan blade, fan belt, radiator shroud and radiator.
14. Install and adjust hood.
15. Connect battery cables.
16. Fill with coolant, engine oil and transmission oil, then start engine and check for leaks.
17. Perform necessary adjustments and install air cleaner.

INTAKE AND EXHAUST MANIFOLDS

Chevrolet, Chevelle and Chevy II

Removal

1. Remove air cleaner.
2. Disconnect both throttle rods at bellcrank and remove throttle return spring.
3. Disconnect fuel and vacuum lines from carburetor.
4. Disconnect choke rod or choke cable from carburetor.
5. Remove carburetor.
6. Disconnect exhaust pipe at manifold flange.
7. Remove manifold attaching bolts and clamps, then remove manifolds as an assembly.

Repair

1. Clean gasket surfaces on cylinder head and manifolds.
2. Check for cracks in manifold castings.
3. If necessary to replace either intake or exhaust manifolds, separate them by removing one attaching bolt and two nuts at center of assembly. Reassemble manifolds using new gasket. Tighten finger tight and torque to specifications after assembly to cylinder head.
4. On L-6 engines transfer choke coil as outlined in Section 6M.

Installation

1. Position new gasket over manifold end studs on head and carefully install the manifold in position making sure the gaskets are in place.
2. Install bolts and clamps while holding manifold in place with hand.
3. Torque bolts to specifications.

   NOTE: On L-6 engines center bolt and end bolt torque differ.

4. Connect exhaust pipe to manifold using a new packing seal.
5. Install carburetor.
6. Connect fuel and vacuum lines to carburetor.
7. Adjust and connect choke rod or choke cable. Adjust and connect both throttle rods at bellcrank and install throttle return springs as outlined in Section 6M.
8. Install air cleaner, start engine, check for leaks and adjust carburetor.

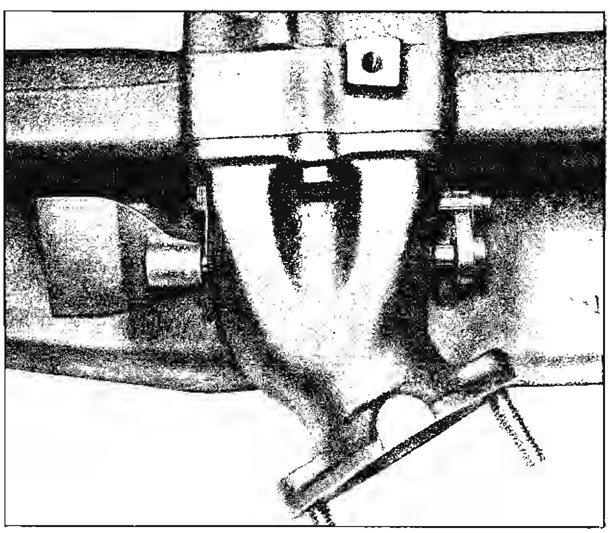


Fig. 3L—Manifold Heat Control Valve

MANIFOLD HEAT RISER VALVE

Chevrolet, Chevelle and Chevy II

Maintenance

Check manifold heat riser valve for freedom of operation. If shaft is sticking, free it up with GM Manifold Heat Control Solvent or its equivalent (fig. 3L).

CYLINDER HEAD ASSEMBLIES

Chevrolet, Chevelle and Chevy II

Removal

1. Drain cooling system and remove air cleaner.
2. Disconnect choke rod or choke cable, accelerator pedal rod at bellcrank on manifold, and fuel and vacuum lines at carburetor.
3. Disconnect exhaust pipe at manifold flange, then remove manifold bolts and clamps and remove manifolds and carburetor as an assembly.
4. Remove fuel and vacuum line retaining clip from water outlet and disconnect wire harness from temperature sending unit and coil leaving harness clear of clips on rocker arm cover.
5. Disconnect radiator hose at water outlet housing and battery ground strap at cylinder head.
6. Disconnect wires and remove spark plugs. On L-6 engines, disconnect coil to distributor primary wire leads at coil and remove coil.
7. Remove rocker arm cover. Back off rocker arm nuts, pivot rocker arms to clear push rods then remove push rods.
8. Remove cylinder head bolts, cylinder head and gasket. Place cylinder head on two blocks of wood to prevent damage.

Installation

CAUTION: The gasket surfaces on both the head and the block must be clean of any foreign matter and free of nicks or heavy scratches. Cylinder bolt threads in the block and threads on the cylinder head bolt must be cleaned. (Dirt will affect bolt torque.)

1. Coat both sides of a new gasket with a good sealer, spread the sealer thin and even. One method of applying the sealer that will assure the proper coat is with the use of a paint roller.

   NOTE: Too much sealer may hold the beads of the gasket away from the head or block.

2. Place the gasket in position over the dowel pins with the bead up (fig. 4L).
3. Carefully guide cylinder head into place over dowel pins and gasket (fig. 5L).
4. Coat threads of cylinder head bolts with sealing compound and install finger tight.

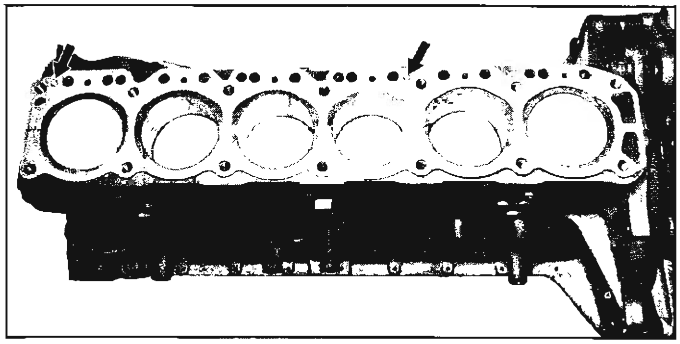


Fig. 4L—Installing Head Gasket

5. Tighten cylinder head bolts a little at a time, in the sequence shown until specified torque is reached (fig. 6L).
6. Install valve push rods down through openings of cylinder head and seat them in lifter sockets.
7. Install valve rocker arms, rocker arm balls and nuts and tighten rocker arm nuts until all push rod end play is taken up (fig. 7L).

NOTE: Whenever new valve rocker arms or valve rocker arm balls are being installed, coat surfaces lightly with Molykote or its equivalent.

8. Install thermostat housing, thermostat and water outlet using new gaskets then connect radiator hose.
9. Install temperature sending switch and torque to specifications.
10. Place new gaskets on spark plugs and install. Torque to specifications. If torque wrench is not available tighten finger tight and then one half turn.
11. Install coil on L-6 engines then connect temperature sending unit, coil primary wires, and connect battery ground cable at cylinder head.
12. Clean manifold gasket surfaces and install new gasket over manifold studs. Position manifold and slide it into place over the studs, making sure it seats against the gasket. Install bolts and clamps and torque to specifications.
13. Connect and adjust throttle linkage and choke rod or choke cable as outlined in Section 6M.
14. Connect fuel and vacuum lines to carburetor and install lines in clip at water outlet.
15. Fill cooling system and check for leaks.
16. Adjust valves as outlined under Valve Lifters.

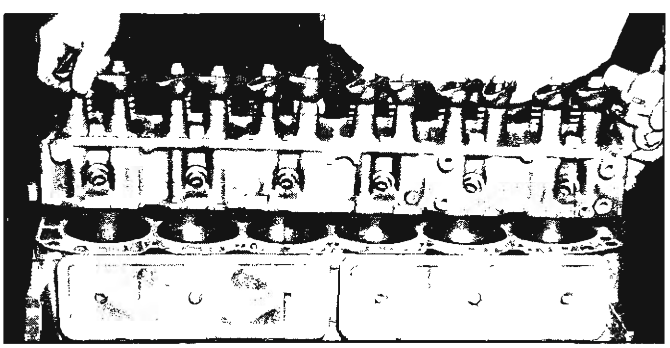


Fig. 5L—Installing Cylinder Head

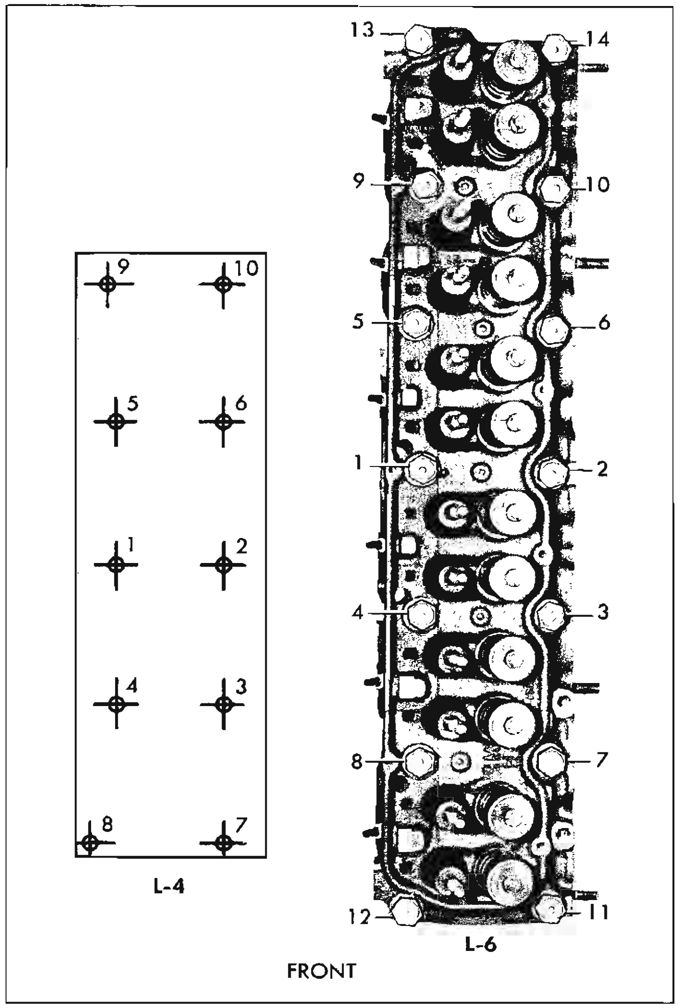


Fig. 6L—Cylinder Head Torque Sequence

17. Install rocker arm cover and position wiring harness in clips on cover.

VALVE LIFTERS (HYDRAULIC)

Chevrolet, Chevelle and Chevy II

Hydraulic valve lifters very seldom require attention. The lifters are extremely simple in design, readjustments are not necessary, and servicing of the lifters requires only that care and cleanliness be exercised in the handling of parts.

Locating Noisy Lifters

Locate a noisy valve lifter by using a piece of garden hose approximately four feet in length. Place one end of the hose near the end of each intake and exhaust valve with the other end of the hose to the ear. In this manner, the sound is localized making it easy to determine which lifter is at fault.

Another method is to place a finger on the face of the valve spring retainer. If the lifter is not functioning properly, a distinct shock will be felt when the valve returns to its seat.

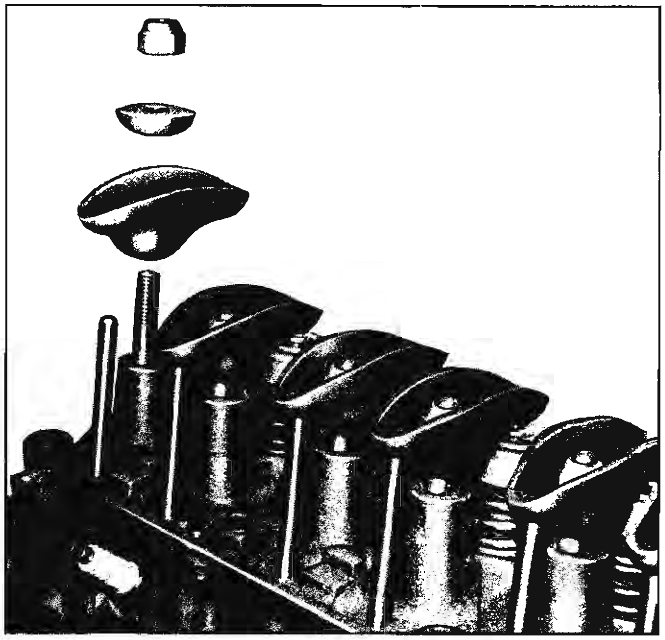


Fig. 7L—Rocker Arm Installation

The general types of valve lifter noise are as follows:

1. Hard Rapping Noise--Usually caused by the plunger becoming tight in the bore of the lifter body to such an extent that the return spring can no longer push the plunger back up to working position. Probable causes are:
   a. Excessive varnish or carbon deposit causing abnormal stickiness.
   b. Galling or "pick-up" between plunger and bore of lifter body, usually caused by an abrasive piece of dirt or metal wedging between plunger and lifter body.
2. Moderate Rapping Noise--Probable causes are:
   a. Excessively high leakdown rate.
   b. Leaky check valve seat.
   c. Improper adjustment.
3. General Noise Throughout the Valve Train--This will, in almost all cases, be a definite indication of insufficient oil supply, or improper adjustment.
4. Intermittent Clicking--Probable causes are:
   a. A microscopic piece of dirt momentarily caught between ball seat and check valve ball.
   b. In rare cases, the ball itself may be out-of-round or have a flat spot.
   c. Improper adjustment.

In most cases where noise exists in one or more lifters all lifter units should be removed, disassembled, cleaned in a solvent, reassembled, and reinstalled in the engine. If dirt, varnish, carbon, etc. is shown to exist in one unit, it more than likely exists in all the units, thus it would only be a matter of time before all lifters caused trouble.

Removal

1. Remove valve rocker arm cover.
2. Note threads showing above rocker arm nuts, then loosen nuts and pivot the rocker arms free of the push rods.
3. Disconnect spark plug wires at plugs and high tension lead from coil.
4. Remove distributor primary lead from coil, note distributor rotor position and remove distributor. (Mark distributor housing with chalk at point of rotor.)
5. Remove push rod covers and gaskets.
6. Remove push rods and valve lifters.

   NOTE: Valve lifters and push rods should be placed in a rack in their proper sequence so they can be reinstalled in the same positions in the cylinder block.

Installation and Adjustment

1. Install valve lifters in cylinder block.

   NOTE: Whenever new valve lifters and/or rocker arms and balls are being installed coat foot of valve lifters and surfaces of rocker arms and balls with Molykote or its equivalent.

2. Install push rods onto lifters and install push rod covers with a new gasket.
3. Install distributor (position rotor to mark on housing). Install spark plug and coil wires.
4. Pivot rocker arms in place and turn adjusting nuts the amount necessary to eliminate lash.
5. Adjust valve when lifter is on base circle of cam as follows:
   a. Crank engine until distributor rotor points to number one cylinder terminal with breaker points open. In this position the piston in number one cylinder is at top center on compression stroke with both lifters on base circle of cam and both valves can be adjusted.
   b. Turn adjusting nut until all lash is removed from valve train. This can be determined by checking push rod side play by hand while turning adjusting nut slowly (fig. 8L). At this point, turn adjusting nut one more turn to place the lifter plunger in center of its travel.
   c. Follow Steps a and b for each cylinder in order of firing order and adjust remaining valves one cylinder at a time. No further adjustment is necessary.
6. Using a new gasket, install valve rocker cover.
7. Connect distributor cap.
8. Start engine and check for oil leaks, then adjust timing and carburetor idle.

OIL PAN

Chevrolet

Removal

1. Disconnect battery positive cable.
2. Disconnect distributor cap from distributor (to prevent breaking distributor cap when engine is raised).
3. Remove fuel pump and discard gasket.

   NOTE: Fuel pump flex line need not be disconnected. Fuel pump need not be removed from engine compartment.

4. Remove through bolts from engine front mounts.
5. Drain radiator, then disconnect upper and lower radiator hoses at radiator.

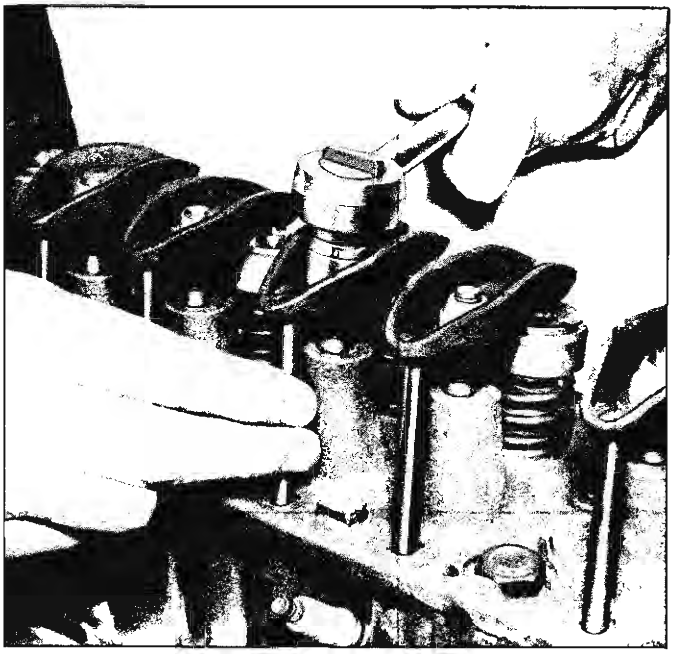


Fig. 8L—Valve Adjustment

6. Remove fan blade as outlined in Section 6K.
7. Raise vehicle then drain engine oil.
8. Disconnect and remove starter.
9. On vehicles equipped with automatic transmission, disconnect transmission cooler lines at transmission and remove convertor housing under pan.
10. Disconnect steering rod at idler lever then swing steering linkage for oil pan clearance.
11. Rotate crankshaft until timing mark on harmonic balancer is at 6:00 o'clock position.
12. Using a suitable jack (and a block of wood to prevent damaging oil pan), raise engine enough to insert 2" x 4" wood blocks under engine mounts (fig. 9L), then lower engine onto blocks.

NOTE: If 2" x 4" wood blocks are cut 5" long they can be used on all Chevrolet engines. The 5" length up for in-line engines and the 4" side up for V-8 engines.

13. Remove oil pan and discard gaskets and seals.

Installation

1. Thoroughly clean all gasket sealing surfaces.

NOTE: Use a new pan gasket set.

2. Install rear seal in rear main bearing cap.
3. Install front seal on crankcase front cover pressing tips into holes provided in cover.
4. Install side gaskets on cylinder block using gasket sealer as a retainer. (Side gasket tabs index into notches of front seal (fig. 10L).

NOTE: Screws into crankcase cover should be installed last. They are installed at an angle and holes line up after rest of pan bolts are snugged up.

5. If crankshaft was rotated while pan was off, place timing mark at 6:00 o'clock position.
6. Install oil pan and torque bolts to specifications.

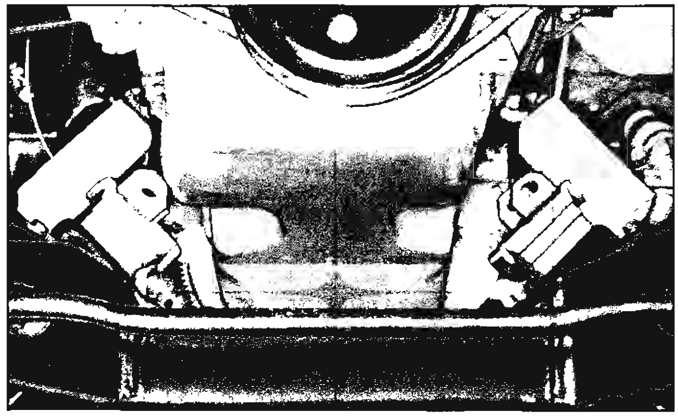


Fig. 9L—Engine Blocked For Pan Removal

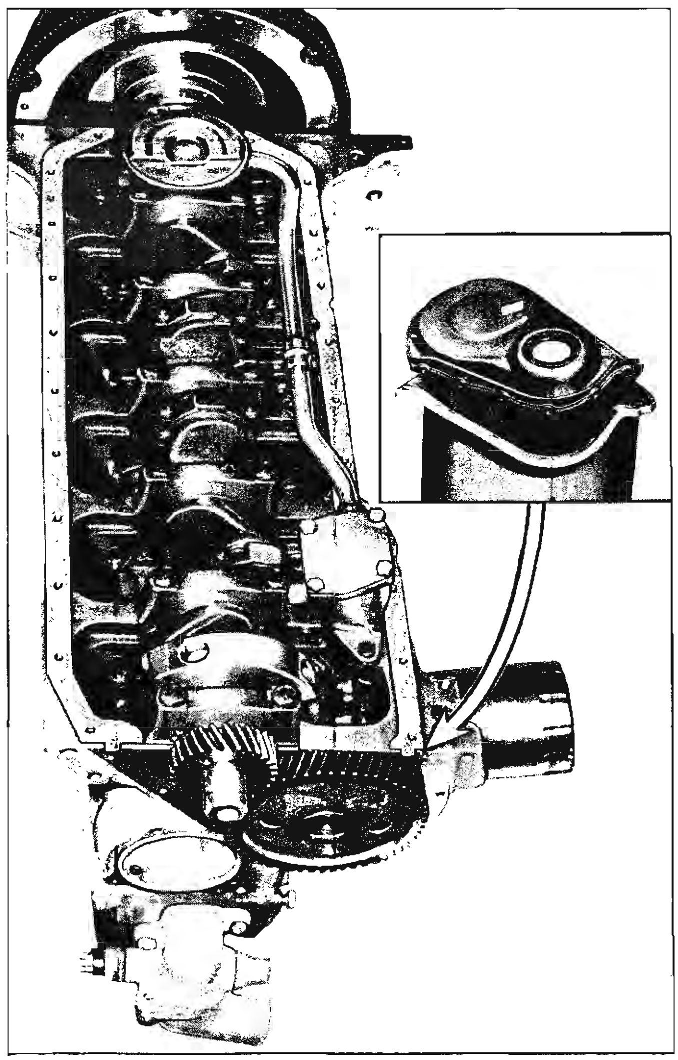


Fig. 10L—Pan Gasket and Seals

7. Using a suitable jack (and a block of wood to prevent damaging oil pan) raise engine enough to remove 2" x 4" wood blocks, then lower engine.
8. On vehicles equipped with automatic transmission install convertor housing under pan, then connect transmission cooler lines.
9. Install and connect starter.
10. Lower vehicle and install fan blades as outlined in Section 6K.
11. Connect upper and lower radiator hoses.
12. Install through bolts in engine front mounts.
13. Using a new gasket, install and connect fuel pump.
14. Connect distributor cap and battery positive cable.
15. Fill radiator with coolant and fill engine with oil, then start engine and check for leaks.

Chevelle

Removal

1. Remove engine from vehicle as outlined.
2. Place engine on jack stands, one at each front mount and one at transmission extension.

CAUTION: Leave engine lift attached to engine. Do not remove all weight of engine from engine lift.

3. On vehicles equipped with automatic transmissions remove convertor housing under pan.
4. Remove starter.
5. Remove oil pan and discard gaskets and seals.

Installation

1. Thoroughly clean all gasket sealing surfaces.

NOTE: Use a new oil pan gasket set.

2. Install rear seal in rear main bearing cap.
3. Install front seal on crankcase front cover pressing tips into holes provided in cover.
4. Install side gaskets on cylinder block using gasket sealer as a retainer. (Side gasket tabs index into notches of front seal (fig. 10L).
5. Install oil pan and torque to specifications.

NOTE: Screws into crankcase front cover should be installed last. They are installed at an angle and holes line up after rest of pan bolts are snugged up.

6. On vehicles equipped with automatic transmission, install convertor housing under pan.
7. Install starter.
8. Install engine as outlined.

Chevy II

Removal

1. Disconnect battery positive cable.
2. Drain engine oil.
3. Disconnect then remove starter.
4. Disconnect steering idler arm bracket at right hand frame rail and swing steering linkage down for pan clearance.
5. On L-6 engines, remove front crossmember.

NOTE: On station wagon let stabilizer bar hang while removing crossmember.

6. Remove oil pan and discard gaskets and seals.

Installation

1. Thoroughly clean all gasket sealing surfaces.

NOTE: Use a new pan gasket set.

2. Install rear seal in rear main bearing cap.
3. Install front seal on crankcase front cover pressing tips into holes provided in cover.
4. Install side gaskets on cylinder block using gasket sealer as a retainer. (Side gasket tabs index into notches of front seal. (fig. 10L).
5. Install oil pan and torque to specifications.

NOTE: Screws into crankcase cover should be installed last. They are installed at an angle and holes line up after rest of pan bolts are snugged up.

6. On L-6 engines, install front crossmember.
7. Connect steering idler arm.
8. Install starter and connect wires.
9. Connect battery cable, fill with oil, start engine and check for leaks.

OIL PUMP

Chevrolet, Chevelle and Chevy II

Removal

1. Remove oil pan as outlined.
2. Remove two flange mounting bolts, pick-up pipe bolt, then remove pump and screen as an assembly.

Installation

1. Align oil pump drive shafts to match with distributor tang, then install oil pump to block positioning flange over distributor lower bushing. Use no gasket.

NOTE: Oil pump should slide easily into place, if not, remove and reposition slot to align with distributor tang.

2. Install oil pan using new gaskets and seals as previously outlined.

CRANKSHAFT PULLEY AND HUB

Chevy II (With L-4 Engine)

Removal

1. Drain radiator and disconnect upper and lower radiator hoses at radiator.
2. Remove radiator core and shroud as outlined in Section 13.
3. Remove fan belt. Remove crankshaft pulley from pulley hub.
4. Install puller Tool J-6978 to pulley hub with two 3/8" x 2" and one 5/16" x 2" bolts and remove hub (fig. 11L). Then remove puller tool.

Installation

1. Coat oil seal contact area on hub with engine oil position hub over crankshaft and key and start hub into position with a mallet. Using Tool J-5590 drive onto crankshaft until it bottoms against crankshaft gear.

NOTE: Crankshaft extends slightly through hub and a tool is necessary to drive hub completely into bottomed position.

2. Install pulley onto hub.

NOTE: There are two 3/8" holes and one 5/16" hole that must be matched on hub in order to properly position timing mark (fig. 12L).

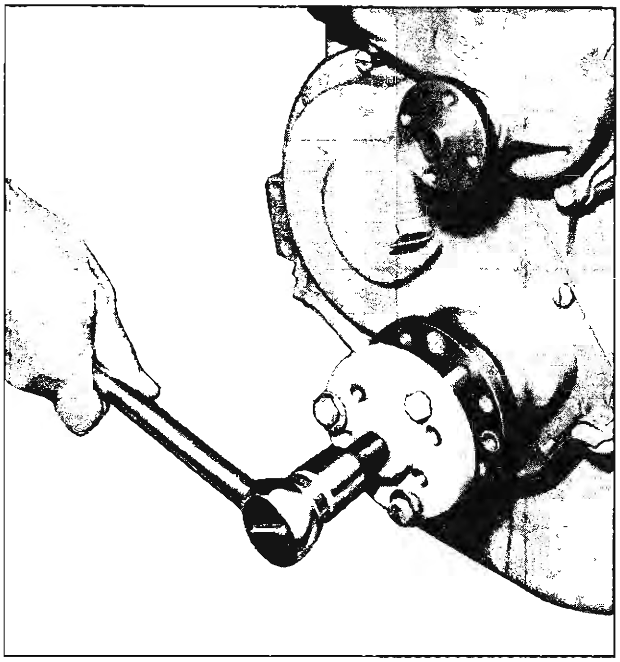


Fig. 11L—Removing Crankshaft Pulley Hub

3. Install fan belt and adjust using strand tension gauge.
4. Install radiator core and shroud as outlined in Section 13.
5. Connect radiator hoses.
6. Fill cooling system, start engine and check for leaks.

HARMONIC BALANCER

Chevrolet, Chevelle and Chevy II

Removal

1. Drain radiator and disconnect radiator hoses at radiator.

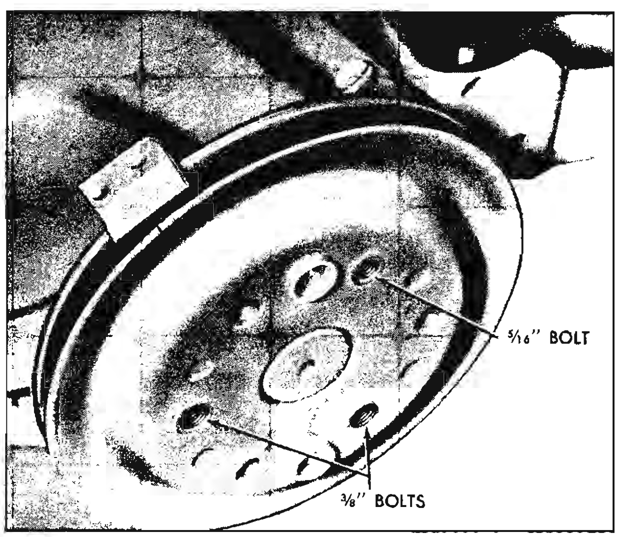


Fig. 12L—Installing Pulley to Hub

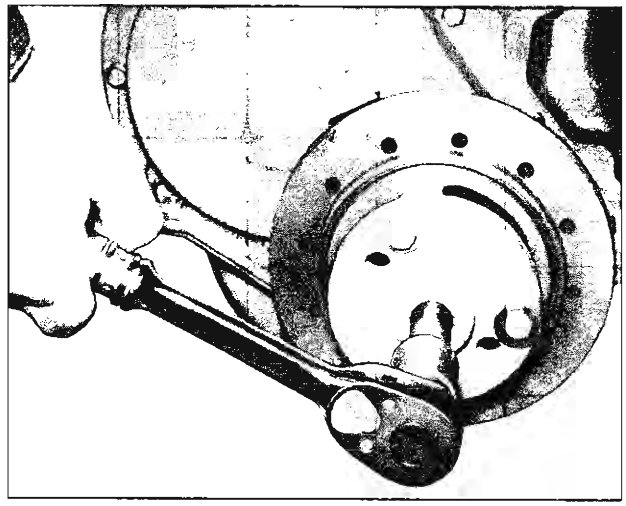


Fig. 13L—Removing Harmonic Balancer

2. Remove radiator core, as outlined in Section 13.
3. Remove fan belt and (if so equipped) accessory drive pulley and belt.
4. Install Tool J-6978 to balancer and turn puller screw to remove balancer (fig. 13L). Then remove tool from balancer.

Installation

1. Coat front cover oil seal contact area of balancer with engine oil.
2. Attach balancer installer tool to balancer (fig. 14L).

   NOTE: This tool is used differently for 8 cylinder engines. Assemble as shown (fig. 15L) for use here.

3. Position balancer on crankshaft and drive into position until it bottoms against crankshaft gear. Remove installer tool.
4. Install fan belt and adjust using strand tension gauge.
5. If so equipped, install accessory drive pulley and belt.
6. Install radiator core as outlined in Section 13.
7. Connect radiator hoses.
8. Fill cooling system and check for leaks.

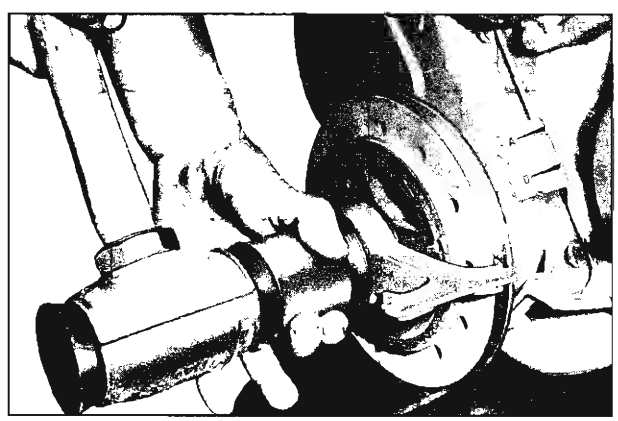


Fig. 14L—Installing Harmonic Balancer

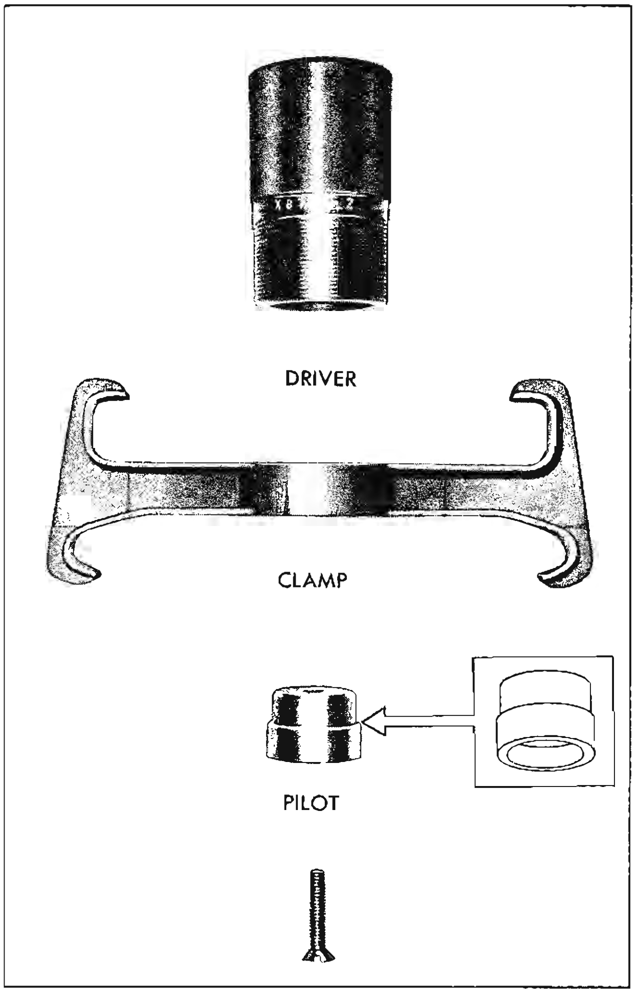


Fig. 15L—Installer Tool Assembly

CRANKCASE FRONT COVER

Chevrolet, Chevelle and Chevy II

Removal

1. Remove oil pan as outlined.
2. Remove crankshaft pulley and hub or harmonic balancer as outlined.
3. Remove crankshaft front cover attaching screws, remove cover and gasket.

Installation

1. Clean gasket surfaces on block and crankcase front cover.
2. Install centering Tool J-0966 over end of crankshaft (fig. 16L) or install centering Tool J-21742 in crankcase front cover seal (fig. 17L).
3. Coat the gasket with gasket sealer and place in position on cover, then install crankcase front cover to block and torque to specifications.
4. Remove centering tool.

NOTE: It is important that centering tool be used to align crankcase front cover so that crankshaft hub or harmonic balancer installation

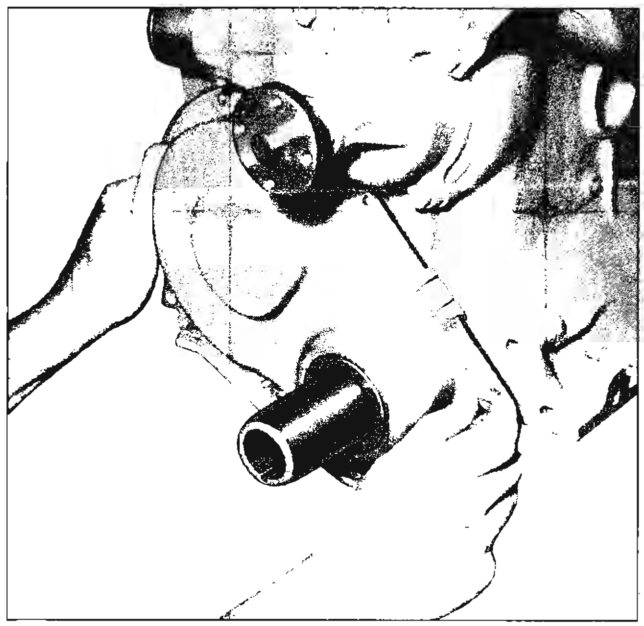


Fig. 16L—Crankcase Front Cover Alignment with J-0966

will not damage seal and to position seal to seal evenly around the balancer or hub surface.

5. Install crankshaft hub and/or harmonic balancer as outlined.
6. Install oil pan with new gaskets and seals as outlined.

CAMSHAFT

Chevrolet and Chevy II

Removal

1. Drain crankcase, radiator and oil pan.
2. Remove radiator as outlined in Section 13.
3. Remove grille assembly as outlined in Section 13.
4. Remove valve cover and gasket, loosen valve rocker arm nuts and pivot rocker arms clear of push rods. Discard gasket.
5. Remove distributor noting position of rotor.
6. Remove coil then remove push rod covers and gaskets. Remove push rods and valve lifters. Discard gaskets.

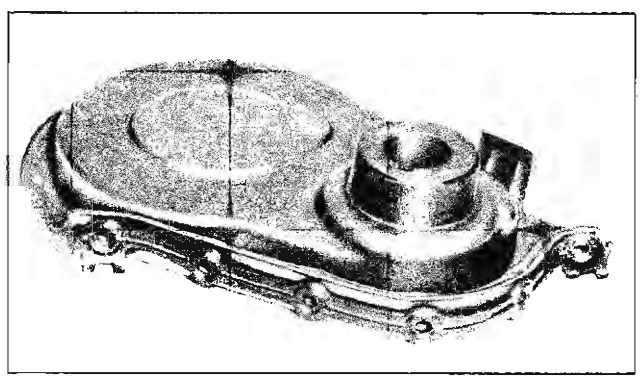


Fig. 17L—J-21742 Centering Tool in Cover

V-8 ENGINES

(283 AND 327 CU. IN.)

GENERAL DESCRIPTION

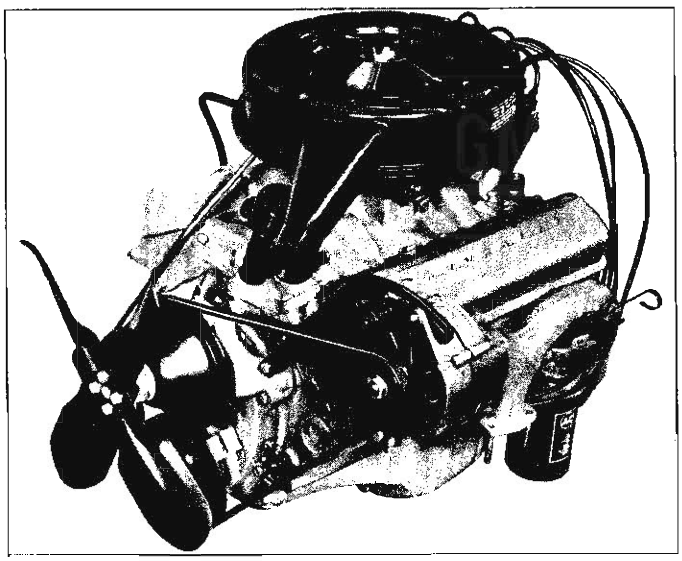


Fig. 1V—V-8 Engine (283 cu. in.)

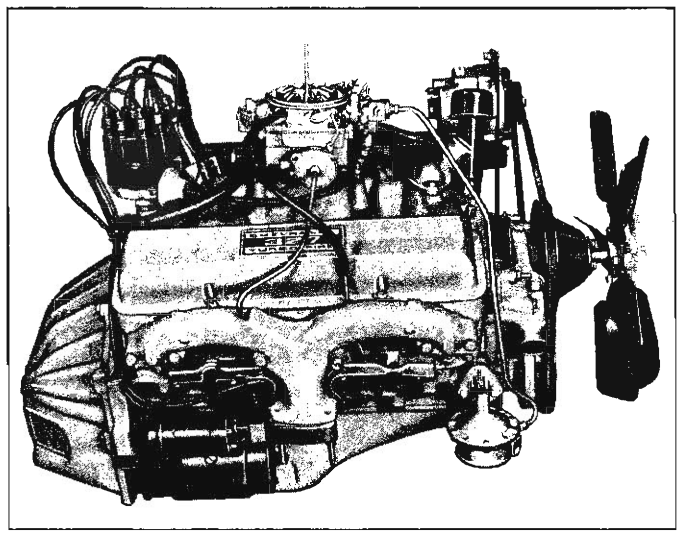


Fig. 2V—V-8 Engine (327 cu. in.)

The V-8 engines covered in this section are the 283 cu. in. and 327 cu. in. engines used in Chevrolet, Chevelle and Chevy II (figs. 1V and 2V).

This section covers the removal and installation of engine assemblies, the removal and installation of engine components and some maintenance procedures. For all service to engine components (after removal) and removal of some subassemblies, refer to Section 6 of the Overhaul Manual.

COMPONENT REPLACEMENT

ENGINE ASSEMBLIES

Chevrolet, Chevelle and Chevy II

Removal

1. Drain cooling system and engine oil.
2. Remove air cleaner and disconnect battery cables at battery, then remove fuel pump.
3. Scribe around hinges, then remove hood.
4. Remove radiator, radiator shroud and fan blade.
5. Disconnect wires at:
   - Starter solenoid
   - Delcotron
   - Temperature switch
   - Oil pressure switch
   - Coil
6. Disconnect:
   - Accelerator linkage at pedal lever.
   - Exhaust pipes at manifold flanges.

- Vacuum line to power brake unit at manifold (if so equipped)
- Oil pressure line (if so equipped)
- Power steering pump lines at pump end (if so equipped).

7. Raise vehicle and place on jack stands.
8. If plug for driveshaft opening in transmission is not available, drain transmission.
9. Remove driveshaft.
10. Disconnect:
    - Shift linkage at transmission.
    - Speedometer cable at transmission.
11. On synchromesh equipped vehicles, disconnect clutch linkage at cross-shaft then remove cross-shaft engine bracket.
12. Remove valve rocker arm covers and attach lifting device.
13. Remove front mount through bolts.
14. Raise engine to take weight off front mounts, then remove rear mount bolts.
15. Raise engine to take weight off rear mount, then remove crossmember.

    NOTE: On Chevrolet vehicles it will be necessary to remove mount from transmission before crossmember can be removed.
16. Remove engine-transmission assembly from vehicle as a unit.
17. Remove transmission (and clutch):

Synchromesh Transmission

a. Remove clutch housing cover plate screws.
b. Remove bolts attaching the clutch housing to engine block then remove transmission and clutch housing as a unit.

NOTE: Support the transmission, as the last mounting bolt is removed, and as it is being pulled away from the engine, to prevent damage to clutch disc.

c. Remove starter and clutch housing cover plate.
d. Loosen clutch mounting bolts a turn at a time (to prevent distortion of clutch cover) until the spring pressure is released. Remove all bolts, clutch disc and pressure plate assembly.

Automatic Transmission

a. Lower engine, secured by the hoist, and support engine on blocks.
b. Remove starter and converter housing under pan.
c. Remove flywheel-to-converter attaching bolts.
d. Support transmission on blocks.
e. Remove transmission-to-engine mounting bolts.
f. With the hoist attached, remove blocks from the engine only and slowly guide the engine from the transmission.

18. Mount engine in stand.

Installation

1. Attach lifting device to engine and remove engine from engine stand.
2. Install transmission (and clutch):

Synchromesh Transmission

a. Install the clutch on flywheel as outlined in Section 7.
b. Install clutch housing cover and starter.
c. Install transmission and clutch housing as outlined in Section 7.
d. Install clutch housing cover screws and tighten securely.

Automatic Transmission

a. Position engine adjacent to the transmission and align the convertor with the flywheel.
b. Bolt transmission to engine, then raise engine and transmission assembly and install flywheel to convertor attaching bolts.
c. Install convertor housing under pan and starter.

3. Tilt and lower engine and transmission assembly into the chassis as a unit, guiding engine to align front mounts with frame supports.
4. Install front mount bolts and tighten securely.
5. Raise engine enough to install rear crossmember, then install crossmember, install rear mount, lower engine and tighten rear mount securely.
6. Remove lifting device and install rocker arm covers with new gaskets.
7. On synchromesh equipped vehicles, install clutch cross-shaft engine bracket, then adjust and connect clutch as outlined in Section 7.
8. Connect:
    - Speedometer cable.
    - Shift linkage at transmission.
9. Install drive shaft.
10. Remove jack stands and lower vehicle.
11. Connect:
    - Power steering pump lines (if disconnected).
    - Vacuum line to power brake unit (if disconnected).
    - Oil pressure line (if disconnected).
    - Exhaust pipes at manifold flanges.
    - Accelerator linkage at pedal lever.
12. Connect wires at:
    - Coil.
    - Oil pressure switch.
    - Temperature switch.
    - Delcotron.
    - Starter solenoid.
13. Install pulley, fan blade, fan belt, radiator shroud and radiator.
14. Install and adjust hood.
15. Connect battery cables, then install and connect fuel pump.
16. Fill with coolant, engine oil and transmission oil, then start engine and check for leaks.
17. Perform necessary adjustments and install air cleaner.

INTAKE MANIFOLD

Chevrolet, Chevelle and Chevy II

Removal

1. Drain radiator and remove air cleaner.
2. Disconnect:
    a. Battery cables at battery.
    b. Upper radiator and heater hose at manifold.
    c. Accelerator linkage at pedal lever.
    d. Fuel line at carburetor.
    e. Wires at temperature sending switch and coil (both sides).
    f. Power brake hose at carburetor base.
    g. Spark advance hose at distributor.

3. Remove distributor cap from distributor, remove distributor clamp then note rotor position, remove distributor and position distributor cap rearward clear of manifold.
4. Remove coil, then disconnect crankcase ventilation hose at adapter on block.
5. Remove manifold-to-head attaching bolts, then remove manifold (with carburetor on) from engine and discard gaskets and seals.
6. If manifold is to be replaced, transfer:
   a. Carburetor and carburetor mounting studs.
   b. Oil filler tube.
   c. Temperature sending switch.
   d. Water outlet and thermostat (use new gasket).
   e. Heater hose adapter.

Installation

1. Clean gasket and seal surfaces of manifold, cylinder heads and block.
2. Install manifold end seals on block with tabs as shown (fig. 3V).
3. Install side gaskets on cylinder heads using sealing compound around water passages.

   NOTE: When installing the intake manifold, any sliding to align bolt holes may roll the end seals out of position. A pilot (wood or metal) used in distributor opening can be made to help install the manifold squarely. Dimensions of pilot shown in Figure 4V.

4. Install pilot in distributor opening in block and install manifold over pilot to guide it squarely in place.

   NOTE: If pilot is not used, be sure end seals stay in place. Check position of tabs that stick out.

5. Install manifold bolts, remove the pilot and torque bolts to specifications in proper sequence (fig. 5V).

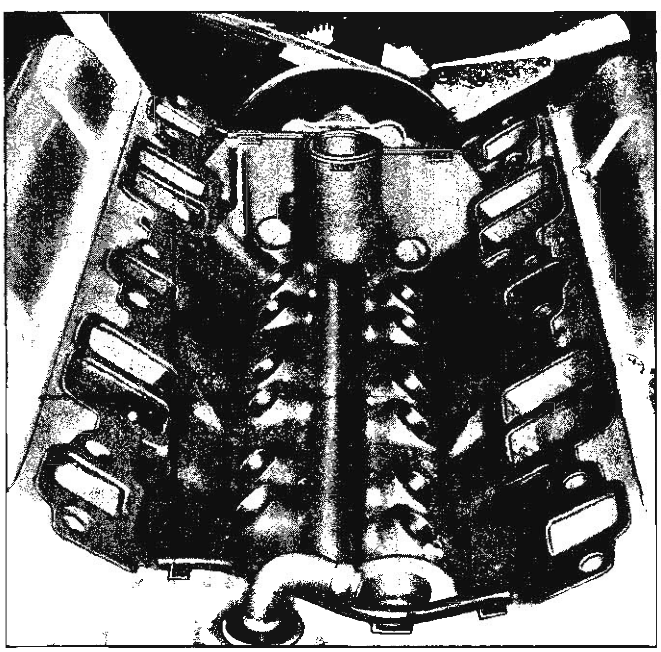


Fig. 3V—Manifold Gasket and Seal Location

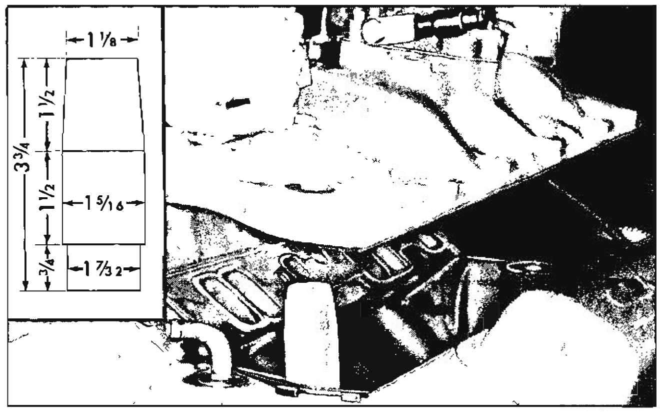


Fig. 4V—Installing Manifold (Using Pilot Tool)

6. Install and connect coil.
7. Connect crankcase ventilation hose.
8. Install distributor with rotor in approximately the same position as when removed.
9. Connect:
   a. Battery cables at battery.
   b. Upper radiator and heater hose at manifold.
   c. Accelerator linkage at pedal lever.
   d. Fuel line at carburetor.
   e. Wires at temperature sending switch and coil (both sides).
   f. Power brake hose at carburetor base.
   g. Spark advance hose at distributor.
10. Fill with coolant, start engine, check for leaks and adjust timing and carburetor idle speed and mixture.

EXHAUST MANIFOLDS

Chevrolet, Chevelle and Chevy II

Removal

1. Disconnect battery ground cable at battery.
2. On left exhaust manifold, disconnect and remove Delcotron.

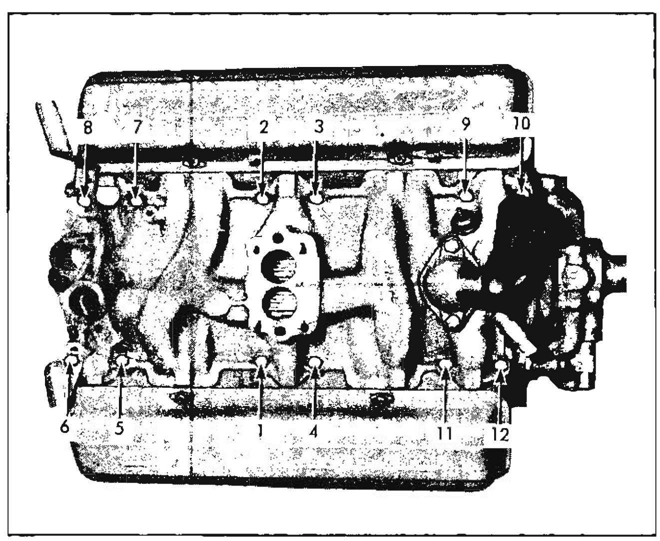


Fig. 5V—Manifold Torque Sequence

3. Remove exhaust manifold flange nuts, then lower exhaust pipe assembly.
4. Bend french lock tabs, remove end bolts then remove center bolts and remove manifold from engine.

NOTE: A 9/16 thin-wall 6 point socket, sharpened at the leading edge, then started on the head of the bolt and tapped in place with a hammer, simplifies bending of french locks.

Installation

1. Clean mating surfaces on manifold and head, then install manifold in position and install center bolts.
2. Install end bolts with french locks and washers under them.
3. Torque center bolts to specifications, then torque end bolts to specifications, and bend french lock tabs to lock end bolts.

NOTE: End bolt and center bolt torque differ.

4. Using a new flange gasket install exhaust pipe to manifold flange.
5. Install and connect Delcotron.
6. Connect the battery ground cable.
7. Start engine and check for leaks.

CYLINDER HEAD ASSEMBLIES

Chevrolet, Chevelle and Chevy II

Removal

1. Remove intake and exhaust manifolds as outlined.
2. Remove rocker arm covers. Discard gaskets.
3. Back off rocker arm nuts, pivot rocker arms to clear push rods and remove push rods.
4. Remove cylinder head bolts, cylinder heads and discard gaskets.

Installation

CAUTION: The gaskets surfaces on both the head and the block must be clean of any foreign matter and free of nicks or heavy scratches. Cylinder bolt threads in the block and threads on the cylinder head bolts must be clean. (Dirt will affect bolt torque.)

1. Coat both sides of a new gasket with a good sealer. Spread the sealer thin and even. One method of applying the sealer that will assure the proper coat is with the use of a paint roller.

NOTE: Too much sealer may hold the bead of the gasket away from the head or block.

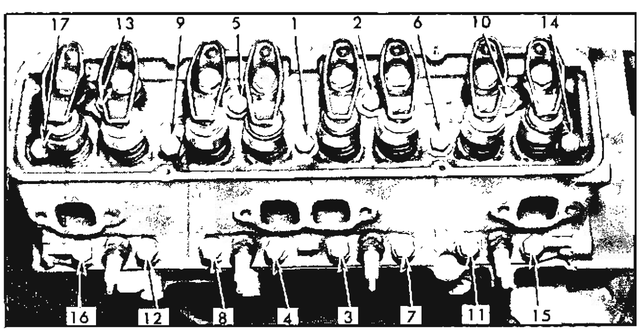


Fig. 6V—Cylinder Head Torque Sequence

2. Place the gasket in position over the dowel pins with the bead up.
3. Carefully guide the cylinder head into place over the dowel pins and gasket.
4. Coat threads of cylinder head bolts with sealing compound and install bolts finger tight.

NOTE: Two intermediate length bolts are used; one at number 17 position and one at number 14 position (fig. 6V).

5. Tighten each cylinder head bolt a little at a time in the sequence shown until the specified torque is reached (fig. 6V).
6. Install valve push rods down through opening of cylinder head and seat them in lifter sockets.
7. Install valve rocker arms, rocker arm balls and nuts and tighten rocker arm nuts until all push rod end play is taken up.

NOTE: Whenever new valve rocker arms or valve rocker arm balls are being installed, coat surfaces lightly with Molykote or its equivalent.

8. Clean gasket surfaces of intake and exhaust manifolds and install as outlined.
9. Install heat riser valve, then connect exhaust pipes at manifold flanges using new gaskets and packing.
10. Clean, inspect and set spark plug gap and install, using new gaskets. Torque to specifications then connect wires.
11. Install distributor and connect distributor and coil wiring. Roughly set timing, by adjusting distributor so points just break with engine in number one firing position.
12. Connect and adjust throttle linkage as outlined in Section 6M.
13. Connect fuel and vacuum lines to carburetor and connect temperature sending unit wire.
14. Inspect and install air cleaner and connect crankcase ventilation hose.
15. Fill cooling system and check leaks.
16. Adjust valves as outlined under Valve Lifters.
17. Install rocker arm covers with new gaskets.
18. Start engine, check for leaks and adjusting timing and carburetor idle speed and mixture

VALVE LIFTERS

Chevrolet, Chevelle and Chevy II

Hydraulic valve lifters very seldom require attention. The lifters are extremely simple in design, readjustments are not necessary, and servicing of the lifters requires only that care and cleanliness be exercised in the handling of parts.

Locating Noisy Lifters (Hydraulic)

Locate a noisy valve lifter by using a piece of garden hose approximately four feet in length. Place one end of the hose near the end of each intake and exhaust valve with the other end of the hose to the ear. In this manner, the sound is localized making it easy to determine which lifter is at fault.

Another method is to place a finger on the face of the valve spring retainer. If the lifter is not functioning properly, a distinct shock will be felt when the valve returns to its seat.

The general types of valve lifter noise are as follows:

1. Hard Rapping Noise--Usually caused by the plunger becoming tight in the bore of the lifter body to such an extent that the return spring can no longer push the plunger back up to working position. Probable causes are:
   a. Excessive varnish or carbon deposit causing abnormal stickiness.
   b. Galling or "pick-up" between plunger and bore of lifter body usually caused by an abrasive piece of dirt or metal wedging between plunger and lifter body.
2. Moderate Rapping Noise--Probable causes are:
   a. Excessively high leakdown rate.
   b. Leaky check valve seat.
   c. Improper adjustment.
3. General Noise Throughout the Valve Train--This will, in almost all cases, be a definite indication of insufficient oil supply, or improper adjustment.
4. Intermittent Clicking—Probable causes are:
   a. A microscopic piece of dirt momentarily caught between ball seat and check valve ball.
   b. In rare cases, the ball itself may be out-of-round or have a flat spot.
   c. Improper adjustment.

In most cases where noise exists in one or more lifters all lifter units should be removed, disassembled, cleaned in a solvent, reassembled, and reinstalled in the engine. If dirt, varnish, carbon, etc. is shown to exist in one unit, it more than likely exists in all the units, thus it would only be a matter of time before all lifters caused trouble.

Removal

1. Remove rocker arm covers and discard gaskets.
2. Remove intake manifold as outlined.
3. Back off rocker arm nuts until arms may be pivoted away from push rods. Remove push rods.
4. Remove valve lifters.

NOTE: Valve lifters should be placed in a rack in their proper sequence so they can be installed in their same positions in the cylinder block.

Installation and Adjustment (Hydraulic)

NOTE: Whenever new valve lifters are being installed coat foot of valve lifters with Molykote or its equivalent.

1. Install valve lifters.
2. Install intake manifold as outlined.
3. Install push rods.
4. Pivot rocker arms to engage push rods and adjust valves.
5. Adjust valves as follows:
   a. Crank engine until mark on harmonic balancer lines up with center or "0" mark on the timing tab fastened to the front end cover and the engine is in the number 1 firing position. This may be determined by placing fingers on the number 1 cylinder valves as the mark on the balancer comes near the "0" mark on the front end cover. If the valves are not moving, the engine is in the number 1 firing position. If the valves move as the mark comes up to the timing tab, the engine is in number 6 firing position and should be turned over one more time to reach the number 1 position.
   b. Valve adjustment is made by backing off the adjusting nut (rocker arm stud nut) until there is play in the valve push rod and then tighten nut to just remove all push rod to rocker arm clearance. This may be determined by rotating push rod with fingers as the nut is tightened (fig. 7V). When rod does not readily move in relation to the rocker arm, the clearance has been eliminated. The adjusting nut should then be tightened an additional 1 turn to place the hydraulic lifter plunger in the center of its travel. No other adjustment is required.
   c. With the engine in the number 1 firing position as determined above, the following valves may be adjusted.
      Exhaust--1,3,4,8
      Intake--1,2,5,7
   d. Crank the engine one revolution until the pointer "0" mark and harmonic balancer mark are again in alignment. This is number 6 firing position. With the engine in this position, the following valves may be adjusted.
      Exhaust--2,5,6,7
      Intake--3,4,6,8
6. Install rocker arm covers, using new gaskets.
7. Start engine and check for oil leaks.

Installation and Adjustment (Mechanical)

1. Install valve lifters.
2. Install intake manifold as outlined.
3. Install push rods.
4. Pivot rocker arms to engage push rods.
5. Make a (cold) preliminary valve adjustment as follows:
   a. Crank engine until mark on harmonic balancer lines up with center of "0" mark on the timing tab and the engine is in the number 1 firing

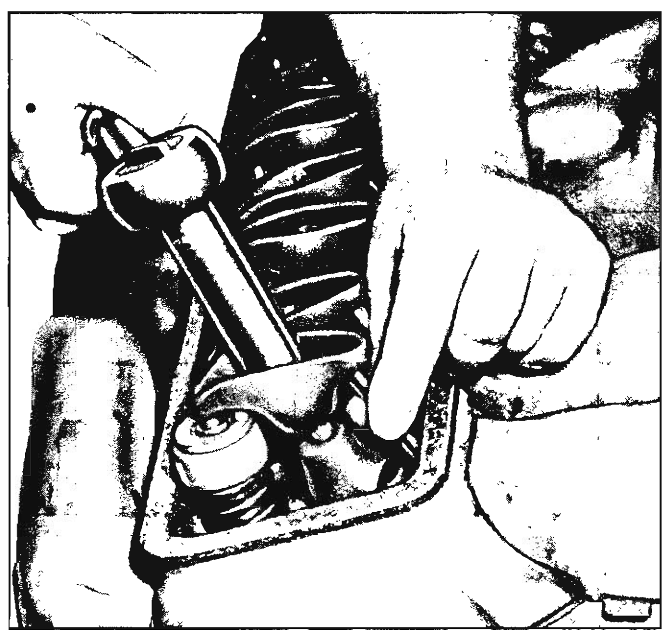


Fig. 7V—Valve Adjustment

position. This may be determined by placing fingers on the number 1 cylinder valves as the mark on the balancer comes near the "0" mark on the front end cover. If the valves are not moving, the engine is in the number 1 firing position. If the valves move as the mark comes up to the timing tab, the engine is in number 6 firing position and crankshaft should be rotated one more turn to reach the number 1 position.

b. With the engine in the number 1 firing position as determined above, adjust the following valves to specifications with a feeler gauge.
   Exhaust--1,3,4,8
   Intake--1,2,5,7
c. Crank the engine one revolution until the pointer "0" mark and harmonic balancer mark are again in alignment. This is number 6 firing position. With the engine in this position, adjust the following valves to specifications with a feeler gauge.
   Exhaust--2,5,6,7
   Intake--3,4,6,8

6. Install rocker arm covers, using new gaskets.
7. Start engine and check for oil leaks. Allow engine to warm up for 20-30 minutes.
8. Stop engine, remove rocker covers, and restart engine then adjust valves (hot and running) to specifications with a feeler gauge.
9. Stop engine, reinstall rocker covers, start engine then check for oil leaks and adjust carburetor idle and mixture.

OIL PAN

Chevrolet

Removal

1. Disconnect battery positive cable.
2. Disconnect distributor cap from distributor (to prevent breaking distributor cap when engine is raised).
3. Remove fuel pump and discard gasket.

   NOTE: Fuel pump flex line need not be disconnected. Fuel pump need not be removed from engine compartment.

4. Remove through bolts from engine front mounts.
5. Drain radiator, then disconnect upper and lower radiator hoses at radiator.
6. Remove fan blade as outlined in Section 6K.
7. Raise vehicle then drain engine oil.
8. Disconnect and remove starter.
9. On vehicles equipped with automatic transmission, disconnect transmission cooler lines at transmission and remove convertor housing under pan.
10. Disconnect steering rod at idler lever then swing steering linkage for oil pan clearance.
11. Rotate crankshaft until timing mark on harmonic balancer is at 6:00 o'clock position.
12. Using a suitable jack (and a block of wood to prevent damaging oil pan), raise engine enough to insert 2" x 4" wood blocks under engine mounts (fig. 8V), then lower engine onto blocks.

    NOTE: If 2" x 4" wood blocks are cut 5" long they can be used on all Chevrolet engines. The 5" length up for In-line engines and the 4" side up for V-8 engines.

13. Remove oil pan and discard gaskets and seals.

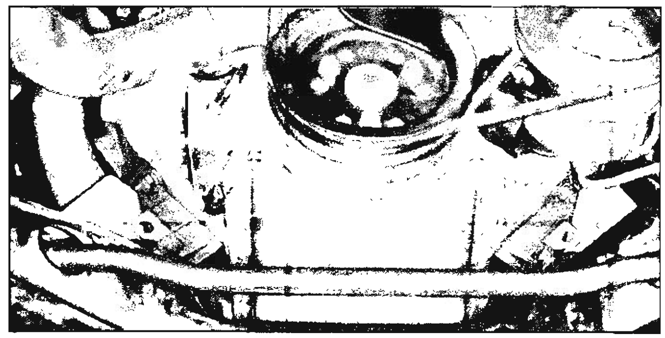


Fig. 8V—Engine Blocked for Pan Removal

Installation

1. Thoroughly clean all gasket sealing surfaces.

   NOTE: Use a new pan gasket set.

2. Install side gaskets on pan rails, using gasket sealer as a retainer (rear end of side gaskets lap rear end gasket). Tuck front end of side gaskets into gap between front end cover seal groove and cylinder block.
3. Install rear oil pan sealing groove in rear main bearing cap. Tuck ends into groove openings in cylinder block.
4. Install oil pan front seal in groove in crankcase front cover, with ends butting side gaskets.
5. If crankshaft was rotated while pan was off, place timing mark at 6:00 o'clock position.
6. Install oil pan and torque bolts to specifications.
7. Using a suitable jack (and a block of wood to prevent damaging oil pan) raise engine enough to remove 2" x 4" wood blocks, then lower engine.
8. On vehicles equipped with automatic transmission install convertor housing under pan, then connect transmission cooler lines.
9. Install and connect starter.
10. Lower vehicle and install fan blades as outlined in Section 6K.
11. Connect upper and lower radiator hoses.
12. Install through bolts in engine front mounts.
13. Using a new gasket, install and connect fuel pump.
14. Connect distributor cap and battery positive cable.
15. Fill radiator with coolant and fill engine with oil, then start engine and check for leaks.

Chevelle

Removal

1. Remove engine from vehicle as outlined.
2. Lower engine onto jack stands, one at each front mount and one at transmission extension.

   CAUTION: Leave engine lift attached to engine. Do not remove all weight of engine off engine lift.

3. Remove starter.
4. On vehicles equipped with automatic transmission remove convertor housing under pan.
5. Remove oil pan and discard gaskets and seals.

Installation

1. Thoroughly clean all gasket sealing surfaces.

   NOTE: Use a new oil pan gasket set.

2. Install side gaskets on pan rails, using gasket sealer as a retainer (rear end of side gaskets lap rear end gasket). Tuck front end of side gaskets into gap between front end cover seal groove and cylinder block.
3. Install rear oil pan sealing groove in rear main bearing cap groove. Tuck ends into groove openings in cylinder block.
4. Install oil pan and torque bolts to specifications.
5. On vehicles equipped with automatic transmission, install convertor housing under pan.
6. Install starter.
7. Install engine as outlined.

Chevy II

Removal

1. Disconnect battery positive cable.
2. Drain engine oil.
3. Disconnect and remove starter.
4. Disconnect steering idler arm bracket at right hand frame rail and swing steering linkage down for pan clearance.
5. Disconnect exhaust pipes at manifolds and allow pipes to hang free.
6. Remove oil pan and discard gaskets and seals.

Installation

1. Thoroughly clean all gasket sealing surfaces.

NOTE: Use a new pan gasket set.

2. Install rear oil pan seal in groove in rear main bearing cap. Tuck ends into groove openings in cylinder block.
3. Install side gaskets on pan rails, using gasket sealer as a retainer. (Rear end of side gaskets lap rear end gasket.) Tuck front ends of side gaskets into gap between front end cover seal groove and cylinder block.
4. Install oil pan front seal in groove in front end cover, with ends butting side gaskets.
5. Install oil pan and torque bolts to specifications.
6. Connect exhaust pipe to manifold flange using new packing seals.
7. Connect steering idler arm bracket.
8. Connect starter wires.
9. Connect battery cable.
10. Fill with oil, start engine and check for leaks.

OIL PUMP

Chevrolet, Chevelle and Chevy II

Removal

1. Remove oil pan as outlined.
2. Remove pump to rear main bearing cap bolt and remove pump, extension shaft and collar.

Installation

1. Assemble pump and extension shaft to rear main bearing cap, aligning slot on top end of extension shaft with drive tang on lower end of distributor drive shaft.
2. Install pump to rear bearing cap bolt and torque to specifications.

NOTE: Install oil pump screen with bottom edge parallel to oil pan rails (fig. 9V).

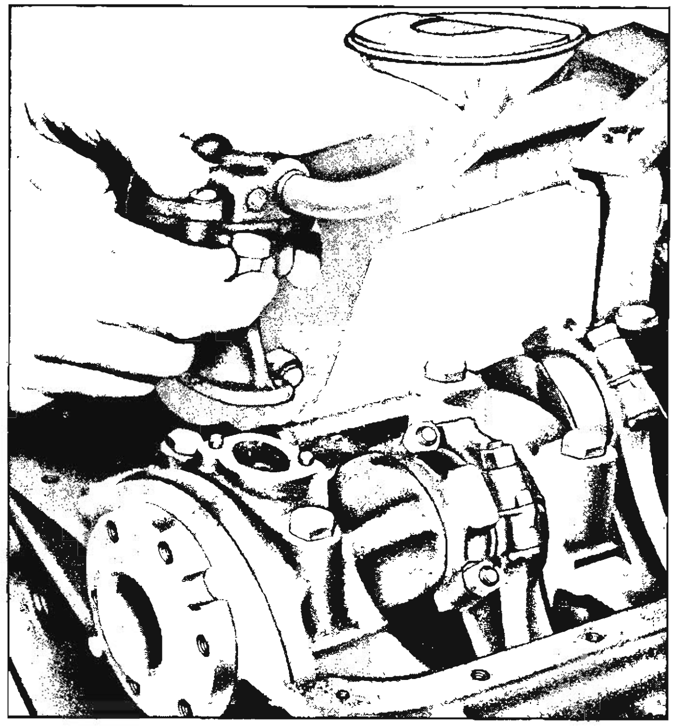


Fig. 9V—Oil Pump Removal and Installation

3. Install oil pan as outlined.

HARMONIC BALANCER

Chevrolet, Chevelle and Chevy II

Removal

1. Drain radiator and disconnect radiator hoses.
2. Remove fan belt, fan and pulley.
3. Remove bolts from fan shroud and radiator.
4. Remove radiator core and shroud assembly as outlined in Section 13.
5. When so equipped, remove accessory drive pulley.
6. Install Tool J-6978 to harmonic balancer and turn puller screw to remove balancer from crankshaft (fig. 10V).
7. Remove tool from harmonic balancer.

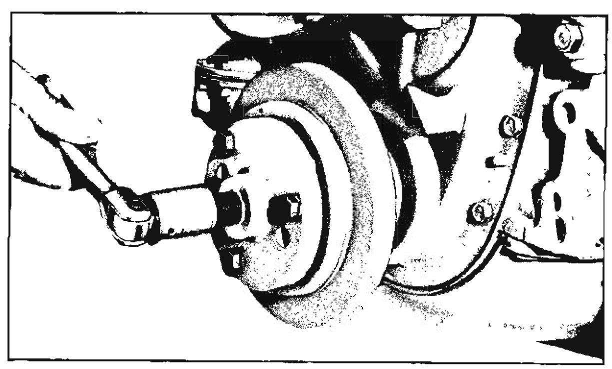


Fig. 10V—Removing Harmonic Balancer

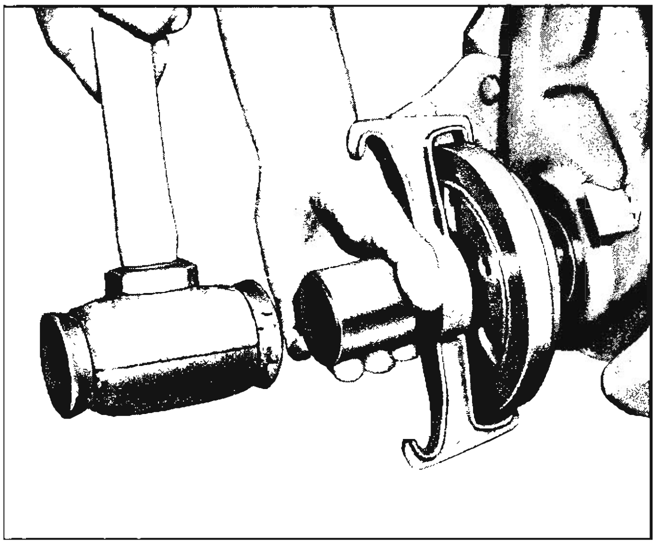


Fig. 11V—Installing Harmonic Balancer

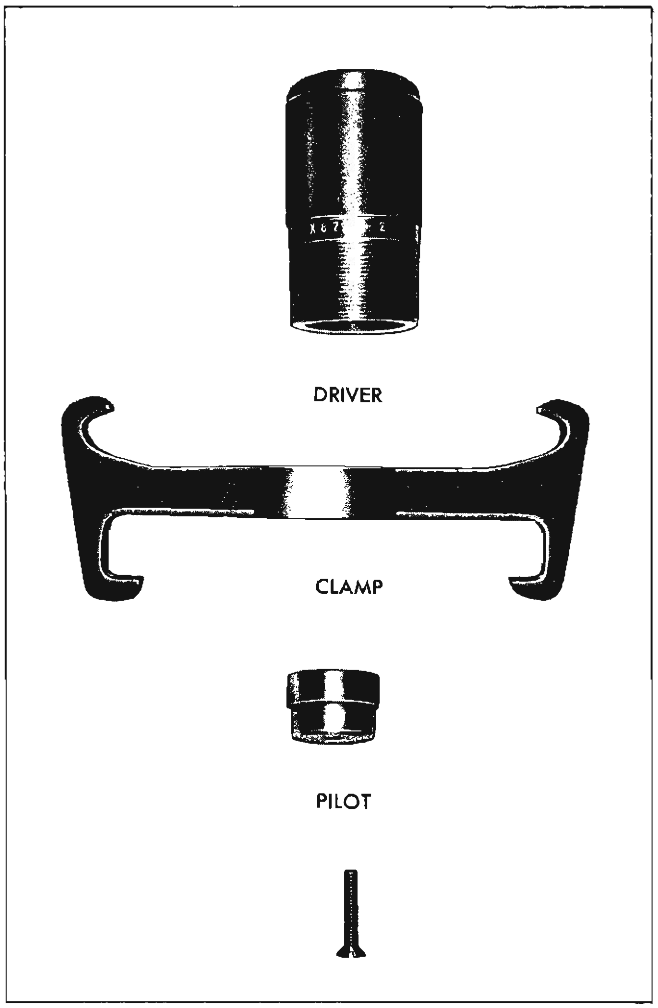


Fig. 12V—Installer Tool Assembly

Installation

1. Coat front cover seal contact area (on harmonic balancer) with engine oil.

   CAUTION: It is necessary to use Installer Tool J-8972 to prevent the inertia weight section from walking off the hub during installation of balancer. This tool is designed to be used on 6 cylinder engines as well as V-8 and care should be taken to proceed as follows when installing the balancer.

2. Thread the driver section of tool into clamp section from shallow fingers to deep fingers (fig. 12V).
3. Arrange adapter pilot into end of driver with flat end out and lock in place with screw.
4. Install tool over balancer with pilot adapter in the bore of hub. Tighten threaded driver only finger tight to keep from pulling balancer apart, then drive balancer on to crankshaft (fig. 11V) and remove tool.
5. If so equipped install accessory drive pulley.
6. Install fan pulley and fan to water pump hub and tighten bolts securely.
7. Install fan belt and adjust to specifications using strand tension gauge.
8. Install radiator and fan shroud, as outlined in Section 13.
9. Fill cooling system.
10. Start engine and check for leaks.

CRANKCASE FRONT COVER

Chevrolet, Chevelle and Chevy II

Removal

1. Remove oil pan as outlined.
2. Remove harmonic balancer as outlined.
3. Remove water pump as outlined in Section 6K.
4. Remove crankcase front cover attaching screws and remove front cover and gasket, then discard gasket.

Installation

1. Make certain that cover mounting face and cylinder block front end face are clean and flat.
2. Coat the oil seal with engine oil and using a new cover gasket, coated with gasket sealer install cover and gasket over dowel pins and cylinder block.
3. Install cover screws and torque to specifications.
4. Install water pump as outlined in Section 6K.
5. Install harmonic balancer as outlined.
6. Install oil pan as outlined.

TIMING CHAIN AND/OR SPROCKETS

Chevrolet, Chevelle and Chevy II

Replacement

1. Remove harmonic balancer and crankcase front cover as outlined.
2. Crank engine until "0" marks on camshaft and crankshaft sprockets are in alignment (fig. 13V).
3. Remove three camshaft sprocket to camshaft bolts.
4. Remove camshaft sprocket and timing chain together. Sprocket is a light press fit on camshaft for approximately 1/8". If sprocket does not come off easily, a light blow with a plastic-faced hammer on the lower edge of the camshaft sprocket should dislodge the sprocket.

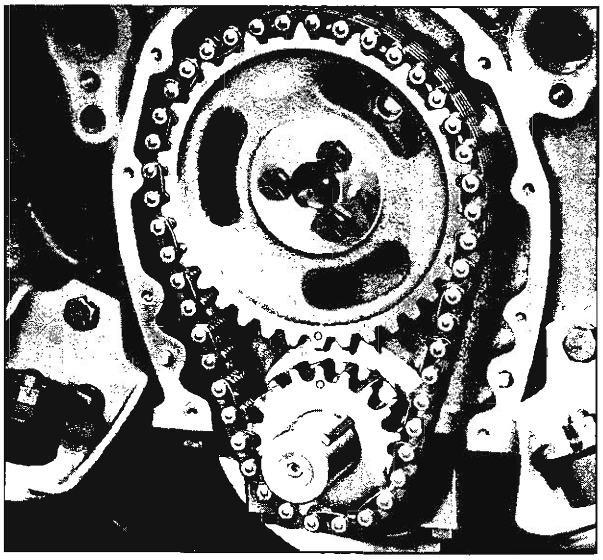


Fig. 13V—Timing Sprocket "O" Marks

5. If crankshaft sprocket is to be replaced, remove it, using Tool J-5825 (fig. 14V). Install new sprocket, aligning key and keyway, using Tool J-5590 (fig. 15V).
6. Install timing chain on camshaft sprocket. Hold the sprocket vertical with the chain hanging below, and orient to align "O" marks on camshaft and crankshaft sprockets.
7. Align dowel in camshaft with dowel hole in camshaft sprocket and install sprocket on camshaft (fig. 16V).

NOTE: Do not attempt to drive cam sprocket on shaft as welsh plug at rear of engine can be dislodged.

8. Draw camshaft sprocket onto camshaft, using the three mounting bolts. Torque to specifications.
9. Lubricate timing chain with engine oil.
10. Install crankcase front cover and harmonic balancer as outlined.

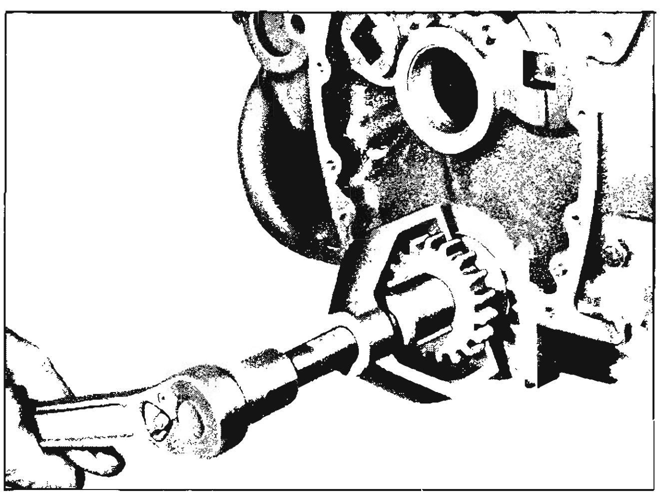


Fig. 14V—Removing Crankshaft Sprocket

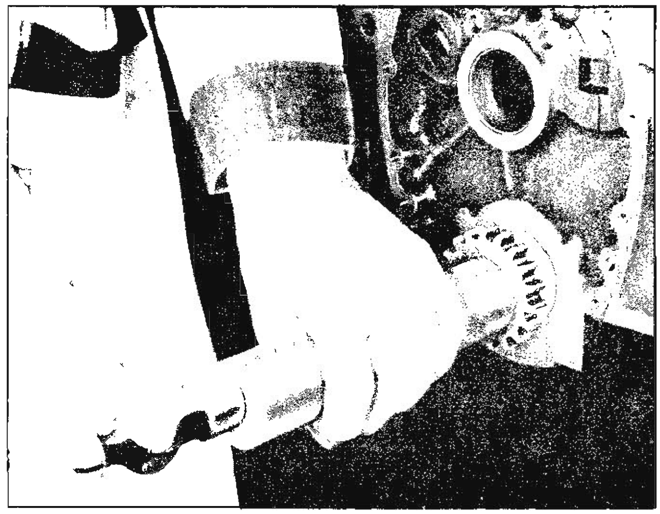


Fig. 15V—Installing Crankshaft Sprocket

CAMSHAFT

Chevrolet and Chevy II

Removal

1. Remove intake manifold and valve lifters as outlined.
2. Remove fuel pump and fuel pump push rod as outlined in Section 6M.
3. Remove grille assembly as outlined in Section 13.
4. Remove oil pan, harmonic balancer and crankcase front cover as outlined.
5. Remove timing chain and camshaft sprocket as outlined.
6. Install two bolts, 5/16" x 18" x 4" in two camshaft bolt holes. Remove camshaft from engine (fig. 17V).

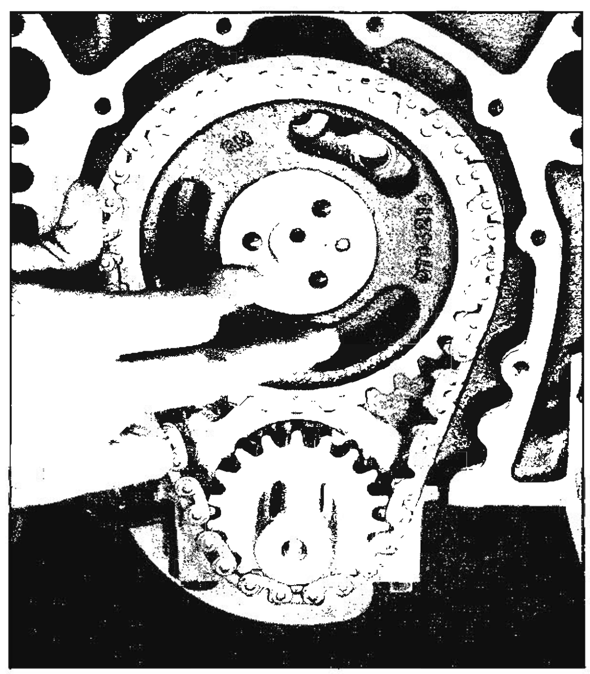


Fig. 16V—Installation of Timing Chain

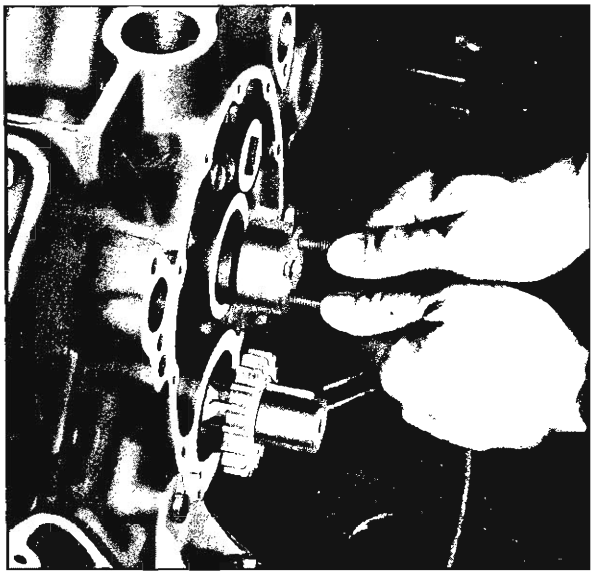


Fig. 17V—Removing Camshaft

CAUTION: All camshaft journals are the same diameter and care must be used in removing camshaft to avoid damage to bearings.

Installation

NOTE: Whenever a new camshaft is installed, coat camshaft lobes with Molykote or its equivalent.

1. Install two bolts in camshaft, lubricate camshaft and install camshaft in engine. Remove bolts.
2. Install timing chain and sprocket as outlined.
3. Install crankcase front cover, oil pan and harmonic balancer as outlined.
4. Install grille assembly as outlined in Section 13.
5. Install valve lifters, valve mechanism, intake manifold and distributor as outlined.
6. Install fuel pump push rod, mounting plate and fuel pump as outlined in Section 6M.
7. Start engine, check for leaks, adjust timing and carburetor idle and mixture.

Chevelle

Removal

1. Remove oil pan as outlined (requires engine removal).
2. Remove intake manifold and valve lifters as outlined.
3. Remove harmonic balancer, crankcase front cover and timing chain and sprocket as outlined.
4. Remove fuel pump push rod as outlined in Section 6M.
5. Install two bolts, 5/16" x 18" x 4" in two of camshaft bolt holes. Remove camshaft from engine (fig. 17V).

CAUTION: All camshaft journals are the same diameter and care must be used in removing camshaft to avoid damage to bearings.

Installation

NOTE: Whenever a new camshaft is installed coat camshaft lobes with Molykote or its equivalent.

1. Install two bolts in camshaft, lubricate camshaft and install camshaft in engine. Remove bolts.
2. Install fuel pump push rod as outlined in Section 6M.
3. Install timing chain and sprocket, crankcase front cover and harmonic balancer as outlined.
4. Install intake manifold and valve lifters as outlined.
5. Install oil pan as outlined.
6. Start engine, check for leaks adjust timing and carburetor idle and mixture.

ENGINE MOUNTS

Engine mounts are the non-adjustable type and seldom require service. Broken or deteriorated mounts should be replaced immediately, because of the added strain placed on other mounts and drive line components.

Chevrolet (Fig. 18V)

Front Mount Replacement

1. Remove nut, washer and engine mount through-bolt.
2. Raise engine to release weight from mount.
3. Remove mount from engine.
4. Install new mount on engine.
5. Lower engine, install through-bolt and tighten all mount bolts to specified torques.

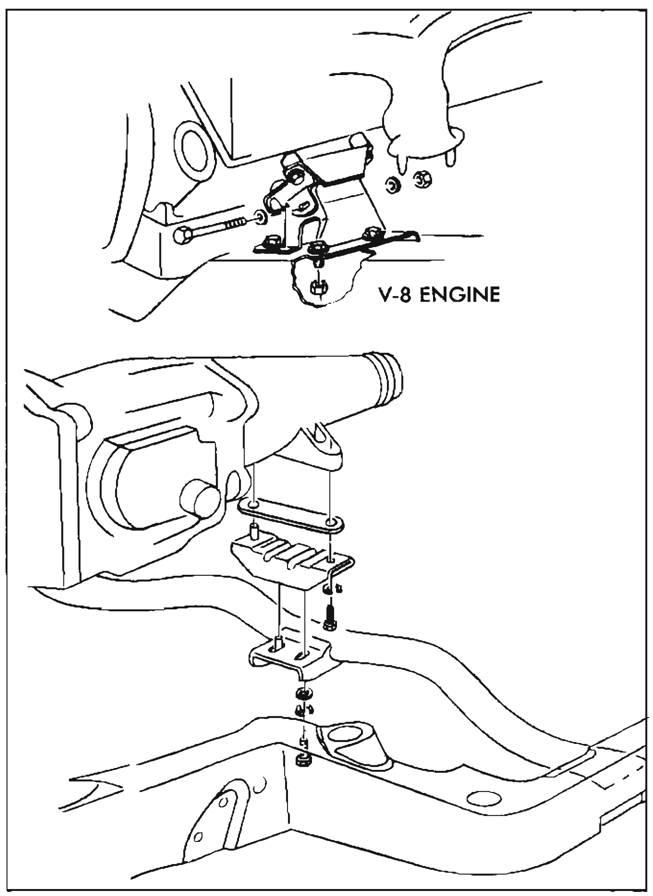


Fig. 18V—Engine Mounts (Chevrolet)

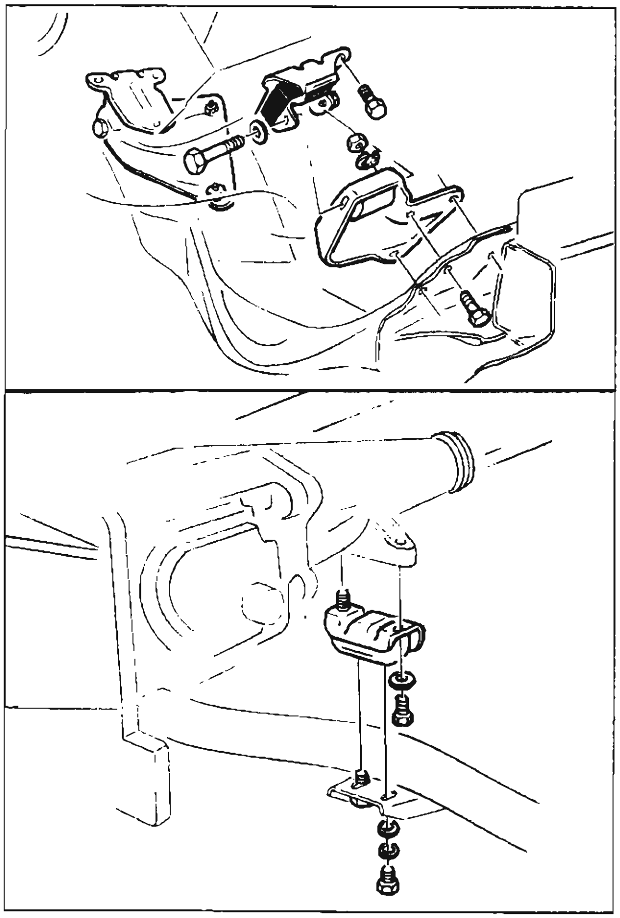


Fig. 19V—Engine Mounts (Chevelle)

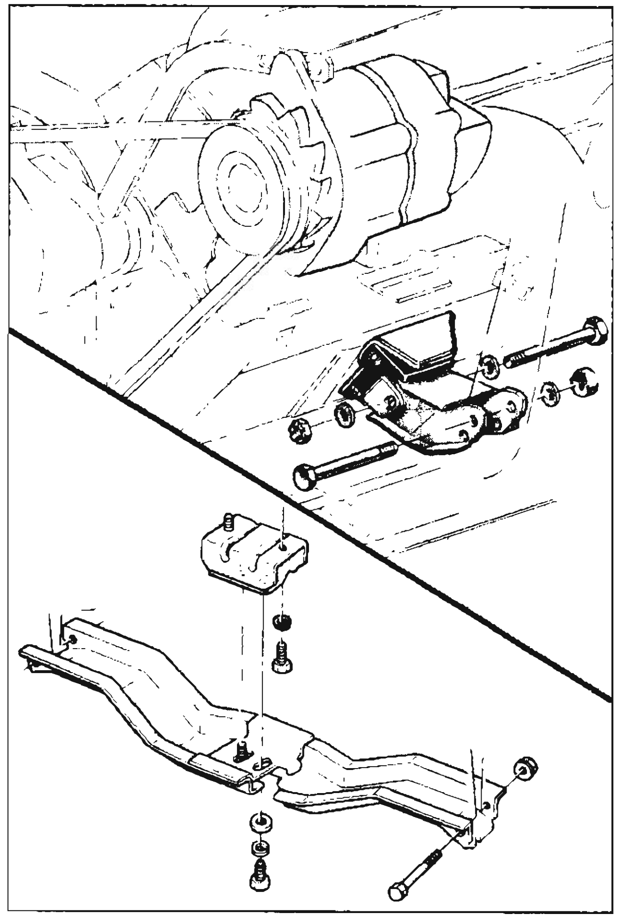


Fig. 20V—Engine Mounts (Chevy II)

Rear Mount Replacement

1. Remove crossmember-to-mount bolts.
2. Raise transmission to release weight from mount.
3. Remove mount-to-transmission bolts, then remove mount and spacer.
4. Install spacer and new mount on transmission.
5. While lowering transmission, align and start cross-member-to-mount bolts.
6. Lower transmission and tighten all mounting bolts to specifications.

Chevelle (Fig. 19V)

Front Mount Replacement

1. Remove nut, washer and engine mount through-bolt.
2. Raise engine to release weight from mount.
3. Remove mount from engine
4. Install new mount on engine.
5. Lower engine, install through-bolt and tighten all mount bolts to specified torques.

Rear Mount Replacement

1. Remove crossmember-to-mount bolts.
2. Raise transmission to release weight from mount.
3. Remove mount-to-transmission bolts, then remove mount.
4. Install new mount on transmission.
5. While lowering transmission align and start cross-member-to-mount bolts.
6. Lower transmission and tighten all mounting bolts to specified torques.

Chevy II (Fig. 20V)

Front Mount Replacement

1. Remove nut, washer and engine mount through-bolt.
2. Raise engine to release weight from mount.
3. Remove mount from engine.
4. Install new mount on engine.
5. Lower engine, install through-bolt and tighten all mount bolts to specified torques.

Rear Mount Replacement

1. Remove crossmember-to-mount bolts.
2. Raise transmission to release weight from mount.
3. Remove mount-to-transmission bolts, then remove mount.
4. Install new mount on transmission.
5. While lowering transmission align and start cross-member-to-mount bolts.
6. Lower transmission and tighten all mounting bolts to specified torques.

V-8 ENGINES

(409 CU. IN.)

INDEX

GENERAL DESCRIPTION

The V-8 engines covered in this section are the 409 cu. in. engines used in Chevrolet vehicles (fig. 1W).

This section covers the removal and installation of engine assemblies, the removal and installation of engine components and some maintenance procedures. For all service to engine components (after removal) and removal of some subassemblies, refer to Section 6 of the Overhaul Manual.

COMPONENT REPLACEMENT

ENGINE ASSEMBLIES

Removal

1. Drain cooling system and engine oil.
2. Remove air cleaner and disconnect battery cables at battery, then remove fuel pump.
3. Scribe around hinges, then remove hood.
4. Remove radiator, radiator shroud and fan blades.
5. Disconnect wires at:
   - Starter solenoid
   - Delcotron
   - Temperature switch
   - Oil pressure switch
   - Coil
6. Disconnect:
   - Accelerator linkage at pedal lever.
   - Exhaust pipes at manifold flanges.

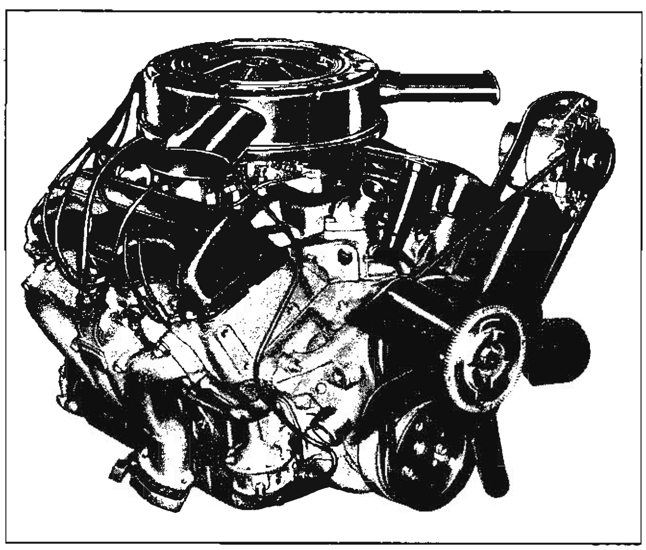


Fig. 1W—V-8Engine (409 cu. in.)

   - Vacuum line to power brake unit at manifold (if so equipped).
   - Power steering pump lines at pump end (if so equipped).
7. Raise vehicle and place on jack stands.
8. If plug for driveshaft opening in transmission is not available, drain transmission.
9. Remove driveshaft.
10. Disconnect:
    - Shift linkage at transmission.
    - Speedometer cable at transmission.
11. On synchromesh equipped vehicles, disconnect clutch linkage at cross-shaft then remove cross-shaft engine bracket.
12. Remove valve rocker arm covers and attach lifting device.
13. Remove front mount bolts.
14. Raise engine to take weight off front mounts, then remove rear mount bolts.
15. Raise engine to take weight off rear mount, then remove crossmember.

    NOTE: It will be necessary to remove mount from transmission before crossmember can be removed.

16. Remove engine-transmission assembly from vehicle as a unit.
17. Remove transmission (and clutch):

Synchromesh Transmission

- Remove clutch housing cover plate screws.
- Remove bolts attaching the clutch housing to engine block then remove transmission and clutch housing as a unit.

  NOTE: Support the transmission, as the last mounting bolt is removed, and as it is being pulled away from the engine to prevent damage to clutch disc.

- Remove starter and clutch housing cover plate.
- Loosen clutch mounting bolts a turn at a time (to prevent distortion of clutch cover) until the spring

pressure is released. Remove all bolts, clutch disc and pressure plate assembly:

Automatic Transmission

- Lower engine, secured by the hoist, and support engine on blocks.
- Remove starter and converter housing under pan.
- Remove flywheel-to-converter attaching bolts.
- Support transmission on blocks.
- Remove transmission-to-engine mounting bolts.
- With the hoist attached, remove blocks from the engine only and slowly guide the engine from the transmission.

18. Mount engine in stand.

Installation

1. Attach lifting device to engine and remove engine from engine stand.
2. Install transmission (and clutch):

Synchromesh Transmission

- Install the clutch on flywheel as outlined in Section 7.
- Install clutch housing cover and starter.
- Install transmission and clutch housing as outlined in Section 7.
- Install clutch housing cover screws and tighten securely.

Automatic Transmissions

- Position engine adjacent to the transmission and align the convertor with the flywheel.
- Bolt transmission to engine, then raise engine and transmission assembly and install flywheel to convertor attaching bolts.
- Install convertor housing under pan and starter.

3. Tilt and lower engine and transmission assembly into the chassis as a unit, guiding engine to align front mounts with frame supports.
4. Install front mount bolts and tighten securely.
5. Raise engine enough to install rear crossmember, then install crossmember, install rear mount, lower engine and tighten rear mount securely.
6. Remove lifting device and install rocker arm covers with new gaskets.
7. On synchromesh equipped vehicles, install clutch cross shaft engine bracket, then adjust and connect clutch as outlined in Section 7.
8. Connect:
   - Speedometer cable.
   - Shift linkage at transmission.
9. Install drive shaft.
10. Remove jack stands and lower vehicle.
11. Connect:
    - Power steering pump lines (if disconnected).
    - Vacuum line to power brake unit (if disconnected).
    - Exhaust pipes at manifold flanges.
    - Accelerator linkage at pedal lever.
12. Connect wires at:
    - Coil.
    - Oil pressure switch.
    - Temperature switch.
    - Delcotron.
    - Starter solenoid.
13. Install pulley, fan blade, fan belt, radiator shroud and radiator.
14. Install and adjust hood.
15. Connect battery cables, then install and connect fuel pump.
16. Fill with coolant, engine oil and transmission oil, then start engine and check for leaks.
17. Perform necessary adjustments and install air cleaner.

INTAKE MANIFOLD

Removal

1. Drain radiator and remove air cleaner.
2. Disconnect:
   a. Battery cables at battery.
   b. Upper radiator and heater hose at manifold.
   c. Accelerator linkage at pedal lever.
   d. Fuel line at carburetor.
   e. Wires at temperature sending switch and coil (both sides).
   f. Power brake hose at carburetor base.
   g. Spark advance hose at distributor.
3. Remove distributor cap from distributor, remove distributor clamp then note rotor position, remove distributor and position distributor cap rearward clear of manifold.
4. Remove coil, then disconnect crankcase ventilation hose at adapter on block.
5. Remove manifold-to-head attaching bolts, then remove manifold (with carburetor on) from engine and discard gaskets and seals.
6. If manifold is to be replaced, transfer:
   a. Carburetor and carburetor mounting studs.
   b. Oil filler tube.
   c. Temperature sending switch.
   d. Water outlet and thermostat (use new gasket).
   e. Heater hose adapter.

Installation

1. Clean gasket and seal surfaces of manifold, cylinder heads and block.
2. Install manifold end seals on block with tabs as shown (fig. 2W).
3. Install side gaskets on cylinder heads using sealing compound around water passages.

NOTE: When installing the intake manifold, any sliding to align bolt holes may roll the end seals out of position. A pilot (wood or metal) used in

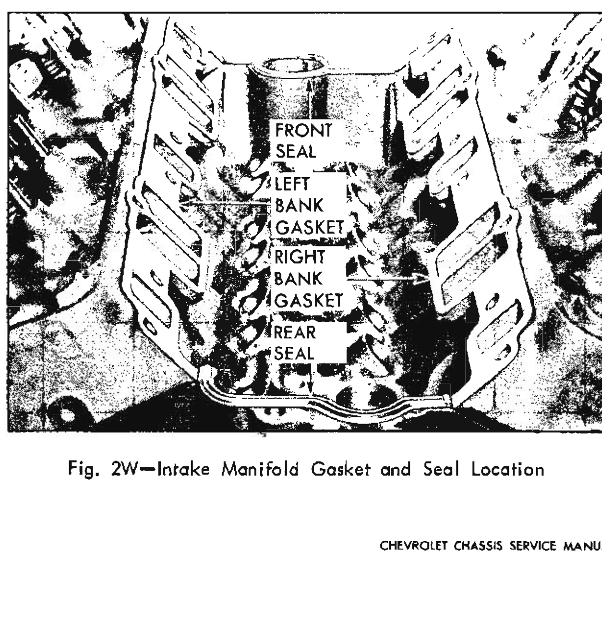


Fig. 2W—Intake Manifold Gasket and Seal Location

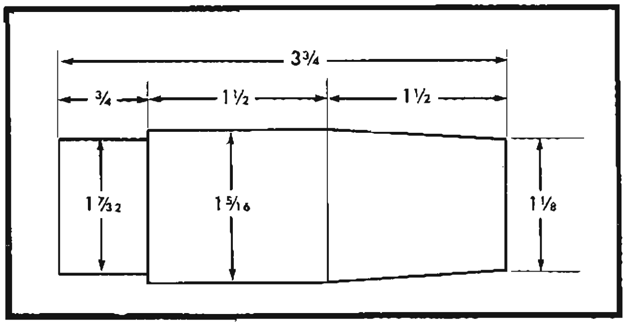


Fig. 3W—Intake Manifold Pilot

distributor can be made to help install the manifold squarely. Dimensions of pilot shown in Figure 3W.

4. Install pilot in distributor opening in block and install manifold over pilot to guide it squarely in place.

   NOTE: If pilot is not used, be sure end seals stay in place. Check position of tabs that stick out.

5. Install manifold bolts, remove the pilot and torque bolts to specifications in proper sequence (fig. 4W).
6. Install and connect coil.
7. Connect crankcase ventilation hose.
8. Install distributor with rotor in approximately the same position as when removed.
9. Connect:
   a. Battery cables at battery.
   b. Upper radiator and heater hose at manifold.
   c. Accelerator linkage at pedal lever.
   d. Fuel line at carburetor.
   e. Wires at temperature sending switch and coil (both sides).
   f. Power brake hose at carburetor base.
   g. Spark advance hose at distributor.
10. Fill with coolant, start engine, check for leaks and adjust timing and carburetor idle speed and mixture.

EXHAUST MANIFOLDS

Removal

1. Disconnect battery ground cable at battery.
2. On left exhaust manifold, disconnect and remove Delcotron.
3. Remove exhaust manifold flange nuts, then lower exhaust pipe assembly.

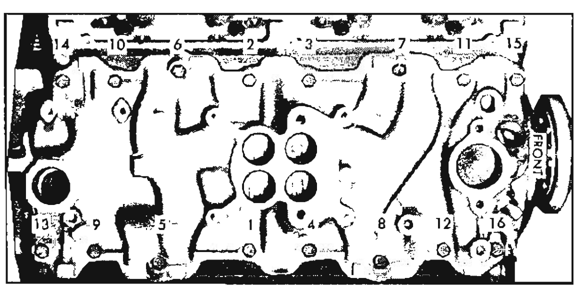


Fig. 4W—Intake Manifold Torque Sequence

4. Bend french lock tabs, remove end bolts then remove center bolts and remove manifold from engine.

   NOTE: A 9/16 thin-wall 6 point socket, sharpened at the leading edge, then started on the head of the bolt and tapped in place with a hammer, simplifies bending of french locks.

Installation

1. Clean mating surfaces on manifold and head, then install manifold in position and install center bolts.
2. Install end bolts with french locks under them.
3. Torque center bolts to specifications, then torque end bolts to specifications, and bend french lock tabs to lock end bolts.

   NOTE: End bolt and center bolt torque differ.

4. Using a new flange gasket install exhaust pipe to manifold flange.
5. Install and connect Delcotron.
6. Connect the battery ground cable.
7. Start engine and check for leaks.

CYLINDER HEAD ASSEMBLIES

Removal

NOTE: Cylinder head and exhaust manifold are removed as an assembly.

1. Drain coolant from crankcase.
2. Remove intake manifold as outlined.
3. On left cylinder head, disconnect and remove Delcotron.
4. Remove exhaust pipe stud nuts on cylinder head to be removed and remove heat control valve from right bank.
5. Remove rocker arm cover and discard gasket.
6. Back off rocker arm nuts, pivot rocker arms to clear push rods and remove push rods.

   NOTE: Exhaust push rods are longer than inlet push rods.

7. Remove cylinder head bolts, then remove cylinder head and exhaust manifold as an assembly.
8. Remove and discard cylinder head gasket.

Installation

CAUTION: The gaskets surfaces on both the head and the block must be clean of any foreign matter and free of nicks or heavy scratches. Cylinder bolt threads in the block and threads on the cylinder head bolts must be clean. (Dirt will affect bolt torque).

1. Coat both sides of a new gasket with a good sealer. Spread the sealer thin and even. One method of applying the sealer that will assure the proper coat is with the use of a paint roller.

   NOTE: Too much sealer may hold the bead of the gasket away from the head or block.

2. Place the gasket in position over the dowel pins with the bead up.
3. Carefully guide the cylinder head and exhaust manifold assembly into place over the dowel pins and gasket.
4. Coat threads of cylinder head bolts with sealing compound and install bolts finger tight.

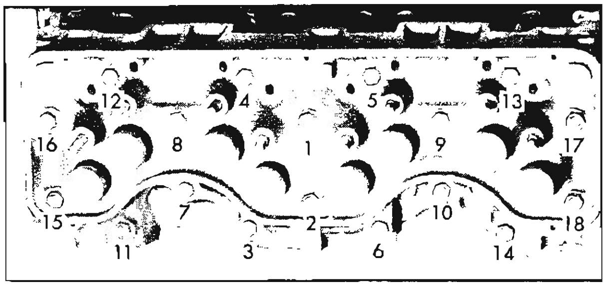


Fig. 5W—Cylinder Head Torque Sequence

5. Tighten each cylinder head bolt a little at a time in the sequence shown until the specified torque is reached (fig. 5W).
6. Install valve push rods down through opening of cylinder head and seat them in lifter sockets.
7. Install valve rocker arms, rocker arm balls and nuts and tighten rocker arm nuts until all push rod end play is taken up.

   NOTE: Whenever new valve rocker arms or valve rocker arm balls are being installed, coat surfaces lightly with Molykote or its equivalent.

8. Clean gasket surfaces of intake manifold and install as previously outlined.
9. Install heat riser valve, then connect exhaust pipes at manifold flanges using new gaskets and packing.
10. Clean, inspect and set spark plug gap and install, using new gaskets. Torque to specifications then connect wires.
11. Install distributor and connect distributor and coil wiring. Roughly set timing, by adjusting distributor so points just break with engine in number one firing position.
12. Connect and adjust throttle linkage as outlined in Section 6M.
13. Connect fuel and vacuum lines to carburetor and connect temperature sending unit wire.
14. Inspect and install air cleaner and connect crankcase ventilation hose.
15. Fill cooling system and check leaks.
16. Adjust valves as outlined under Valve Lifters.
17. Install rocker arm covers with new gaskets.
18. Start engine, check for leaks and adjusting timing and carburetor idle speed and mixture.

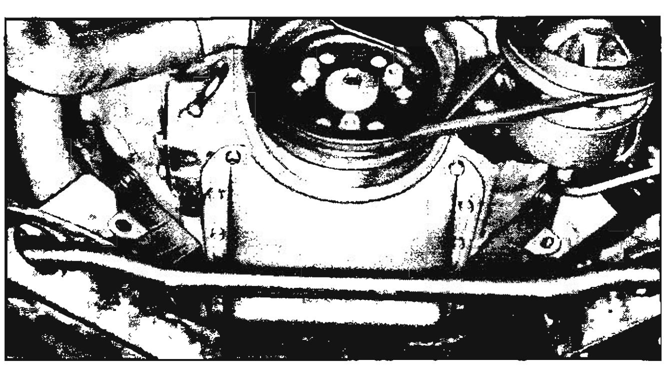


Fig. 6W—Engine Blocked for Pan Removal

VALVE LIFTERS

Hydraulic valve lifters very seldom require attention. The lifters are extremely simple in design, readjustments are not necessary, and servicing of the lifters requires only that care and cleanliness be exercised in the handling of parts.

Locating Noisy Lifters (Hydraulic)

Locate a noisy valve lifter by using a piece of garden hose approximately four feet in length. Place one end of the hose near the end of each intake and exhaust valve with the other end of the hose to the ear. In this manner, the sound is localized making it easy to determine which lifter is at fault.

Another method is to place a finger on the face of the valve spring retainer. If the lifter is not functioning properly, a distinct shock will be felt when the valve returns to its seat.

The general types of valve lifter noise are as follows:

1. Hard Rapping Noise -- Usually caused by the plunger becoming tight in the bore of the lifter body to such an extent that the return spring can no longer push the plunger back up to working position. Probable causes are:
   a. Excessive varnish or carbon deposit causing abnormal stickiness.
   b. Galling or "pick-up" between plunger and bore of lifter body, usually caused by an abrasive piece of dirt or metal wedging between plunger and lifter body.
2. Moderate Rapping Noise -- Probable causes are:
   a. Excessively high leakdown rate.
   b. Leaky check valve seat.
   c. Improper adjustment.
3. General Noise Throughout the Valve Train -- This will, in almost all cases, be a definite indication of insufficient oil supply, or improper adjustment.
4. Intermittent Clicking -- Probable causes are:
   a. A microscopic piece of dirt momentarily caught between ball seat and check valve ball.
   b. In rare cases, the ball itself may be out-of-round or have a flat spot.
   c. Improper adjustment.

In most cases where noise exists in one or more lifters all lifter units should be removed, disassembled, cleaned in a solvent, reassembled, and reinstalled in the engine. If dirt, varnish, carbon, etc. is shown to exist in one unit, it more than likely exists in all the units, thus it would only be a matter of time before all lifters caused trouble.

Removal

1. Remove rocker arm covers and discard gaskets.
2. Remove intake manifold as outlined.
3. Back off rocker arm nuts until arms may be pivoted away from push rods. Remove push rods.
4. Remove valve lifters.

   NOTE: Valve lifters should be placed in a rack in their proper sequence so they can be installed in their same positions in the cylinder block.

   NOTE: Whenever new rocker arms, and/or valve lifters are being installed coat foot of valve lifters and surfaces of rocker arms and balls with Molykote or its equivalent.

Installation and Adjustment (Hydraulic)

1. Install valve lifters.
2. Install intake manifold as outlined.
3. Install push rods.
4. Pivot rocker arms to engage push rods and adjust valve lash.
5. Adjust valve as follows:
   a. Crank engine until mark on harmonic balancer lines up with center or "0" mark on the timing tab fastened to the front end cover and the engine is in the number 1 firing position. This may be determined by placing fingers on the number 1 cylinder valve as the mark on the balancer comes near the "O" mark on the front end cover. If the valves are not moving, the engine is in the number 1 firing position. If the valves move as the mark comes up to the timing tab, the engine is in number 6 firing position and should be turned over one more time to reach the number 1 position.
   b. Valve adjustment is made by backing off the adjusting nut (rocker arm stud nut) until there is play in the valve push rod and then tighten nut to just remove all push rod to rocker arm clearance. This may be determined by rotating push rod with fingers as the nut is tightened. When rod does not readily move in relation to the rocker arm, the clearance has been eliminated. The adjusting nut should then be tightened an additional 1 turn to place the hydraulic lifter plunger in the center of its travel. No other adjustment is required.
   c. With the engine in the number 1 firing position as determined above, the following valves may be adjusted.
      Exhaust - 1, 3, 4, 8
      Intake - 1, 2, 5, 7
   d. Crank the engine one revolution until the pointer "0" mark and harmonic balancer mark are again in alignment. This is number 6 firing position. With the engine in this position the following valves may be adjusted.
      Exhaust - 2, 5, 6, 7
      Intake - 3, 4, 6, 8
6. Install rocker arm covers, using new gaskets.
7. Start engine and check for oil leaks.

Installation and Adjustment (Mechanical)

1. Install valve lifters.
2. Install intake manifold as outlined.
3. Install push rods.
4. Pivot rocker arms to engage push rods.
5. Make a (cold) preliminary valve adjustment as follows:
   a. Crank engine until mark on harmonic balancer lines up with center or "0" mark on the timing tab and the engine is in the number 1 firing position. This may be determined by placing fingers on the number 1 cylinder valve as the mark on the balancer comes near the "0" mark on the front end cover. If the valves are not moving, the engine is in the number 1 firing position. If the valves move as the mark comes up to the timing tab, the engine is in number 6 firing position and crankshaft should be rotated one more turn to reach the number 1 position.
   b. With the engine in the number 1 firing position as determined above, adjust the following valves to specifications with a feeler gauge.
      Exhaust - 1, 3, 4, 8
      Intake - 1, 2, 5, 7
   c. Crank the engine one revolution until the pointer "0" mark and harmonic balancer mark are again in alignment. This is number 6 firing position. With the engine in this position, adjust the following valves to specifications with a feeler gauge.
      Exhaust - 2, 5, 6, 7
      Intake - 3, 4, 6, 8
6. Install rocker arm covers, using new gasket.
7. Start engine and check for oil leaks. Allow engine to warm up for 20-30 minutes.
8. Stop engine, remove rocker covers, and restart engine then adjust valves (hot and running) to specifications with a feeler gauge.
9. Stop engine, reinstall rocker covers, start engine then check for oil leaks and adjust carburetor idle and mixture.

OIL PAN

Removal

1. Disconnect battery positive cable.
2. Disconnect distributor cap from distributor (to prevent breaking distributor cap when engine is raised).
3. Remove fuel pump and discard gasket.

   NOTE: Fuel pump flex line need not be disconnected. Fuel pump need not be removed from engine compartment.

4. Remove through bolts from engine front mounts, then remove oil dip stick tube.
5. Drain radiator, then disconnect upper and lower radiator hoses at radiator.
6. Remove fan blade as outlined in Section 6K.
7. Raise vehicle then drain engine oil.
8. Disconnect and remove starter.
9. On vehicles equipped with automatic transmission, disconnect transmission cooler lines at transmission and remove convertor housing under pan.
10. Disconnect steering rod at idler lever then swing steering linkage down for oil pan clearance.
11. Rotate crankshaft until timing mark on harmonic balancer is at 6:00 o'clock position.
12. Using a suitable jack (and a block of wood to prevent damaging oil pan), raise engine enough to insert 2" x 4" wood blocks under engine mounts (fig. 6W), then lower engine onto blocks.

    NOTE: If 2" x 4" wood blocks are cut 5" long they can be used on all Chevrolet engines. The 5" length up for In-line engines and the 4" side up for V-8 engines.

13. Remove oil pan and discard gaskets and seals.

Installation

1. Thoroughly clean all gaskets sealing surfaces.

   NOTE: Use a new pan gasket set.

2. Install side gaskets on pan rails, using gasket sealer as a retainer (rear end of side gaskets lap rear end gasket). Tuck front end of side gaskets into gap between front end cover seal groove and cylinder block.

3. Install rear oil pan sealing groove in rear main bearing cap. Tuck ends into groove openings in cylinder block.
4. Install oil pan front seal in groove in crankcase front cover, with ends butting side gaskets.
5. If crankshaft was rotated while pan was off, place timing mark at 6:00 o'clock position.
6. Install oil pan and torque bolts to specifications.
7. Using a suitable jack (and a block of wood to prevent damaging oil pan) raise engine enough to remove 2" x 4" wood blocks, then lower engine.
8. On vehicles equipped with automatic transmission install convertor housing under pan, then connect transmission cooler lines.
9. Install and connect starter.
10. Lower vehicle and install fan blades as outlined in Section 6K.
11. Connect upper and lower radiator hoses.
12. Install through bolts in engine front mounts, then install oil dip stick tube.
13. Using a new gasket, install and connect fuel pump.
14. Connect distributor cap and battery positive cable.
15. Fill radiator with coolant and fill engine with oil, then start engine and check for leaks.

OIL PUMP

Removal

1. Remove oil pan as outlined.
2. Remove pump to rear main bearing cap bolt and remove pump, extension shaft and collar.

Installation

1. Assemble pump and extension shaft to rear main bearing cap, aligning slot on top end of extension shaft with drive tang on lower end of distributor drive shaft.
2. Install pump to rear bearing cap bolt and torque to specifications.

   NOTE: Install oil pump screen with bottom edge parallel to all pan rails (fig. 7W).

3. Install oil pan as outlined.

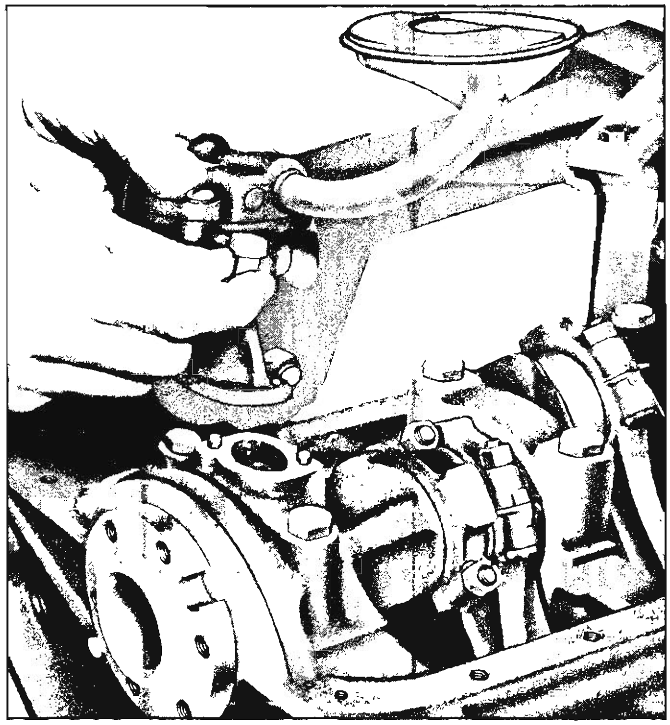


Fig. 7W—Oil Pump Removal and Installation

HARMONIC BALANCER

Removal

1. Drain radiator and disconnect radiator hoses.
2. Remove fan belt, fan and pulley.
3. Remove bolts from fan shroud and radiator as outlined in Section 13.
4. Remove radiator core and shroud assembly.
5. When so equipped, remove accessory drive pulley.
6. Install Tool J-6978 to harmonic balancer and turn puller screw to remove balancer from crankshaft (fig. 8W).
7. Remove tool from harmonic balancer.

Installation

1. Coat front cover seal contact area (on harmonic balancer) with engine oil.

   CAUTION: It is necessary to use installer Tool J-8972 to prevent the inertia weight section from walking off the hub during installation of balancer. This tool is designed to be used on 6 cylinder engines as well as V-8 and care should be taken to proceed as follows when installing the balancer.

2. Thread the driver section of tool into clamp section from shallow fingers to deep fingers (fig. 10W).
3. Arrange adapter pilot into end of driver with flat end out and lock in place with screw.
4. Install tool over balancer with pilot adapter in the bore of hub. Tighten threaded driver only finger tight to keep from pulling balancer apart, then drive balancer onto crankshaft (fig. 9W) and remove tool.
5. If so equipped install accessory drive pulley.
6. Install fan pulley and fan to water pump hub and tighten bolts securely.
7. Install fan belt and adjust to specifications using strand tension gauge.
8. Install radiator, fan shroud as outlined in Section 13.

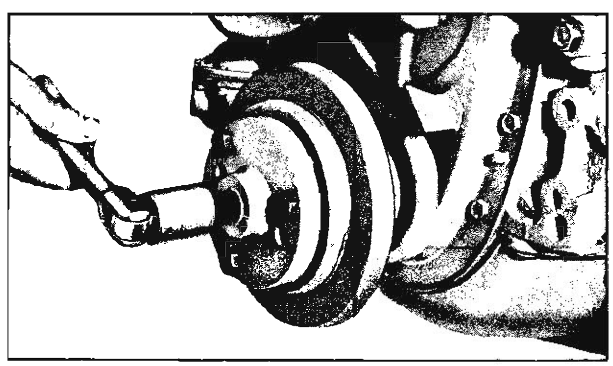


Fig. 8W—Removing Harmonic Balancer

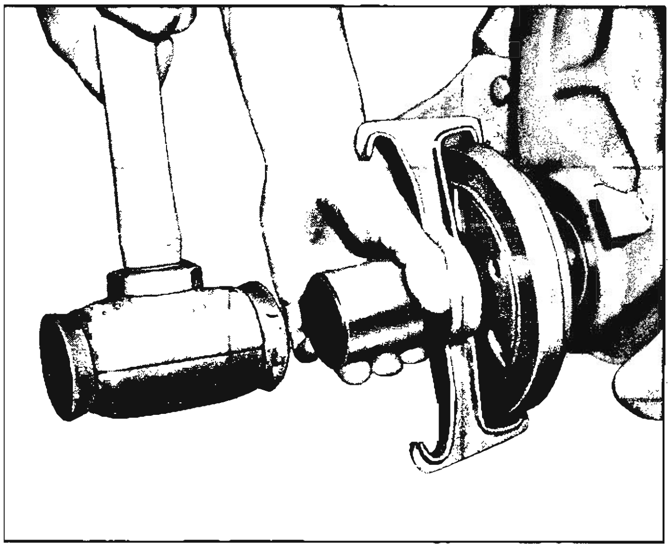


Fig. 9W—Installing Harmonic Balancer

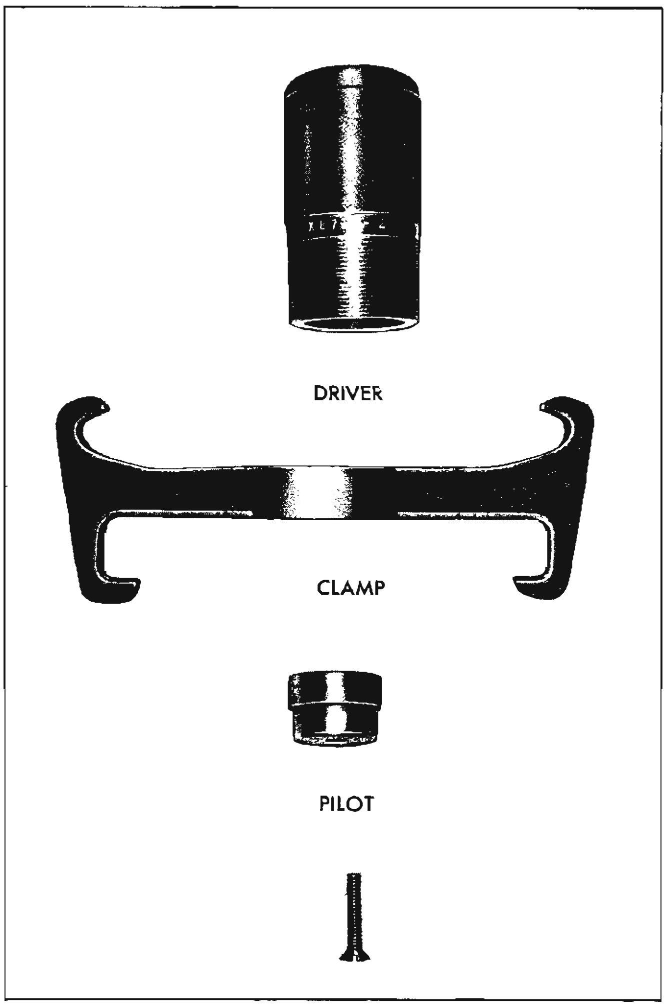


Fig. 10W—Installer Tool Assembly

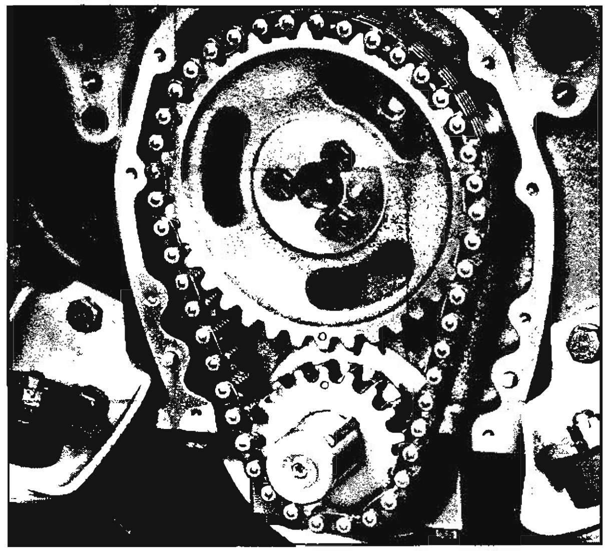


Fig. 11W—Timing Sprocket "O" Marks

9. Fill cooling system.
10. Start engine and check for leaks.

CRANKCASE FRONT COVER

Removal

1. Remove oil pan as outlined.
2. Remove harmonic balancer as outlined.
3. Remove water pump as outlined in Section 6K.
4. Remove crankcase front cover attaching screws and remove front cover and gasket, then discard gasket.

Installation

1. Make certain that cover mounting face and cylinder block front end face are clean and flat.
2. Coat the oil seal with engine oil and using a new cover gasket coated with gasket sealer, install cover and gasket over dowel pins and cylinder block.
3. Install cover screws and torque to specifications.
4. Install water pump as outlined in Section 6K.
5. Install harmonic balancer as outlined.
6. Install oil pan as outlined.

TIMING CHAIN AND/OR SPROCKETS

Replacement

1. Remove harmonic balancer and crankcase front cover as outlined.
2. Crank engine until "0" marks on camshaft and crankshaft sprockets are in alignment (fig. 11W).
3. Remove three camshaft sprocket to camshaft bolts.
4. Remove camshaft sprocket and timing chain together. Sprocket is a light press fit on camshaft for approximately 1/8". If sprocket does not come off easily, a light blow with a plastic-faced hammer on the lower edge of the camshaft sprocket should dislodge the sprocket.
5. If crankshaft sprocket is to be replaced, remove it using Tool J-5825 (fig. 12W). Install new sprocket, aligning key and keyway, using Tool J-5590 (fig. 13W).

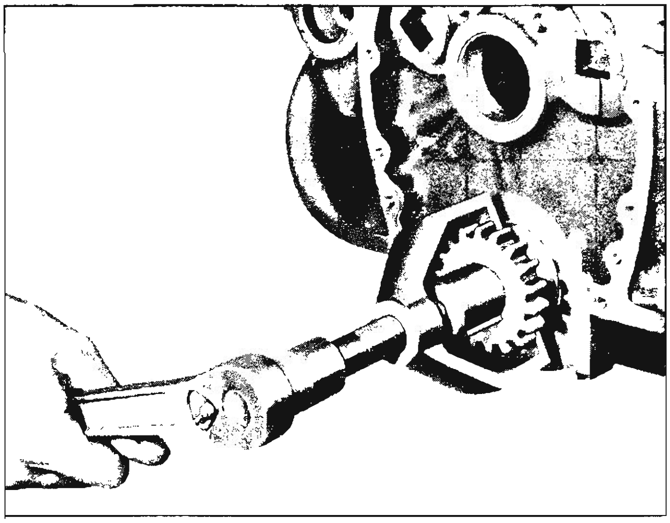


Fig. 12W—Removing Crankshaft Sprocket

6. Install timing chain on camshaft sprocket. Hold the sprocket vertical with the chain hanging below, and orient to align "O" marks on camshaft and crankshaft sprockets.
7. Align dowel in camshaft with dowel hole in camshaft sprocket and install sprocket on camshaft (fig. 14W).

NOTE: Do not attempt to drive cam sprocket on shaft as welsh plug at rear of engine can be dislodged.

8. Draw camshaft sprocket onto camshaft, using the three mounting bolts. Torque to specifications.
9. Lubricate timing chain with engine oil.
10. Install crankcase front cover and harmonic balancer as outlined.

CAMSHAFT

Removal

1. Remove intake manifold and valve lifters as outlined.

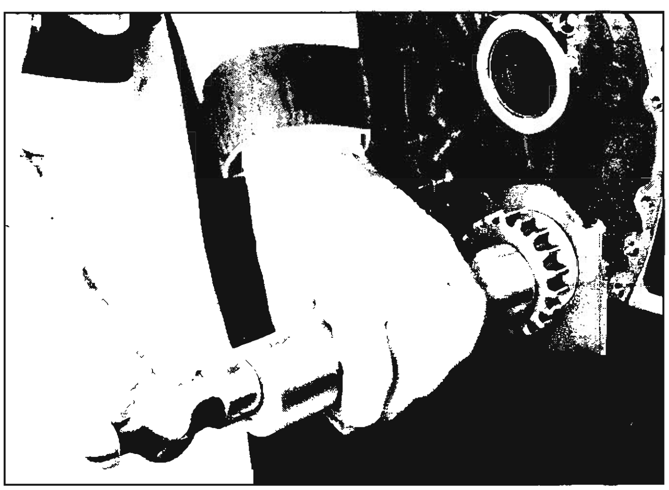


Fig. 13W—Installing Crankshaft Sprocket

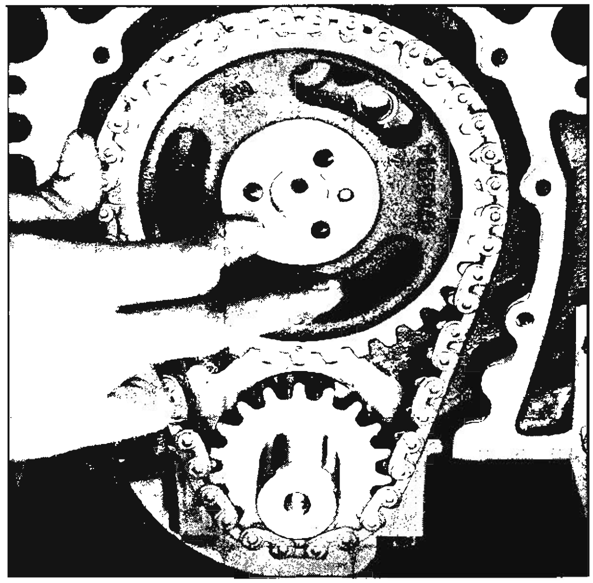


Fig. 14W—Installation of Timing Chain

2. Remove fuel pump and fuel pump push rod as outlined in Section 6M.
3. Remove grille assembly as outlined in Section 13.
4. Remove oil pan, harmonic balancer and crankcase front cover as outlined.
5. Remove timing chain and camshaft sprocket as outlined.
6. Install two bolts, 5/16" x 18 x 4" in two of camshaft bolt holes. Remove camshaft from engine (fig. 15W).

CAUTION: All camshaft journals are the same diameter and care must be used in removing camshaft to avoid damage to bearings.

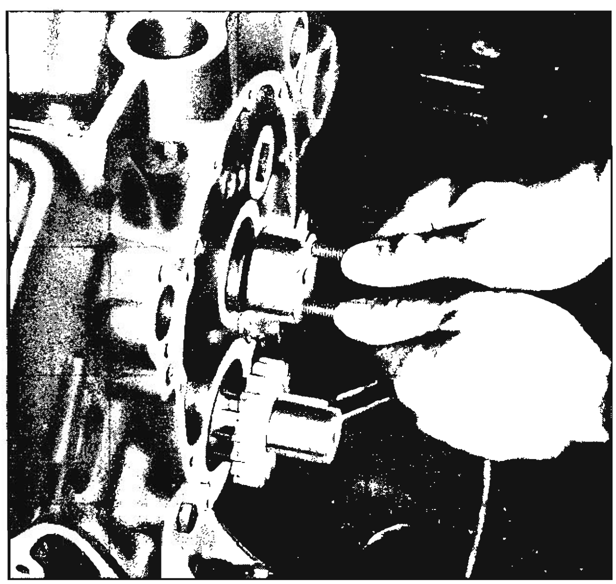


Fig. 15W—Removing Camshaft

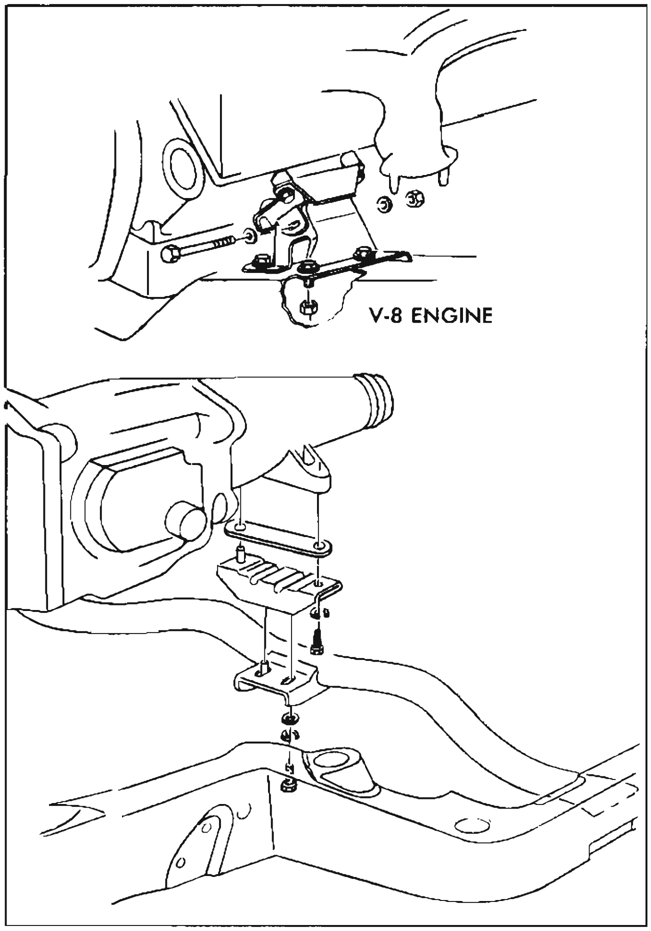


Fig. 16W—Engine Mounts

Installation

NOTE: Whenever a new camshaft is installed, coat camshaft lobes with Molykote or its equivalent.

1. Install two bolts in camshaft, lubricate camshaft and install camshaft in engine. Remove bolts.
2. Install timing chain and sprocket as outlined.
3. Install crankcase front cover, oil pan and harmonic balancer as outlined.
4. Install grille assembly as outlined in Section 13.
5. Install valve lifters, valve mechanism, intake manifold and distributor as outlined.
6. Install fuel pump push rod, mounting plate and fuel pump as outlined in Section 6M.
7. Start engine, check for leaks, adjust timing and carburetor idle and mixture.

ENGINE MOUNTS

Engine mounts are the non-adjustable type and seldom require service. Broken or deteriorated mounts should be replaced immediately, because of the added strain placed on other mounts and drive line components.

Front Mount Replacement (Fig. 16W)

1. Remove nut, washer and engine mount through-bolt.
2. Raise engine to release weight from mount.
3. Remove mount from engine.
4. Install new mount on engine.
5. Lower engine, install through-bolt and tighten all mount bolts to specified torques.

Rear Mount Replacement (Fig. 16W)

1. Remove crossmember-to-mount bolts.
2. Raise transmission to release weight from mount.
3. Remove mount-to-transmission bolts, then remove mount and spacer.
4. Install spacer and new mount on transmission.
5. While lowering transmission, align and start cross-member-to-mount bolts.
6. Lower transmission and tighten all mounting bolts to specified torques.

SPECIAL TOOLS

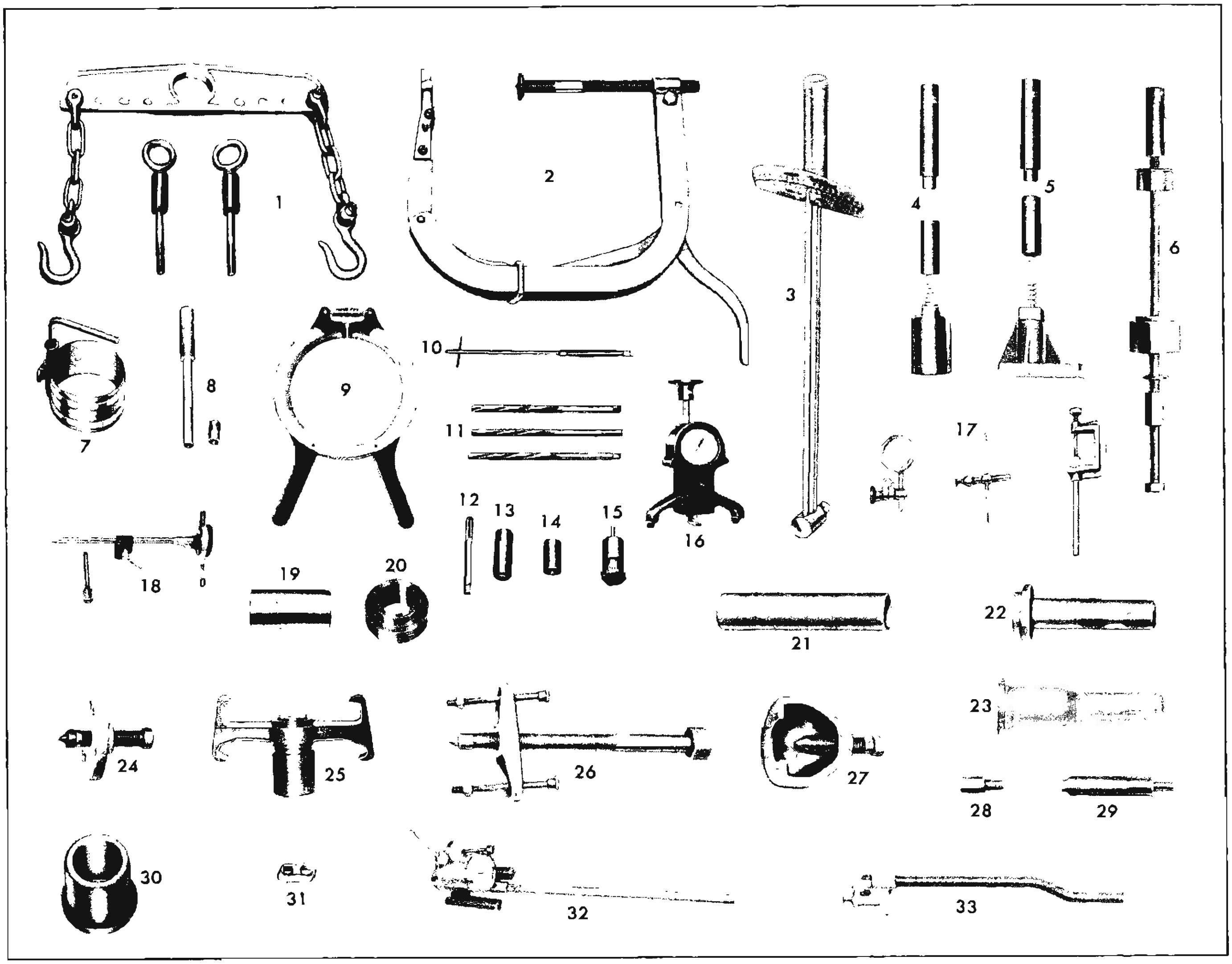


Fig. 1T—Engine Special Tools

1.	J-4536	Engine Lift Kit
2.	J-8062	Valve Spring Compressor
3.	J-1264 (0-200 ft. lb.)	Torque Wrench
	J-8058 (0-50 ft. lb.)	
	J-5853 (0-100 in. lb.)	
4.	J-6994	Piston Pin Assy. Tool
5.	J-9510	Piston Pin Assy. Tool
6.	J-6098	Cam Bearing Tool
7.	J-8037	Piston Ring Compressor
8.	J-6305	Connecting Rod Guide Set
9.	J-8020 (3 9/16")	Piston Ring Expander
	J-8021 (3 7/8")	
	J-8032 (4")	
	J-21989 (4 5/16")	
10.	J-8101	Valve Guide Cleaner
11.	J-5830 (11/32")	Valve Guide Reamer Set
	J-7049 (3/8")	
12.	J-5715 (.003")	Rocker Arm Stud Reamer
	J-6036 (.013")	
13.	J-6880	Rocker Arm Stud Installer
14.	J-5802	Rocker Arm Stud Remover
15.	J-8089	Carbon Removing Brush
16.	J-7316	Belt Tension Gauge
17.	J-8001	Indicator Set (Universal)
18.	J-8520	Indicator Set (Camshaft Lobe)
19.	J-0966	Crankcase Cover Centering Gauge
20.	J-21742	Crankcase Cover Centering Gauge
21.	J-5590	Crankshaft Sprocket or Gear Installer
22.	J-5595	Crankcase Cover Seal Installer
23.	J-8340	Crankcase Cover Seal Installer
24.	J-6978	Harmonic Balancer Puller
25.	J-8792	Harmonic Balancer Installer
26.	J-8105	Crankshaft Gear Puller
27.	J-5825	Crankshaft Sprocket Puller
28.	J-9534	Distributor Lower Bushing Remover
29.	J-9535	Distributor Lower Bushing Installer
30.	J-0971	Camshaft Gear Support
31.	J-5860	Cylinder Head Bolt Wrench
32.	J-8087	Indicator Set (Cylinder Bore)
33.	J-8369	Oil Pick-Up Screen Installer

SECTION 6K

ENGINE COOLING

INDEX

GENERAL DESCRIPTION

A pressure cooling system is provided for on all models by a pressure type radiator cap (fig. 1). The pressure type radiator cap used is designed to hold a pressure of approximately 13 pounds per square inch (15 lb. on air conditioned vehicles) above atmospheric pressure in the cooling system. Above 13 pounds the pressure is relieved by a valve within the cap that opens to radiator overflow.

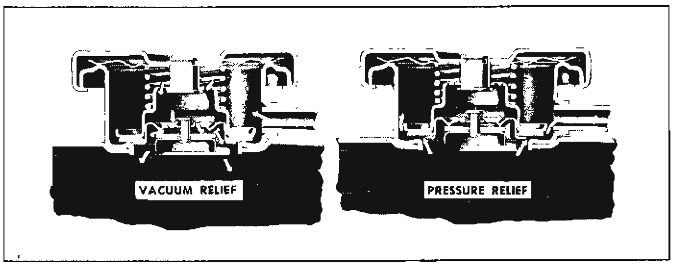


Fig. 1—Pressure Radiator Cap

The water pump (figs. 2 and 3) is a ball bearing, centrifugal vane impeller type. It requires no care other than to make certain the air vent at the top of the housing and the drain holes in the bottom do not become plugged with dirt or grease. Removal and installation of the water pump are covered in this section. For overhaul procedures of the water pump refer to Section 6K of the Overhaul Manual.

For radiator removal and installation refer to Section 13 of this manual. For radiator shroud, refer to Section 11 of this manual.

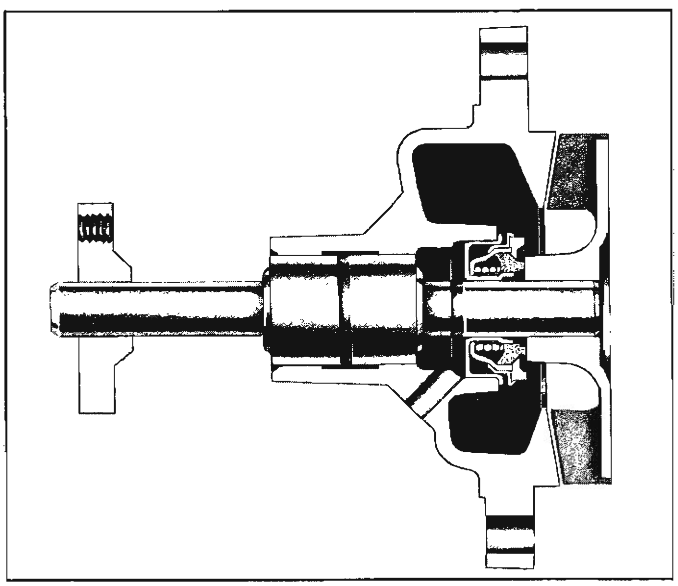


Fig. 2—Water Pump Cross Section (In-Line)

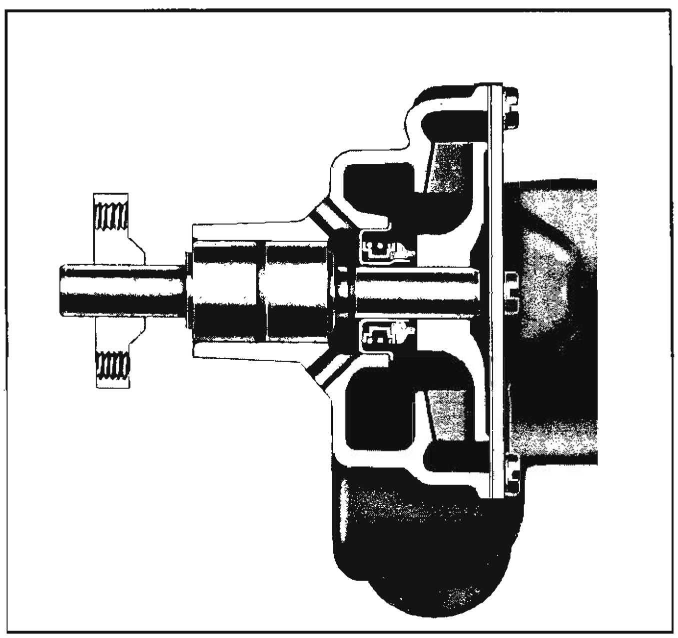


Fig. 3—Water Pump Cross Section (V-8)

MAINTENANCE AND ADJUSTMENTS

COOLANT LEVEL

The radiator coolant level should only be checked when the engine is cool, particularly on cars equipped with air conditioning. If the radiator cap is removed from a hot cooling system, serious personal injury may result.

The cooling system fluid level should be maintained one inch below the bottom of the filler neck of the radiator when cooling system is cold, or at the bottom of the filler neck when the system is warm. It is very important that the correct fluid level be maintained. The sealing ability of the radiator cap is affected when the cooling level is too high.

All passenger car cooling systems are pressurized with a pressure cap which permits safe engine operation at cooling temperatures of up to 243°F.

When the radiator cap is removed or loosened, the system pressure drops to atmospheric, and the heat which had caused water temperature to be higher than 212°F, will be dissipated by conversion of water to steam. Inasmuch as the steam may form in the engine water passages, it will blow coolant out of the radiator upper hose and top tank, necessitating coolant replacement. Engine operating temperatures higher than the normal boiling point of water are in no way objectionable so long as the coolant level is satisfactory when the engine is cool.

Upon repeated coolant loss, the pressure radiator cap and seat should be checked for sealing ability. Also, the cooling system should be checked for loose hose connections, defective hoses, gasket leaks, etc.

COOLANT SYSTEM CHECKS

1. Test for restriction in the radiator, by warming the engine up and then turning the engine off and feeling the radiator. The radiator should be hot at the top and warm at the bottom, with an even temperature rise from bottom to top. Cold spots in the radiator indicate clogged sections.
2. Water pump operation may be checked by running the engine while squeezing the upper radiator hose. A pressure surge should be felt. Check for a plugged vent-hole in pump.

   NOTE: A defective head gasket may allow exhaust gases to leak into the cooling system. This is particularly damaging to the cooling system as the gases combine with the water to form acids which are particularly harmful to the radiator and engine.

3. To check for exhaust leaks into the cooling system, drain the system until the water level stands just above the top of the cylinder head, then disconnect the upper radiator hose and remove the thermostat and fan belt. Start the engine and quickly accelerate several times. At the same time note any appreciable water rise or the appearance of bubbles which are indicative of exhaust gases leaking into the cooling system.

PERIODIC MAINTENANCE

Periodic service must be performed to the engine cooling system to keep it in efficient operating condition. These services should include a complete cleaning and reverse flushing as well as a reconditioning service.

In the course of engine operation, rust and scale accumulate in the radiator and engine water jacket. The accumulation of these deposits can be kept to a minimum by the use of a good rust inhibitor but it should be remembered that an inhibitor will not remove rust already present in the cooling system.

Two common causes of corrosion are: (1) air suction—Air may be drawn into the system due to low liquid level in the radiator, leaky water pump or loose hose connections; (2) exhaust gas leakage—exhaust gas may be blown into the cooling system past the cylinder head gasket or through cracks in the cylinder head and block.

Cleaning

A good cleaning solution should be used to loosen the rust and scale before reverse flushing the cooling system. There are a number of cleaning solutions available and the manufacturer's instructions with the particular cleaner being used should always be followed.

An excellent preparation to use for this purpose is GM Cooling System Cleaner. The following directions for cleaning the system applies only when this type cleaner is used.

1. Drain the cooling system including the cylinder block and then close both drain plugs.
2. Remove thermostat and replace thermostat housing.
3. Add the liquid portion (No. 1) of the cooling system cleaner.
4. Fill the cooling system with water to a level of about 3 inches below the top of the overflow pipe.
5. Cover the radiator and run the engine at moderate speed until engine coolant temperature reaches 180 degrees.
6. Remove cover from radiator and continue to run the engine for 20 minutes. Avoid boiling.
7. While the engine is still running, add the powder portion (No. 2) of the cooling system cleaner and continue to run the engine for 10 minutes.
8. At the end of this time, stop the engine, wait a few minutes and then open the drain cocks or remove pipe plugs. Also remove lower hose connection.

   CAUTION: Be careful not to scald your hands.

   NOTE: Dirt and bugs may be cleaned out of the radiator air passages by blowing out with air pressure from the back of the core.

Reverse Flushing

Reverse flushing should always be accomplished after the system is thoroughly cleaned as outlined above. Flushing is accomplished through the system in a direction opposite to the normal flow. This action causes the water to get behind the corrosion deposits and force them out.

Radiator

1. Remove the upper and lower radiator hoses and replace the radiator cap.
2. Attach a lead-away hose at the top of the radiator.
3. Attach a new piece of hose to the radiator outlet connection and insert the flushing gun in this hose.

4. Connect the water hose of the flushing gun to a water outlet and the air hose to an air line.
5. Turn on the water and when the radiator is full, turn on the air in short blasts, allowing the radiator to fill between blasts of air.

CAUTION: Apply air gradually as a clogged radiator will stand only a limited pressure.

6. Continue this flushing until the water from the lead-away hose runs clear.

Cylinder Block and Cylinder Head

1. With the thermostat removed, attach a lead-away hose to the water pump inlet and a length of new hose to the water outlet connection at the top of the engine.

NOTE: Disconnect the heater hose when reverse flushing engine.

2. Insert the flushing gun in the new hose.
3. Turn on the water and when the engine water jacket is full, turn on the air in short blasts.
4. Continue this flushing until the water from the lead-away hose runs clear.

Hot Water Heater

1. Remove water outlet hose from heater core pipe.

NOTE: Be sure heater control valve is open.

2. Remove inlet hose from engine connection.
3. Insert flushing gun and flush heater core. Care must be taken when applying air pressure to prevent damage to the core.

FAN BELT

Adjustment

1. Loosen bolts at Delcotron slotted bracket.
2. Pull Delcotron away from engine until desired tension reading is obtained with a strand tension gauge. Refer to Section 6 under tune-up.
3. Tighten all Delcotron bolts securely.

THERMOSTAT

The thermostat consists of a restriction valve actuated by a thermostatic element. This is mounted in the housing at the cylinder head water outlet above the water pump. Thermostats are designed to open and close at predetermined temperatures and if not operating properly should be removed and tested as follows.

1. Remove radiator to water outlet hose.
2. Remove thermostat housing bolts and remove water outlet and gasket from thermostat housing (fig. 4).
3. Inspect thermostat valve to make sure it is in good condition.
4. Place thermostat in hot water 25° above the temperature stamped on the thermostat valve.
5. Submerge the valve completely and agitate the water thoroughly. Under this condition the valve should open fully.

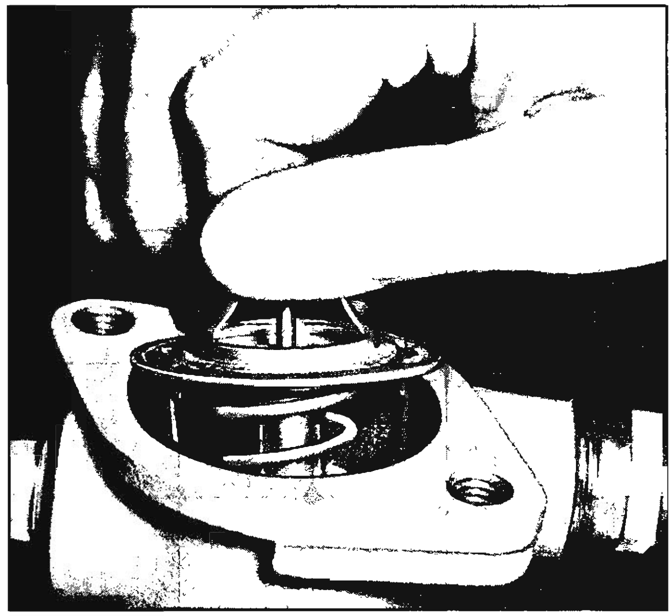


Fig. 4—Replacing Thermostat

6. Remove the thermostat and place in water 10° below temperature indicated on the valve.
7. With valve completely submerged and water agitated thoroughly, the valve should close completely.
8. If thermostat checks satisfactorily, re-install, using a new housing gasket.
9. Refill cooling system.

WATER PUMP

Removal

1. Drain radiator and break loose the fan pulley bolts.
2. Disconnect heater hose at water pump.
3. Loosen Delcotron and remove fan belt then remove pump to cylinder block bolts and remove pump from engine.

NOTE: On in-line engines, pull the pump straight out of the block first, to avoid damage to impeller.

4. Remove bolts and fan and pulley.

Installation

1. Install pump pulley and fan on pump hub and tighten bolts securely.
2. Install pump assembly on cylinder block and tighten bolts securely. Use a new pump to block gasket.
3. Connect hoses and fill cooling system.
4. Install fan belt and adjust. See Section 6.
5. Start engine and check for leaks.

SECTION 6M
ENGINE FUEL

CONTENTS OF THIS SECTION

CARBURETORS

INDEX

GENERAL DESCRIPTION

Many various carburetors are used in the Chevrolet, Chevelle and Chevy II (fig. 1). These carburetors are designed to meet the particular requirements of engines, transmissions and vehicles.

This section covers removal and installation of carburetors and adjustments that must be made while the carburetor is on the engine. For repair procedures and other adjustments refer to the Overhaul Manual, Section 6M. Specifications are covered in the rear of this manual.

This section also covers service and repair procedures for choke coils, throttle linkage and fuel filters.

SERVICE PROCEDURES

CARBURETOR

Preliminary Checks

1. Thoroughly warm-up engine. If the engine is cold, allow to run for at least 15 minutes.
2. Inspect torque of carburetor to intake manifold bolts and intake manifold to cylinder head bolts to exclude the possibility of air leaks.
3. Inspect manifold heat control valve (if used) for freedom of action and correct spring tension.

Idle Speed and Mixture Adjustment

NOTE: This adjustment should be performed with engine at operating temperature and parking brake applied.

1. Remove Air Cleaner.
2. Connect tachometer and vacuum gauge to engine, then set hand brake and shift transmission into neutral.
3. As a preliminary adjustment, turn idle mixture screws lightly to seat and back out 1-1/2 turns.

CAUTION: Do not turn idle mixture screw tightly against seat or damage may result.

4. With engine running (choke wide open) adjust idle speed screw to specified idle speed, (Powerglide in drive, manual transmission in neutral).
5. Adjust idle mixture screw to obtain highest steady vacuum at specified idle speed.

NOTE: On Rochester BV carburetors the idle mixture screw should be turned out 1/4 turn from the "lean roll" position.

6. Repeat Steps 4 and 5 as needed for final adjustment.

NOTE: If necessary, final adjustment of the carburetor may be made with the air cleaner installed.

7. Shut down the engine, remove gauges and install air cleaner.

NOTE: On carburetors equipped with a hot idle compensator valve; if engine idles erratic, hold hot idle compensator valve closed with a pencil or a small wooden dowel, while adjusting idle mixture screws.

CARBURETOR APPLICATION

Model	Engine	Option	Chevrolet	Chevelle	Chevy II
Rochester BV	L-6 (194)	Syn.		7025105	7025105
		P/G		7025108	7025108
	L-6 (230)	Syn.	7025003	7025003	7025003
		P/G	7025000	7025000	7025000
Rochester 2GV	V-8 (283)	Syn.	7024101	7024101	7024101
		P/G	7024110	7024110	7024110
		A/C	7024112	7024112	7024112
Rochester 4GC	V-8 (327)	Syn.		7024127	7024127
		P/G	7025121	7025126	7025126
		A/C	7025122	7025128	7025128
Rochester 4GC (Low Silhouette)	V-8 (409)	Syn.	7025123		
		P/G	7025124		
Carter YF	L-4 (153)	Syn.			(3379 S) 3792945
		P/G			(3402 S) 3793019
Carter WCFB	V-8 (327)	Syn.	(3679 S) 3846247		
		P/G	(3696 S) 3846246		
Carter AFB	V-8 (327)	Syn.	(3721 SA) 3851761	(3721 SA) 3851761	(3721 SA) 3851761
		P/G	(3720 SA) 3851762	(3720 SA) 3851762	(3720 SA) 3851762
	V-8 (409)	Syn.	(3499 S) 3827324		
Holley 4150	V-8 (327)	Syn.		(3043 A) 3863150	(3043 A) 3863150

CAUTION: Never bend or adjust bi-metal strip on hot idle compensator. If malfunctioning, replace complete valve.

Test Before Installation

It is good shop practice to fill the carburetor bowl before installing the carburetor. This reduces the strain on the starting motor and battery and reduces the possibility of backfiring while attempting to start the engine. A fuel pump clamped to the bench, a small supply of fuel and the necessary fittings enable the carburetor to be filled and the operation of the float and intake needle and seat to be checked. Operate the throttle several times and check the discharge from the pump jets before installing the carburetor.

Removal

Flooding, stumble or acceleration and other performance complaints are, in many instances, caused by the presence of dirt, water, or other foreign matter in the carburetor. To aid in diagnosing the cause of the complaint, the carburetor should be carefully removed from the engine without draining the fuel from the bowl. The contents of the fuel bowl may then be examined for contamination as the carburetor is disassembled.

1. Remove air cleaner and gasket.
2. Disconnect fuel and vacuum lines from carburetor.
3. Disconnect choke rod or choke tube.
4. Disconnect accelerator linkage.
5. If equipped with Powerglide transmission, disconnect TV linkage (only necessary on V-8 engines).
6. Remove carburetor attaching nuts and remove carburetor.

Installation

1. Be certain throttle body and intake manifold sealing surfaces are clean.

   NOTE: On V-8 engines, remove carbon from heat crossover ports.

2. Install new carburetor to manifold flange gasket. (Not necessary on Rochester BV Carburetors)
3. Install carburetor over manifold studs.
4. Start vacuum and fuel lines at carburetor.
5. Install attaching nuts and tighten securely.

   NOTE: On vehicles equipped with Rochester 2GV Carburetors, the two front studs have copper washers under the nuts.

6. Tighten fuel and vacuum lines.
7. Connect and adjust accelerator and TV linkage.
8. Connect choke tube or choke rod. On vehicles so equipped adjust choke rod.
9. Adjust idle speed and mixture, then install air cleaner.

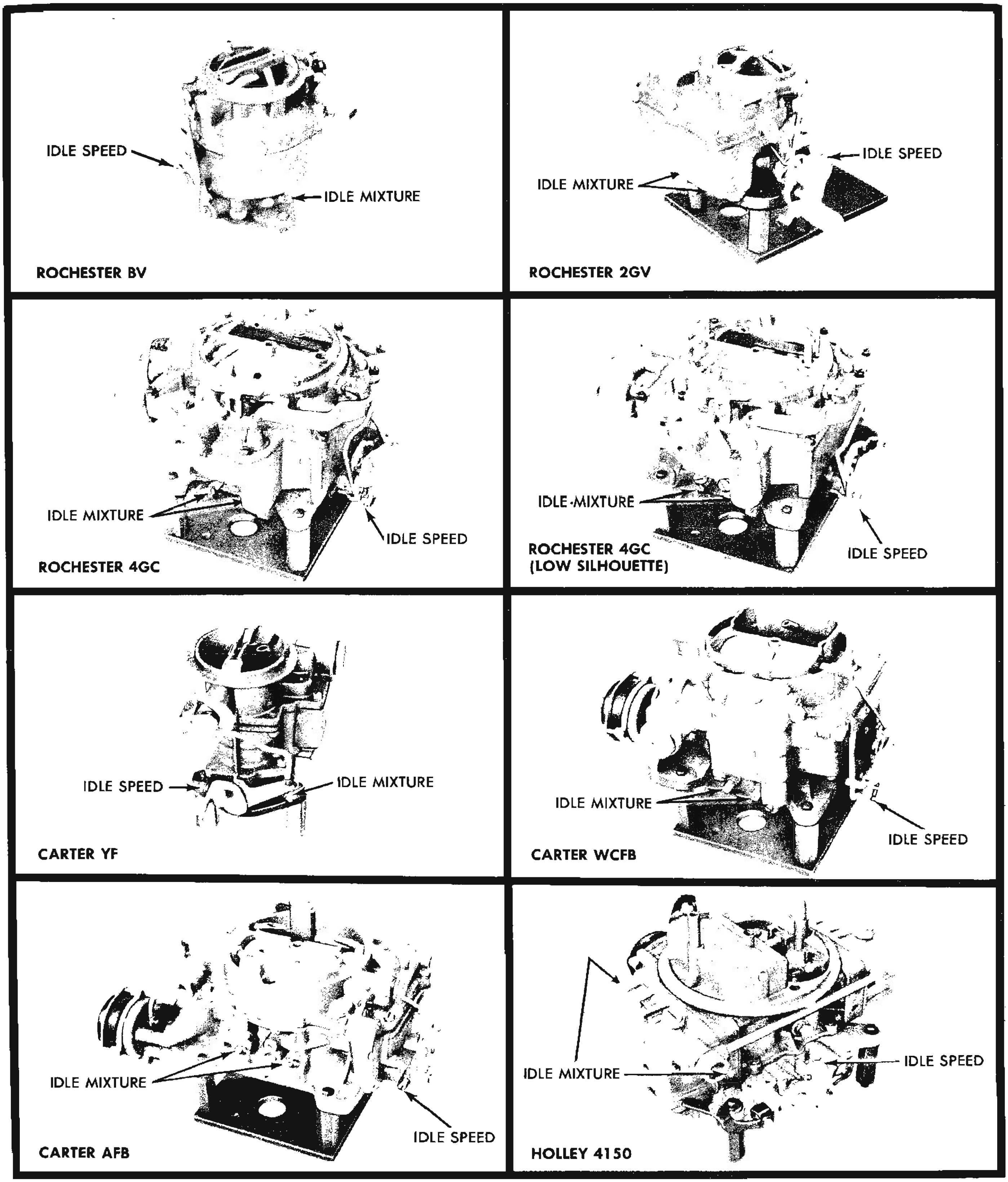


Fig. 1—Carburetors

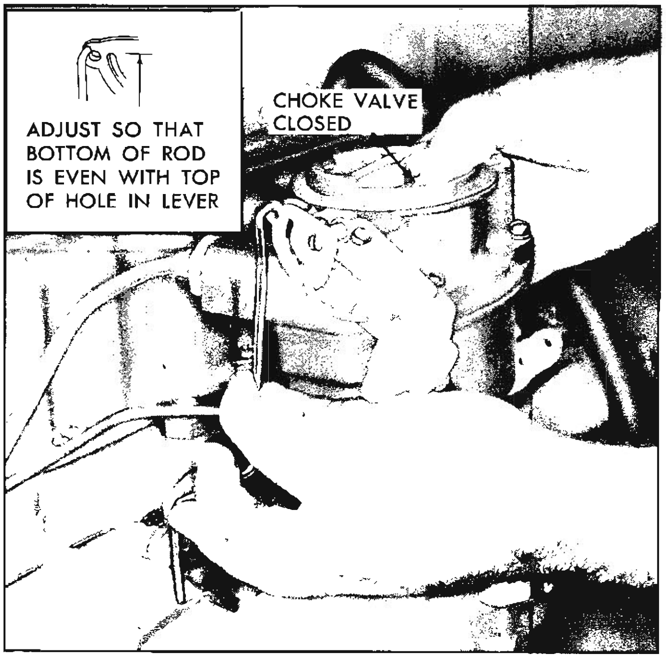


Fig. 2—Rochester BV Choke Adjustment

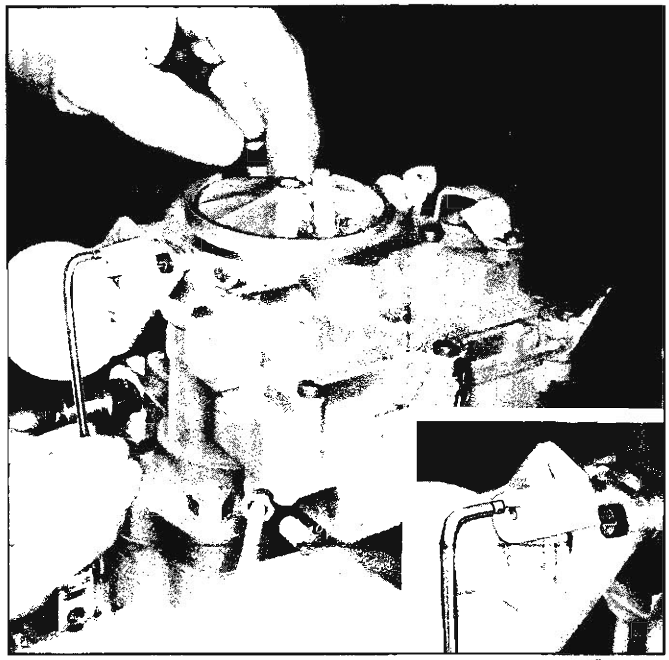


Fig. 3—Rochester 2GV Choke Adjustment

Choke Adjustment

Rochester BV (Fig. 2)

1. Remove air cleaner and disconnect choke rod from choke lever at carburetor.
2. Hold choke valve closed and pull choke rod up against stop in thermostat housing, while checking and adjusting rod length as follows:
   a. Nominal (Index) setting is provided when the bottom edge of the choke rod end aligns with the top edge of the hole in the choke lever (equivalent to one rod diameter above the hole).
   b. Leaner settings, if desired, can be made by bending the choke rod in the offset area to decrease rod effective length. At the maximum allowable lean setting, AT LEAST the upper quarter of the rod end should overlap the top edge of the lever hole.

   NOTE: After making any change in choke rod length, check for free operation as interferences may exist at the manifold end of the rod. If a lean adjustment is made, make sure that it is possible for the choke valve to fully close at the new setting.

   c. To adjust for a choke setting equivalent to "2 notches" rich, the choke rod should be bent at the rod offset area to effectively lengthen the rod and bring the rod end 2 rod diameters above the hole in the choke lever.
3. Connect rod at choke lever and install air cleaner.

Rochester 2GV (Fig. 3)

1. Remove air cleaner and check to see that choke valve and rod move freely.
2. Disconnect choke rod at choke lever.
3. Hold choke valve closed and pull rod up against stop in thermostat housing. The top of choke rod end should be approximately 1/2 rod diameter above top of hole in choke valve lever as shown to assure choke valve closing.
4. If necessary, adjust rod length by bending rod at offset bend. (Bend must be such that rod enters choke lever hole freely and squarely.)
5. Connect rod at choke lever and install air cleaner.

Carter YF

1. Remove air cleaner.
2. Push hand choke knob in to within 1/8" of instrument panel.
3. Loosen choke cable clamp at carburetor bracket and adjust cable through the clip until the choke valve is wide open.
4. Tighten cable clamp at carburetor bracket and check operation of choke valve to ensure full closed and wide open positions
5. Install air cleaner.

Float Adjustment

Holley 4150 (Fig. 4)

1. Remove air cleaner then remove the sight plugs.
2. With parking brake on, and transmission in neutral, start the engine and allow it to idle.
3. With the car on a level surface, the fuel level should be on a level with the threads at the bottom of the sight plug port (plus or minus 1/32 inch).

   NOTE: No float drop adjustment is required on this carburetor.

4. If necessary to adjust (either or both bowls), loosen inlet needle lock screw and turn the adjusting nut clockwise to lower or counter-clockwise to raise fuel level, then tighten lock screw.

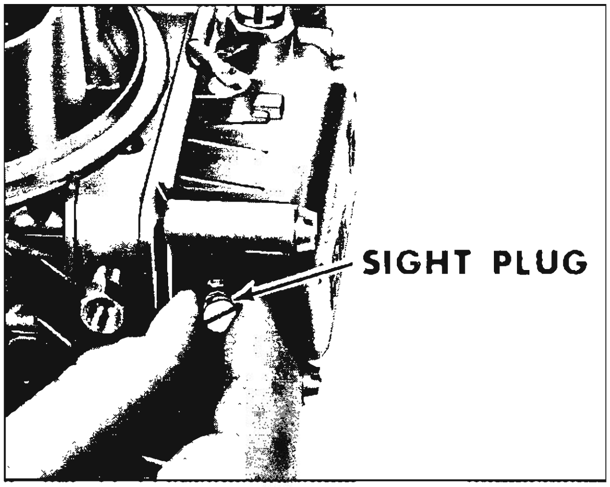


Fig. 4—Fuel Level Sight Plug

NOTE: 1/6 turn of adjusting nut equals approximately 1/16" fuel level change.

5. Allow a minute for fuel level to stabilize then recheck the level at sight plug.
6. Readjust, if necessary, until proper level is obtained, then install sight plug and air cleaner.

NOTE: To assure proper secondary float level setting it is advisable to accelerate primary throttles slightly and hand operate secondary throttle. This assures a stabilized secondary fuel level.

Secondary Throttle Valve Lock Spring Adjustment

Rochester 4GC (Fig. 5)

This adjustment must be made to ensure a positive closing of the secondary throttle valves on idle. Adjustment of this U-shaped spring establishes tension against the secondary operating lever, holding the secondary throttle valves positively closed.

Following is the adjustment procedure. This is an on the car adjustment only.

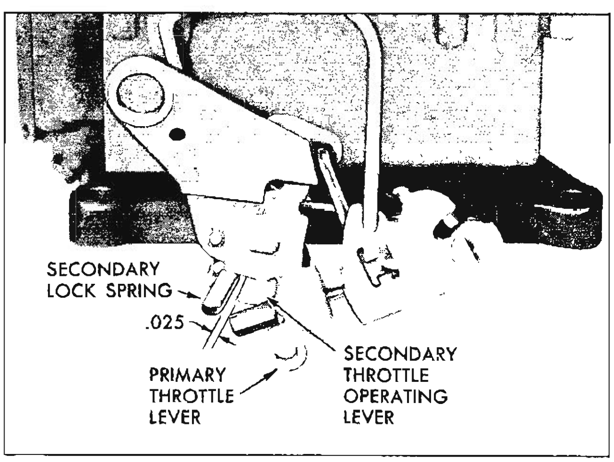


Fig. 5—Secondary Throttle Lock Spring Adjustment

1. Adjust carburetor idle speed and mixture (be sure secondary valves are completely closed).
2. Shut off engine and place idle speed screw on second step of the fast idle cam as shown.
3. Measure clearance between the secondary lock spring and the secondary throttle operating lever. This clearance should be .025" (Tool J-8879). Bend lock spring to adjust.

Additional Adjustments

NOTE: The following adjustments may be made without removing the carburetor from the engine. For procedure refer to the Overhaul Manual, Section 6M.

Rochester BV and Rochester 2GV

Float
Idle Vent
Choke Rod (Fast Idle)
Choke Unloader
Choke Vacuum Break

Rochester 4GC and Rochester 4GC "Low Silhouette"

Float
Accelerator Pump Rod
Idle Vent
Intermediate Choke Rod
Choke Cover
Choke Rod (Fast Idle)
Choke Unloader
Secondary Throttle Opening
Secondary Throttle Lockout

Carter YF

Float
Idle Vent
Choke Rod (Fast Idle)

Carter WCFB

Float
Accelerator Pump Rod
Metering Rod
Choke Rod (Fast Idle)
Idle Vent
Intermediate Choke Rod
Choke Cover
Choke Unloader

Carter AFB

Float
Accelerator Pump Rod
Intermediate Choke Rod
Choke Cover
Choke Rod (Fast Idle)
Choke Unloader
Closing Shoe
Secondary Throttle Opening
Secondary Throttle Lockout

Holley 4150

Fast Idle
Accelerator Pump

CHOKE COIL

Replacement

With Rochester BV Carburetor (Fig. 6)

1. Disconnect choke rod upper clip.
2. Remove bolts attaching choke coil to manifold, then remove choke coil and choke rod as an assembly.
3. Disconnect choke rod from choke coil.
4. Connect choke rod to new choke coil and install assembly on manifold.
5. Install bolts and tighten securely.
6. Adjust and connect choke rod as outlined.

With Rochester 2GV Carburetor (Fig. 7)

1. Remove shield by prying with screw driver in cutout provided (fig. 8).
2. Disconnect choke rod upper end clip and remove rod.
3. Remove coil bracket screw and coil assembly.
4. Install new coil assembly, indexing tab side towards engine, then install mounting screw.
5. Check to see that choke rod eye of coil is below the stop tab on the bracket, then install choke rod and adjust if necessary.
6. Install heat shield over choke coil and move shield to best fit along manifold.

   NOTE: It may be necessary to pinch the bottom edges together slightly to pass by mounting screw.

7. Make sure choke rod moves freely from full open to full closed choke.
8. Start and warm-up the engine and check operation of choke.

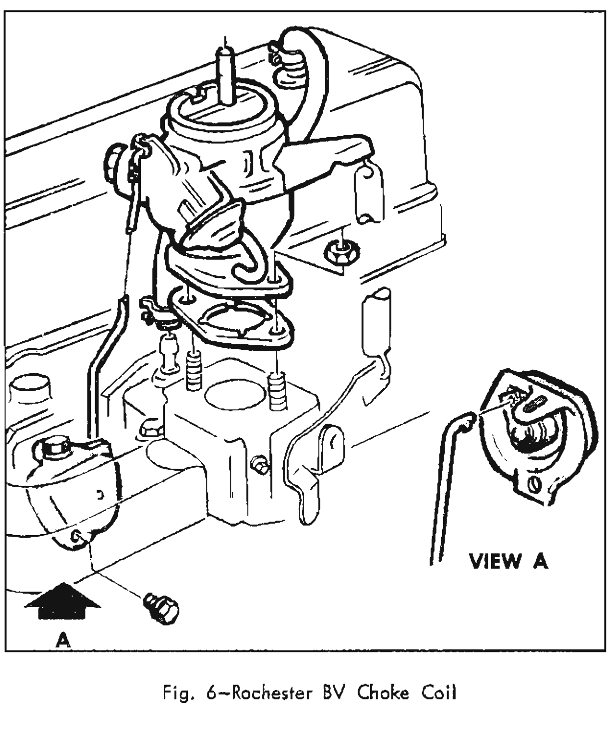


Fig. 6—Rochester BV Choke Coil

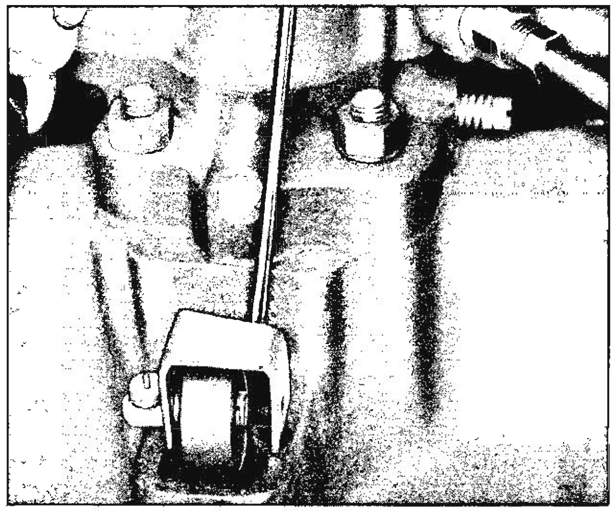


Fig. 7—Rochester 2GV Choke Coil

THROTTLE LINKAGE

Adjustment

In-Line Engines (Fig. 9)

1. Disconnect throttle rod at bellcrank lever on manifold.
2. On Powerglide vehicles disconnect TV rod at bellcrank.
3. Hold carburetor throttle valve in wide open position, pull throttle rod forward (to position accelerator pedal at the floor mat) and adjust rod to just enter hole in bellcrank lever.
4. Connect rod to bellcrank lever and install retainer.
5. On Powerglide vehicle hold throttle rod in full throttle position, push TV rod to full detent position and adjust swivel on TV rod to just enter hole on

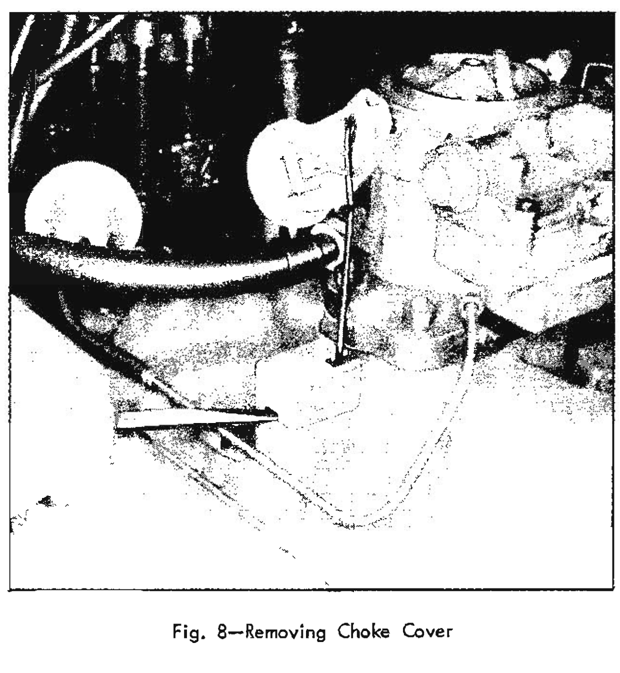


Fig. 8—Removing Choke Cover

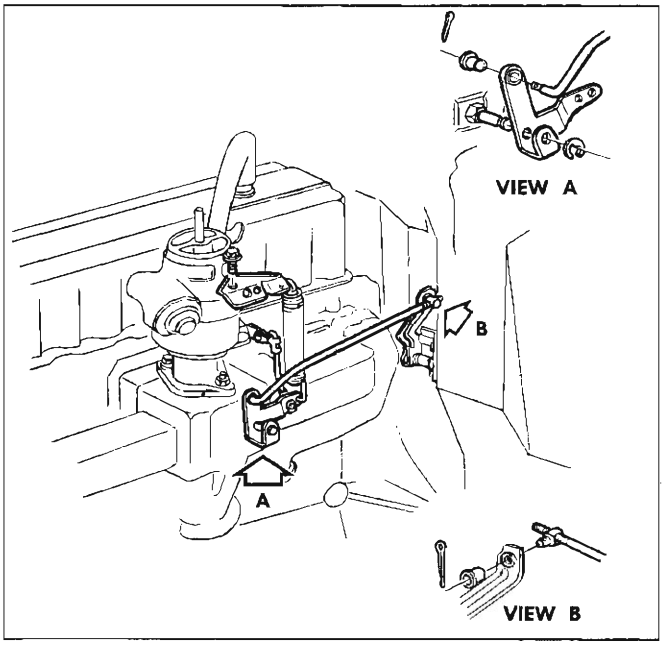
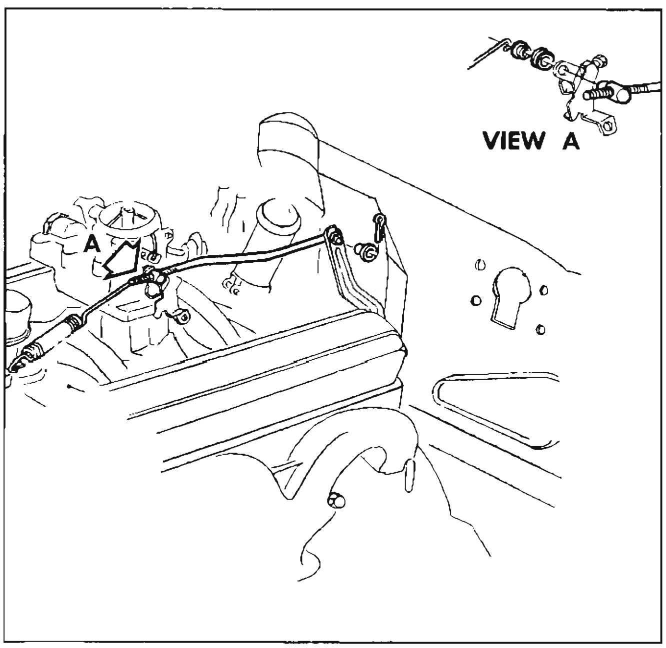


Fig. 9—Throttle Linkage In-Line Engines

throttle bellcrank, then connect TV rod swivel at bellcrank.

V-8 Engines (Fig. 10)

1. Disconnect throttle rod swivel at throttle lever on carburetor.
2. On Powerglide vehicles disconnect TV rod at throttle lever.
3. Hold carburetor throttle valve in wide open position, pull throttle rod forward (to position accelerator



Fig, 10—Throttle Linkage V-8 Engines

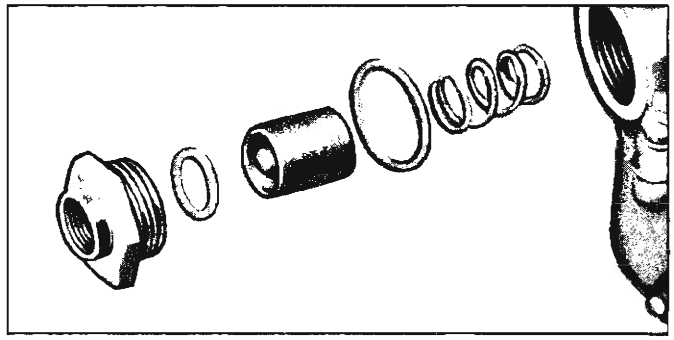


Fig. 11—Inlet Fuel Filter

pedal at the floor mat) and adjust swivel to just enter hole in throttle lever.

4. Connect swivel to throttle lever and install accelerator return spring.
5. On Powerglide vehicle hold throttle rod in full throttle position, push TV rod to full detent position and adjust TV rod to just enter hole on throttle lever, then connect TV rod at throttle lever.

FUEL FILTER

Maintenance

Inlet Fuel Filter (Fig. 11)

1. Remove fuel line connection at inlet fuel filter nut.
2. Remove inlet fuel filter nut from carburetor inlet fuel filter with a 1" box wrench or socket.
3. Remove filter element and spring.
4. Clean element by washing in solvent and blowing out. Blow in opposite direction of fuel flow.
5. Install element spring, then install element in carburetor so small section of cone faces out.
6. Install the two gaskets on inlet fitting nut, then install nut in carburetor.
7. Install fuel line and tighten connector.

NOTE: Element should be replaced if plugged or if flooding occurs.

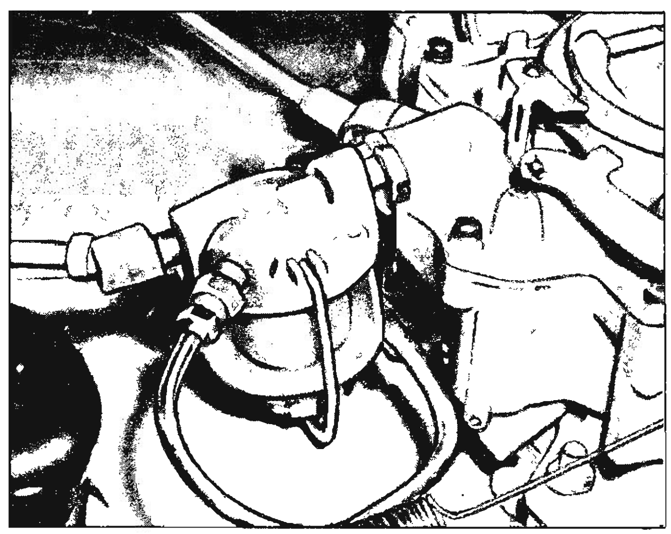


Fig. 12—Fuel Filter Installed

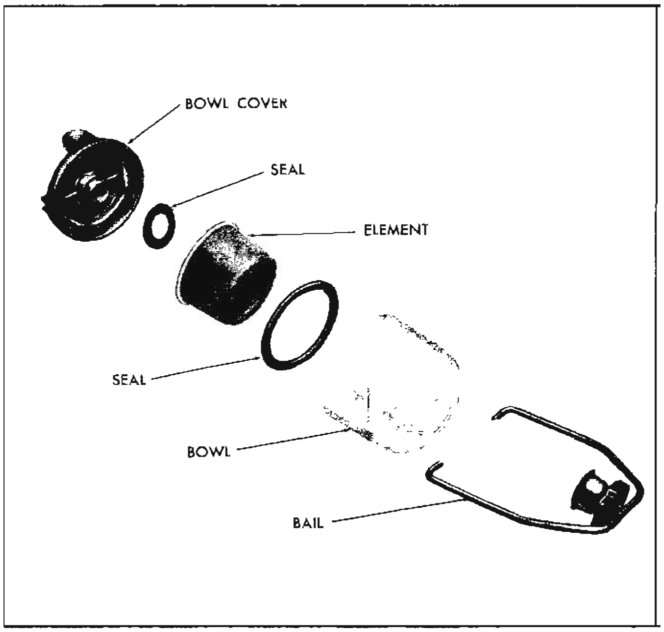


Fig. 13—Fuel Filter Assembly

Glass Bowl Fuel Filter (Fig. 12)

1. Loosen bail nut then remove glass bowl and paper filter element (fig. 13).
2. Replace paper filter element.
3. Install with new gaskets.

AIR CLEANERS

INDEX

GENERAL DESCRIPTION

Air cleaners on all models operate primarily to remove dust and dirt' from the air that is taken into the carburetor and engine. All air cleaners on engines equipped with "Closed Positive" ventilation incorporate flame arresters. Every 12,000 miles the flame arresters should be removed, cleaned in solvent and blown dry with compressed air.

An oil wetted polyurethane element air cleaner (fig. 14) is standard equipment on in-line engines. This type cleaner element is reusable and should be removed, cleaned, re-oiled and reinstalled every 12,000 miles or more often during dusty or other adverse driving conditions.

On the V-8 engines, a replaceable, oil wetted, paper element type is used (fig. 15). Both ends of the paper element are bonded with plastisol sealing material. Every 12,000 miles or more often during dusty or other adverse driving conditions, either replace, oil wetted, paper element or test element using Tool J-7825.

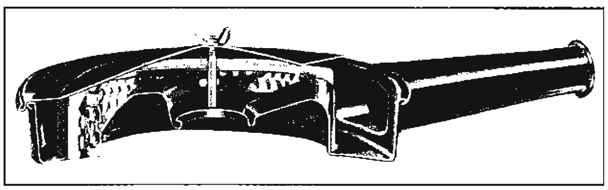


Fig. 14—In-Line Engine Air Cleaner

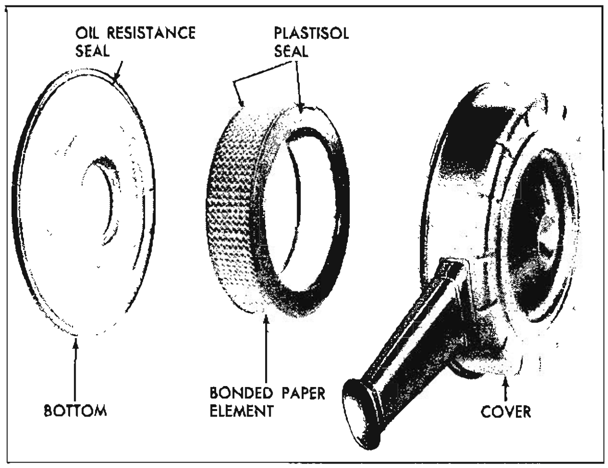


Fig. 15—V-8 Engine Air Cleaner

SERVICE PROCEDURES

POLYURETHANE ELEMENT (Fig. 16)

Maintenance

1. Remove cover wing nut, cover and filter element.
2. Visibly check the element for tears or rips and replace if necessary.
3. Clean all accumulated dirt and grime from air cleaner bottom and cover. Discard bowl cover to air cleaner gasket.
4. Remove support screen from element and wash element in kerosene or mineral spirits; then squeeze out excess solvent (fig. 17).

NOTE: Never use a hot degreaser or any solvent containing acetone or similar solvent.

5. Dip element into light engine oil and squeeze out excess oil.

NOTE: Never shake, swing or wring the element to remove excess oil or solvent as this may tear the polyurethane material. Instead, "squeeze" the excess from the element.

6. Install element on screen support (fig. 18).
7. Using a new gasket, replace air cleaner body over carburetor bowl cover.

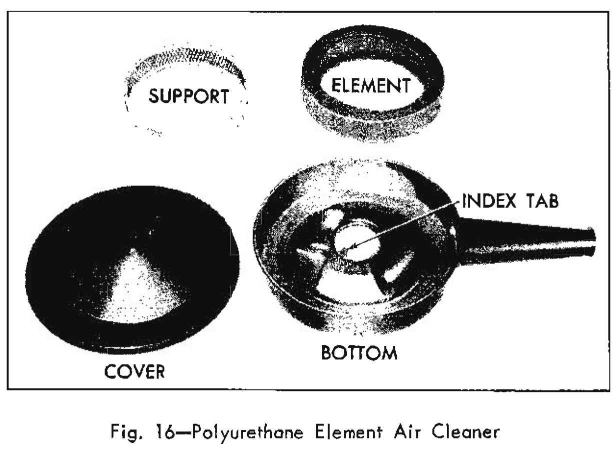


Fig. 16—Polyurethane Element Air Cleaner

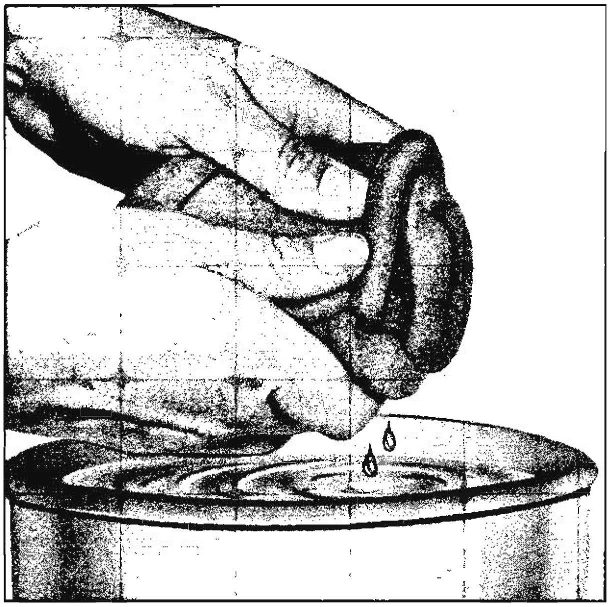


Fig. 17—Cleaning Polyurethane Element

8. Replace the element in the air cleaner. Care must be taken that the lower lip of the element is properly placed in the assembly and that the filter material is not folded or creased in any manner that would cause an imperfect seal. Take the same precautions when replacing the cover that the upper lip of the element is in proper position.
9. Replace cover and wing nut.

OIL WETTED PAPER ELEMENT

Replacement

NOTE: Before testing, inspect for holes or breaks in the element, as these defects require immediate replacement. If testing indicates that the element restriction is satisfactory at 12,000 miles, the element need not be replaced but should be retested every 6,000 miles thereafter until replaced.

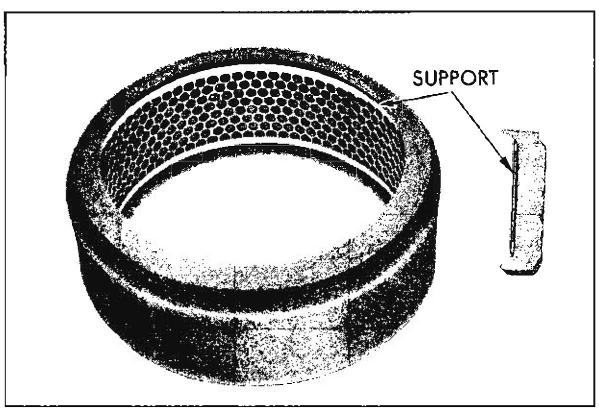


Fig. 18—Polyurethane Support

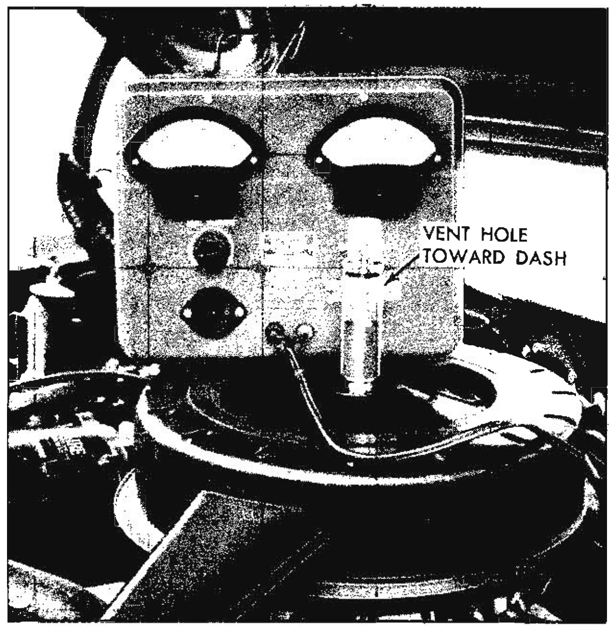


Fig. 19—Tool Installed on Air Cleaner (Typical)

1. Remove wing nut, washer and cover.
2. Remove paper element and discard.
3. Remove bottom section of air cleaner and gasket on air horn of carburetor. Discard air horn gasket.
4. Clean bottom section of air cleaner and cover pieces thoroughly to remove dust and grime.

   NOTE: Check bottom section of air cleaner seal for tears or cracks.

5. Install a new gasket on carburetor air horn and set bottom section of air cleaner on carburetor.
6. Install new paper element on bottom section of air cleaner with either end up.

   NOTE: Plastisol seal is the same material on both ends.

7. Install cover, washer and wing nut.

Testing

Tool J-7825, is designed to check paper element air cleaners to determine whether the element has materially decreased in efficiency and should be replaced or has only slightly increased air restriction and is suitable for further service. In combination with a tachometer, this instrument will quickly and accurately determine the air cleaner element condition without removing the element from the air cleaner.

1. Remove the wing nut and washer (if used) from the air cleaner cover stud, then screw Tool J-7825 onto the stud until it seals tightly against the air cleaner cover. Rotate the entire tool so that the scale can be read from the left side of the car. Be sure the vent hole is toward the dash (fig. 19).
2. Connect a tachometer and place it so that it may be read simultaneously with Tool J-7825 (fig. 19).
3. Zero oil level in the inner tube by pulling inner tube upward until the rubber seal is above the vent hole,

then raise or lower as required until the inner tube oil level is exactly to the "0" mark.

4. Start engine. If engine is cold, allow to run for 2 to 3 minutes. The automatic choke must be fully open.
5. Accelerate the engine slowly until the oil level in Tool J-7825 just reaches the 1/4 mark. Allow engine speed to stabilize and note tachometer reading. Decelerate engine.
6. If the tachometer reading is at or below the following, the oil wetted, paper air cleaner element is restricted beyond the allowable limit and should be replaced.

Engine		Minimum Allowable RPM @ ¼" H_2O
283 V-8	195 H.P.	2300 R.P.M.
327 V-8	250 H.P.	2100 R.P.M.
	300 H.P.	2100 R.P.M.
	350 H.P.	2600 R.P.M.
	365 H.P.	2600 R.P.M.
409 V-8	340 H.P.	1100 R.P.M.
	400 H.P.	1100 R.P.M.

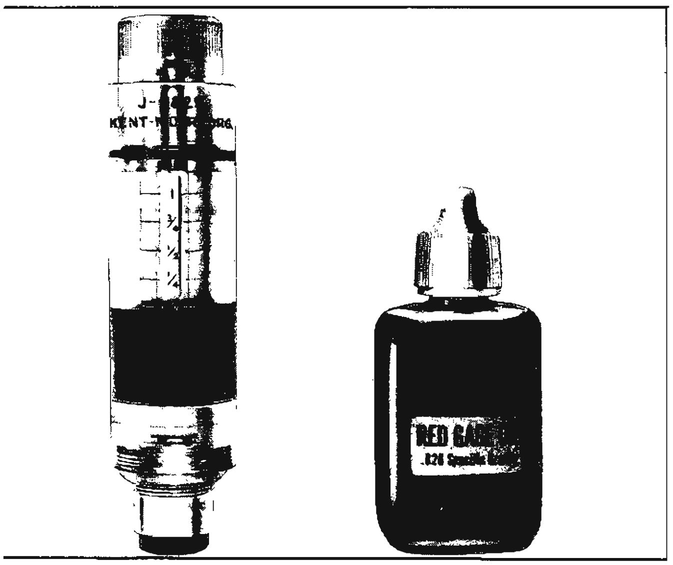


Fig. 20—Tool J-7825

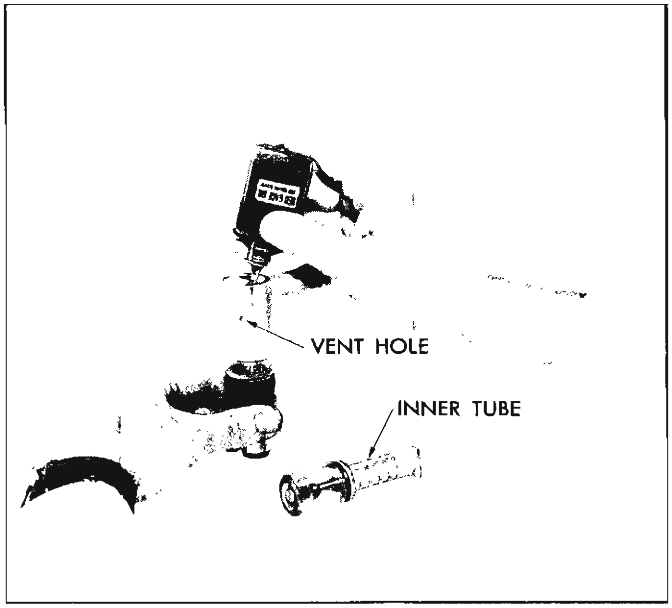


Fig. 21—Filling Tool with Oil

7. Remove tachometer and Tool J-7825 from vehicle and push down inner tube until seal is below vent hole to prevent oil loss. Replace tubing from choke heat pipe to its clean air source on air cleaner.

Tool J-7825 (Fig. 20)

Tool J-7825 is shipped dry and must be filled with the red gauge oil (specific gravity .826) provided.

Filling Tool

Pull the knurled inner tube completely out of the gauge and add oil to the reservoir until the oil level is between the two "FILL" lines (fig. 21). Refill whenever the level falls below the lower "FILL" line.

Storing Tool

When the tool is not in use, fully depress the inner tube. This seals off the oil reservoir from the vent hole to prevent oil loss if the tool is tipped.

FUEL PUMP

INDEX

GENERAL DESCRIPTION

The fuel pumps used on both In-Line (fig. 22) and V-8 (fig. 23) engines are of the diaphragm type. The pumps are operated by an eccentric located toward the front end of the engine camshaft. On In-Line engines, an eccentric on the camshaft actuates the pump rocker arm. On V-8 engines the pump rocker arm is actuated by a push rod, located in the cylinder block between the pump and the fuel pump eccentric on the camshaft. The V-8 engine pump is inverted relative to the In-Line engine pump, and has a larger capacity. A rubber oil seal is used on both pumps. Figures 22 and 23 show a cross-section of each pump.

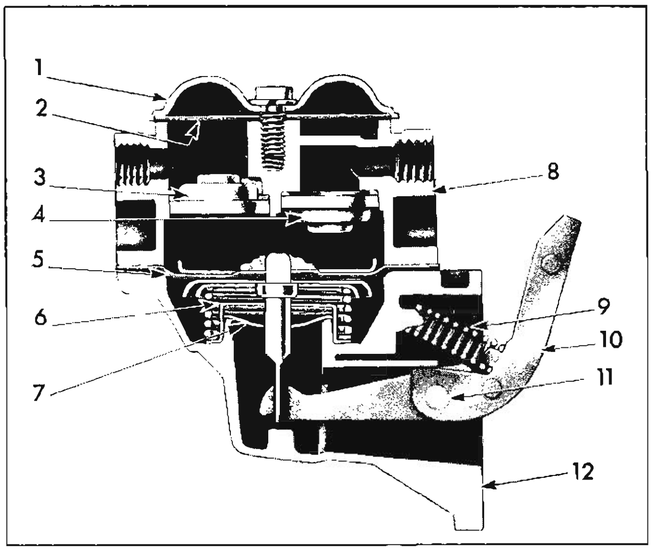


Fig. 22—In-Line Engine Fuel Pump

1. Pulsator Cover
2. Pulsator Diaphragm
3. Outlet Valve
4. Inlet Valve
5. Diaphragm Assembly
6. Diaphragm Spring
7. Oil Seal
8. Fuel Cover
9. Rocker Arm Return Spring
10. Rocker Arm and Lever Assembly
11. Pivot Pin
12. Pump Body

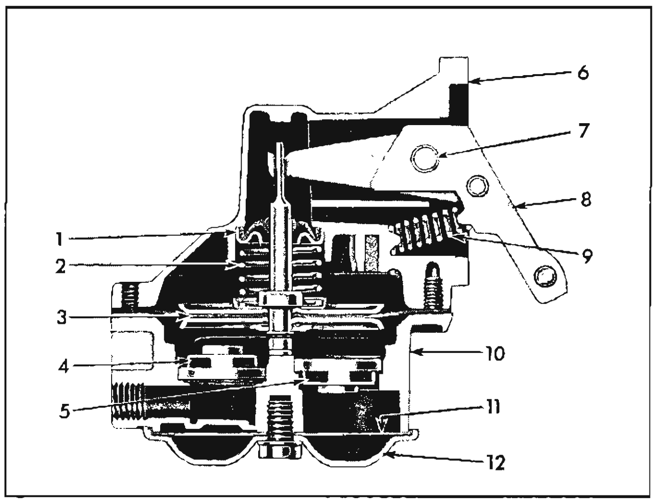


Fig. 23—V-8 Engine Fuel Pump

1. Oil Seal and Retainer
2. Diaphragm Spring
3. Diaphragm Assembly
4. Inlet Valve
5. Outlet Valve
6. Pump Body
7. Pivot Pin
8. Rocker Arm and Lever Assembly
9. Rocker Arm Return Spring
10. Fuel Cover
11. Pulsator Diaphragm
12. Pulsator Cover

SERVICE PROCEDURES

IN-LINE AND V-8 ENGINES

Inspection

The fuel pump should be checked regularly to make sure that the mounting bolts, cover to body bolts, pulsator diaphragm cover screws and inlet and outlet connections are tight.

Test

Always test pump while it is mounted on the engine and be sure there is gasoline in the tank.

The line from the tank to the pump is the suction side of the system and the line from the pump to the carburetor is the pressure side of the system. A leak on the pressure side, therefore, would be made apparent by dripping fuel, but a leak on the suction would not be apparent except for its effect of reducing volume of fuel on the pressure side.

1. Tighten any loose line connections and look for bends or kinks in lines which would reduce fuel flow.
2. Tighten diaphragm flange screws.

3. Disconnect fuel pipe at carburetor. Disconnect distributor to coil primary wire so that engine can be cranked without firing. Place suitable container at end of pipe and crank engine a few revolutions. If little or no gasoline flows from open end of pipe then fuel pipe is clogged or pump is inoperative. Before removing pump disconnect fuel pipe at gas tank and outlet pipe and blow through them with an air hose to make sure they are clear. Reconnect pipes to pump and retest while cranking engine.

   CAUTION: Whenever the engine is cranked remotely at the starter, with a special jumper cable or other means, the primary distributor lead must be disconnected from the negative post on the coil and the ignition switch must be in the "ON" position. Failure to do this will result in a damaged grounding circuit in the ignition switch.

4. If fuel flows from pump in good volume from pipe at carburetor, check fuel delivery pressure to be certain that pump is operating within specified limits as follows:
   a. Attach a fuel pump pressure test gauge to disconnected end of pump to carburetor pipe.
   b. Run engine at approximately 450 and 1,000 rpm on gasoline in carburetor bowl and note reading on pressure gauge.
   c. If pump is operating properly the pressure will be 3 1/2 to 4 1/4 psi on In-Line engines, 5 1/4-6 1/2 psi on 283 and 327 engines (except 327 Special Hi-performance), 6-7 1/2 psi on 327 Special Hi-performance engines and 7 1/4-8 1/2 psi on 409 engines. The pressure will remain constant at speeds between 450-1000 rpm. If pressure is too low, too high, or varies materially at different speeds, the pump should be removed for repair or replacement.

Removal

1. Disconnect fuel inlet and outlet pipes at fuel pump.
2. Remove two fuel pump mounting bolts and lock washers, and remove pump and gasket.
3. On V-8 engines, if rocker arm push rod is to be removed, remove two adapter mounting bolts and lock washers, and remove adapter and gasket from block. Remove push rod from block.

   NOTE: After removal of pump from engine and before disassembly is started, plug all openings and thoroughly wash exterior of pump with cleaning solvent to remove all dirt and grease.

Disassembly

1. Remove fuel pulsator diaphragm plate and diaphragm from fuel cover.
2. Mark edges of fuel cover and body flange with file. The parts may then be assembled in the same relative position.
3. Remove cover screws and lock washers. Separate fuel cover from body by jarring cover loose with a light plastic hammer.
4. Raise fuel pump link with a screw driver (fig. 24). Unhook diaphragm from the link by pressing down and away from the rocker arm side. Remove oil seal and retainer.

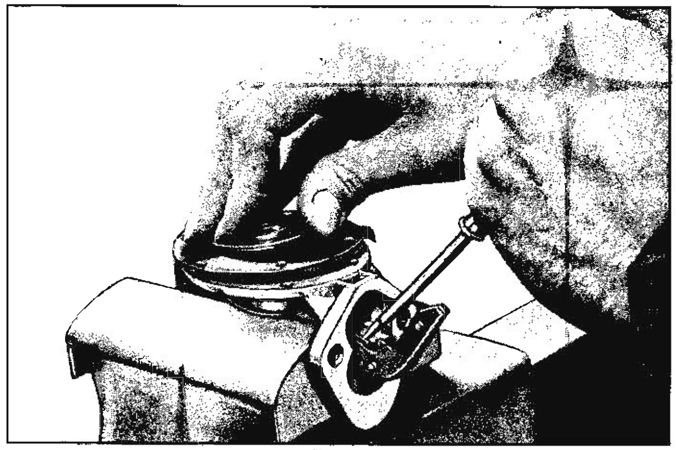


Fig. 24—Raising Fuel Link

NOTE: Fig. 25 shows the In-Line engine fuel pump disassembled as typical.

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 one of the main castings is not serviceable.
3. Inspect the rocker arm and link for excessive wear and for loose hinge pin.
4. Replace diaphragm.
5. Replace rocker arm spring and diaphragm springs as removed, because old springs may be distorted, weak or corroded.
6. Check the condition of the valves by pushing each valve off its seat with a thin rod or pencil. A hooked wire may be inserted through inlet opening in fuel cover to move the fuel inlet valve off its seat. If a valve sticks to its seat, if it moves off its seat and does not rebound, or if the cage is damaged, the complete valve must be replaced. To remove the valves, clear the staked metal with a sharp chisel, file or suitable scraper and pull valve out with a hook shaped tool.

Assembly

1. Install the oil seal over the pump body opening, place the oil seal retainer over the lip of the oil seal and secure in place with the diaphragm and seal retainer spring.
2. With the seal, retainer and spring assembled, place the spring seat over the spring and carefully insert diaphragm into the pump body.

   NOTE: It is extremely important to seal the pump from any leakage of oil that might come up from the crankcase. Make sure that the rubber seal and retainer are properly seated before assembling to the pump body.

3. Raise the pump lever with a screw driver (fig. 24), install the diaphragm push rod and hook over the end of the lever.

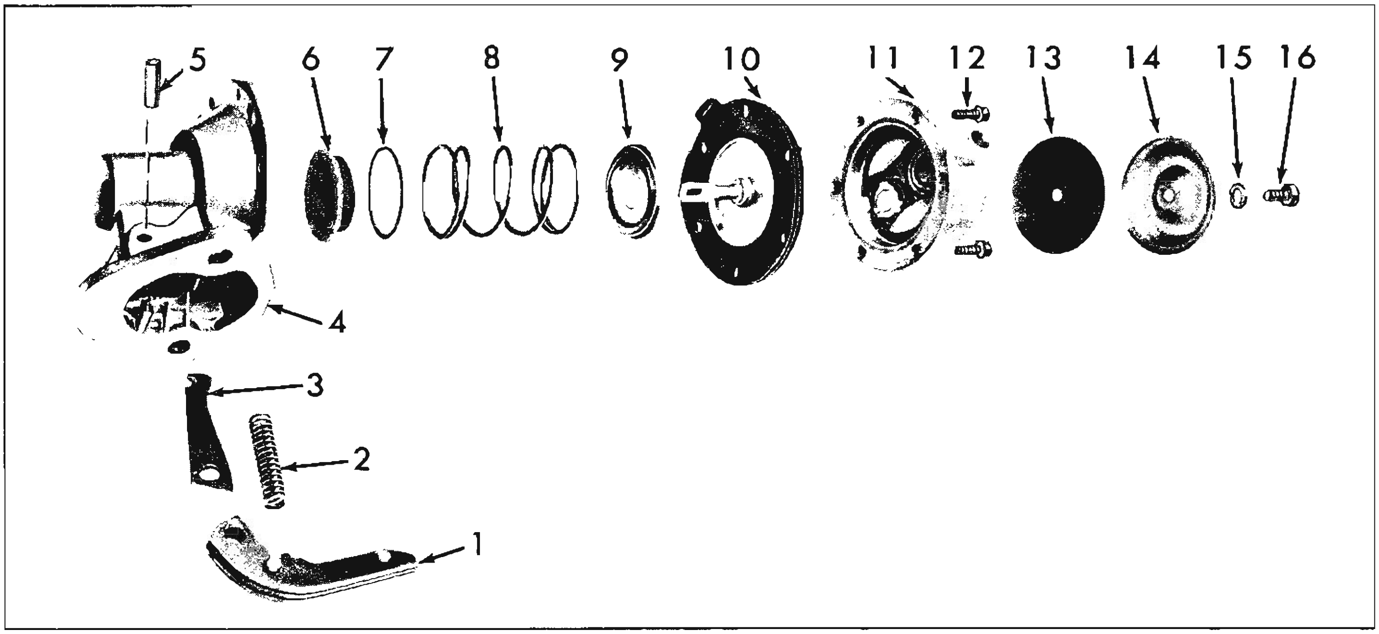


Fig. 25—In-Line Engine Fuel Pump Disassembled

1. Rocker Arm
2. Rocker Arm Return Spring
3. Actuating Lever
4. Pump Body
5. Arm and Lever Pivot Pin
6. Oil Seal
7. Oil Seal Retainer
8. Diaphragm and Seal Retainer Spring
9. Diaphragm Spring Seat
10. Diaphragm Assembly
11. Valve Body and Pump Cover Assy.
12. Valve Body and Fuel Cover Screws
13. Pulsator Diaphragm
14. Pulsator Cover
15. Pulsator Cover Lock Washer
16. Pulsator Cover Bolt

4. If either valve was removed from the fuel cover, install by placing gasket in recess of pressing valve into place. Outlet valve cage must face away from diaphragm, and inlet valve cage must face opposite. Secure valve assembly by staking cover metal in four places around valve.
5. Place new pulsator diaphragm over fuel cover opening, install plate and retain with the screw and fiber washer.
6. Install valve body and cover assembly on pump body, making sure that file marks on cover and body line up. Push on rocker arm until diaphragm is flat across body flange. Install cover screws and lock washers loosely until screws just engage lock washers. Push rocker arm through its full stroke to flex diaphragm and hold in that position while tightening cover screws securely.

CAUTION: Diaphragm must be flexed to its full stroke while tightening cover screws or pump diaphragm protector will not be properly centered, resulting in diaphragm wear due to rubbing on pump body casting.

Installation

1. Install fuel pump gasket and fuel pump. Use GM high compression sealer or its equivalant on threads of fuel pump mounting bolts.

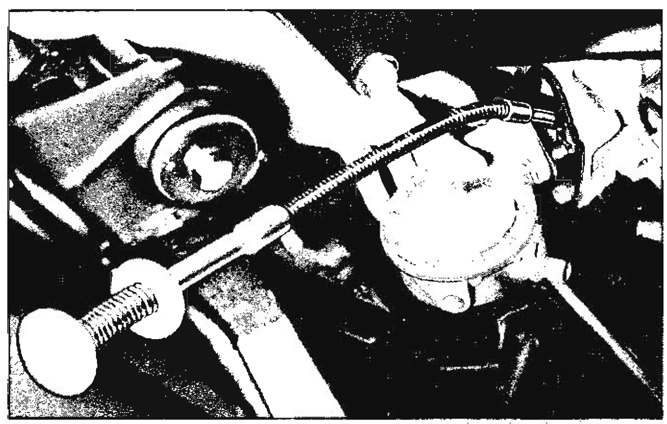


Fig. 26—Installing V-8 Engine Fuel Pump

2. Connect fuel pipes to pump.
3. Start engine and check for leaks.

NOTE: On V-8 engines a pair of mechanical fingers may be used to hold fuel pump push rod up while installing pump (fig. 26).

SPECIAL TOOLS

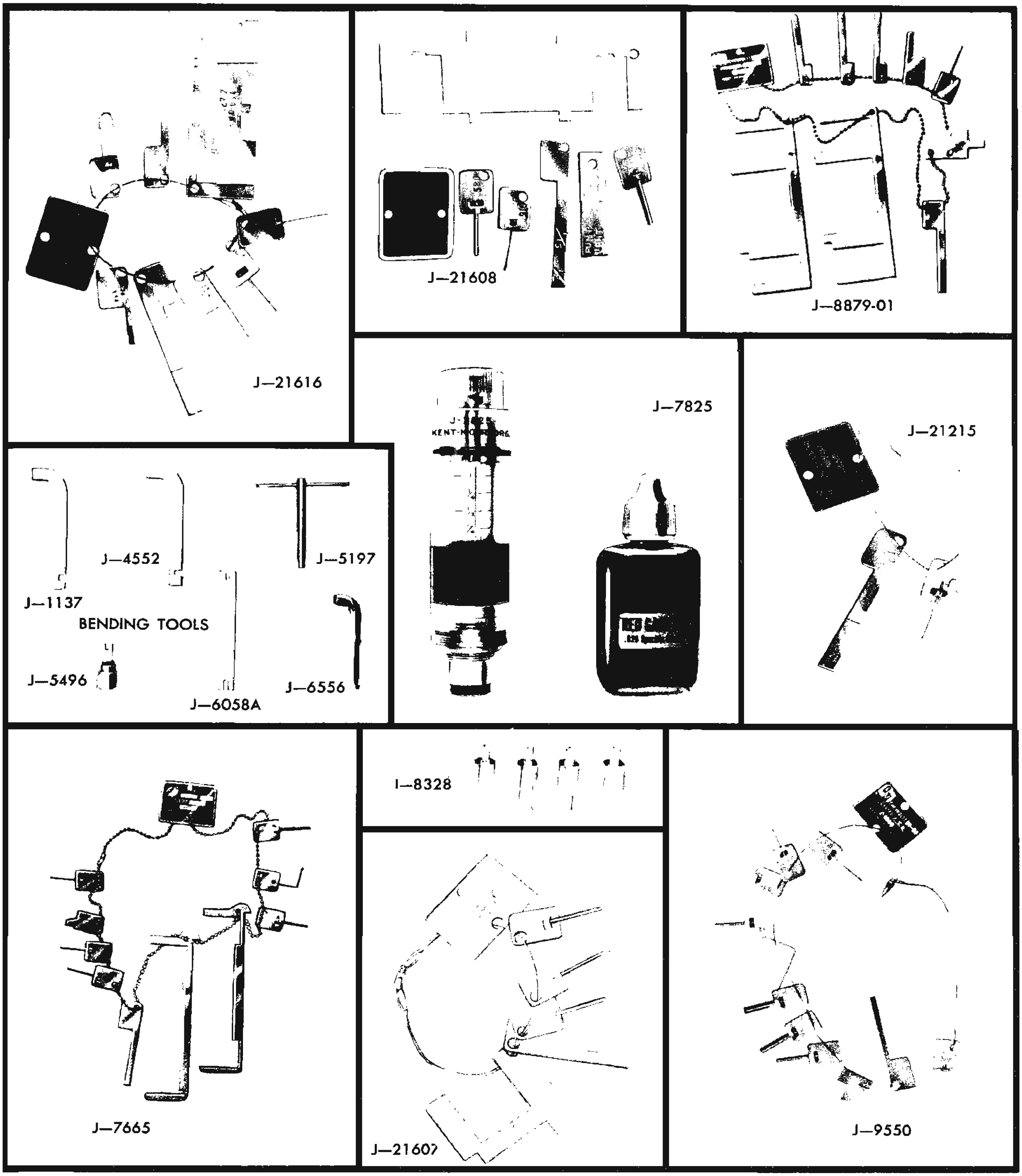


Fig. 27—Engine Fuel Special Tools

SECTION 6Y

ENGINE ELECTRICAL

CONTENTS OF THIS SECTION

BATTERY

INDEX

GENERAL DESCRIPTION

The source of electrical power for operating the electrical current consuming automotive components may be either the battery or generator or, under certain conditions, both the battery and the generator. It is the role of the battery to furnish electrical power for the electrical accessories when the engine and generator are not in operation. The battery (fig. 1) not only furnishes the electrical power necessary for cranking the engine, but must also help in cases where generator output is not sufficient to handle the electrical loads.

The "dry charge" battery contains fully charged positive and negative plates separated by high-quality separators. The battery contains no electrolyte until it is activated for service in the field and therefore leaves the factory dry.

COMMON CAUSES OF FAILURE

When a battery fails, the cause of failure may lie outside the battery itself. For this reason when a battery failure is encountered, do not be satisfied to merely recharge or replace it. Find the cause of failure and prevent recurrence of the trouble. Listed below are some of the common causes of battery failure:

1. Defect in the generating system such as high resistance, slipping fan belt, faulty generator or regulator.
2. Overloads caused by defective starting or excessive use of accessories.
3. Driver habits or driving conditions such as using the vehicle only for short drives.

Liquid level in the battery should be checked regularly. If the liquid level is found to be low, colorless, odorless drinking water should be added to each cell until the liquid level rises to the bottom of the split ring in the cell filler well.

Inspect for signs of corrosion on battery, cables and surrounding area, loose or broken carriers, cracked or bulged cases, dirt and acid, electrolyte leakage and low electrolyte level. Fill cells to proper level with colorless, odorless drinking water.

The top of the battery should be clean and the battery hold-down bolts properly tightened. Particular care should be taken to see that the tops of the 12-volt batteries are kept clean of acid film and dirt because of the high voltage between the battery terminals. For best results when cleaning batteries, wash first with a dilute ammonia or soda solution to neutralize any acid present and then flush off with clean water. Care must be taken to keep vent plugs tight so that the neutralizing solution does not enter the cell. The hold-down bolts should be kept tight enough to prevent the battery from shaking around in its holder, but they should not be tightened to the point where the battery case will be placed under a severe strain.

To insure good contact, the battery cables should be tight on the battery posts. Oil the battery terminal felt

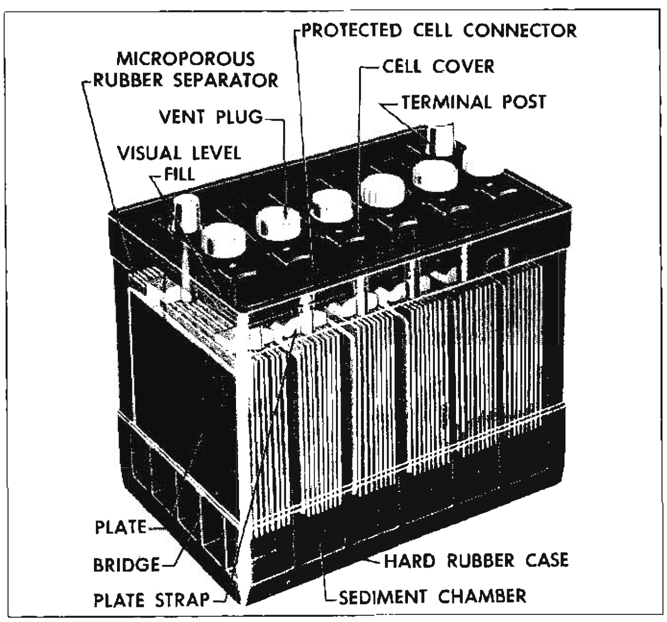


Fig. 1—Battery

washer. If the battery posts or cable terminals are corroded, the cables should be cleaned separately with a soda solution and a wire brush. After cleaning and installing clamps, apply a thin coating of petrolatum to the posts and cable clamps to help retard corrosion. See Figure 2 for correct installation of cable terminal clamps.

QUICK-IN-THE-VEHICLE TESTS

1. Visual Inspection
2. Light Load Test

VISUAL INSPECTION

Inspect for signs of corrosion on battery, cables and surrounding area, loose or broken carriers, cracked cases, dirt and acid, electrolyte leakage and low electrolyte level. Fill cells to proper level with colorless, odorless drinking water.

LIGHT LOAD TEST

Check electrical condition of battery cells as follows:

1. Check electrolyte level in each cell, and, if needed, adjust to proper level by adding water.
2. Place load on battery by holding ignition switch in the "Start" position for 3 seconds or until engine starts. If engine starts, turn off ignition immediately.
3. Turn on headlights (low beam). After 1 minute, with lights still "ON," read voltage of each battery cell with voltmeter, noting exact voltages (.01 volt division). It is necessary to remember only the highest and lowest cell voltage.

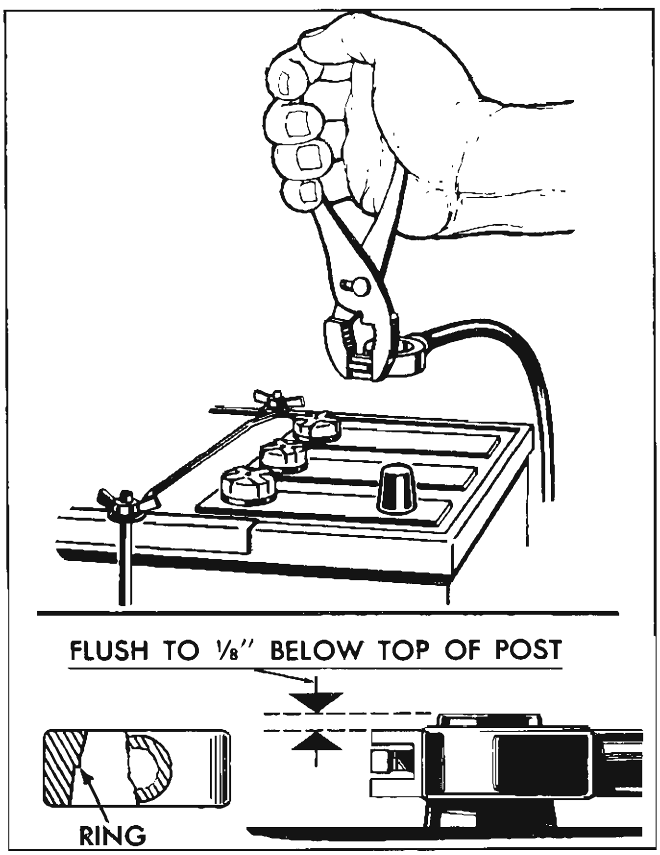


Fig. 2—Installing Battery Cable Terminals

Uniform Readings

If all cells read 1.95 volts or more and the difference between the highest and lowest cells is less than .05 volts, battery is good and sufficiently charged.

However, if any cell reads less than 1.95 volts and difference between the highest and lowest cells is less than .05 volts, battery is good but should be fully recharged for good performance. Refer to "Battery Charging Rates."

Non-Uniform Readings

If any cell reads 1.95 volts or more and there is a difference of .05 volts or more between the highest and lowest cell, the battery should be replaced.

Low Readings

If all cells read less than 1.95 volts, battery is too low to test properly. FAILURE OF THE METER TO REGISTER ON ALL CELLS DOES NOT INDICATE A DEFECTIVE BATTERY. Boost charge battery and repeat Light Load Test (Refer to "Battery Charging Rates"). If battery is found to be good after boosting, it should be fully recharged for good performance.

If none of the cells come up to 1.95 volts after the first boost charge, the battery should be given a second boost. Batteries which do not respond after second boost charge should be replaced.

> **NOTE:** If any battery found to be good by the Light Load Test does not perform satisfactorily in subsequent service, it should again be tested by the Light Load Test and if it still tests "good," it should be removed from the car and tested as outlined under OUT-OF-THE-VEHICLE CHARGING AND TESTING.

OUT-OF-THE-CAR CHARGING AND TESTING

The procedures outlined below under Slow Charging and The Full Charge Hydrometer Test should be used on:

Any battery originally found to be "good" by the Light Load Test, but which has since failed to perform satisfactorily in service and which still tests "good" by the Light Load Test.

> CAUTION: The "Full Charge Hydrometer Test" is not valid unless battery has been tested and found to be good by the Light Load Test.

SLOW CHARGING

- Adjust electrolyte to proper level by adding water, then charge battery at 5 amperes until fully charged. Full charge of the battery is indicated when all cell gravities do not increase when checked at three intervals of one hour and all cells are gassing freely.
- Due to the low rate during slow charging, plenty of time must be allowed. Charge periods of 24 hours or more are often required.

FULL CHARGE HYDROMETER TEST

1. Make sure battery is fully charged as described under "Slow Charging" above. HYDROMETER

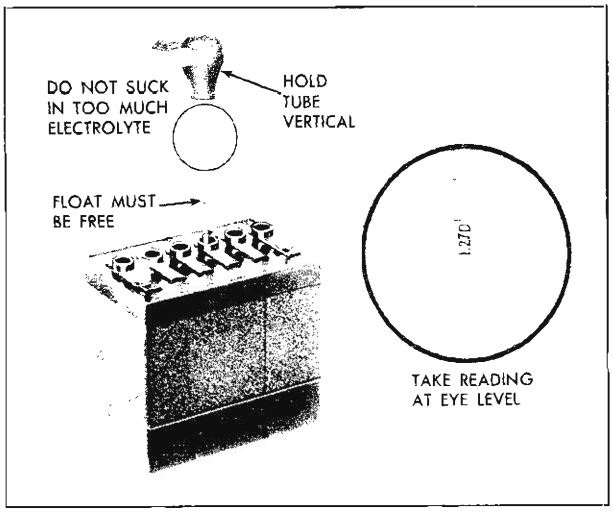


Fig. 3—Testing Specific Gravity of Battery

READINGS TAKEN ON PARTIALLY CHARGED BATTERIES ARE UNRELIABLE FOR THE FOLLOWING TEST:

2. Measure specific gravity of electrolyte in each cell (fig. 3) and compare readings with the following:
   - If cell readings range between 1.250 and 1.290, the battery is ready for use. (Readings should be corrected to 80°F for comparison.) All it needed was a full charge. Any variation in the specific gravity between cells within this range does not indicate a defective battery.
   - If the specific gravity of any cell or cells falls outside this range, (1.250 to 1.290), replace the battery.

BATTERY CHARGING RATES (SUGGESTED)

1. For those batteries which require a boost charge for the "Light Load Test" procedure.
2. For those batteries which have become discharged and require charging. It should be recognized that slow charging is the best and only method of completely recharging batteries. However, since time is often of importance to the battery owner two other methods are offered for partial battery re-charge.
3. For those dry charged batteries being activated with electrolyte at a temperature under 60°F or those batteries which are expected to go into immediate operation in below freezing weather.

12 VOLT BATTERY RE-CHARGE
(100 Amp/hr or Less Capacity)

TYPE OF CHARGE	LENGTH OF TIME	CHARGING RATE
Boost Charge for Light Load Test	20 Minutes	50 Amps
Slow Charge	24 Hours	4 Amps
Fast Charge	1-1/2 Hours	40-50 Amps
Quick Boost	30 Minutes	40-50 Amps
Dry Charge Warm-up Boost	10 Minutes	15 Amps

CHARGING SYSTEM

INDEX

GENERAL DESCRIPTION

The charging system includes the battery, generator, regulator, telltale light, and necessary wiring to connect these components. The Delcotron is offered as standard equipment, although there are various capacities available on all models.

The Delcotron continuous output A.C. generator (fig. 1c) consists of two major parts, a stator and a rotor. The stator is composed of a large number of windings assembled on the inside of a laminated core that is attached to the generator frame. The rotor revolves within the stator on bearings located in each end frame. Two brushes are required to carry current through the two slip rings to the field coils wound concentric with the shaft of the rotor. Six rectifier diodes are mounted in the slip ring end frame and are joined to the stator windings at three internally located terminals.

Diodes are mounted in heat sinks to provide adequate heat dissipation. The six diodes replace the separately mounted rectifier as used in other types of application. The diodes change the Delcotron A.C. current to D.C. current.

Two regulators (fig. 2c) are available on the 1965 vehicles, a double contact two unit type and a transistorized regulator. The function of these regulators in the charging system is to limit the generator voltage to a pre-set value by controlling the generator field current. Both regulators have an internal field relay unit. The relay unit allows the lamp to light (as a bulb check) with the ignition key on and engine not running. When the engine is started and the generator begins to charge, the indicator light goes out indicating that the system is operating normally.

The double-contact regulator assembly (fig. 2c) consists of a double contact voltage regulator unit and a field relay unit. This unit uses two sets of contact points on the voltage regulator unit to obtain desired field excitation under variable conditions. A wiring diagram of the regulator internal circuits is illustrated in Figure 3c.

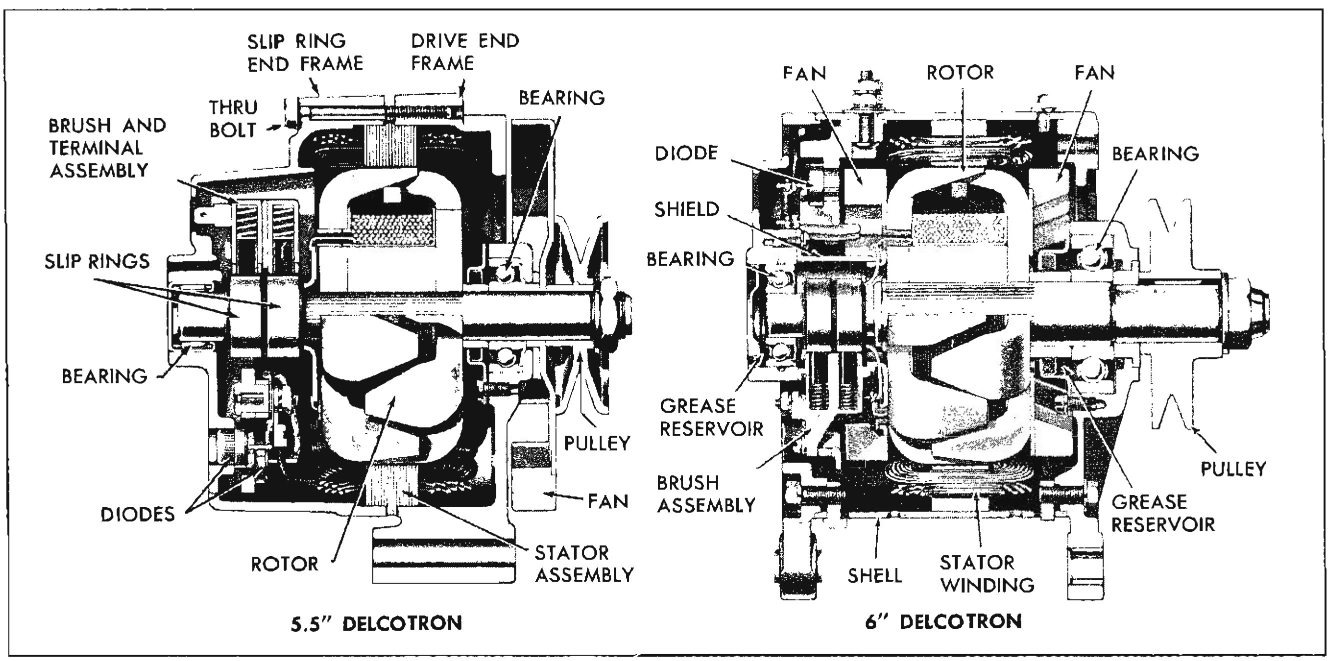
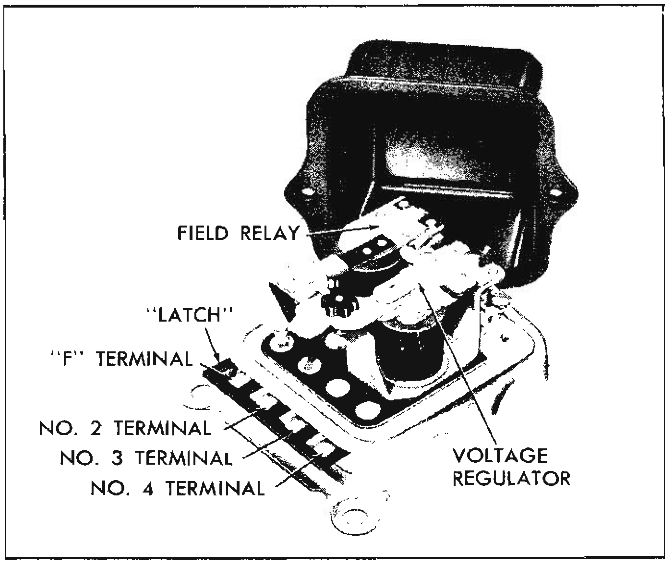
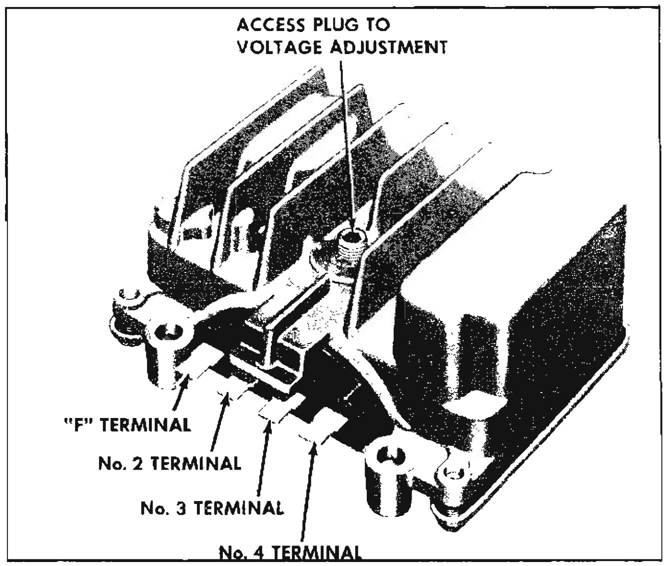


Fig. 1c—Delcotron Cross-section View



DOUBLE CONTACT



TRANSISTOR

Fig. 2c—Voltage Regulator Assemblies

The transistor regulator (fig. 2c) is an assembly composed principally of transistors, diodes, resistors, a capacitor, and a thermistor to form a completely static voltage regulating unit in combination with a conventional vibrating type field relay.

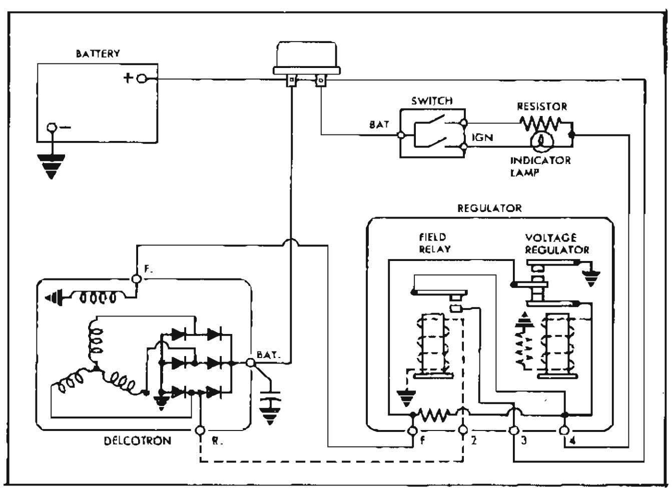
The transistor is an electrical device which limits the generator voltage to a preset value by controlling the generator field current. The diodes, capacitor and resistors act together to aid the transistors in controlling the generator voltage. This is the only function that the regulator performs in the charging circuit. The thermistor provides a temperature-compensated voltage setting. A wiring diagram of this regulator's internal circuit is shown in Figure 3c.

The voltage at which the generator operates is determined by the regulator adjustment. The regulator voltage setting can be adjusted externally by removing a pipe plug in the cover (fig. 2c) and turning the adjusting arm inside the regulator. This procedure is explained in the following section, and permits regulator adjustments without removing the cover.

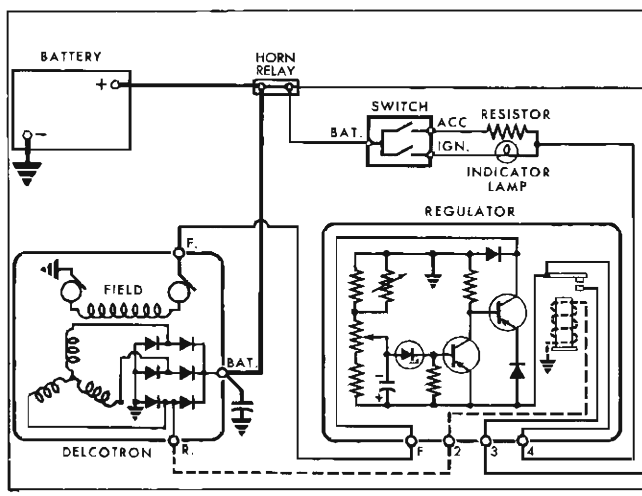
MAINTENANCE AND ADJUSTMENTS

At regular intervals, inspect the terminals for corrosion and loose connections, and the wiring for frayed insulation. Check mounting bolts for tightness. Check the drive belt for alignment, proper tension and wear. Because of the higher inertia and load capacity of the rotor used in A.C. generators, PROPER BELT TENSION is more critical than on D.C. generators.

Since the Delcotron and its companion regulator are



DOUBLE CONTACT



TRANSISTOR

Fig. 3c—Circuitry - Voltage Regulator Assemblies designed for use on negative polarity systems only, the following precautions must be observed. Failure to observe these precautions may result in serious damage to the charging system.

1. When installing a battery, always make absolutely sure the ground polarity of the battery, generator and regulator is the same.
2. When connecting a booster battery, make certain to connect the correct battery terminals together.
3. When connecting a charger to the battery, connect the correct charger leads to the battery terminals.
4. Never operate the generator on an uncontrolled open circuit. Make absolutely certain all connections in the circuit are secure.
5. Do not short across or ground any of the terminals on the generator or regulator.
6. Do not attempt to polarize the generator.
7. Do not disconnect lead at generator without first disconnecting battery ground cable.

Trouble in the A.C. charging system will usually be indicated by one or more of the following conditions:

1. Faulty indicator lamp or ammeter operation.
2. An undercharged battery (usually evidenced by slow cranking speeds).
3. An overcharged battery (usually evidenced by excessive battery water usage).
4. Excessive generator noise or vibration.

Described below are a series of on-the-vehicle quick checks which are designed to assist the service technician in locating troubles within the various components of the engine electrical system. Additional checks, adjustments and overhaul procedures of these components are also described in the "Charging Systems—Service Operations Section" and should be referred to as necessary.

STATIC CHECKS

Before making any electrical checks, perform the following static checks:

1. Check for loose fan belt.
2. Check for defective battery. (Refer to Battery.)
3. Inspect all connections, including the slip-on connectors at the regulator and Delcotron.

NOTE: Do not short field to ground to check if generator is charging since this will seriously damage the charging system.

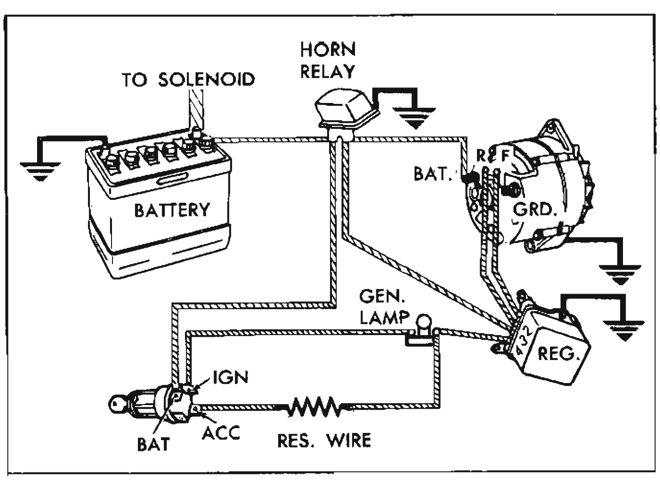


Fig. 4c—Typical Wiring Diagram Showing Lead Connections

SYSTEM CONDITION TEST

This test is used to indicate the overall condition of the charging system (both good and defective) and to isolate the malfunctioning unit if the system is defective.

1. With ignition off, perform the prescribed Static Checks outlined in this section. Then set hand brake and shift transmission into neutral.
2. Connect a voltmeter from junction block on horn relay to ground at regulator base.

   CAUTION: Be sure meter clip does not touch a resistor or terminal extension under regulator.

3. Connect a tachometer on engine.
4. Standard Models equipped with Indicator Lamp: Turn ignition switch to "ON" position and check indicator lamp. If lamp fails to glow, perform appropriate tests and corrections (Indicator Lamp Circuit Tests) before continuing.

   Super Sports Models equipped with Ammeter: Turn ignition switch to "ACC" with an accessory on and check ammeter. If ammeter fails to read discharge, perform Field Circuit Resistance Check before continuing.
5. Standard Models equipped with Indicator Lamp: If lamp glows, start the engine and run it at 1500 rpm or above. Check indicator lamp. If lamp fails to go out, perform appropriate test and corrections (Indicator Lamp Circuit Test) before continuing.

   Super Sports Models equipped with Ammeter: If ammeter reads discharge, start the engine and observe ammeter. If meter fails to move toward charge (from original position), perform appropriate test and corrections (Field Circuit Tests) before continuing.

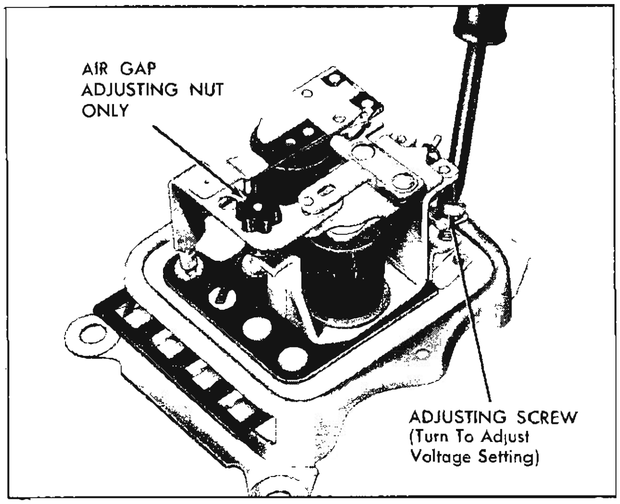
   NOTE: At this point a field circuit has been established and any other problem will lie in generator or regulator.

6. Turn on high-beam headlights and heater blower motor to high speed, run engine at or above 1500 rpm (for a few minutes, if necessary) and read the voltage on meter.

   NOTE: Voltage will not greatly exceed 12-1/2 volts until the battery develops a surface charge, a few minutes generally, unless the battery is severely discharged or is hot.

   If reading is:

   a. 12-1/2 volts or more, turn off electrical loads, stop engine and proceed to Step 7.
   b. Less than 12-1/2 volts, perform "Delcotron Output Test—Voltmeter Method."
      1. Delcotron tests bad—refer to "Service Operations" and repair Delcotron, then repeat Step 6.
      2. Delcotron tests good—disconnect regulator connector, remove regulator cover and reconnect the connector. Then repeat Step 6 and turn voltage adjusting screw (fig. 5c) to raise setting to 12-1/2 volts. On transistor regulator remove pipe plug (fig. 5c), insert screw driver into slot and turn clockwise one or two



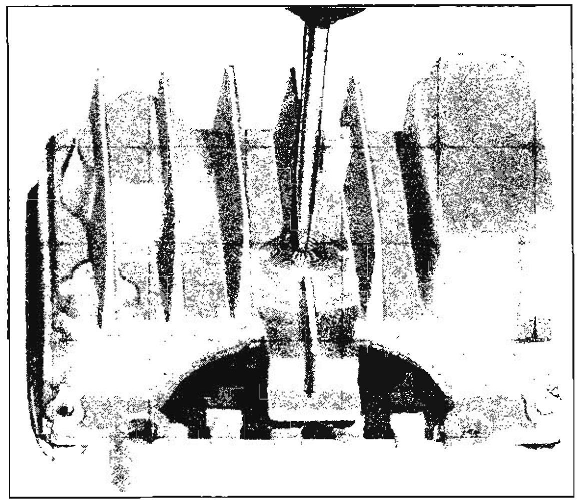


Fig. 5c—Adjusting Voltage Setting

notches to increase setting. Turning counterclockwise decreases setting. For each notch moved, the voltage setting will change approximately .3 volt. Turn off loads, stop engine and proceed to Step 7. If 12-1/2 volts cannot be obtained, install a new regulator and repeat Step 6.

ADJUSTING REGULATOR VOLTAGE

7. Connect a 1/4 ohm-25 watt fixed resistor (purchased commercially) into the charging circuit at horn relay junction block as shown in Figure 7c.

   NOTE: Between both leads and the terminal.

8. Run engine at 1500 rpm or above for at least 15 minutes of warm-up, then cycle regulator voltage control (by disconnecting and re-connecting regulator connector) and read voltage.

If voltage is 13.5 to 15.2, the regulator is okay.

If voltage is not within 13.5 to 15.2 volts, leave engine running at 1500 rpm or above and:

a. Disconnect four terminal connector and remove regulator cover. Then re-connect four terminal connector and adjust voltage to 14.2 to 14.6. (Refer to Step 6 and fig. 5c).
b. Disconnect four terminal connector and reinstall regulator cover, then reinstall connector.
c. Continue running engine at 1500 rpm for 5-10 minutes to re-establish regulator internal temperature.
d. Cycle regulator voltage by disconnecting and reconnecting regulator connector. Read voltage. A reading between 13.5 and 15.2 indicates a good regulator.

CAUTION: Be sure four terminal regulator

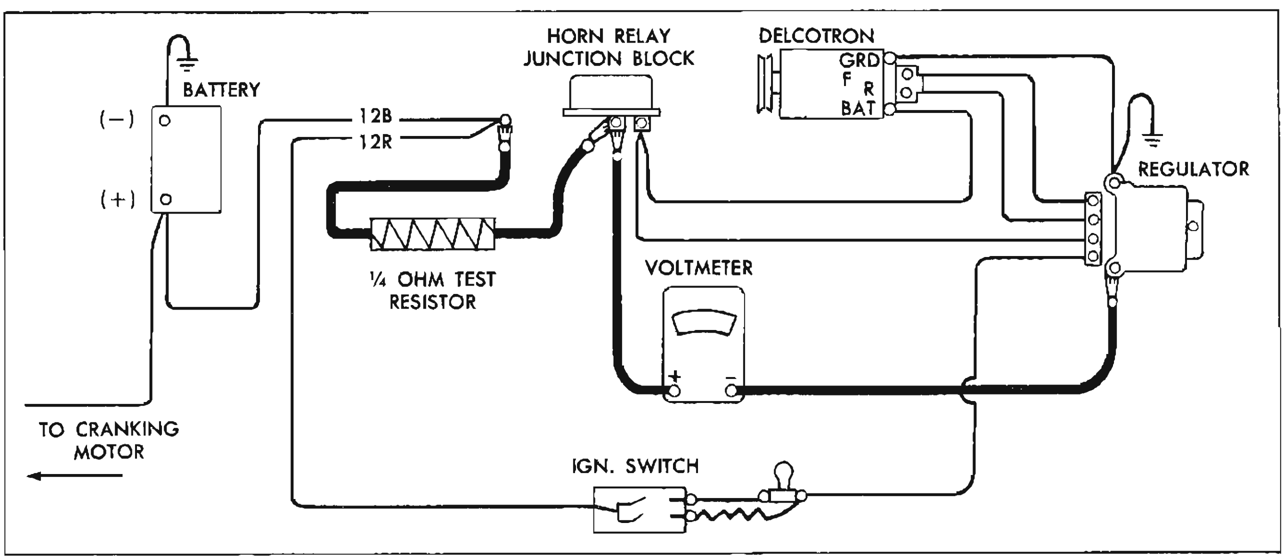


Fig. 6c—Voltage Setting Test Connections

connector is disconnected when removing or installing cover. This is to prevent regulator damage by short circuits.

GENERATOR OUTPUT TEST

Voltmeter Method (Fig. 7C)

1. Disconnect the two-terminal connector from the Delcotron "F" and "R" terminals.
2. Connect a jumper wire from the Delcotron "BAT" terminal to the Delcotron "F" terminal. This provides a full field excitation.
3. Connect a voltmeter from the Delcotron "BAT" terminal to the Delcotron "GRD" terminal.
4. Start engine and turn on high beam headlights and either the high speed on the heater blower or medium speed on the air conditioner blower motor. Slowly increase engine speed to 1500 rpm or slightly above with 6.2" generator run engine at 600 rpm and note voltage reading obtained. A voltage of 12.5 volts or more within a few minutes indicates Delcotron output is satisfactory. Stop engine and reconnect wiring.

   CAUTION: When performing Step 4, engine speed should be increased slowly to prevent the unregulated voltage from exceeding 16 volts during test. If battery is in a normal state of charge, voltage will exceed 12.5 volts as soon as engine speed is increased.

5. If voltage is less than 12.5 volts, refer to the appropriate shop manual for Delcotron trouble diagnosis aids (Diodes, field circuit checks, etc.)

DELCOTRON DIODE AND FIELD TEST (Fig. 8C)

NOTE: These tests will indicate good, shorted or open field or shorted diode but will not indicate a failed open diode. If output was low and following tests show good, refer to service operations to determine cause and repair.

1. Disconnect battery ground cable at battery.
2. Positive diodes (Test A) connect an ohmmeter between "R" terminal and "BAT" terminal and note reading, then reverse the leads at same terminals and note this reading. Meter should read high resistance in one direction and low in the other.

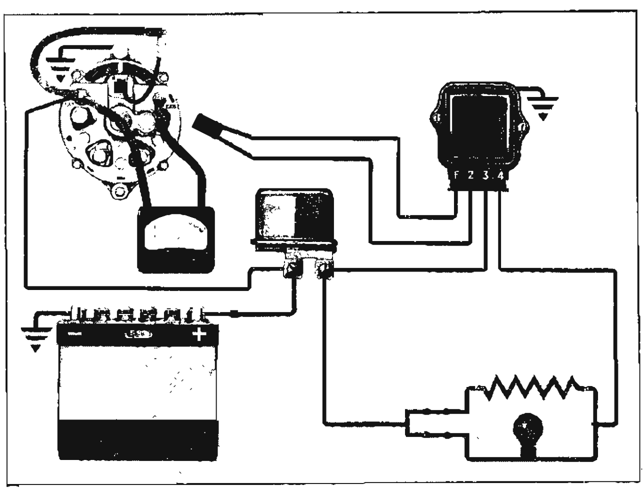


Fig. 7c—Voltmeter Method Test Connections

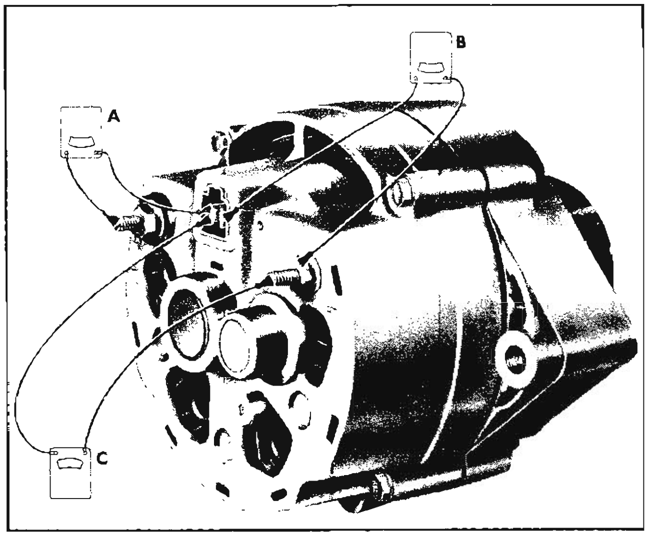


Fig. 8c—Delcotron Diode and Field Test

3. Negative diodes (Test B) connect ohmmeter between "R" terminal and "GRD" and note reading, then reverse the leads and note this reading. Meter should read high in one direction and low in the other.

   NOTE: A high or low reading in both directions indicates a defective diode.

4. Open Field Check:
   a. Connect an ohmmeter from "F" terminal to "GRD" terminal stud and note reading on the lowest range scale. Meter should read 7 to 20 ohms.
   b. If meter reads zero or excessively high resistance, the Delcotron is faulty.
5. If above tests indicate a defective Delcotron, remove and completely check Delcotron as outlined under "Service Operations".

INDICATOR LAMP/INITIAL FIELD EXCITATION CIRCUIT TESTS

On standard models the indicator lamp circuit provides initial field excitation (causing lamp to glow). The light is cancelled by closing the field relay which applies battery voltage to both sides of bulb (bulb goes out).

The indicator light should glow when ignition switch is "ON" and go out almost immediately when engine starts.

Ammeter equipped vehicles use the same initial field excitation and control circuits as the indicator lamp except the lamp is omitted. The continuity tests on both type vehicles can be made as follows:

If Lamp Fails to Glow or Ammeter Fails to Function the Possible Causes are:

1. Faulty bulb or bulb socket.
2. Faulty ammeter.
3. An open circuit in wiring, regulator, or field.

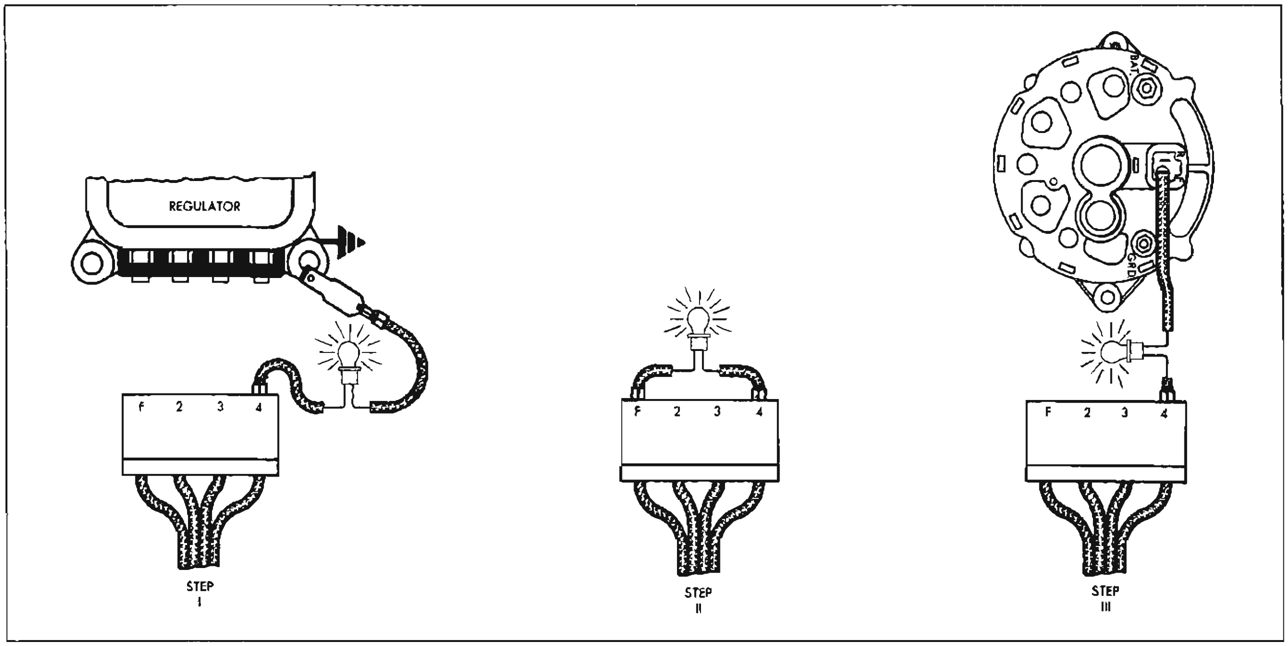


Fig. 9c—Initial Field Excitation Circuit Tests

4. A shorted positive diode—(may also cause glow with ignition switch "OFF").

TEST AS FOLLOWS:

1. Disconnect connector from regulator and turn ignition switch to "ON". Connect a test lamp from connector terminal "4" to ground (fig. 9c, Step 1) and note test lamp.
   a. Lamp fails to glow—check for faulty bulb, socket or open circuit between switch and regulator connector. Repair as needed.
   b. Light goes on—failure is in regulator, Delcotron, or wire between "F" terminals on regulator and Delcotron. Go to Step 2.
2. Disconnect lamp lead at ground end and connect between connector "F" and "4" terminals (fig. 9c, Step 2), and note lamp:
   a. Test Lamp glows—problem is in regulator. An open circuit in regulator or relay is stuck closed. See "Service Operations" for repair.
   b. Fails to glow—problem is in wire between "F" terminals on generator and regulator or in field windings. Go to Step 3.
3. Disconnect test lamp at connector "F" terminal and connect to "F" terminal on Delcotron (fig. 9c, Step 3), and note lamp:
   a. Lamp glows—an open circuit in wire between "F" terminals—correct as needed.
   b. Fails to glow—Delcotron field has open circuit, see "Service Operations" to repair.

If Lamp Fails to Go Out, or if Ammeter Shows Discharge the Possible Causes are:

1. Loose drive belt—adjust as necessary.
2. Faulty field relay—(see relay test and adjustment).
3. Defective Delcotron—(see Delcotron output test).

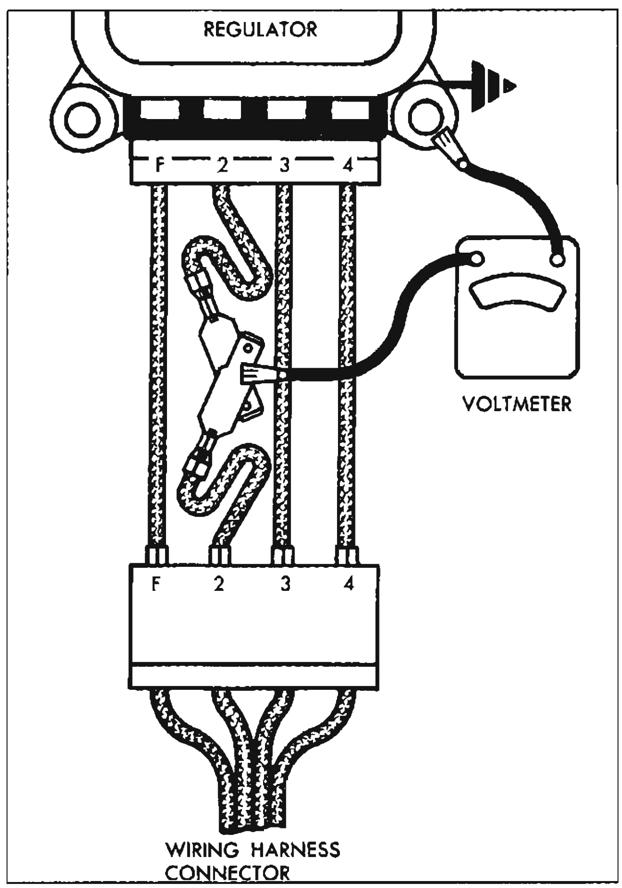


Fig. 10c—Testing Field Relay

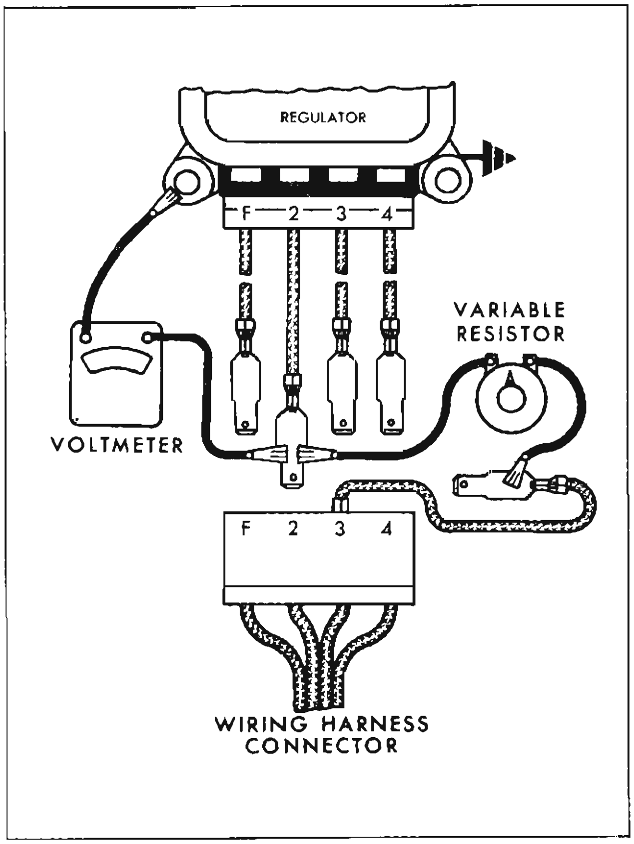


Fig. 11c—Field Relay Closing Voltage Test

4. At normal idle—parallel resistance wire open (see Resistance test). On ammeter models the initial field excitation wire to "ACC" terminal is open.
5. Switch off—positive diode shorted (see Diode test).

FIELD CIRCUIT RESISTANCE WIRE CHECKS

The resistance wire is an integral part of the ignition harness. However, the resistance wire is not solderable; it must be spliced with a crimp-type connector. It is rated at 10 ohms, 6.25 watts minimum.

The check for an open resistor or field excitation wire (connected to the ignition switch "ACC" terminal) is as follows:

1. Connect a test lamp from the wiring harness connector terminal "4" to ground as shown in Figure 9c (Step 1).
2. Turn the ignition switch to the "ON" position and note test bulb.
   a. Test lamp glows—resistance is O.K.
   b. Test lamp does not glow—the resistor is open circuited—note also that dash lamp does not glow during this test because series resistance of the 2 bulbs causes amperage to be too low.

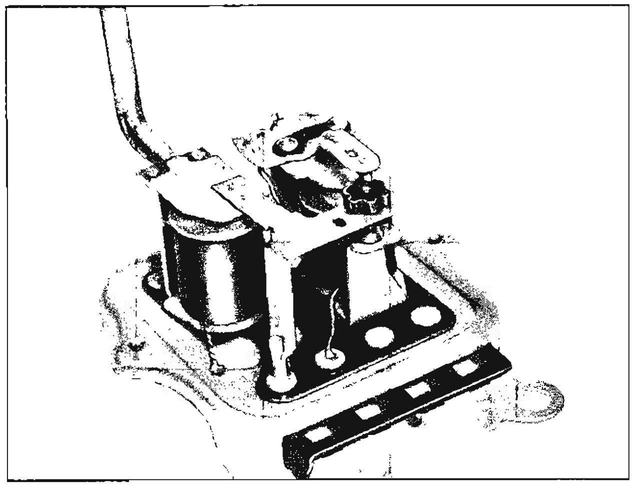


Fig. 12c—Adjusting Field Relay Closing Voltage

FIELD RELAY CHECKS AND ADJUSTMENT

To check for a faulty relay proceed as follows:

1. Connect a voltmeter into the system at the regulator No. 2 terminal to ground (fig. 10c).
2. Operate the engine at fast idle (1500 to 2000 rpm) and observe voltmeter reading.
3. If voltmeter shows zero voltage at regulator, check circuit between No. 2 terminal on regulator to "R" terminal on Delcotron.
4. If voltage at regulator exceeds closing voltage specification and light remains on, regulator field relay is faulty (Refer to specifications). Check and adjust regulator as follows:

CLOSING VOLTAGE ADJUSTMENT

1. Make connections as shown in Figure 11c using a 50 ohm variable resistor.

   NOTE: This gives us a variable resistance in series from a hot lead to the relay coil.

2. Turn resistor to "open" position.
3. Turn ignition switch off.
4. Slowly decrease resistance and note closing voltage of the relay. Adjust by bending heel iron in the manner illustrated in Figure 12c.

OTHER HARNESS CHECKS

Other wires in the charging system harness need be checked for continuity by use of an ohmmeter or a test light (12 Volt). Connect the test so the wire in question is in series in the test circuit.

SERVICE OPERATIONS

Service Procedures described in this section are for the 5.5" aluminum and 6.2" perforated stator Delcotrons (fig. 13c). Where important differences are encountered separate mention will be made of the two generators.

GENERATOR

REMOVAL AND INSTALLATION (Fig. 14C)

1. Disconnect the battery ground strap at battery to prevent damaging diodes.

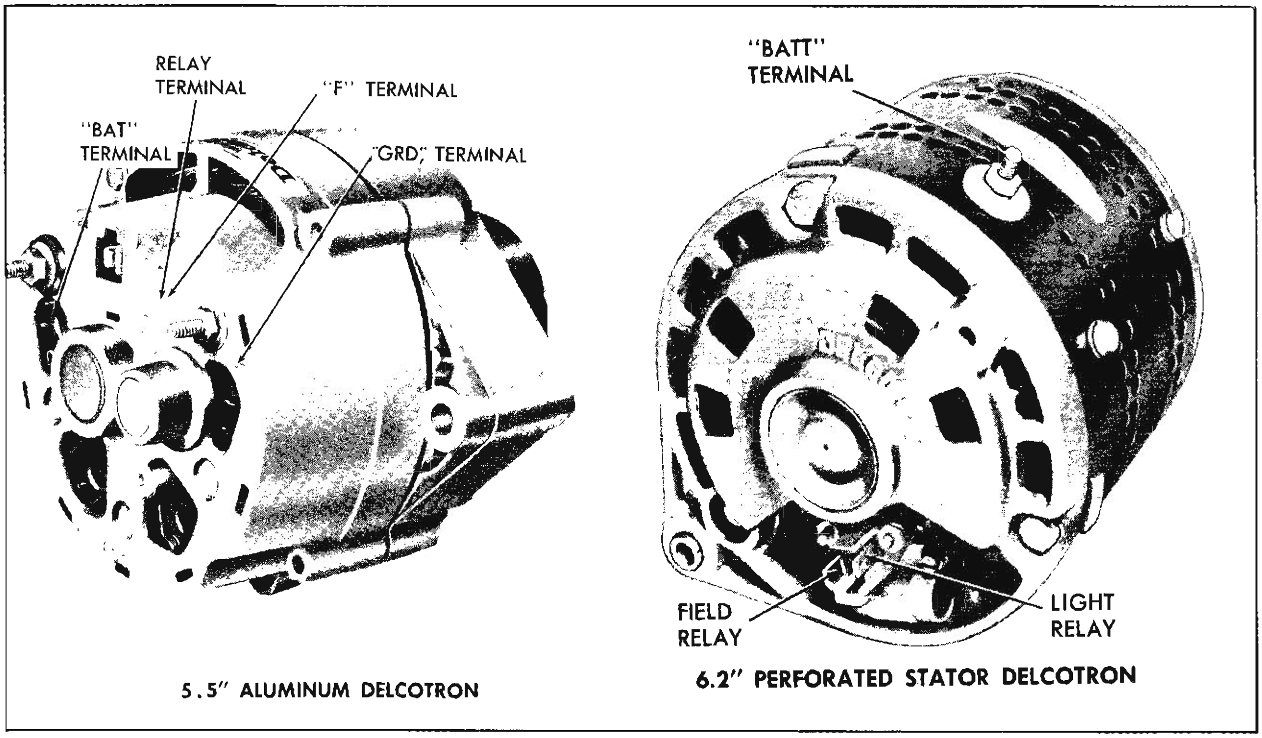


Fig. 13c—Delcotrons - Full View

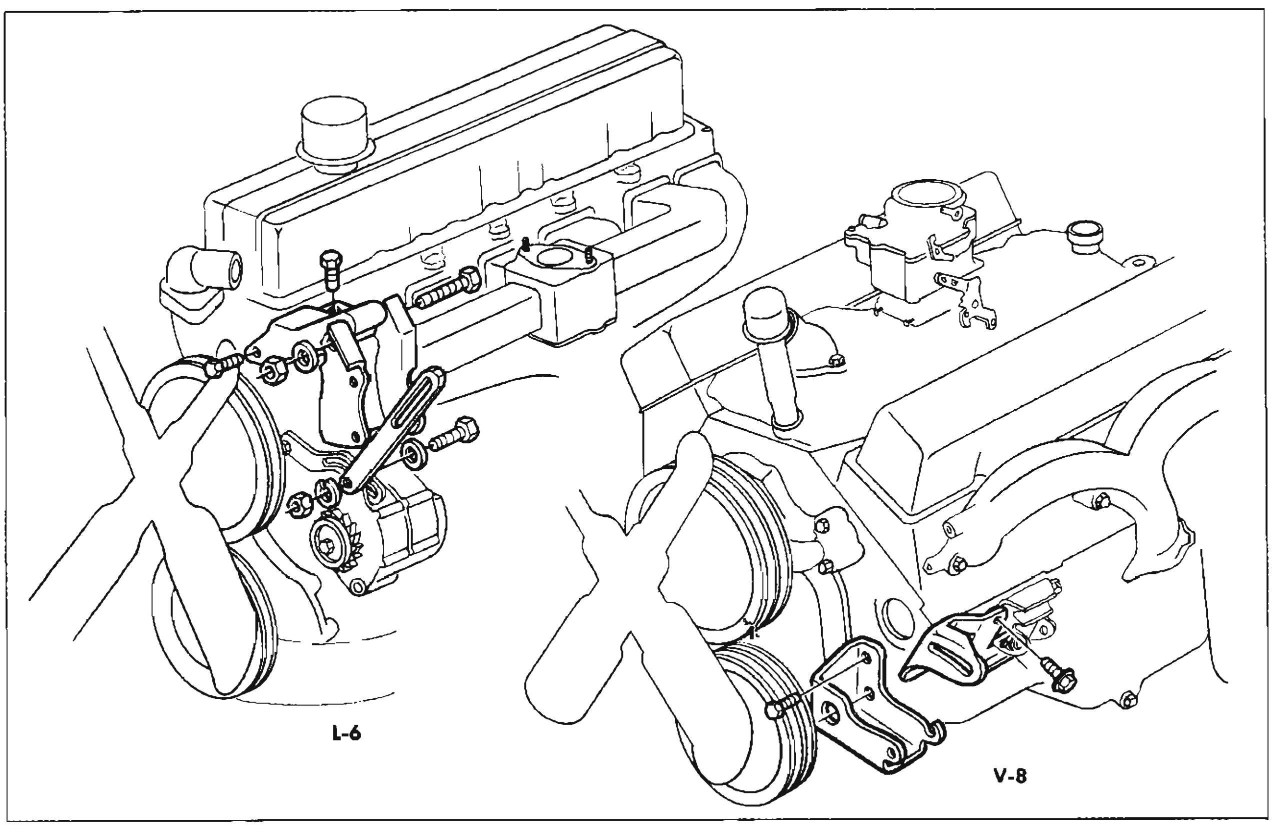


Fig. 14c—Delcotron Installation

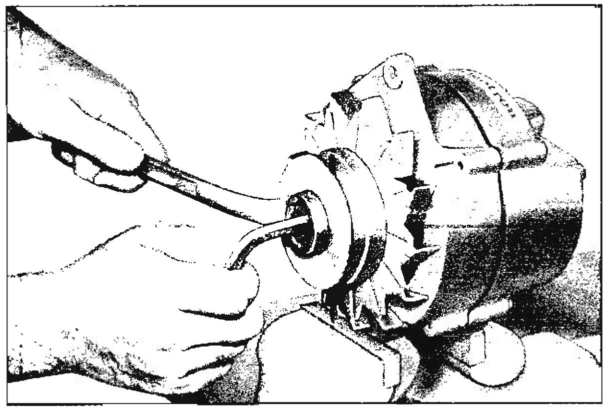


Fig. 15c—Pulley Removal

2. Disconnect wiring leads at Delcotron.
3. Remove generator brace bolt, (if power steering equipped, loosen pump brace and mount nuts) then detach drive belt (belts).
4. Support the generator and remove generator mount bolt (6.2" Delcotron uses 2 mount bolts) or bolts and remove from vehicle.
5. Reverse the removal procedure to install then adjust drive belt.

PULLEY REPLACEMENT

5.5" Delcotron

Single Groove Pulley

1. Place 15/16" box wrench on retaining nut and insert a 5/16" allen wrench into shaft to hold shaft while removing nut (fig. 15c).
2. Remove washer and slide pulley from shaft.
3. Reverse Steps 1 and 2 to install, use a torque wrench with a crow-foot adapter (instead of box wrench) and torque the nut to 50 ft. lbs. (fig. 16c).

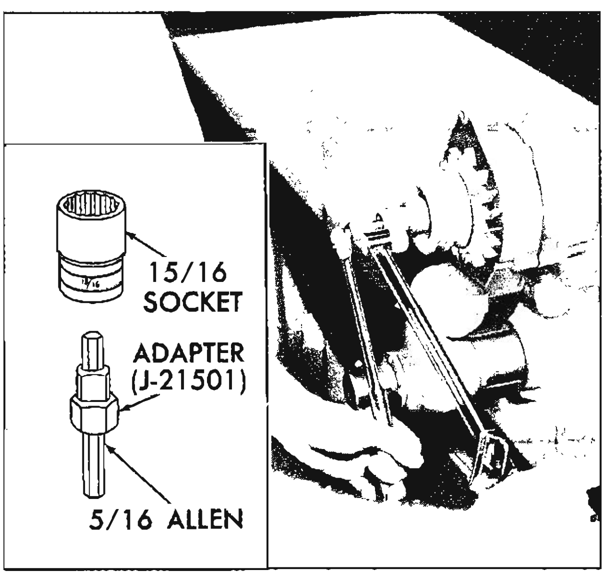


Fig. 16c—Torquing Pulley Nut

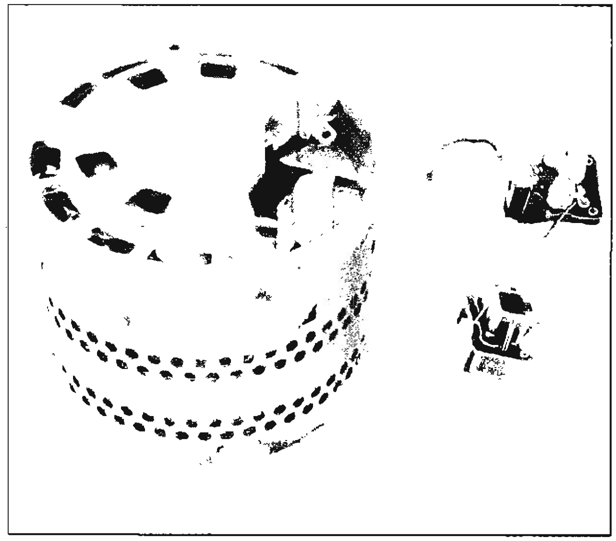


Fig. 17c—6.2" Brush Holder Assembly

Double Groove Pulley

1. Place a 15/16" socket (with wrench flats on the drive end or use Adapter J-21501 and a box wrench) on retaining nut, insert a 5/16" allen wrench through socket and adapter into hex on shaft to hold the shaft while removing the nut.
2. Remove washer and slide pulley from shaft.
3. To install, slide pulley and washer on shaft and start the nut.
4. Use the socket and adapter with a torque wrench and tighten nut to 50 ft. lbs. torque.

BRUSH REPLACEMENT

6.2" Delcotron

1. Remove two nuts retaining the blade connectors and remove the connectors (fig. 17c). Slide the indicator light relay wire from the terminal post.

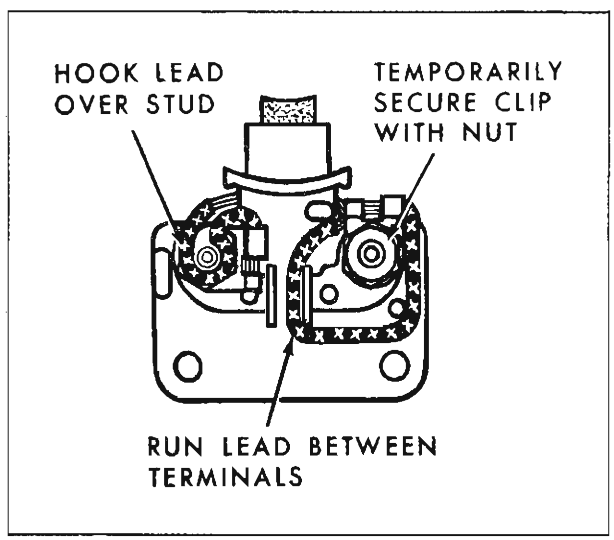


Fig. 18c—Brush Lead Arrangement during Assembly

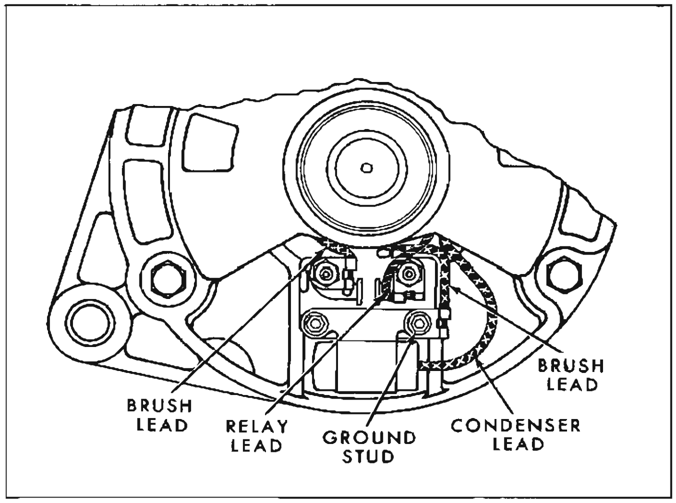


Fig. 19c—Lead Arrangement after Assembly

2. Remove two screws retaining the capacitor and brush holder to rear end frame. Remove brush holder.
3. To install brushes, push brushes into holder and secure leads as shown in Figure 18c to keep the brushes in holder.
4. Attach brush assembly and condenser to the end frame with hex-head stud on the left side only.
5. Rearrange leads as shown in Figure 19c with right-hand brush lead connected under the right hand hex-head stud.
6. Attach terminal cover with two screws, making sure leads are not caught underneath the cover.

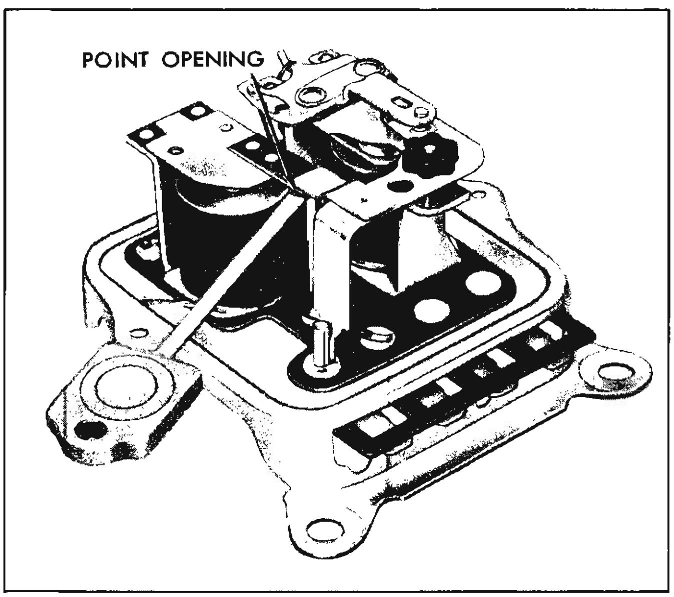


Fig. 20c—Checking Field Relay Point Opening

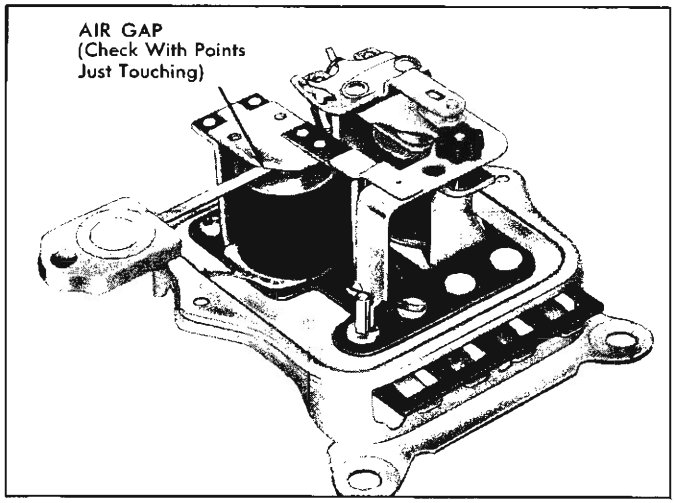


Fig. 21c—Checking Field Relay Air Gap

DOUBLE CONTACT REGULATOR

While most regular adjustments are made on the vehicle as outlined under "Maintenance and Adjustments," the regulator may be removed for field relay point and air gap adjustment. However, voltage regulating contacts should never be cleaned as they are made of special material that may be destroyed by cleaning with any abrasive material.

NOTE: A sooty or discolored condition of the contacts is normal after a relatively short period of operation.

REMOVAL AND INSTALLATION

To remove the regulator assembly, disconnect the battery ground cable and the wiring harness connector at the regulator, then remove the screws securing the regulator to the vehicle.

Electrical settings must be checked and adjusted after making mechanical adjustments. Before installing regulator cover, make sure the rubber gasket is in place on the regulator base.

MECHANICAL ADJUSTMENTS

NOTE: Only an approximate voltage regulator air gap setting should be made by the "feeler gauge" method.

Field Relay Adjustment

1. Point Opening: The point opening is checked as illustrated in Figure 20c. If adjustment is necessary, carefully bend the armature stop.
2. Air Gap: Check the air gap with the points just touching (fig. 21c). The air gap normally need not be adjusted. If the point opening and closing voltages are within specifications, the relay will operate satisfactorily even though the air gap may not be exactly according to specifications. If adjustment is necessary, bend the flat contact spring.

IGNITION SYSTEMS

INDEX

GENERAL DESCRIPTION

There are two ignition systems available on 1965 vehicles. The breaker point type which is continued as the regular production system and the optional transistor controlled breakerless ignition system (magnetic pulse type). The transistor ignition system features a specially designed distributor, control unit (ignition pulse amplifier), and a special coil. Two resistance wires are also used in the circuit; one as a ballast between the coil negative terminal and ground, while the other resistance wire provides a voltage drop for the engine run circuit and is by-passed at cranking. The other units in the system (the ignition switch, spark plugs, and battery) are of standard design. The distributor and control unit (ignition pulse amplifier) are shown in Figures 1i and 2i.

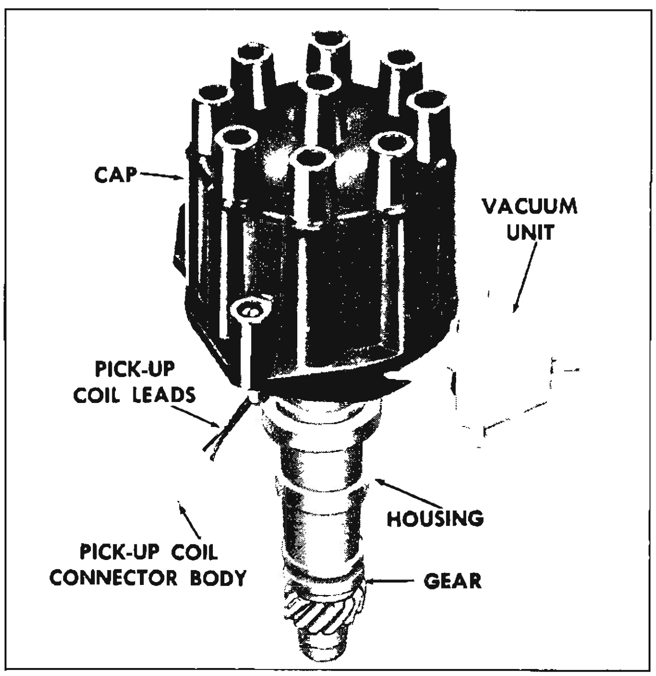


Fig. 1i—Magnetic Pulse Distributor

Although the external appearance of the distributor resembles a standard distributor, the internal construction is quite different. As shown in the exploded view (fig. 16i) an iron timer core replaces the conventional breaker cam. The timer core has the same number of equally-spaced projections, or vanes as engine cylinders.

The timer core rotates inside a magnetic pickup assembly, which replaces the conventional breaker plate, contact point set, and condenser assembly. The magnetic pickup assembly consists of a ceramic permanent magnet, a pole piece, and a pickup coil. The pole piece is a steel plate having equally spaced internal teeth, one tooth for each cylinder of the engine.

The magnetic pickup assembly is mounted over the main bearing of the distributor housing, and is made to rotate by the vacuum control unit, thus providing vacuum advance. The timer core is made to rotate about the shaft by conventional advance weights, thus providing centrifugal advance.

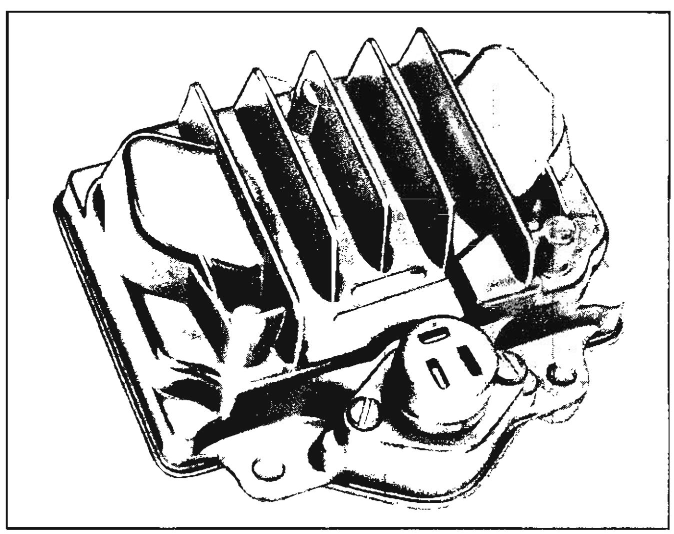


Fig. 2i—Ignition Pulse Amplifier Unit

MAINTENANCE AND ADJUSTMENTS

PERIODIC MAINTENANCE

BREAKER POINT SYSTEM

The distributor breaker points and spark plugs are the only ignition system components that require periodic service. The remainder of the ignition system requires only periodic inspection to check operation of the units, tightness of the electrical connections, and condition of the wiring. When checking the coil, test with a reputable tester.

Breaker type distributors are equipped with cam lubricator and should have the wick replaced at the same time contact point set is replaced. It is not necessary to lubricate the breaker cam when using a cam lubricator. Do not attempt to lubricate the wick - Replace when necessary. When installing a new wick, adjust its position so the end of the wick just touches the lobe of the breaker cam.

Distributor shaft lubrication is accomplished by a reservoir of lube around the mainshaft in the distributor body.

BREAKERLESS SYSTEM

Since there are no moving parts in the ignition pulse amplifier unit mounted forward of the radiator bulkhead, and the distributor shaft and bushings have permanent type lubrication, no periodic maintenance is therefore required for the breakerless ignition system. The distributor lower bushing is lubricated by engine oil through a splash hole in the distributor housing, and a housing cavity next to the upper bushing contains a supply of lubricant which will last between overhaul periods. At time of overhaul, the upper bushing may be lubricated by removing the plastic seal and then adding SAE 20 oil to the packing in the cavity. A new plastic seal will be required since the old one will be damaged during removal.

Tachometer readings for test purposes can be made on the primary circuit of the breakerless ignition system in the same manner as on the conventional ignition system, however before attempting to connect a test tachometer into the primary circuit check with your instrument supplier to insure that satisfactory readings can be obtained and the breakerless system will not be damaged by the tachometer that is to be used.

CAUTION: Never install a condenser of any rating between the coil positive and ground. The use of a condenser at this location for radio noise suppression can damage the power transistor in the ignition amplifier unit.

IGNITION COIL CHECK (BREAKERLESS)

The ignition coil primary can be checked for an open condition by connecting an ohmmeter across the two primary terminals with the battery disconnected. Primary resistance at 75°F. should be between .35 and .55 ohm. An infinite reading indicates the primary is open. For the engine to run but miss at times, the primary open may be of the intermittent type.

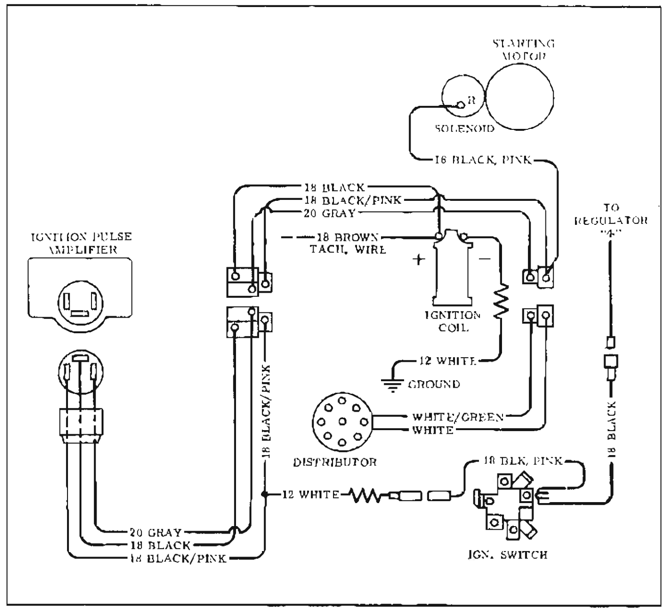


Fig. 3i—Breakerless Ignition Circuitry

The coil secondary can be checked for an open by connecting an ohmmeter from the high tension center tower to either primary terminal. To obtain a reliable reading, a scale on the ohmmeter having the 20,000 ohm value within, or nearly within, the middle third of the scale should be used. Secondary resistance at 75°F. should be between 8,000 and 12,500 ohms. If the reading is infinite, the coil secondary winding is open.

A number of different types of coil testers are available from various test equipment manufacturers. When using these testers, follow the procedure recommended by the tester manufacturer.

NOTE: Make sure the tester will properly check this special coil.

SPARK PLUGS

Should be removed, inspected cleaned and regapped at tune-up. Defective plugs should be replaced, see Servicing of Units Off the Vehicle.

SERVICE OPERATIONS

DISTRIBUTOR CONTACT POINTS

CLEANING

Dirty contact points should be dressed with a few strokes of a clean, fine-cut contact file. The file should not be used for other metals and should not be allowed to become greasy or dirty. Never use emery cloth to clean contact points. Contact surfaces, after considerable use, may not appear bright and smooth, but this is not necessarily an indication that they are not functioning satisfactorily. Do not attempt to remove all roughness nor dress the point surfaces down smooth; merely remove scale or dirt.

Badly burned or pitted contact points should be replaced and the cause of trouble determined so it can be eliminated. High resistance or loose connections in the condenser circuit, oil or foreign materials on the contact surfaces, improper point adjustment or high voltages may cause oxidized contact points. Check for these conditions where burned contacts are experienced. An out-of-balance condition in the ignition system, often the result of too much or too little condenser capacity, is indicated where point pitting is encountered.

REPLACEMENT

Four and Six Cylinder Engine Distributor

1. Release distributor cap hold-down screws, remove cap and place it out of work area.
2. Remove rotor.
3. Pull primary and condenser lead wires from contact point quick disconnect terminal (fig. 4i).
4. Remove contact set attaching screw, lift contact point set from breaker plate.
5. Clean breaker plate of oil smudge and dirt.
6. Place new contact point assembly in position on breaker plate, install attaching screw.

   CAUTION: Carefully wipe protective film from point set prior to installation.

   NOTE: Pilot on contact set must engage matching hole in breaker plate.

7. Connect primary and condenser lead wires to quick disconnect terminal on contact point set.

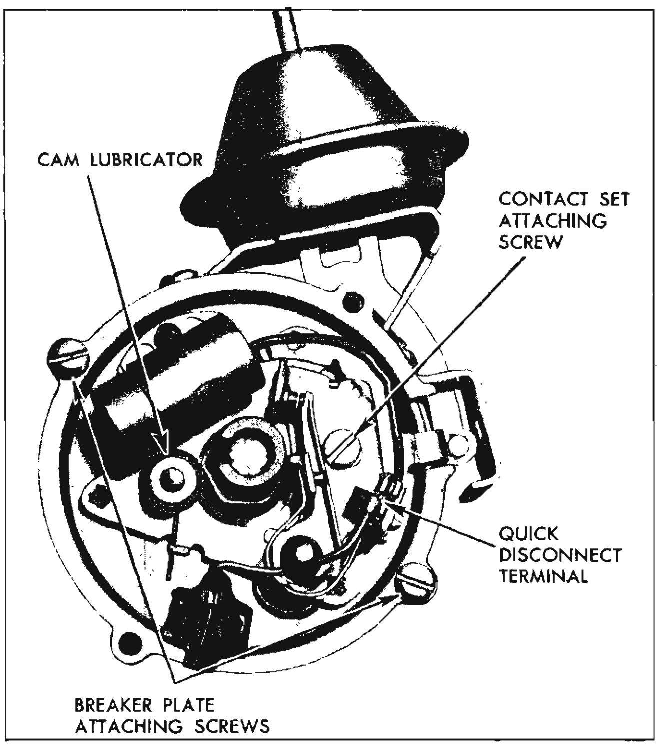


Fig. 4i—Breaker Plate and Attaching Parts

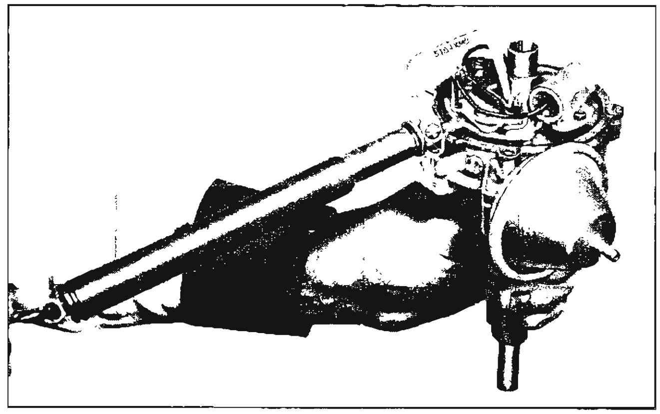


Fig. 5i—Checking Breaker Arm Spring Tension

8. Check and adjust points for proper alignment and breaker arm spring tension (fig. 5i). Use an aligning tool to bend stationary contact support if points need alignment.

   NOTE: The contact point pressure must fall within specified limits. Weak tension will cause chatter resulting in arcing and burning of the points and an ignition miss at high speed, while excessive tension will cause undue wear of the contact points, cam and rubbing block. Breaker arm spring tension should be 19-23 ounces. The contact point pressure should be checked with a spring gauge. The scale should be hooked to the breaker lever and the pull exerted at 90 degrees to the breaker lever as shown in Figure 5i. The reading should be taken just as the points separate. The pressure can be adjusted by bending the breaker lever spring. If the pressure is excessive, it can be decreased by pinching the spring carefully. To increase pressure, the lever must be removed from the distributor so the spring can be bent away from the lever. Avoid excessive spring distortion.

9. Set point opening (.019" for new points).
10. Reinstall rotor, position and lock distributor cap to housing.
11. Start engine and test point dwell and ignition timing.

Eight Cylinder Engine Distributor

1. The contact point set is replaced as one complete assembly and only dwell angle requires adjustment after replacement. Breaker lever spring tension and point alignment are factory set.
2. Remove the distributor cap by placing a screw driver in the slot head of the latch, press down and turn 1/4 turn in either direction.
3. Remove the two attaching screws which hold the base of the contact set assembly in place.
4. Remove the primary and condenser leads from their nylon insulated connection (fig. 6i) in contact set.
5. Reverse Steps 2, 3 and 4 to install new contact set.

   CAUTION: Install the primary and condenser leads as shown in Figure 6i. Improper installa-

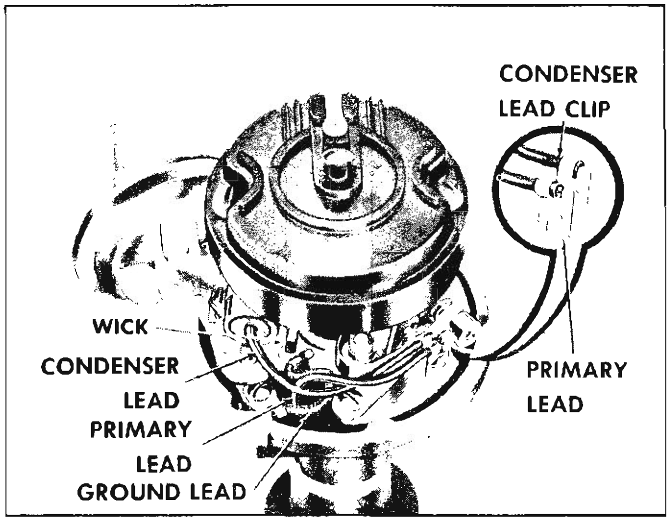


Fig. 6i—Distributor Lead Arrangements

tion will cause lead interference between the cap, weight base and breaker advance plate.

6. If car has 20,000 to 25,000 miles (or sooner if desired) the cam lubricator wick (fig. 7i) should be changed. Using long nosed pliers squeeze assembly together at base and lift out. Remove all old lubricant from cam surface. Replace in same manner.

NOTE: End of cam lubricant wick should be adjusted to just touch cam lobes. Over lubrication of cam resulting in grease on contact points

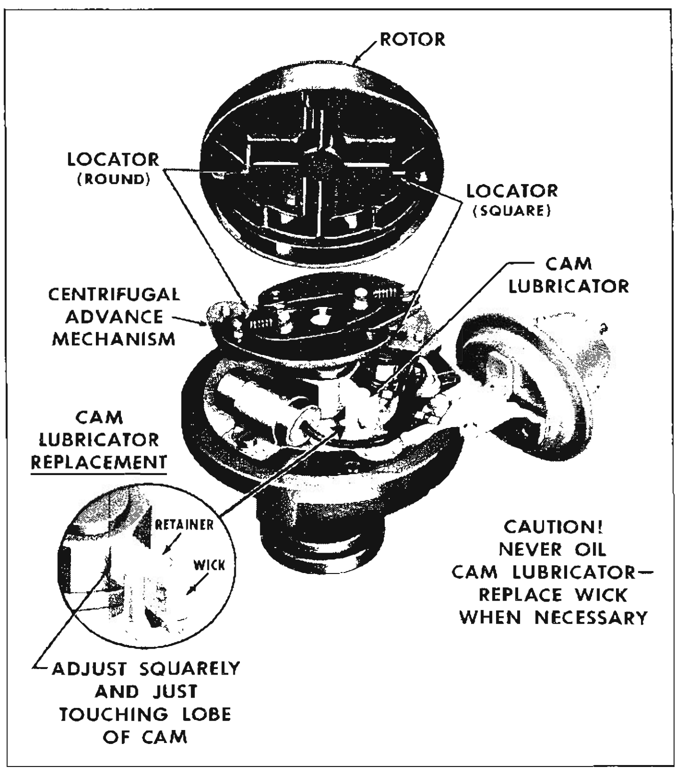


Fig. 7i—Top View of Distributor

can be caused by cam lubrication wick bearing too hard against cam surface. A correctly adjusted cam lubricator wick will provide adequate lubrication for cam. Do not apply additional grease to cam surface.

7. Start engine and check point dwell and ignition timing.

SETTING DWELL ANGLE

Four and Six Cylinder Engine Distributors

The point opening of new points can be checked with a feeler gauge, but the use of a feeler gauge on rough or uncleaned used points is not recommended since accurate mechanical gauging cannot be done on such points (fig. 8i).

Contact points must be set to the proper opening. Points set too close may tend to burn and pit rapidly. Points with excessive separation tend to cause a weak spark at high speed. Proper point setting for all models are:

.019" for new points
.016" for used points

New points must be set to the larger opening as the rubbing block will wear down slightly while seating to the cam. Contact points should be cleaned before adjusting if they have been in service.

To adjust the contact point opening:

1. If necessary, align points (fig. 9i) by bending the fixed contact support. Do not bend the breaker lever. Do not attempt to align used points; replace them where serious misalignment is observed. Use an aligning tool if available.
2. Turn or crank the distributor shaft until the breaker arm rubbing block is on the high point of the cam lobe. This will provide maximum point opening.
3. Loosen the contact support lock screw.

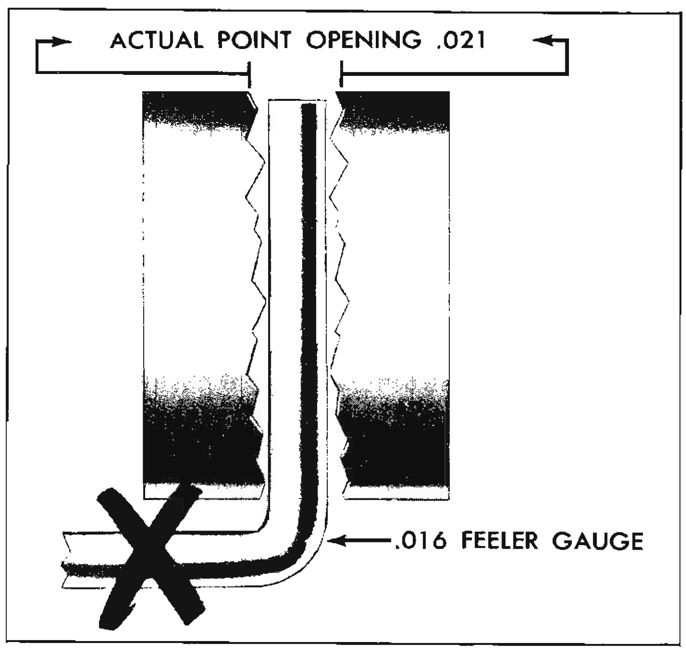


Fig. 8i—Inaccurate Gauging of Rough Points

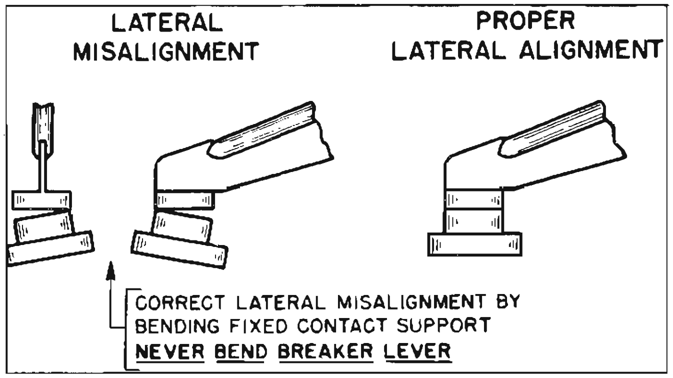


Fig. 9i—Alignment of Points

4. Use a screw driver (fig. 10i) to move the point support to obtain a .019" opening for new points and a .016" opening for used points.
5. Tighten the contact support lock screw and recheck the point opening.
6. After checking and adjusting the contact point opening to specifications, the cam angle or dwell should be checked with a dwell angle meter if such equipment is available (see Specifications for proper dwell angle). If the cam angle is less than the specified minimum, check for defective or misaligned contact points or worn distributor cam lobes. The variation in cam angle readings between idle speed and 1750 engine rpm should not exceed 3°. Excessive variation in this speed range indicates wear in the distributor.

   NOTE: Cam angle readings taken at speeds above 1750 engine rpm may prove unreliable on some cam angle meters.

Eight Cylinder Engine Distributor

On the Vehicle

With the engine running at idle and operating temperatures normalized, the dwell is adjusted by first raising the window provided in the cap and inserting a "Hex" type wrench into the adjusting screw head (fig. 11i).

1. Preferred Method - Turn the adjusting screw until the specified dwell angle is obtained as measured in degrees (28° to 32°, 30° preferred) by a dwell angle meter.
2. Alternate Method - Turn adjusting screw in (clockwise) until the engine begins to misfire, then turn screw 1/2 turn in the opposite direction (counterclockwise). This will give the approximate dwell angle required. (Use only when meter is not available.)

Off the Vehicle

1. Distributor Test Method:
   a. With the distributor mounted on a distributor testing machine, connect the dwell meter to the distributor primary lead.
   b. Turn the adjusting screw (fig. 11i) to set the dwell angle to 30 degrees.
2. Test Light Method:
   a. With the distributor mounted in a vise, connect a testing lamp to the primary lead.

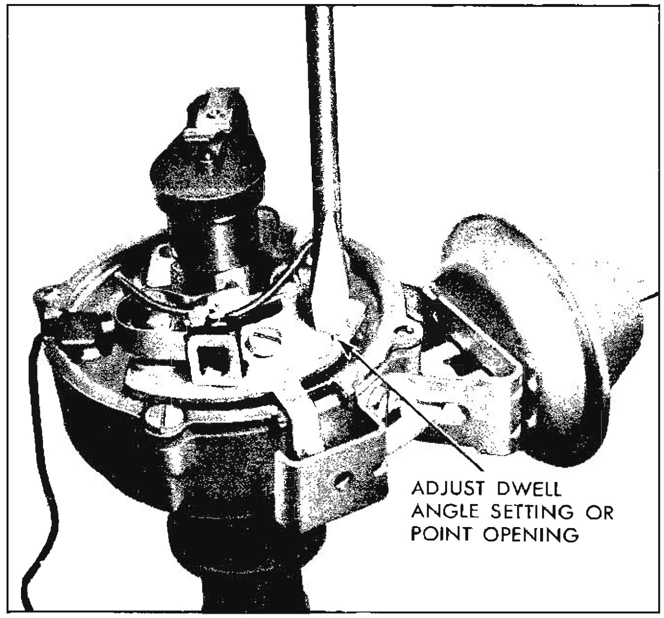


Fig. 10i—Setting Point Opening

   b. Rotate the shaft until one of the circuit breaker cam lobes is under the center of the rubbing block of the breaker lever.
   c. Turn the adjusting screw clockwise (fig. 11i) until the lamp lights, then give the wrench 1/2 turn in the opposite direction (counter-clockwise) to obtain the proper dwell angle.

DISTRIBUTOR CONDENSER

PERFORMANCE DIAGNOSIS

The following four factors affect condenser performance, and each factor must be considered in making any condenser test.

1. **Breakdown** - A failure of the insulating material. A direct short between the metallic elements of the condenser. This prevents any condenser action.

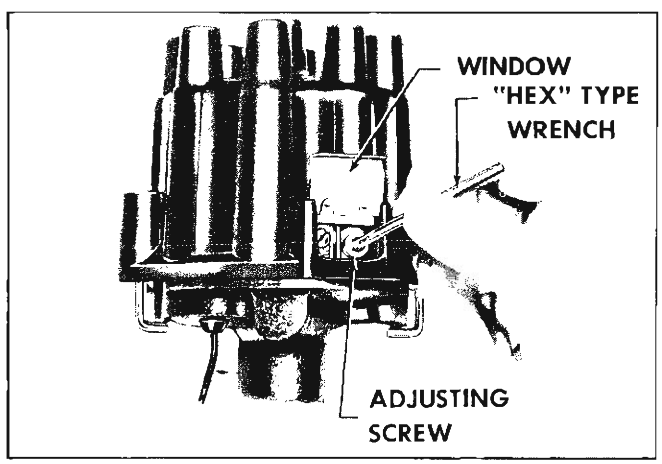


Fig. 11i—Adjusting Dwell Angle

2. **Low Insulating Resistance (Leakage)** - Low insulation resistance prevents the condenser from holding a charge. All condensers are subject to leakage which, up to a certain limit, is not objectionable.
3. **High Series Resistance** - Excessive resistance in the condenser circuit due to broken strands in the condenser leak or to a defective connection. This will cause burned points and ignition failure upon initial starts and at high speeds.
4. **Capacity** - Capacity is determined by the area of the metallic elements and the insulating and impregnating materials.

For a complete check of the condenser, use a tester which will check for all of the above conditions. Follow the instructions given by the manufacturer of the test equipment. Condenser capacity should be .18-.23 microfarads.

REPLACEMENT

Four and Six Cylinder Engine Distributor (Fig. 4i)

1. Release distributor cap hold-down screws, remove cap and place it out of the work area.
2. Remove rotor.
3. Disconnect condenser lead wire from contact point quick-disconnect terminal.
4. Remove condenser attaching screw, lift condenser from breaker plate and wipe breaker plate clean.
5. Install new condenser using reverse of procedure outlined above.

Eight Cylinder Engine Distributor

1. Remove distributor cap.
2. Loosen condenser lead attaching screw (fig. 6i) and lift out condenser lead clip.
3. Remove screw holding condenser bracket to breaker plate and slide condenser from bracket.
4. To replace condenser reverse the above procedure.

NOTE: Make sure that new condenser lead is installed in proper position (fig. 6i).

DISTRIBUTOR (BREAKER POINT TYPE)

REMOVAL

1. Release the distributor cap hold-down screws, remove the cap and place it clear of the work area.

   NOTE: If necessary, remove secondary leads from the distributor cap after first marking the cap tower for the lead to No. 1 cylinder. This will aid in the reinstallation of leads in the cap.

2. Disconnect the distributor primary lead from the coil terminal.
3. Scribe a realignment mark on the distributor bowl and engine in line with the rotor segment.
4. Disconnect vacuum line to distributor, remove the distributor hold-down bolt and clamp, remove the distributor from the engine. Note position of vacuum advance mechanism relative to the engine.

   CAUTION: Avoid rotating the engine with the distributor removed as the ignition timing will be upset.

DISASSEMBLY

It is advisable to place the distributor in a distributor testing machine or synchroscope prior to disassembly. When mounting distributors for tests, first secure the gear in the test drive mechanism, then push the distributor housing downward toward the gear to take up any end play between the gear and the housing.

NOTE: When testing distributors that have their lower shaft support bushing located in the engine block (6 cylinder engines), a special adapter should be used to insure the shaft will run true in its housing.

Test the distributor for variation of spark, correct centrifugal and vacuum advance and condition of contacts. This test will give valuable information on distributor condition and indicate parts replacement which may be necessary. Check the area on the breaker plate just beneath the contact points. A smudgy line indicates that oil or crankcase vapors have been present between the points.

Four and Six Cylinder Engines

Refer to Figure 12i.

1. Remove the rotor.
2. Remove the vacuum control assembly retaining screws, detach the unit from the distributor housing.
3. Disconnect the primary and condenser leads from the contact point quick disconnect terminal, remove the contact point set attaching screw, condenser attaching screw. Remove the point set and condenser from the breaker plate.
4. Remove the breaker plate attaching screws, remove the breaker plate from the distributor housing (fig. 12i).

   NOTE: Do not disassemble breaker plate any further.

5. Remove the roll pin retaining the driven gear to the mainshaft, slide the gear from the shaft.
6. Slide the cam and mainshaft from the distributor housing.
7. Remove the weight cover and stop plate screws, remove the cover, weight springs, weights and slide cam assembly from the mainshaft.

V-8 Engines

Refer to Figure 13i.

1. Remove the rotor.
2. Remove both weight springs and advance weights.
3. Remove roll pin retaining driven gear to distributor shaft, slide the gear and spacers from the shaft.
4. Before sliding the distributor shaft from the housing, check for and remove any burrs on the shaft. This will prevent damage to the seals and bushing still positioned in the housing.
5. Slide the distributor mainshaft and cam-weight base assembly from the housing.
6. Remove vacuum advance mechanism retaining screws, remove the vacuum advance assembly.
7. Remove the spring retainer, remove the breaker plate assembly from the distributor housing. Remove the contact point and condenser from the breaker plate. Remove the felt washer and plastic seal located beneath the breaker plate.

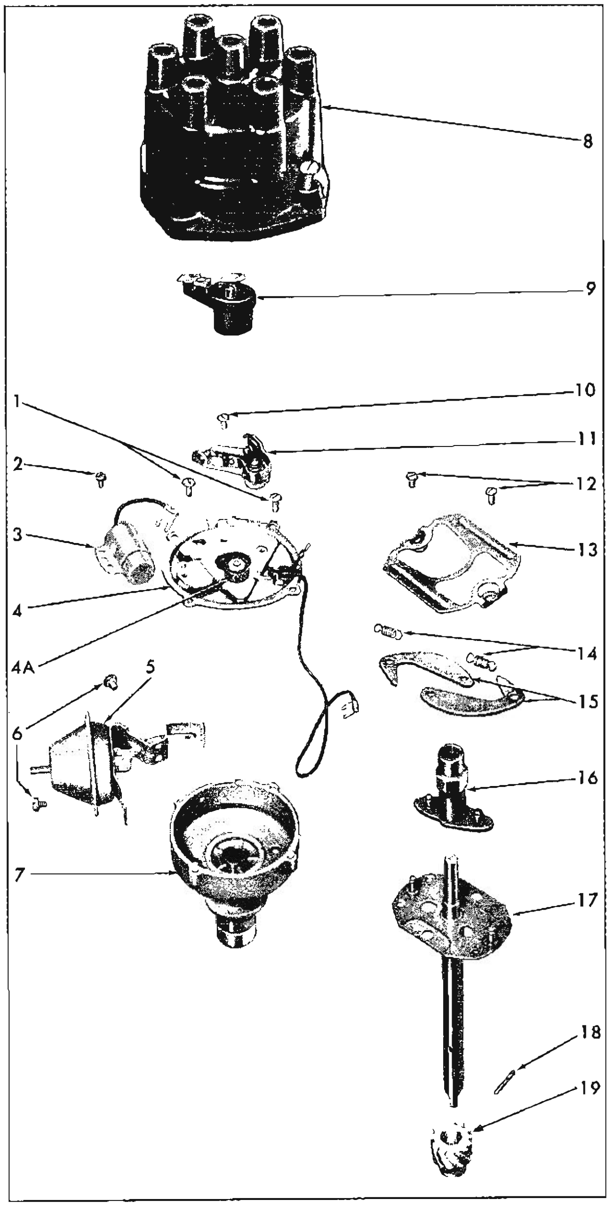


Fig. 12i—L-6 Distributor-Exploded View

1. Breaker Plate Attaching Screws
2. Condenser Attaching Screws
3. Condenser
4. Breaker Plate Assembly
4a. Cam Lubricator
5. Vacuum Control Assembly
6. Vacuum Control Attaching Screws
7. Housing
8. Cap
10. Contact Point Attaching Screw
11. Contact Point Assembly
12. Weight Cover Attaching Screws
13. Weight Cover
14. Weight Springs
15. Advance Weights
16. Cam Assembly
17. Main Shaft Assembly
18. Roll Pin
19. Drive Gear

CLEANING AND INSPECTION

1. Wash all parts in cleaning solvent except cap, rotor, condenser, breaker plate assembly and vacuum control unit. Degreasing compounds may damage insulation of these parts or saturate the lubricating felt in the case of the breaker plate assembly.
2. Inspect the breaker plate assembly for damage or wear and replace if necessary.
3. Inspect the shaft for wear and check its fit in the bushings in the distributor body. If the shaft or bushings are worn, the parts should be replaced.
4. Mount the shaft in "V" blocks and check the shaft alignment with a dial gauge. The run-out should not exceed .002".
5. Inspect the advance weights for wear or burrs and free fit on their pivot pins.
6. Inspect the cam for wear or roughness. Then check its fit on the end of the shaft. It should be absolutely free without any roughness.
7. Inspect the condition of the distributor points. Dirty points should be cleaned and badly pitted points should be replaced. (See Distributor Contact Points.)
8. Test the condenser for series resistance, microfarad capacity (.18 to .23) and leakage or breakdown, following the instructions given by the manufacturer of the test equipment used.
9. Inspect the distributor cap and spark plug wires for damage and replace if necessary.

ASSEMBLY

Four and Six Cylinder Engine

Refer to Figure 12i for Exploded View of Distributor.

1. Replace cam assembly to mainshaft.

   NOTE: Lubricate top end of shaft with Delco cam and ball bearing grease or equivalent prior to replacing.

2. Install governor weights on their pivot pins, replace weight springs. Install weight cover and stop plate.
3. Lubricate mainshaft and install it in distributor housing.
4. Install distributor driven gear to mainshaft and insert retaining roll pin. Check to see that shaft turns freely.
5. Install breaker plate assembly in the distributor body and attach retaining screws.
6. Attach condenser and contact point set in proper location with appropriate attaching screws.

   NOTE: Contact point set pilot must engage matching hole in breaker plate. Connect primary and condenser leads to contact set quick-disconnect terminal.

7. Attach vacuum control assembly to distributor housing.
8. Check and adjust contact point opening and alignment. (See setting and alignment of points.)
9. Check breaker lever spring tension which should be 19-23 ounces. (See contact point replacement.)

V-8 Assembly—(Fig. 13i)

1. Fill housing lubricating cavity with proper compound, press in new plastic seal and install felt washer.
2. Replace the vacuum advance unit, install the breaker plate in housing and install the spring retainer on the upper bushing.

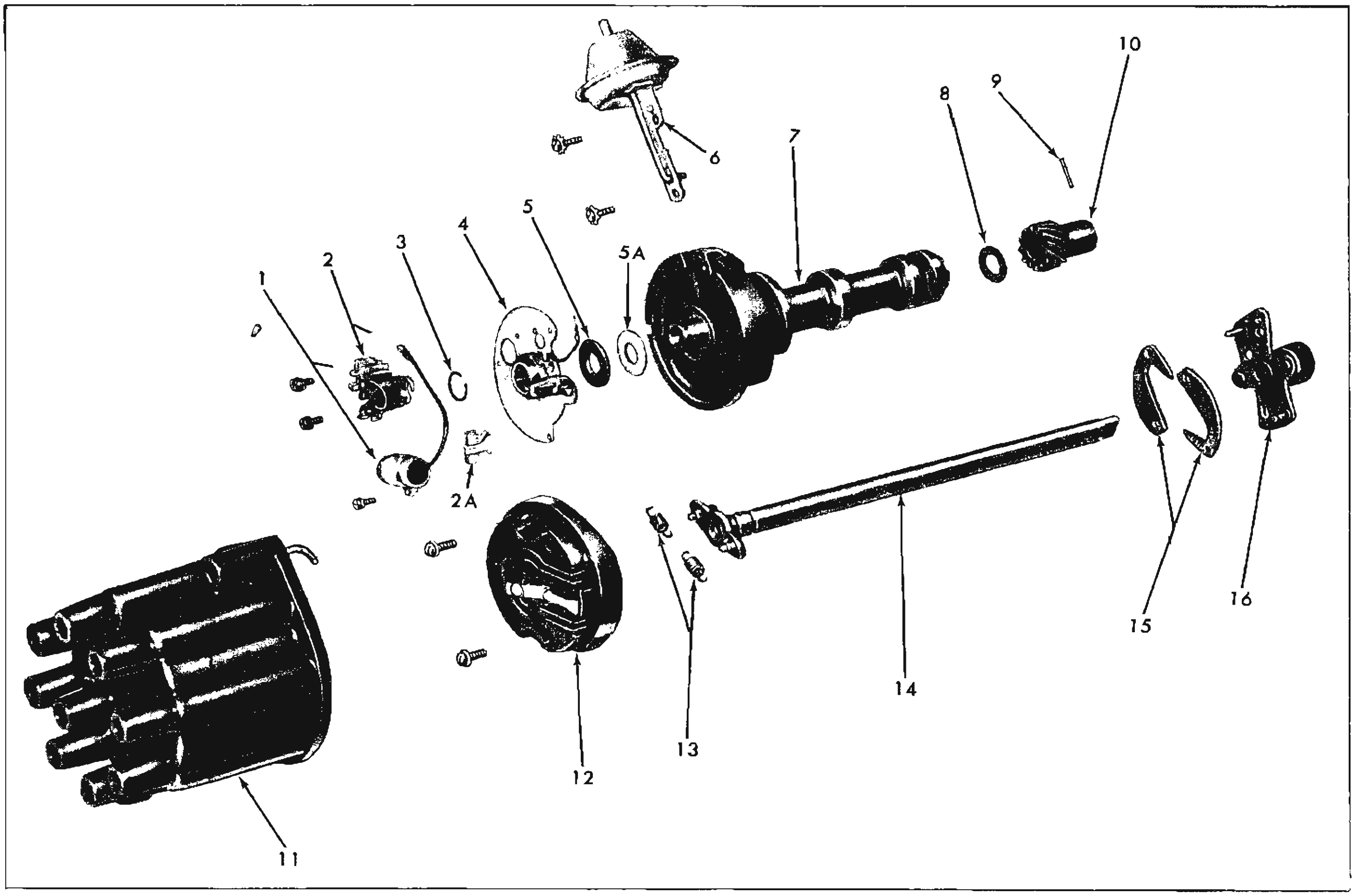


Fig. 13i—V-8 Distributor (Typical)-Exploded View

1. Condenser
2. Contact Point Assembly
2a. Cam Lubricator
3. Retaining Ring
4. Breaker Plate
5. Felt Washer
5a. Plastic Seal
6. Vacuum Advance Unit
7. Housing
8. Shim Washer
9. Drive Gear Pin
10. Drive Gear
11. Cap
12. Rotor
13. Weight Springs
14. Mainshaft
15. Advance Weights
16. Cam Weight Base Assembly

3. Lubricate and slide weight cam over mainshaft and install weights and spring (fig. 14i).
4. Insert mainshaft into housing, indexing it with drive gear and washers.
5. Slide distributor drive gear shims and gear over shaft and install new pin. Tap new pin through gear and mainshaft. Check shaft for free rotation.

   NOTE: Mainshaft end clearance should be .002"-.007". Add or remove shims as necessary.

6. Install contact point set and condenser to breaker plate. Connect leads as shown in Figure 49.

   NOTE: Contact point spring tension is factory-set above specifications to assure ease of final adjustment. Correct tension is 19-23 oz.

7. Install rotor to cam assembly, indexing round and square pilot holes.

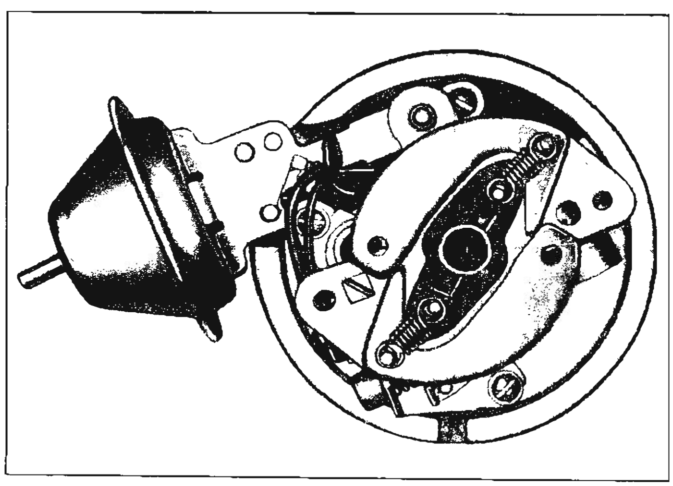


Fig. 14i—Advance Weights Installed

INSTALLATION—ENGINE NOT DISTURBED (ALL MODELS)

1. Turn the rotor about 1/8 turn in a clockwise direction past the mark previously placed on the distributor housing to locate rotor.
2. Push the distributor down into position in the block with the housing in a normal "installed" position (fig. 15i).

   NOTE: It may be necessary to move rotor slightly to start gear into mesh with camshaft gear, but rotor should line up with the mark when distributor is down in place.

3. Tighten the distributor clamp bolt snugly and connect vacuum line. Connect primary wire to coil terminal and install cap. Also install spark plug and high tension wires if removed.

   NOTE: It is important that the spark plug wires be installed in their proper location in the supports (fig. 16i).

4. Time ignition as previously described under Tune-Up in Section 6.

INSTALLATION—ENGINE DISTURBED (ALL MODELS)

1. Locate No. 1 piston in firing position by either of two methods described below.
   a. Remove No. 1 spark plug and, with finger on plug hole, crank engine until compression is felt in the No. 1 cylinder. Continue cranking until timing mark on crankshaft pulley lines up with timing tab attached to engine front cover.
   b. Remove rocker cover (left bank on V-8 engines) and crank engine until No. 1 intake valve closes and continue to crank slowly about 1/3 turn until timing mark on pulley lines up with timing tab.

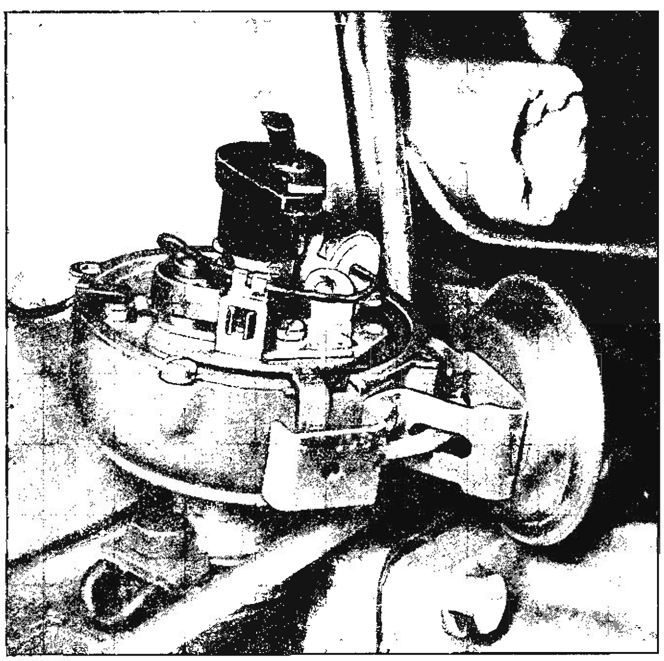


Fig. 15i—Six Cylinder Engine Distributor

2. Position distributor to opening in block in normal installed attitude (fig. 15i and 16i), noting position of vacuum control unit.
3. Position rotor to point toward front of engine (with distributor housing held in installed attitude), then turn rotor counter-clockwise approximately 1/8 turn more toward left cylinder bank and push distributor down to engine camshaft. It may be necessary to rotate rotor slightly until camshaft engagement is felt.
4. While pressing firmly down on distributor housing, kick starter over a few times to make sure oil pump shaft is engaged. Install hold-down clamp and bolt and snug up bolt.
5. Turn distributor body slightly until points just open and tighten distributor clamp bolt.
6. Place distributor cap in position and check to see that rotor lines up with terminal for No. 1 spark plug.
7. Install cap, check all high tension wire connections and connect spark plug wires if they have been removed. It is important that the wires be installed in their location in the supports.

   NOTE: The brackets are numbered to show the correct installation. Wires must be installed as indicated to prevent cross firing.

8. Connect vacuum line to distributor and distributor primary wire to coil terminal.
9. Start engine and set timing as described under Turn-Up in Section 6.

BREAKERLESS (MAGNETIC PULSE) DISTRIBUTOR

REMOVAL

1. Disconnect pickup coil leads at connector.
2. Remove distributor cap.
3. Crank engine so rotor is in position to fire No. 1 cylinder and timing mark on harmonic balancer is indexed with pointer.
4. Remove vacuum line from distributor.
5. Remove distributor clamping screw and hold-down clamp.
6. Remove distributor and distributor-to-block gasket. It will be noted that the rotor will rotate as the distributor is pulled out of the block. Mark the relationship of the rotor and the distributor housing after removal so that the rotor can be set in the same position when the distributor is being installed.

DISASSEMBLY (Fig. 16i)

NOTE: If a distributor is being disassembled for replacement of the stationary magnetic pickup assembly only, it will be necessary to perform only Steps 3, 4, 5, 7, 8, and 11 of the service procedure listed below.

1. Remove screws securing rotor and remove rotor.
2. Remove centrifugal weight springs and weights.
3. Remove roll pin, then remove distributor drive gear and washer.

   CAUTION: To prevent damage to the permanent magnet, support drive gear when driving out roll pin.

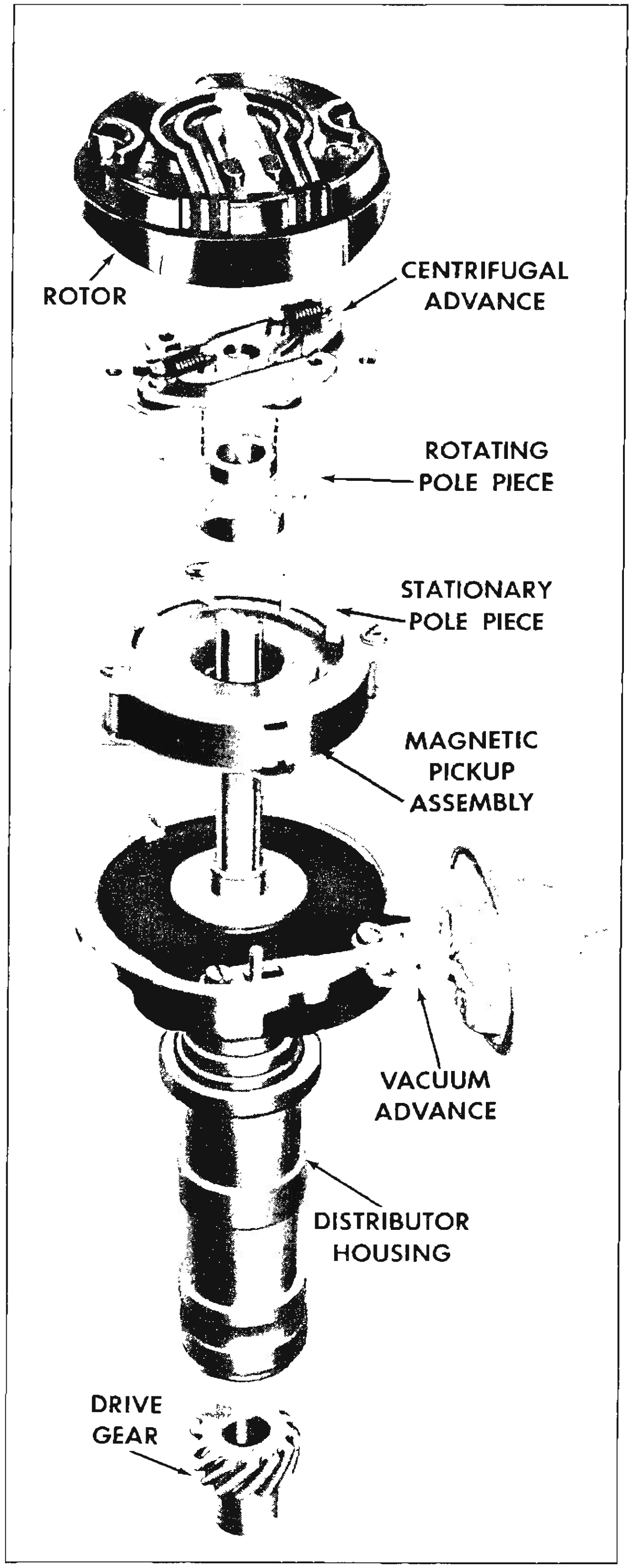


Fig. 16i—Magnetic Pulse Distributor Components

4. Remove drive shaft assembly.
5. Remove centrifugal weight support and inner core from drive shaft.
6. Remove connector from pickup coil leads.
7. Remove retaining ring which secures magnetic core support plate to distributor shaft bushing in housing.
8. As a unit, remove the entire magnetic pickup assembly from the distributor housing.
9. Remove brass washer and felt pad.

NOTE: Before removing plastic seal, refer to instructions provided earlier in this article, under the heading, "Periodic Maintenance."

10. Remove vacuum advance unit.
11. To reassemble distributor, performing the above steps in reverse order.

INSTALLATION

1. Check to see that the engine is at firing position for No. 1 cylinder (timing mark on harmonic balancer indexed with pointer).
2. Position a new distributor-to-block gasket on the block.
3. Before installing distributor, index rotor with housing as noted when distributor was removed. Install distributor in block so that vacuum diaphragm faces approximately 45° forward on the right side of the engine and the rotor points toward contact in cap for No. 1 cylinder.
4. Replace distributor clamp leaving screw loose enough to allow distributor to be turned for timing adjustment.
5. Install spark plug wires in distributor cap. Place wire for No. 1 cylinder in tower (marked on old cap during disassembly) then install remaining wires clockwise around the cap according to the firing order (1-8-4-3-6-5-7-2).
6. Attach distributor to coil primary wires.
7. Replace distributor cap.
8. Adjust timing and then fully tighten distributor clamp screw.
9. Attach vacuum line to distributor.

DISTRIBUTOR OFF-ENGINE TEST

The distributor's centrifugal and vacuum advance can be checked in a distributor testing machine or synchroscope specially adapted or designed to accommodate this type distributor. However, since this envolves removing the distributor from the engine, this test may be postponed until other system checks have been made. A dwell reading cannot be obtained on this distributor and it is not likely that the centrifugal or vacuum advance will be a cause of trouble.

COIL REPLACEMENT

1. Disconnect ignition switch and distributor leads from terminals on coil.
2. Pull high tension wire from center terminal of coil.
3. Remove the two coil support mounting bolts or loosen friction clamp screw and remove coil.
4. Place new coil in position and install attaching bolts or tighten clamp screw.
5. Place high tension lead securely in center terminal of coil and connect ignition switch and distributor primary leads to terminals on coil.
6. Start engine and test coil operation.

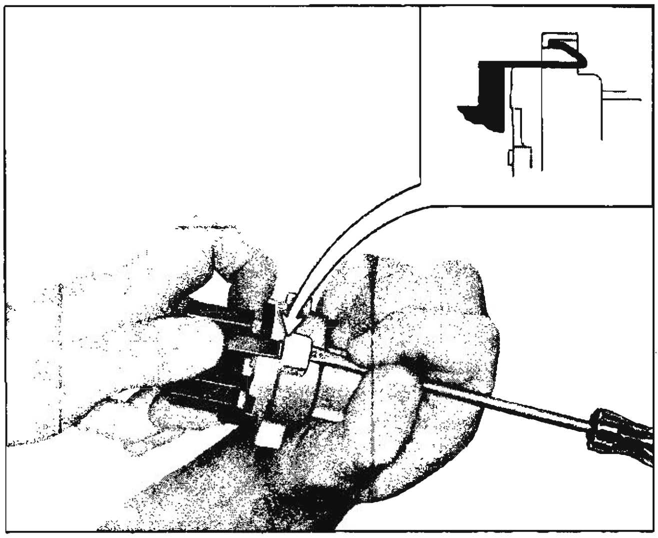


Fig. 17i—Unlocking Ignition Switch Connector

IGNITION SWITCH REPLACEMENT

Refer to Figures 17i and 18i.

1. Raise hood and disconnect battery ground cable from battery.
2. Remove lock cylinder by positioning switch in "off" position and inserting wire in small hole in cylinder face. Push in on wire to depress plunger and continue to turn key counter-clockwise until lock cylinder can be removed.
3. Remove the metal ignition switch nut from the passenger side of the dash.
4. Pull the ignition switch out from under the dash and remove the wiring connectors.
5. To remove the "theft resistant" connector, the switch must be out from under the dash as outlined in Step 4. Using a screw driver unsnap the locking

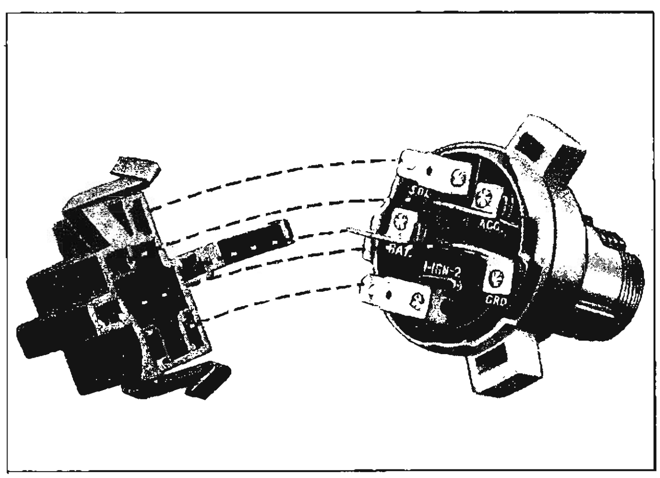


Fig. 18i—Switch and Connector Unplugged

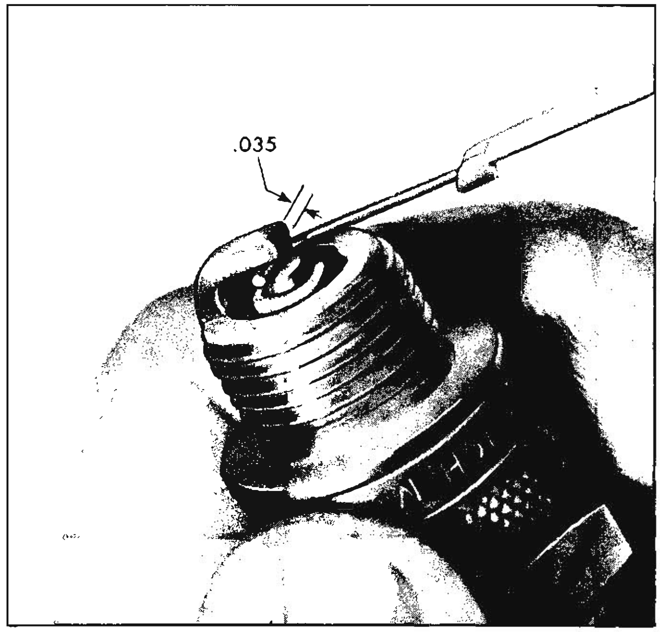


Fig. 19i—Setting Spark Plug Gap

tangs on the connector from their position on the switch as shown in Figure 17i. Unplug the connector.
6. Snap the connector into place on a new ignition switch.
7. Place the switch into position from behind the dash and install the metal ignition switch nut.
8. Install the lock cylinder.
9. Install the battery cable to the battery and lower the hood.

SPARK PLUGS

CLEANING AND REGAPPING

Clean the spark plugs thoroughly, using an abrasive-type cleaner. If the porcelains are badly glazed or blistered, the spark plugs should be replaced. All spark plugs must be of the same make and number or heat range. Use a round feeler gauge to adjust the spark plugs gaps to .035" (fig. 19i).

CAUTION: Before adjusting gap, file center electrode flat. In adjusting the spark plug gap, never bend the center electrode which extends through the porcelain center. Always make adjustment by bending the ground or side electrode.

INSTALLATION

Install the spark plugs in the engine with new gaskets and tighten to 20-25 ft. lbs. torque. If torque wrench is not available, tighten plugs finger tight and 1/2 turn more. Plugs are of a 14 millimeter size and care must be exercised when installing or the gap setting may be changed.

STARTER CIRCUIT

INDEX

GENERAL DESCRIPTION

The function of the starting system, composed of the starting motor, solenoid and battery, is to crank the engine. The battery supplies the electrical energy, the solenoid completes the circuit to the starting motor, and the motor then does the actual work of cranking the engine.

The starting motor (fig. 1s) consists primarily of the drive mechanism, frame, armature, brushes, and field windings. The starting motor is a pad mounted 12-volt extruded frame type, having four pole shoes and four fields, connected with the armature. The aluminum drive end housing is extended to enclose the entire shift lever and plunger mechanism, protecting them from dirt, splash, and icing. The flange mounted solenoid switch operates the overrunning clutch drive by means of a linkage to the shift lever.

The V-8 wiring harness differs from the in-line engine in that the ignition lead to the coil from the switch is attached at the coil instead of at the starter solenoid (fig. 2s).

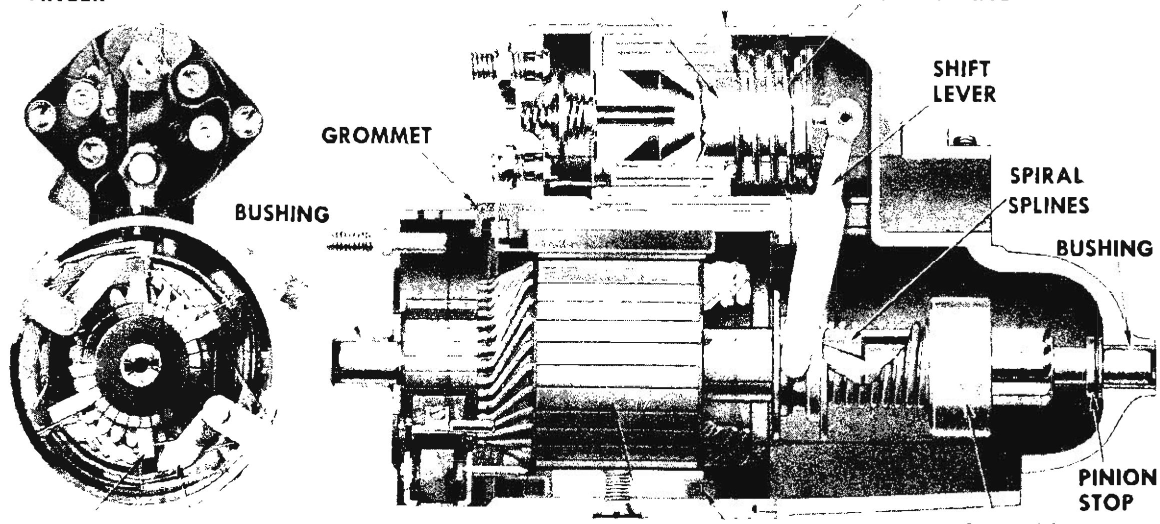


Fig. 1s—Starting Motor Cross Section (Typical)

MAINTENANCE AND ADJUSTMENTS

No periodic lubrication of the starting motor or solenoid is required. Since the starting motor and brushes cannot be inspected without disassembling the unit, no service is required on these units between overhaul periods.

RESISTANCE CHECKS

Although the starting motor cannot be checked against specifications on the car, a check can be made for excessive resistance in the starting circuit. Place a voltmeter across points in the cranking circuit as outlined

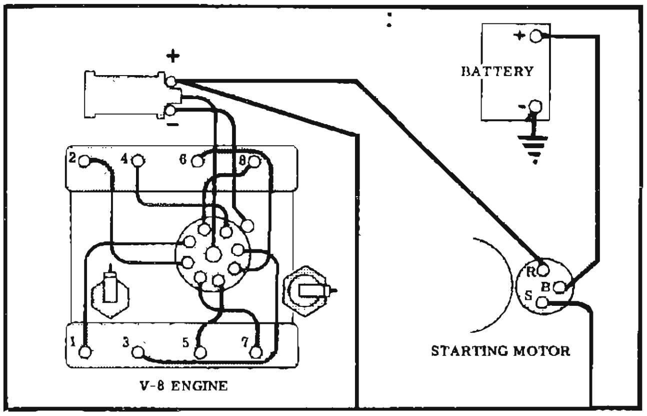


Fig. 2s—V-8 Starting Circuit Diagram

below and observe the reading with the starting switch closed and the motor cranking (distributor primary lead grounded to prevent engine firing).

1. From battery positive post To solenoid battery terminal.
2. From battery negative post To starting motor housing.
3. From solenoid battery terminal To solenoid motor terminal.

If voltage drop in any of above check exceeds 0.2 volts, excessive resistance is indicated in that portion of starting circuit and the cause of the excessive resistance should be located and corrected in order to obtain maximum efficiency in the circuit.

CAUTION: Do not operate the starting motor continuously for more than 30 seconds to avoid overheating.

When the solenoid fails to pull in, the trouble may be due to excessive voltage drop in the solenoid control circuit. To check for this condition, close the starting switch and measure the voltage drop between the BATTERY terminal of the solenoid and the SWITCH (S) terminal of the solenoid.

1. If this voltage drop exceeds 3.5 volts, excessive resistance in the solenoid control circuit is indicated and should be corrected.
2. If the voltage drop does not exceed 3.5 volts and the solenoid does not pull in, measure the voltage available at the SWITCH terminal of the solenoid.
3. If the solenoid does not feel warm, it should pull in whenever the voltage available at the SWITCH terminal is 7.7 volts or more. When the solenoid feels warm, it will require a somewhat higher voltage to pull in.

STARTING MOTOR AND SOLENOID CHECK

The following checks may be made if the specific gravity of the battery is 1.215 or higher.

1. If the solenoid does not pull in, measure the voltage between the switch (S) terminal of the solenoid and ground with the starting switch closed.

   CAUTION: If the solenoid feels warm, allow to cool before checking.

   If the voltage is less than 7.7 volts, check for excessive resistance in the solenoid control circuit. If the voltage exceeds 7.7 volts, remove the starting motor and check (1) solenoid current draw, (2) starting motor pinion clearance, and (3) freedom of shift lever linkage.
2. If the solenoid "chatters" but does not hold in, check the solenoid for an open "hold-in" winding. Whenever it is necessary to replace a starting motor solenoid, always check starting motor pinion clearance.
3. If motor engages but does not crank or cranks slowly, check for excessive resistance in the external starting circuit, trouble within the starting motor, or excessive engine resistance to cranking.

SERVICE OPERATIONS

STARTING MOTOR

REMOVAL AND INSTALLATION (Fig. 3s)

1. Disconnect battery ground cable at battery.
2. Raise vehicle to a good working height.
3. Disconnect all wires at solenoid terminals.

   NOTE: It is a good idea to reinstall the nuts as each wire is disconnected as thread size is different but may be mixed and stripped.
4. Loosen starter front bracket (nut on V-8 and bolt on L-6) then remove two mount bolts.
5. Remove the front bracket bolt or nut and rotate bracket clear of work area then lower starter from vehicle by lowering front end first - (hold starter against bell housing and sort of roll end-over-end).
6. Reverse the removal procedure to install then torque the mount bolts to 25-35 ft. lbs.
7. Check operation of starter on vehicle.

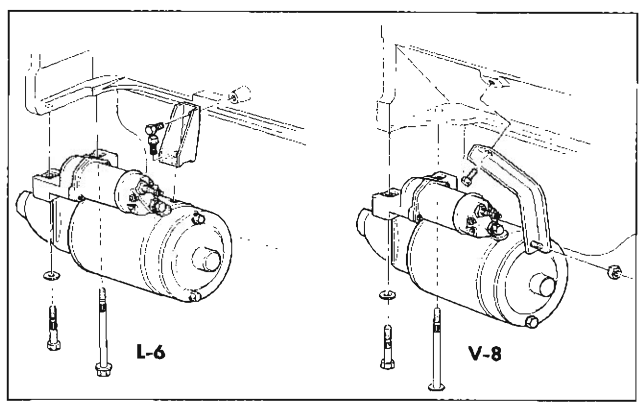


Fig. 3s—Starter Mounting and Solenoid Connections

SPECIAL TOOLS

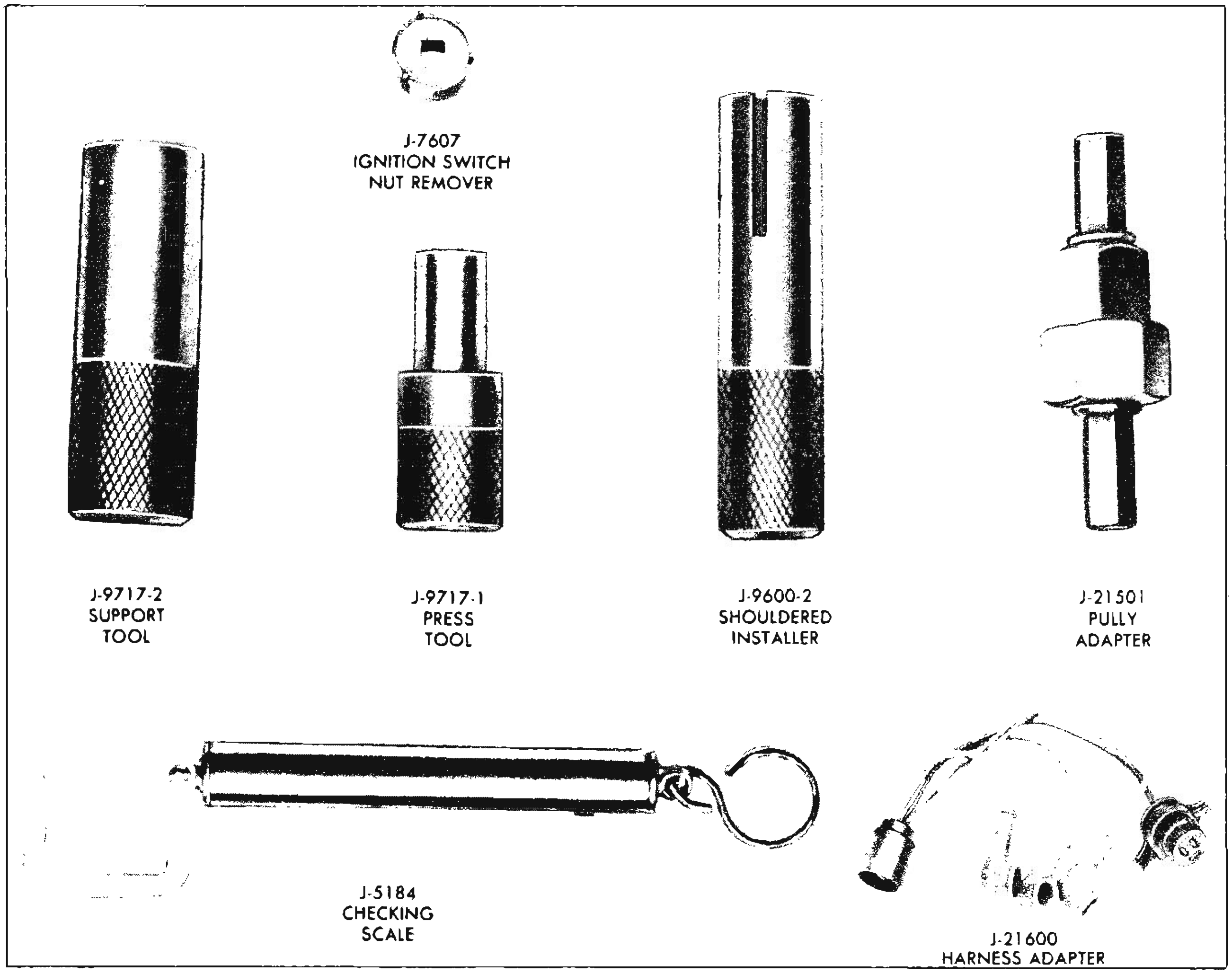


Fig. 45—Special Tools

SECTION 7
CLUTCH AND TRANSMISSIONS

CONTENTS OF THIS SECTION

CLUTCH

INDEX

GENERAL DESCRIPTION

A diaphragm spring-type clutch assembly is used with manual transmissions.

The clutch assembly is enclosed in a 360° bell housing which must be removed to gain access to the clutch.

V-8 engines (equipped with a 4 speed transmission) use a bent-finger, centrifugal diaphragm type clutch assembly. All its integral release fingers are bent back to gain a centrifugal boost and to insure quick re-engagement at high engine speeds.

This type of clutch has the advantages of increasing pressure plate load as the driven plate wears, and of low pedal effort with high plate loads without requiring over-center booster springs on the clutch linkage.

The pressure plate is a high tensile strength iron designed for maximum speed conditions.

Due to the clutch property of load increase with wear, a new clutch should be properly worn or seated in by making 20 to 50 normal starts or by placing a .010" shim between the clutch cover and the flywheel at each bolt location.

The clutch release bearing (fig. 4), used with the bent finger diaphragm clutch, has an overall length of approximately 1-1/4". The longer bearing, used with the straight diaphragm, will cause inability to obtain free pedal travel, especially as the clutch wears, resulting in slippage and rapid wear. DO NOT INTERCHANGE!

The clutch is operated by conventional linkage consisting of two groups, upper linkage and lower linkage.

The return spring pre-loads clutch linkage, removing looseness due to wear. The clutch free pedal travel, therefore, will increase with linkage wear and decrease with driven disc wear, and free travel felt at pedal is throwout bearing lash.

MAINTENANCE AND ADJUSTMENTS

LINKAGE INSPECTION

There are several things which affect good clutch operation. Therefore, it is necessary, before performing any major clutch operations, to make preliminary inspections to determine whether trouble is actually in the clutch.

Check the clutch linkage to be sure the clutch releases fully as follows:

1. With engine running, hold the clutch pedal approximately 1/2" from floor mat and move shift lever between first and reverse several times. If this can be done smoothly, the clutch is fully releasing. If shift is not smooth, clutch is not fully releasing and adjustment is necessary.
2. Check clutch pedal bushings for sticking or excessive wear.
3. Check fork for proper installation on ball stud. Lack of lubrication on fork can cause fork to be pulled off the ball.
4. Check for bent, cracked or damaged cross shaft levers or support bracket.
5. Loose or damaged engine mounts may allow the engine to shift its position causing a bind on clutch linkage at the cross shaft. Check to be sure there is some clearance between cross shaft and both its mounting brackets.

CLUTCH LINKAGE ADJUSTMENT

There is one linkage adjustment (clutch fork push rod or pedal push rod) to compensate for all normal clutch wear.

The clutch pedal should have 3/4" to 1-1/8" free travel

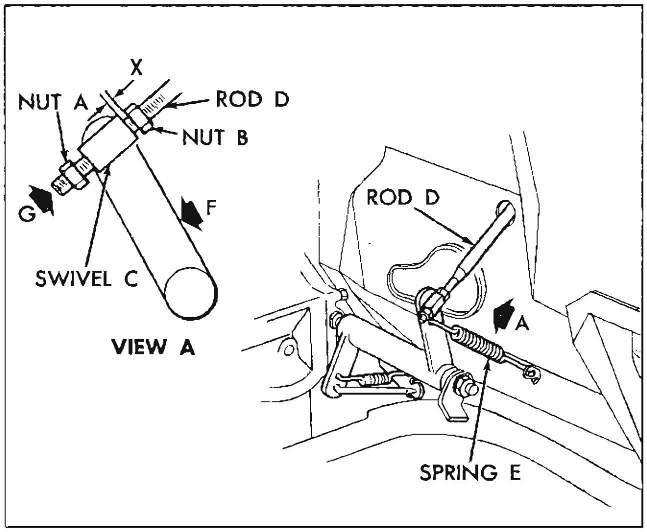


Fig. 1—Chevrolet Clutch Pedal Free Travel Adjustment

(measured at clutch pedal pad) before the throwout bearing engages the clutch diaphragm spring levers. Lash is required to prevent clutch slippage which would occur if the bearing was held against the fingers and to prevent the bearing from running continually until failure.

Chevrolet Linkage Adjustment (Fig. 1)

With Nuts (A) & (B) loose on Rod (D) & before installation of Clutch Pedal Return Spring (E), apply approximately 5 lbs. load in direction of arrow (F) to eliminate clearance between throwout bearing and clutch fingers. Move Rod (D) in direction of arrow (G) until Clutch Pedal Arm makes contact with Bumper Stop on instrument panel brace. Run Nut (B) toward Swivel until dimension (X) is 5/32". Tighten Nut (A) to lock Swivel (C) against Nut (B). Install Clutch Pedal Return Spring (E).

The foregoing procedure will provide a free pedal travel of 5/32"—7/8" measured on a perpendicular from the crown of the pedal pad to the bare metal toe pan.

Chevelle Linkage Adjustment (Fig. 2)

1. Disconnect spring between cross shaft lever and clutch fork.
2. Loosen push rod locknut about three turns.
3. If there is no free travel, shorten the rod (by turning at square wrench area) until it is free of clutch fork.
4. Hold the clutch fork rearward to move throwout lightly against clutch release fingers, then adjust rod length until rod just touches its seat in the fork.
5. Adjust locknut to obtain approximately 3/16" clearance between nut and rod sleeve end.
6. Turn the rod with wrench, until the nut just comes in contact with rod sleeve end, then hold the rod with wrench and tighten locknut.
7. Check free pedal travel at pedal (3/4" to 1-1/8" is proper clearance). Readjust if necessary.

Chevy II Linkage Adjustment (Fig. 3)

L-4 & L-6 Models

1. Loosen locknut "A" and lengthen or shorten push rod in swivel as required by turning with wrench on machined flat "B". (Shorten push rod to increase pedal lash.)
2. Hold push rod at flat "B" and tighten lock nut "A".
3. Recheck pedal free travel.

NOTE: A measurement of approximately 1/8" between push rod and its seat in fork will give required pedal free travel.

V-8 Models

The eight cylinder linkage has a two-piece clutch fork push rod (fig. 3). Adjust clutch pedal free travel by turning the adjusting rod portion of the push rod to obtain approximately 1/8" clearance between clutch fork and end of rod, then tighten locknut to 8-12 lbs. ft. and check check free travel at pedal. Pedal free travel on all models should be 3/4" to 1-1/8".

A clutch that has been slipping prior to free play adjustment may still slip right after the new adjustment due to previous heat. The vehicle should be returned to the Dealership the next day (at least 12 hours) to give clutch time to cool to normal temperatures. Any slippage should then be evaluated as follows:

1. Drive in high gear at 20-25 MPH.
2. Depress clutch pedal to the floor and rev engine to 2500-3500 rpm.
3. Engage clutch quickly (snap foot off pedal) and press accelerator to full throttle.

Engine speed should drop noticeably then accelerate with vehicle. If clutch is bad, the engine speed will increase.

NOTE: Do not repeat more than once or clutch will overheat.

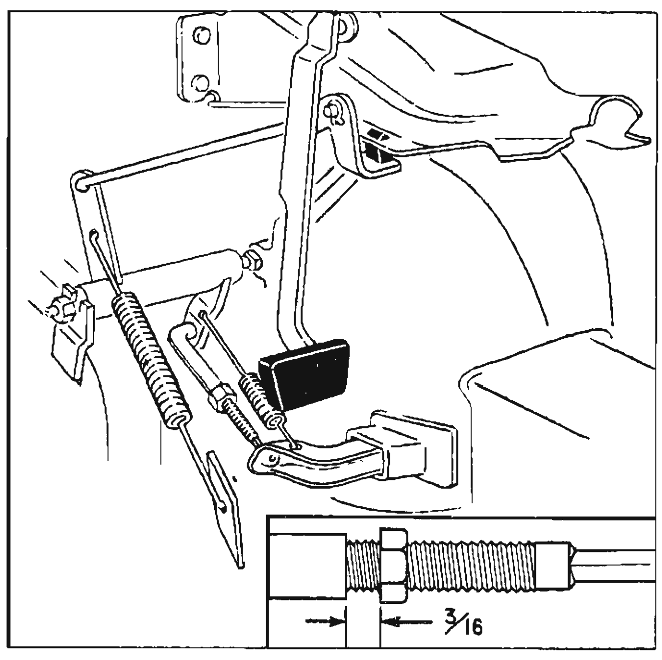


Fig. 2—Chevelle Clutch Pedal Free Travel Adjustment

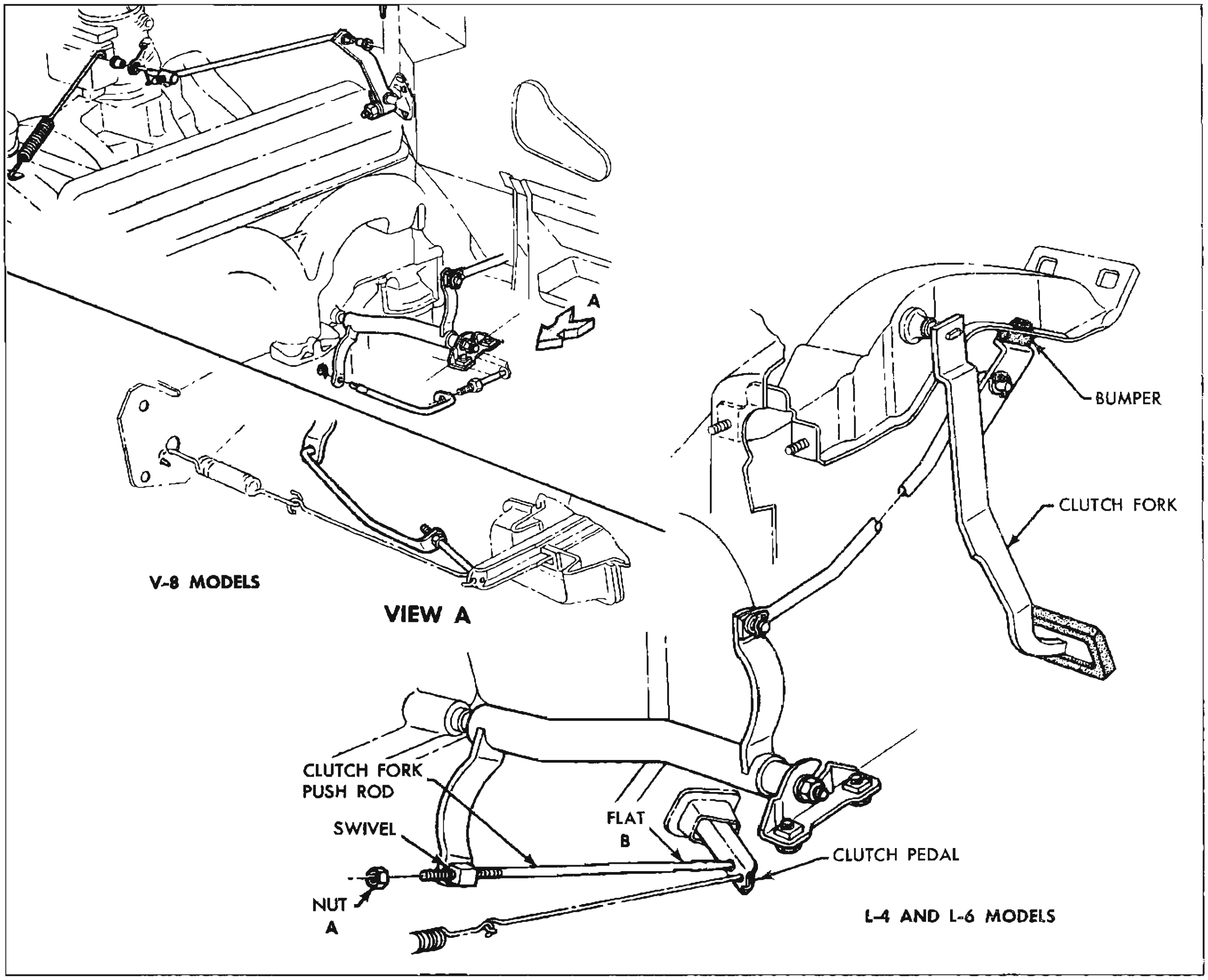


Fig. 3—Chevy II Clutch Pedal Free Travel Adjustment

COMPONENT PARTS REPLACEMENT

CLUTCH ASSEMBLY

Removal From Vehicle

1. Support engine and remove transmission as outlined in transmission section.
2. Disconnect clutch fork push rod and spring.
3. Remove flywheel housing.
4. Slide clutch fork from ball stud and remove fork from dust boot.

   NOTE: Ball stud is threaded into clutch housing and is easily replaced, if necessary.

5. Install Tool J-5824 to support the clutch assembly during removal.

   NOTE: Look for "X" mark on flywheel and on clutch cover. If "X" mark is not evident, prick punch marks on flywheel and clutch cover for indexing purposes during installation.

6. Loosen the clutch-to-flywheel attaching bolts evenly 1 turn at a time until spring pressure is released, then remove the bolts, and remove clutch assembly.

Installation to Vehicle

Clean pressure plate and flywheel face. (They should be free of oil, grease, metal deposits or burned spots.)

1. Position the clutch disc and pressure plate in relative installed position and support them with alignment Tool J-5824.

   NOTE: The driven disc on the 4 and 6 cylinder engines is installed with the damper springs to the flywheel side; the V-8 is opposite, however, THE GREASE SLINGER IS ALWAYS ON THE TRANSMISSION SIDE.

2. Turn clutch assembly until "X" mark on cover lines up with "X" mark on flywheel, then align cover bolt holes to nearest flywheel holes.
3. Install a bolt in every hole and tighten down evenly

and gradually until tight (to avoid possible clutch distortion).

NOTE: Cover loads are as high as 1-1/4 tons.

4. Remove pilot tool.
5. Unhook clutch fork and lubricate ball socket and fork fingers at release bearing end with a high melting point grease such as graphite and reinstall fork on ball stud.
6. Lubricate the recess on the inside of throwout bearing collar and the throwout fork groove with a light coat of graphite grease (fig. 4).
7. Install clutch fork and dust boot into clutch housing and install throwout bearing to the throwout fork, then install flywheel housing.
8. .Install transmission as outlined in transmission section.
9. Connect fork push rod and spring.
10. Adjust shift linkage as outlined in transmission section.
11. Perform linkage adjustment for pedal free play and check clutch release position.

CLUTCH PEDAL

The clutch pedal is the pendant-type hung from a support brace common to the brake pedal and must be removed to remove brake pedal. Refer to Section 5 for brake and clutch pedal service procedure.

CLUTCH CROSS SHAFT (Fig. 5)

Removal

1. Remove linkage return and lower linkage springs and disconnect clutch pedal and fork push rods from respective cross shaft levers.
2. Loosen outboard ball stud nut and slide stud out of bracket slot.
3. Move cross shaft outboard, and as required to clear inboard ball stud, then merely lift out to remove from vehicle.

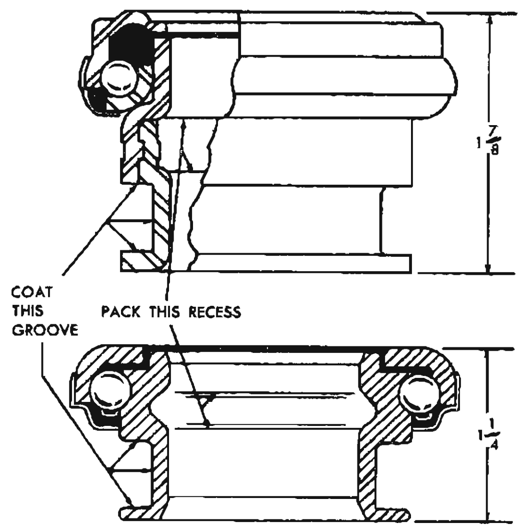


Fig. 4—Release Bearing Lubrication and Comparison

Repairs

The cross shaft has nylon ball stud seats which should be inspected for wear or damage. Also check condition of engine bracket ball stud assembly and special anti-rattle "O" ring. Figure 5 shows component parts of cross shaft. Replace parts as necessary based on wear or damage. Lubricate ball studs and seats with graphite grease before reassembly.

Installation

1. Reverse removal procedure to install.
2. Adjust clutch linkage as previously outlined.

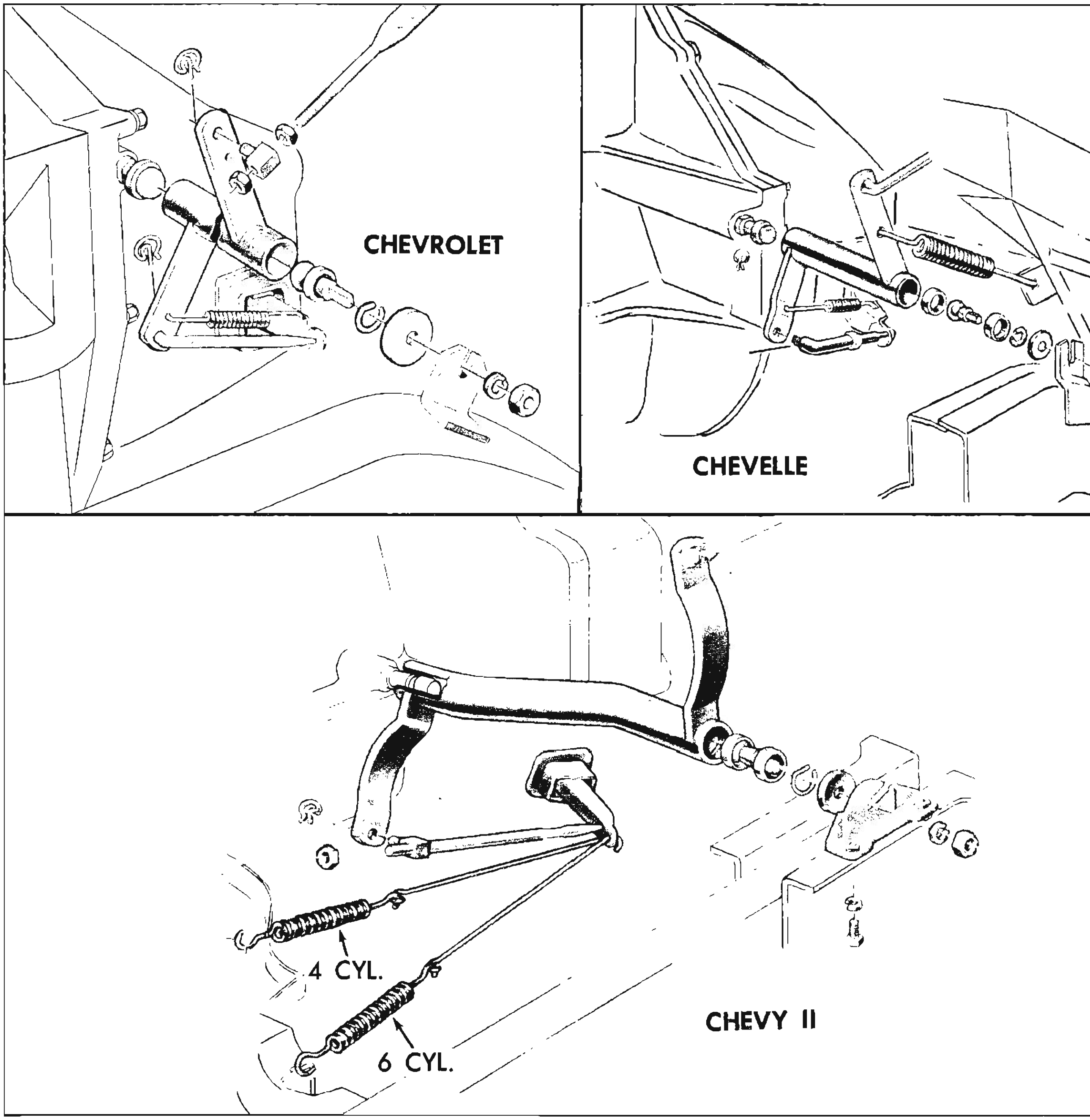


Fig. 5—Lower Linkage Details

THREE-SPEED TRANSMISSION

INDEX

GENERAL DESCRIPTION

A three-speed synchromesh transmission is used as standard equipment. This transmission incorporates all helical gears which are machined from drop forged steel gear blanks, heat treated and shot peened for strength and long life. The shafts are machined from high grade steel, heat treated and ground to close limits.

The rear end of the clutch gear is supported by a heavy duty ball bearing at the front end of the transmission case and is piloted at its front end in an oil impregnated bushing mounted in the engine crankshaft. The front end of the mainshaft is piloted in a double set of roller bearings set into the hollow end of the clutch gear and the rear end is carried by a ball bearing.

The countergear is carried on roller bearings at both ends while thrust is taken on thrust washers located between each end of gear and the case. Roller bearing thrust washers are installed between the countergear thrust washers and the roller bearings.

The reverse idler gear except for V-8 models, is carried on ball-indented bronze bushings. Forward thrust of the gear is taken on a washer located between front of gear and the case, and rearward thrust is taken on a radial needle bearing and a washer located between rear of gear and case. On V-8 models the reverse idler gear is supported by 20 roller bearings at each end of the reverse idler shaft.

Gearshifting is manual through shift control rods to the transmission cover located on the side of the transmission. Shifting is accomplished by ~~two~~ rotating cranks which directly engage the gears to be shifted, thus affording a highly efficient mechanical action.

MAINTENANCE AND ADJUSTMENTS

SHIFT LINKAGE ADJUSTMENT (Fig. 1A)

In cases where the gearshift linkage has been disconnected, it should be adjusted as follows:

1. Move both transmission shift levers until transmission is in neutral. Neutral detents in transmission cover must both be engaged to make this adjustment correctly. (To check, start engine with clutch disengaged, and release clutch slowly.)
2. Move selector lever to neutral position. Align first and reverse tube lever with the second and third shifter tube lever on the mast jacket.
3. Refer to Figure 1A for appropriate vehicle and make necessary adjustment to align shift control rods and levers in neutral position.

Move selector lever through all positions to check adjustment and to insure over-travel in all positions.

SPEEDOMETER DRIVEN GEAR

Disconnect speedometer cable, remove lock plate to housing bolt and lock washer and remove lock plate. Insert screwdriver in lock plate slot in fitting and pry fitting, gear and shaft from housing. Pry "O" ring from groove in fitting.

Install new "O" ring in groove in fitting. Coat "O" ring and driven gear shaft with transmission lubricant and insert shaft.

Hold the assembly so slot in fitting is toward lock plate boss on housing and install in housing. Push fitting into housing until lock plate can be inserted in groove and attach to housing.

EXTENSION OIL SEAL REPLACEMENT

1. Remove propeller shaft as outlined in Section 4 and disconnect any necessary items to obtain clearance.
2. Pry seal out of extension.
3. Wash counterbore with cleaning solvent and inspect for damage.
4. Prelubricate between sealing lips and coat new seal O.D. with Permatex or equivalent and start stright in bore in case extension. Using Tool J-5154, tap seal into counterbore until flange bottoms against extension.
5. Reinstall propeller shaft and any items removed to obtain clearance.

TRANSMISSION SIDE COVER

On any replacement of parts in the side cover assembly, it is necessary to remove cover from transmission case.

1. Disconnect control rods from levers.
2. Remove cover assembly from transmission case.
3. Remove outer shifter levers from shifter shafts.
4. Remove nuts and locks and remove shifter interlock retainer. This will allow removal of shifter shaft and fork assembly and cam assembly, or interlock, from cover.
5. Replace necessary parts. Coat shifter shaft "O" ring seal with transmission lubricant before installing in cover. Install shifter interlock retainer and bend tabs on locks after installing nuts.

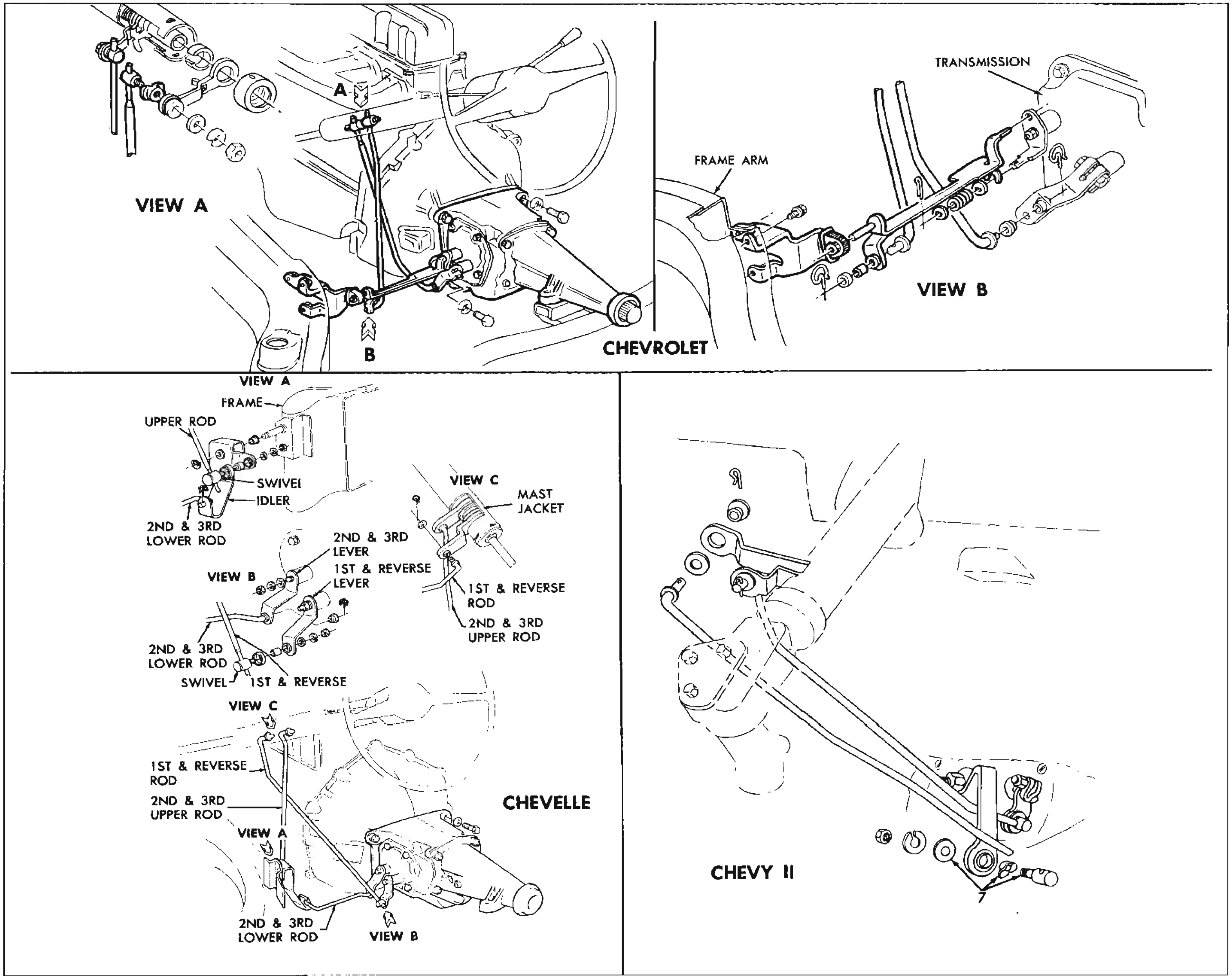


Fig. 1A—Shift Linkage Adjustment

6. Install outer shifter levers on shifter shafts.
7. With transmission gears in neutral and shifter forks in neutral, install cover to transmission using a new gasket. Coat screws with Permatex No. 2 or equivalent. Tighten retaining cap screws to 15-18 ft. lbs. torque.

   NOTE: Hump on first and reverse shifter fork (fig. 2A) must be toward rear of transmission.
8. Attach control rods to shifter levers and cordon shaft to 2nd and 3rd lever on Chevrolet Models.
9. Fill transmission with transmission lubricant as specified in Section 0 to level of filler plug.

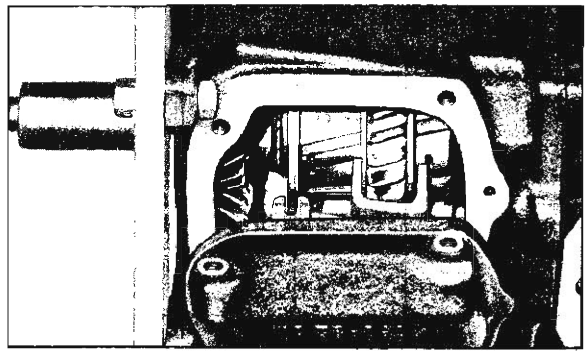


Fig. 2A—Cover Assembly Installation

COMPONENT PARTS REPLACEMENT

TRANSMISSION REPLACEMENT

Removal from Vehicle

1. Remove propeller shaft assembly.
2. Disconnect speedometer cable at transmission.
3. Disconnect shifter rods at transmission levers.
4. Support engine assembly.
5. Remove transmission to flywheel housing bolts.
6. Remove transmission crossmember to mount bolts.
7. Loosen transmission crossmember and move rearward or remove.
8. Slide transmission rearward and remove.

Installation in Vehicle

1. Raise transmission into position and slide forward piloting clutch gear retainer into clutch housing.
2. Install transmission to clutch housing retaining bolts and lock washers, torque to 40-50 ft. lbs.
3. Reposition transmission crossmember and install retaining bolts.
4. Install transmission crossmember to mount bolts.
5. Connect and adjust shift rods at transmission levers and cordon shaft to 2nd and 3rd lever on Chevrolet Models.
6. Connect speedometer cable.
7. Install propeller shaft assembly.
8. Fill transmission with lubricant specified in Section O.

TRANSMISSION OVERDRIVE

INDEX

GENERAL DESCRIPTION

The overdrive unit is essentially a two-speed planetary transmission attached to the rear of a conventional three-speed transmission. In overdrive, engine speed is approximately 30 per cent slower at a given road speed since the drive train includes planetary gears which provide a lower overall gear ratio than that obtained in high gear with the conventional transmission.

The electrical equipment which controls the automatic action of the mechanical portion of the overdrive unit consists of a solenoid, a speed-sensitive governor switch, a relay and a kickdown switch. The circuit including this equipment makes it possible to operate in overdrive above a pre-set cut-in speed, or in conventional drive at any speed.

SERVICING THE OVERDRIVE

With the overdrive assembly removed from the transmission, service operations on the transmission proper are the same as for the standard three-speed transmission.

Repairs to the overdrive housing, output shaft, ring gear assembly, clutch cam, roller retainer, pinion cage, sun gear, shift rail, sun gear control plate, output shaft bearing, oil seal, speedometer drive gear, solenoid pawl and interlock plunger may be performed underneath the car, if so desired, by removing the overdrive housing without disturbing the transmission. Refer to Overhaul Manual for Service Procedure.

If the transmission mainshaft, overdrive adapter or transmission rear bearing which is retained in adapter require replacement, the entire transmission and overdrive assembly should be removed and overhauled on the bench.

MAINTENANCE AND ADJUSTMENTS

Servicing of the overdrive governor switch and pinion, the sun gear solenoid, oil seal and cable bracket, the output shaft rear oil seal, the control shaft lever, and the speedometer driven gear may be accomplished without removing the overdrive from the vehicle, as discussed in the following paragraphs:

GOVERNOR SWITCH AND PINION

To remove governor switch, disconnect wires at governor switch and screw governor out of housing, using Tool J-4653 on the flat hexagonal surface of governor case. The pinion may be separated from the governor by removing the snap ring on the shaft.

SUN GEAR SOLENOID, OIL SEAL AND CONTROL CABLE BRACKET

Remove the solenoid by taking out the two mounting bolts and lock washers, removing the cable bracket with the lower bolt. Turn the solenoid 1/4 turn and pull solenoid plunger out of adapter. The oil seal may be pried out of the adapter.

CASE REAR OIL SEAL

Removal

1. Remove propeller shaft as outlined in Section 4 and disconnect parking brake idler lever for clearance.
2. Using a punch against seal in housing, pry out seal from housing.

Installation

1. Prelubricate between sealing lips and coat outside of new oil seal with a suitable sealant, then start seal into bore in overdrive housing.
2. Using Tool J-5154 drive oil seal into counterbore.
3. Install propeller shaft as outlined in Section 4.

CONTROL SHAFT LEVER AND OIL SEAL

To remove the control shaft oil seal, disconnect the control cable, remove tapered pin and pull lever out. Then pry out oil seal with a sharp punch.

Coat outside of new oil seal with suitable sealant and start seal straight into counterbore in housing. Using a suitable driver having an outside diameter of 15/16", drive seal into place. Insert shaft through seal and install tapered pin. Connect control wire to lever.

SPEEDOMETER DRIVEN GEAR

Disconnect speedometer cable, remove lock plate to housing bolt and lock washer and remove lock plate. Insert screw driver in lock plate slot in fitting and pry fitting, gear and shaft from housing. Pry "O" ring from groove in guide.

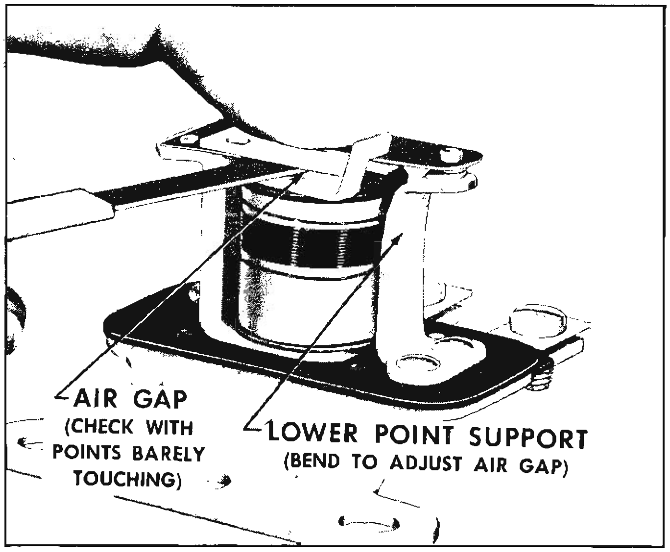


Fig. 1B—Checking Relay Air Gap

Install new "O" ring in groove in fitting and insert shaft.

Hold the assembly so slot in fitting is toward lock plate boss on housing and install in housing. Push fitting into housing until lock plate can be inserted in groove and attached to housing.

ELECTRICAL UNIT CHECKS

Overdrive Relay

Specifications and checking procedures for this relay are as follows:

Specifications

Air Gap	.011 inch minimum
Point Opening	.025 inch
Closing Voltage	8.3-10.2 volts
Armature Sealing Voltage	11.2 volts maximum

Three checks and adjustments are required on the overdrive relay; air gap, point opening and closing voltage. The air gap contact point opening checks and adjustments should be made with the battery disconnected.

Air Gap

The air gap should not normally require adjustment unless the relay has been misadjusted. Check the air gap with the points barely touching and adjust if necessary by bending the lower point support (fig. 1B).

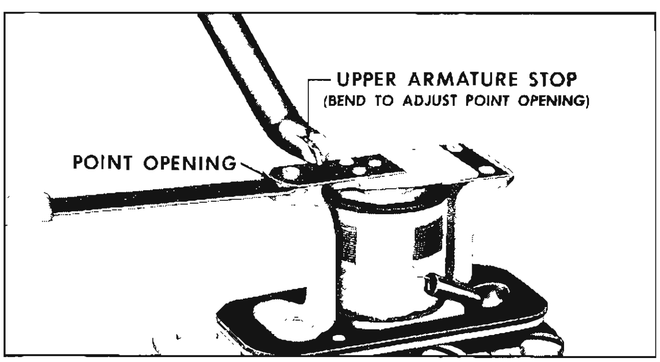


Fig. 2B—Adjusting Relay Point Opening

Point Opening

Check the contact point opening and adjust by bending the upper armature stop (fig. 2B).

Closing Voltage

To check the relay closing voltage, connect a potentiometer or variable resistance of sufficient value (not less than 50 ohms) in series with the "KD" terminal, connect a voltmeter to the "IGN" and "KD" terminals. With the ignition switch on, slowly decrease the amount of resistance in order to check the relay closing voltage (the overdrive solenoid and relay should click when the relay closes). Adjust the closing voltage by bending the armature spring post (fig. 3B). Bend down to increase the closing voltage and bend up to decrease the closing voltage.

To check the sealing voltage, increase the voltage after the relay closes until the armature seals against the core. Decrease the sealing voltage by reducing the relay air gap.

Solenoid

Closing Coil

Remove solenoid from transmission, connect a jumper wire between negative terminal of battery and mounting flange of solenoid. Connect a second jumper wire between the battery positive terminal and solenoid terminal No. 4; this should cause the solenoid pawl to move out. If solenoid chatters, Hold-In Coil is defective.

Engaging Spring

With jumper wire connected as in paragraph above, (solenoid energized, plunger extended) place ball end of solenoid against bench. Push down on solenoid. The pawl rod should move in 3/8" under a load of not less than 8 lbs. nor more than 12. Pawl should move out to extended position when load is removed.

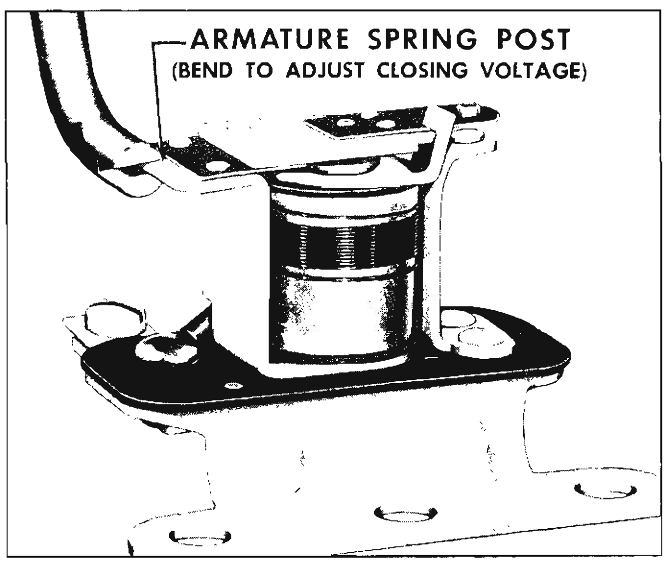


Fig. 3B—Adjusting Relay Closing Voltage

Ignition Grounding Contact

Place a test lamp between negative battery terminal and solenoid terminal No. 6. Lamp should light when this connection is made. Remove jumper from between negative battery terminal and solenoid terminal No. 4. Pawl rod should snap "in" and test lamp should go out.

Governor Switch

Remove overdrive wire at governor and connect test lamp between governor overdrive terminal and positive terminal of battery. Drive car on road or raise on jacks. The lamp should light at a car speed of between 26 to 30 MPH. Upon decreasing speed, the lamp should go out at between 28 and 23.5 MPH. The car speed differential between light "on" and light "off" should be 2 or 3 MPH.

Kickdown Switch

Disconnect the 4 wires at kickdown switch.

1. Connect test lamp between "SW" terminal and positive terminal of battery; with switch in normal position, lamp should light when "REL" terminal is grounded but should not light when "IGN" or "SOL" terminals or switch case is grounded.
2. Connect test lamp between "IGN" terminal and positive terminal of battery; with switch stem pushed in, lamp should light when "SOL" terminal is grounded, but should not light when "SW" or "REL" terminals or switch case is grounded.

DIAGNOSIS—OVERDRIVE

MECHANICAL

Any one of the following general complaints may be due to non-standard mechanical conditions in the overdrive unit:

1. Does not drive unless locked up manually.
2. Does not engage, or lock-up does not release.
3. Engages with a severe jolt, or noise.
4. Free-wheels at speeds over 30 mph.

These troubles may be diagnosed and remedied as described in the following paragraphs.

1. Does not drive unless locked up manually

a. Occasionally, the unit may not drive the car forward in direct drive, unless locked up by pulling the dash control. This may be caused by one or more broken rollers in the roller clutch, the remedy for which is the replacement of the entire set of rollers.

b. This may also be caused by sticking of the roller retainer upon the cam. This retainer must move freely to push the rollers into engaging position, under the pressure of the two actuating springs.

c. Sometimes this is due to slight indentations, worn in the cam faces by the rollers spinning, remedied by replacement of the cam.

2. Does not engage, or lock-up does not release

a. Dash control improperly connected—Unless the overdrive dash control wire is connected to the lockup lever on the left side of the overdrive housing in such a manner as to move the lever all the way back when the dash control knob is pushed in, it may hold the shift rail in such a position as to interlock the pawl against full engagement resulting in a buzzing noise when overdrive engagement is attempted.

   To correctly make this connection, loosen binding post at lever, pull dash control knob out 1/4", move lever all the way to the rear, and tighten binding post.

b. Transmission and overdrive improperly aligned—The same symptoms as above may also result from misalignment, at assembly, of the overdrive housing to the transmission case, resulting in binding of the overdrive shift rail, so that the retractor spring cannot move the rail fully forward, when the dash control knob is pushed in, and the transmission is not in reverse. Under such conditions, the unit may remain fully locked up.

   To test for this, be sure that the transmission is not in reverse; disconnect the dash control wire from the lockup lever, and feel the lever for free forward movement. If the lever can be moved forward more than 1/4", it indicates that misalignment probably exists. To correct this, loosen the capscrews between the overdrive housing and transmission case, and tap the adapter plate and overdrive housing until a position is found where the rail shifts freely; tighten capscrews.

c. Kickdown switch improperly adjusted—The position of the kickdown switch should be adjusted, by means of the two large nuts which clamp the switch shank, so the switch plunger travels 3/16" before the throttle lever touches its stop.

   Occasionally the large nuts which clamp the switch through the switch bracket are tightened sufficiently to bend the switch shank, thus preventing free motion of the switch stem. This may usually be remedied by loosening the upper of the two nuts.

d. Improper installation of solenoid—If car cannot be rolled backward under any circumstances and there is no relay click when the ignition is turned on, it probably indicates that the solenoid has been installed directly, without twisting into the bayonet lock between solenoid stem and pawl, thus jamming the pawl permanently into overdrive engagement. If the car will occasionally roll backwards, but not always, (and there is no relay click when the ignition switch is turned on) it may indicate that, upon installation, the bayonet lock was caught, and the solenoid forcibly twisted into alignment with the attaching flange, thus shearing off the internal keying of the solenoid. Under these circumstances, the end of the solenoid stem may not catch in the pawl, and upon release of the solenoid, the pawl will not be withdrawn promptly from engagement, but simply drift out. If the solenoid stem end has its two flats exactly facing the two solenoid flange holes, it will not withdraw the pawl properly. If the stem can be rotated when grasped by a pair of pliers, it indicates that the internal keying has been sheared.

e. Improper positioning of blocker ring—Occasionally, either in assembly at the factory, or in service operations in the field, the internal parts of the overdrive unit may have been rotated with the solenoid pawl removed, causing the blocker ring to rotate, so that its two lugs are not located with respect to the pawl as shown in Figure 12B. In other words, the solid portion of the blocker ring may be in alignment with the pawl, which will prevent full engagement of the pawl with the sun gear control plate.

To test for this condition, remove solenoid cover, pull dash control knob out, roll car 2 ft. forward. Push dash control in, turn ignition switch on. Then ground the "KD" terminal of relay, and watch movement of center stem of solenoid. It should not move more than 1/8" when the solenoid clicks. Then, with the relay terminal still grounded, shift into low gear, and roll car forward by hand. Solenoid stem should then move an additional 3/8", as the pawl engages fully. These two tests indicate proper blocker action. Unless both tests are met, the blocker ring is probably not in the correct position.

3. Engages with a severe jolt or noise

Insufficient blocker ring friction may cause the ring to lose its grip on the hub of the sun gear control plate. Check the fit and tension of the ring as described under "Cleaning and Inspection."

4. Free-wheels at speeds over 30 MPH

If cam roller retainer spring tension is weak the unit will free wheel at all times. Check spring action as described under "Cleaning and Inspection."

ELECTRICAL

Any one of the following general complaints may be due to electrical trouble in the overdrive circuit.

1. Does not engage.
2. Does not release.
3. Does not kickdown from overdrive.

These troubles may be traced and remedied as described in the following paragraphs.

1. Does not engage

a. With the ignition switch on, ground the "KD" terminal of the solenoid relay with a jumper lead. If the solenoid clicks, the relay and solenoid circuits are in operating condition. If no click is heard in the relay, check the fuse and replace if defective.

b. If the fuse is good, use a second jumper lead to connect the "SOL" and "BAT" terminals of the relay. If a click is now heard in the solenoid, the relay is probably at fault and should be repaired or replaced.

c. If the solenoid does not click in Step b, check the wiring to the No. 4 terminal of the solenoid and replace if necessary. If the wiring is not defective, the trouble is probably in the solenoid. Remove the solenoid cover, examine the solenoid contacts in series with the pull-in winding and clean if necessary. Test again for clicks, as in Step b, after replacing solenoid cover and lead wires. Replace the solenoid if trouble has not been corrected.

d. If the relay and solenoid circuits are in good condition as determined in Step a, leave the ignition switch on and make sure the manual control knob is in the overdrive position. Ground one and then the other of the two terminals next to the stem of the kickdown switch (identified as "SW" and "REL"). If the solenoid clicks when one terminal is grounded but not the other, replace the switch. If the solenoid does not click when either of the terminals is grounded, check the wiring between the relay and the kickdown switch and replace if defective.

e. If the solenoid clicks as each terminal is grounded in Step d, ground the governor switch terminal. If the solenoid clicks, the governor switch may be defective. If the solenoid does not click, check the wiring between the kickdown and governor switches and replace if necessary.

2. Does not release

a. Remove the connection to the "KD" terminal of the relay. If this releases overdrive, look for a grounded control circuit between the relay and governor switch.

b. If the overdrive is not released in Step a, disconnect the lead to the "SOL" terminal of relay. If this releases the overdrive, replace the relay.

3. Does not kickdown from overdrive

a. With the engine running, connect a jumper lead between the No. 6 terminal of the solenoid and ground. Operate the kickdown switch by hand. This should stop the engine. If it does, the solenoid is probably defective and it should be checked for dirty ground-out contacts or other defects within the ground-out circuit of the solenoid (fig. 4B). Clean the contacts or replace the contact plate as required.

b. If the engine does not stop in Step a, ground one and then the other of the two terminals (Identified

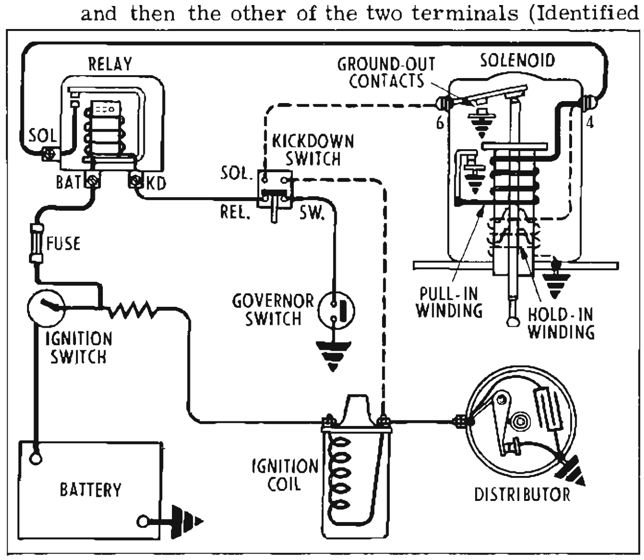


Fig. 4B—Overdrive Electrical Circuit Wiring Diagram as "IGN" and "SOL") farthest from the stem of the kickdown switch. The engine should stop when one of the two terminals (IGN) is grounded. If the engine does not stop when the terminal is grounded, the wiring or connections to the switch between the switch and coil are defective. When the other terminal (SOL) is grounded, the engine should stop when the kickdown switch is operated. If the engine does not stop when the kickdown switch is operated with the second terminal grounded, the kickdown switch is defective. If the trouble is in the kickdown switch, adjust the linkage to give more travel of the switch rod. If this does not correct the trouble, replace the kickdown switch.

If the kickdown switch operates as it should, check for an open circuit in the wiring between the kickdown switch and the No. 6 terminal of the solenoid.

c. If the trouble is not located by the above checks, the upper contacts of the kickdown switch may not be opening. To check for this condition, ground the overdrive control circuit at the governor switch. This should cause the solenoid to click. Operate the kickdown switch by hand. This should cause a second click as the solenoid releases. If there is no second click, adjust the linkage to give more travel of the switch rod. If this does not correct the trouble, replace the kickdown switch.

FOUR SPEED TRANSMISSION

INDEX

GENERAL DESCRIPTION

The four-speed synchromesh transmission incorporates helical gears throughout specially designed to provide high torque capacity without additional weight, and gear teeth proportioned to operate at high speeds with neither excessive heat generation nor excessive frictional losses. Shafts, bearings, high capacity clutches and other precision parts are held to close limits, providing proper clearances necessary for durability during extended heavy usage.

The main drive gear is supported by a heavy-duty ball bearing at the front end of the transmission case and is piloted at its front end in an oil impregnated bushing mounted in the engine crankshaft. The front end of the mainshaft is piloted in a row of roller bearings set into the hollow end of the main drive gear and the rear end is carried by a heavy-duty ball bearing mounted at the rear end of the transmission case in a retainer casing.

The counter gear is carried on a double row of rollers at both ends while thrust is taken on thrust washers located between the ends of the gear and the thrust bosses in the case.

The two-piece reverse idler gear is carried on bronze bushings while thrust is taken on thrust washers located between the front of the gear and the back of the reverse idler thrust boss and between the rear of the gear and the reverse idler shaft boss in the case extension.

Gearshifting is manual through shift control rods to the transmission cover shifter levers for first through fourth gears, and to the reverse lever located in the case extension. The shifter lever to the rear of the transmission cover controls first and second gears while the lever to the front controls third and fourth gears. All four forward gears are fully synchronized. The transmission may be used as an aid in deceleration by downshifting in sequence without double clutching. Reverse is not synchronized, however it is a helical gear to insure quiet operation.

MAINTENANCE AND ADJUSTMENTS

SHIFT LINKAGE ADJUSTMENT (Fig. 1M)

1. Set Transmission Levers (M), (P) and (S) in neutral detent position.
2. Move Shift Lever (A) to neutral detent position and insert a Locating Gauge [1/8" thick by 41/64" (.646) wide and 3" long] (B) into Control Lever Bracket Assembly slot.
3. Install Rod (V) with retainer on Lever (D).
4. Maintaining Lever (D) against Locating Gauge, adjust Clevis (T) at Lever (S) until clevis pin freely passes through holes in Clevis and Lever.
5. Install clevis pin, washer, and cotter pin. Tighten Jam Nut (U) against Clevis.
6. Install Rod (H) with retainer on Lever (W).
7. With Jam Nuts (J) and (L) and Swivel (K) loose on Rod (H), insert and attach Swivel with washer and retainer to Lever (M).
8. Maintaining Lever (W) against Locating Gauge (B) and while holding Swivel (K), run Jam Nut (J) against Swivel until Nut contacts Swivel. Then tighten Jam Nut (L) against Swivel.
9. Install Rod (R) with retainer on Lever (P).
10. With Jam Nuts (E) and (G) and Swivel (F) loose on Rod (R), insert and attach Swivel with retainer to Lever (C).
11. Maintaining Lever (C) against Locating Gauge (B) and while holding Swivel (F), run Jam Nut (G) against Swivel until Nut contacts Swivel. Then tighten Jam Nut (E) against Swivel.
12. Remove Locating Gauge and check shifts to insure proper operation. Readjust clevis and swivels if necessary.

NOTE: Control rods may be attached to transmission shift lever lower holes, to reduce shift lever travel, for a "faster shift" adjustment option. Increased shifting effort is required when control rods are installed in this "short throw" position.

GEARSHIFT LEVER REVERSE BLOCKER CABLE (Fig. 2M)

Replacement

Figure 2M shows the adjustment and lubrication procedure for the mechanism. This Figure applies to both models of lever ssemblies.

NOTE: If, for any reason, the cable assembly is removed from the handle; it is difficult to install without rework. This is due to the fact that the extra length of the cable is trimmed

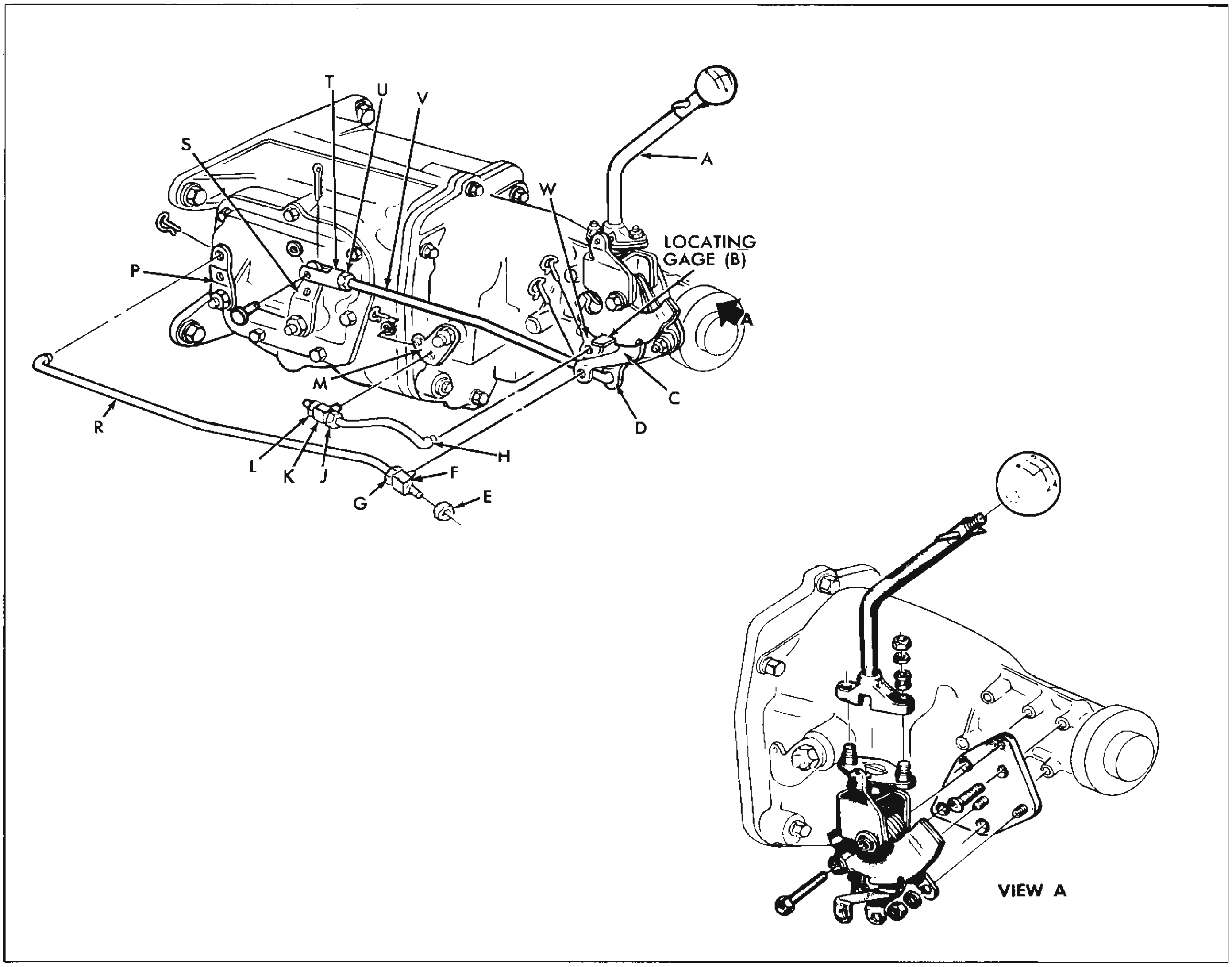


Fig. 1M—Four-Speed Transmission Gearshift Linkage (Chevrolet Shown)

after assembly and, therefore, it is almost impossible to get the shortened cable to enter the cable hole in the cylindrical retainer.

If new service cable assemblies are not available, the original part can be re-used by butt soldering a 2.00 inch piece of small wire to the cable end. Trim the solder joint so that it will pass through the hole in the retainer. After assembly, trim off the excess wire as shown in Figure 2M.

Adjustment

1. With set screw loose, assemble cable through hole in cylindrical retainer above handle.
2. With handle in full down position-adjust cable to acquire dimension shown, be certain that cable is pulled taut.
3. Tighten set screw to 15-20 in. lbs.
4. Bend excess wire and cut-be certain that wire does not interfere with I.D. of lever or threads of shifter knob.

NOTE: Handle must return freely from any position.

SPEEDOMETER DRIVEN GEAR AND OIL SEAL

Replacement

Disconnect speedometer cable, remove retainer to housing bolt and lock washer and remove retainer. Insert screw driver in slot in fitting and pry fitting, gear and shaft from housing. Pry "O" ring from groove in fitting.

Install new "O" ring in groove and insert shaft. Hold the assembly so slot in fitting is toward boss on housing and install in housing. Push fitting into housing until retainer can be inserted in groove and install retainer lock washer and bolt.

TRANSMISSION SIDE COVER

Removal

1. Disconnect control rods from levers.

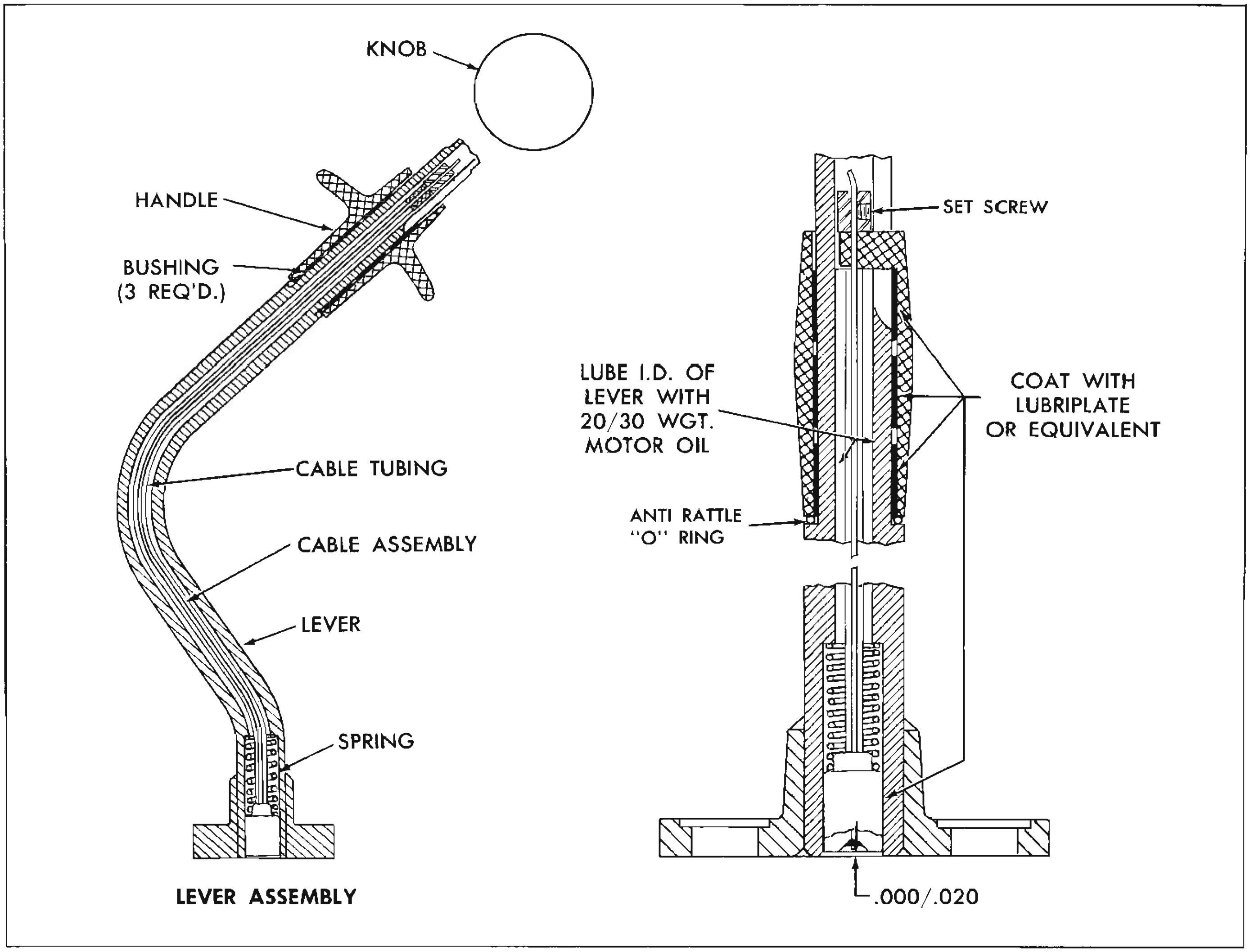


Fig. 2M—Gearshift Lever Assembly and Adjustment

2. Shift transmission into second speed before removing cover, by moving 1-2 (Rear Cover) shifter lever into forward detent position.
3. Remove cover assembly from transmission case carefully and allow oil to drain.

Disassembly (Fig. 3M)

1. Remove the outer shifter lever nuts, lock washers and flat washers. Pull levers from shafts.
2. Remove both shift forks from shifter shaft and detent plate assemblies. Remove both shifter shaft assemblies from cover. Lip seals in side cover may now be pryed out if replacement is required because of damage.
3. Remove detent cam spring and pivot retainer "C" ring. Remove both detent cams.
4. Replace necessary parts.

Assembly (Fig. 3M)

1. Install 1-2 detent cam to cover pivot pin first, then install 3-4 detent cam so the detent spring notches are offset or opposite each other. Detent cam notches must be facing downward.

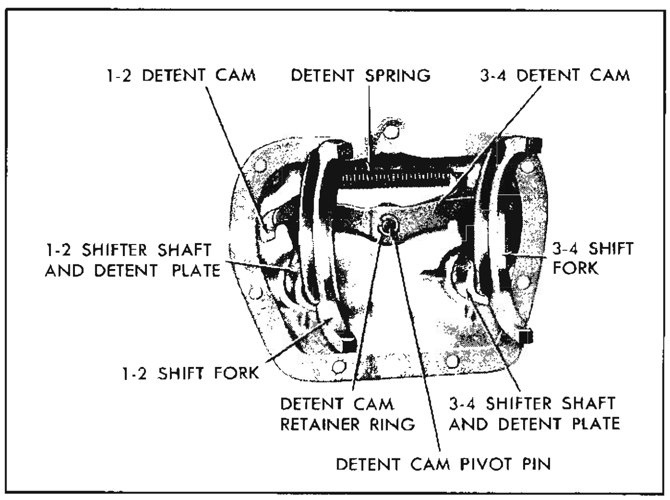


Fig. 3M—Transmission Side Cover, Shift Fork and Detent Assembly

2. Install detent cam retaining "C" ring to pivot shaft, and hook spring into detent cam notches.
3. Install both shifter shaft assemblies in cover being careful not to damage lip seals. Install both shift forks to detent plates, lifting up on detent cam to allow forks to fully seat into position.
4. Install outer shifter levers, flat washers, lock washers and nuts.

Installation (Fig. 4M)

1. Shift 1-2 shifter lever into second speed (forward) position. Position cover gasket on case.
2. Carefully position side cover into place making sure the shift forks are aligned with their respective mainshaft clutch sliding sleeves.
3. Install cover attaching bolts and tighten evenly to 15-20 ft. lbs. torque.
4. Remove filler plug and add lubricant to level of filler plug hole.

EXTENSION OIL SEAL

Replacement

1. Remove propeller shaft.
2. Pry out the extension oil seal.
3. Prelubricate between sealing lips and press new oil seal carefully into place in extension using J-5154 or similar tool.

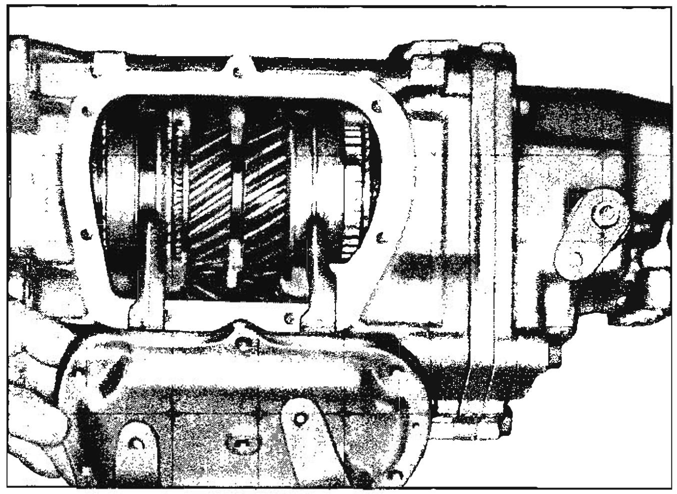


Fig. 4M—Installing Side Cover Assembly

CAUTION: Do not excessively force the seal against the seat in the extension.

COMPONENT PARTS REPLACEMENT

TRANSMISSION REPLACEMENT

Removal From Vehicle

1. Remove shift lever trim plate and dust boot.
2. Remove shift lever assembly.
3. Raise vehicle to desired working height.
4. Disconnect the speedometer cable from speedometer driven gear fitting.
5. Remove propeller shaft, then support engine at the oil pan rail with a jack or other suitable support capable of supporting the engine when transmission is removed.
6. Disconnect shift lever bracket assembly from extension housing and remove all 3 transmission shifter levers to shifter shafts, (leave linkage connected to levers) and remove bracket assembly levers and linkage.
7. Remove extension mount-to-crossmember attaching bolts.
8. Loosen transmission crossmember and move rearward or remove.
9. Remove the transmission-to-clutch housing retaining bolts and install two guide pins, J-1126, in top holes.
10. Slide the transmission straight back until the input shaft is free of splines in the clutch disc.
11. Slide the transmission rearward to allow sufficient clearance of input shaft and clutch housing. Then tilt input shaft end of transmission downward and withdraw transmission from vehicle.

Installation in Vehicle

1. Raise transmission and rotate as necessary to start input shaft into clutch disc and slide transmission forward until it bottoms against clutch housing. Remove guide pins.
2. Install the transmission-to-clutch housing retaining bolts. Torque all four retaining bolts to 40-50 ft. lbs.
3. Raise engine and position extension mount to crossmember, and loosely install the retaining bolts. Tighten crossmember to frame retaining bolts.
4. Remove temporary support from engine, and torque the extension mount retaining bolts.
5. Install propeller shaft.
6. Connect speedometer cable to driven gear fitting and tighten securely.
7. Install control lever bracket assembly to transmission extension and connect shifter levers to shifter shafts.
8. Fill transmission to level of filler plug hole with correct lubricant.
9. Lower vehicle and install shift lever assembly, check shift pattern and adjust linkage as required.
10. Install trim plate and dust boot.

ALUMINUM POWERGLIDE

INDEX

GENERAL DESCRIPTION

The case and converter housing of the two speed aluminum Powerglide transmission are a single case aluminum unit. When the manual control is placed in the drive position, the transmission automatically shifts to low gear for initial vehicle movement. As the car gains speed and depending on load and throttle position, an automatic shift is made to high gear. A forced downshift feature provides a passing gear by returning the transmission to low range.

The front pump assembly is a conventional gear type and the oil pump housing is of the large diameter type acting as the front bulkhead of the transmission. The conventional gear type rear oil pump is bolted outside the rear bulkhead of the case and is completely enclosed by the one piece aluminum extension housing. The torque converter is a conventional three element welded design bolted to the engine flywheel which drives through a two-speed planetary gearset. The high clutch assembly is typical of the designs used in this type transmission. The aluminum Powerglide uses an output shaft mounted governor which requires a hole through the output shaft. The reverse clutch assembly is a multiple disc type clutch. The steel plates are splined directly to the case while the face plates are splined to the internal or ring gear. The clutch piston operates within the rear portion of the case. The internal diameter of the piston is sealed to an integral hub portion of the case rear bulkhead. The outside diameter is sealed to a machined portion of the case. The piston is hydraulically applied and is released by separate coil springs. The valve body assembly is bolted to the bottom of the transmission case and is accessible for service by removing the oil pan assembly. The valve body consists of an upper and lower body located on either side of a transfer plate. The vacuum modulator is located on the left rear face of the transmission case. The modulator valve bore is located in the upper valve body.

MAINTENANCE AND ADJUSTMENTS

OIL LEVEL AND REQUIREMENTS

The transmission oil level should be checked periodically as recommended in Section O. Oil should be added only when level is near the "ADD" mark on the dip stick with oil hot or at operating temperature. The oil level dip stick is located at the right rear of the engine compartment. Fill with oil specified in Section O.

In order to check oil level accurately, the engine should be idled with the transmission oil hot and the control lever in neutral (N) position.

It is important that the oil level be maintained no higher than the "FULL" mark on the transmission oil level gauge. DO NOT OVERFILL, for when the oil level is at the full mark on the dip stick, it is just slightly below the planetary gear unit. If additional oil is added, bringing the oil level above the full mark, the planetary unit will run in the oil, foaming and aerating the oil. This aerated oil carried through the various oil pressure passages (low servo, reverse servo, clutch apply, converter, etc.) may cause malfunction of the transmission assembly, resulting in cavitation noise in the converter and improper band or clutch application. Overheating may also occur.

If the transmission is found consistently low on oil, a thorough inspection should be made to find and correct all external oil leaks. Transmission oil leakage is now easily identified as all automatic transmission fluid used in Chevrolet production is dyed red. The mating surfaces of servo cover, converter housing, transmission case and transmission case extension should be carefully examined for signs of leakage. The vacuum modulator must also be checked to insure that the diaphragm has not ruptured as this would allow transmission oil to be drawn into the intake manifold. Usually, the exhaust will be excessively smoky if the diaphragm ruptures due to the transmission oil added to the combustion. The transmission case extension rear oil seal should also be checked. All test plugs should be checked to make sure that they are tight and that there is no sign of leakage at these points. The converter underpan should also be removed. Any appreciable quantity of oil in this area would indicate leakage at the front pump square seal ring, front pump seal assembly, or front pump bolt "O" ring seals.

DRAINING AND REFILLING

When the transmission is to be removed from the vehicle for repairs, drain and refill as follows:

To drain the transmission, remove the oil pan drain plug. Position a pan or can to catch the draining oil. If the transmission is to be removed from the vehicle for repairs, the draining operation may be performed after removal if desired.

To refill the transmission, remove dip stick from oil filler tube and refill transmission with oil specified in Section 0 using filler tube and funnel J-4264. Then, after shifting into all ranges at idle speed to fill all oil passages, the engine should be run at 800-1000 rpm with the transmission in Neutral until the oil warms up, then add oil as required to raise the fluid level to the full mark on the dip stick. Total capacity including converter is 17.7 pts. for L-6 and 20.1 pts. for V-8 models.

SERVICE ADJUSTMENTS

Four service adjustments are required for Aluminum Powerglide equipped cars: Shift linkage, throttle valve linkage, neutral safety switch and throttle return check valve (Dashpot) adjustment.

Conventional Shift Linkage Check and Adjustment

Chevrolet Linkage Adjustment (Fig. 1PG)

1. The Tube and Lever Assembly (B) must be free in the Mast Jacket.

   NOTE: No bind can be tolerated when making this adjustment.

2. Assemble swivel, clamp, grommet, bushing, washers and nut on Rod (C) loosely. See view A.
3. Set Transmission Lever (A) in drive position.

   NOTE: Obtain drive position by moving Transmission Lever counter-clockwise to low detent, then clockwise one detent position to drive.
4. Place Tube and Lever Assembly to the reverse position and then bring lever down to insert Rod (C) in swivel and retainer. See view A.
5. Set Tube and Lever Assembly in drive position and tighten Nut (D). See view A and B.

Chevelle Linkage Adjustment (Fig. 2PG)

Refer to above procedure under Chevrolet Linkage Adjustment.

Chevy II Linkage Adjustment (Fig. 3PG)

Refer to above procedure under Chevrolet Linkage Adjustment.

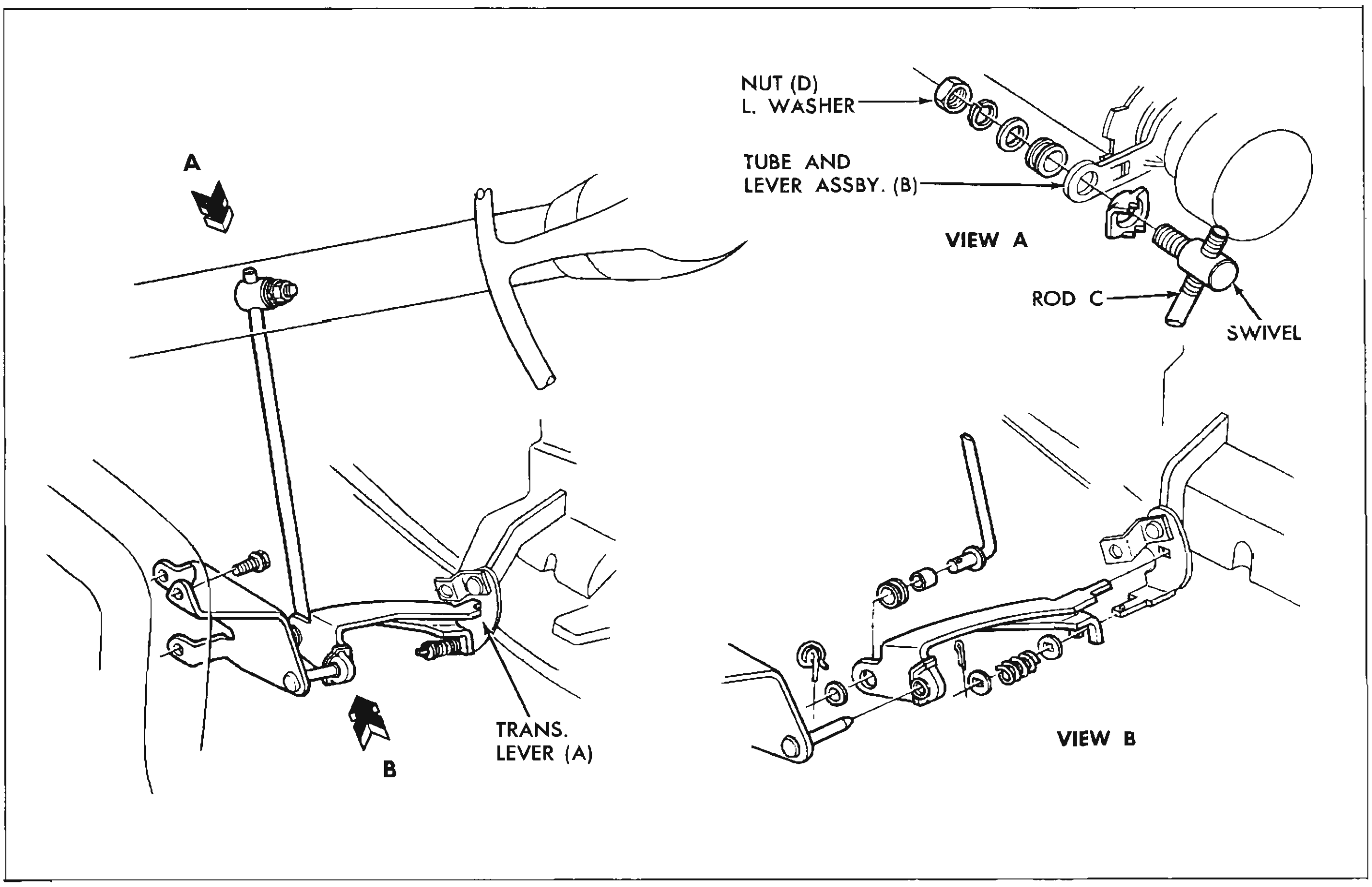


Fig. 1PG—Chevrolet Shift Linkage Adjustments

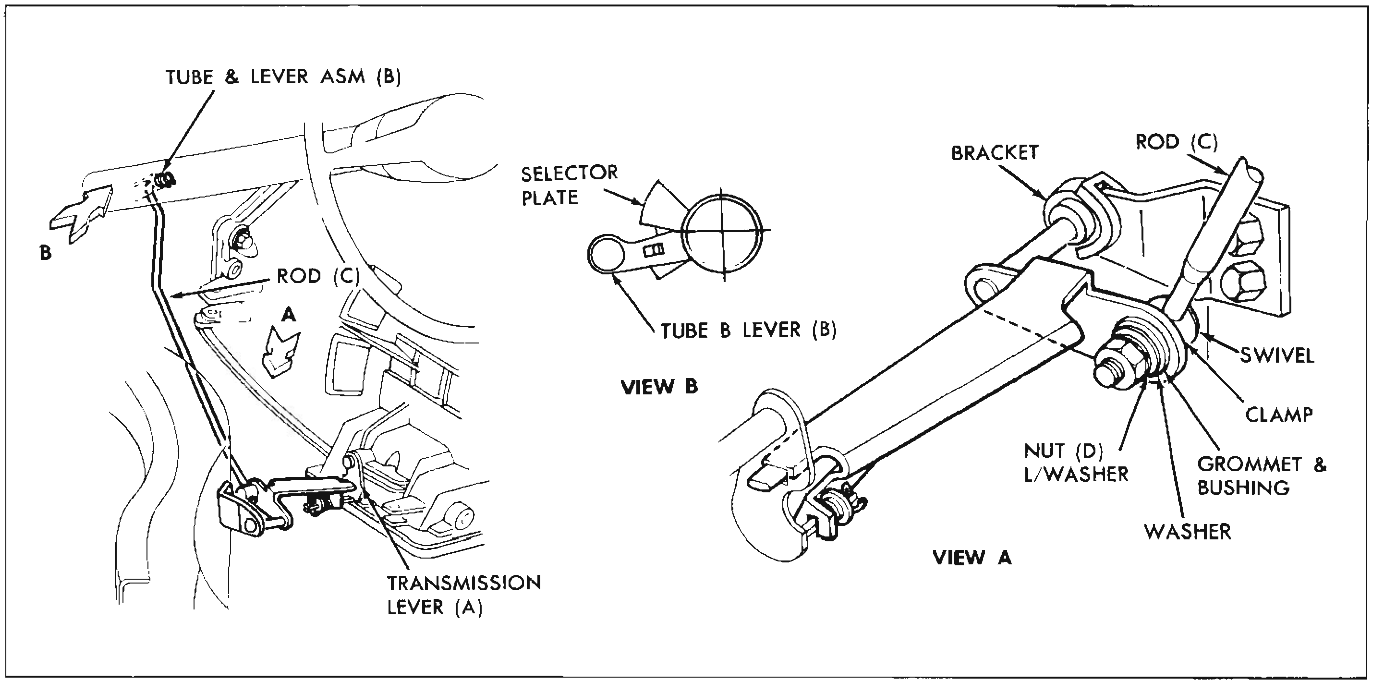


Fig. 2PG—Chevelle Shift Linkage Adjustments

NOTE: When above procedure is adhered to, the following conditions must be met by manual operation of the steering column shift lever: From reverse to drive position travel, the transmission detent feel must be noted and related to indicated position on dial.

When in drive and reverse position, pull lever upward (toward steering wheel) and then release. It must drop back into position with no restriction.

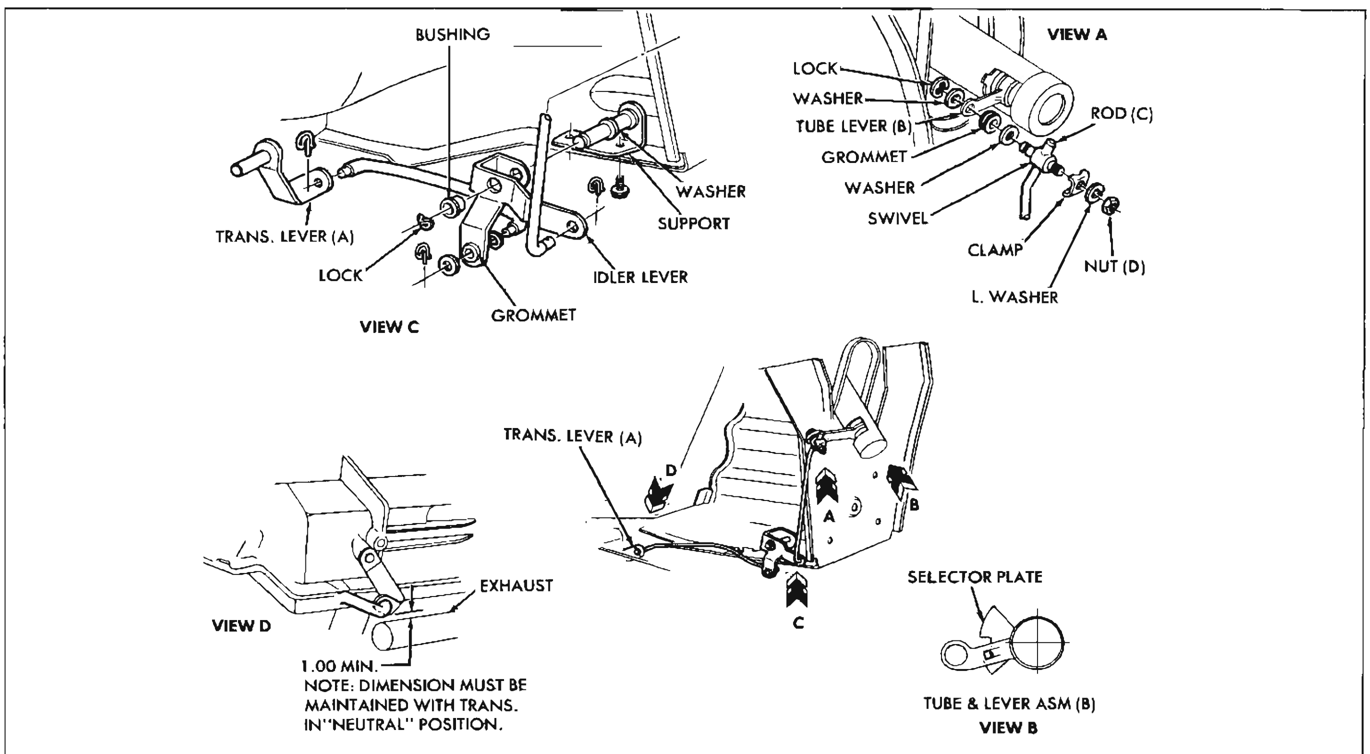


Fig. 3PG—Chevy II Shift Linkage Adjustments

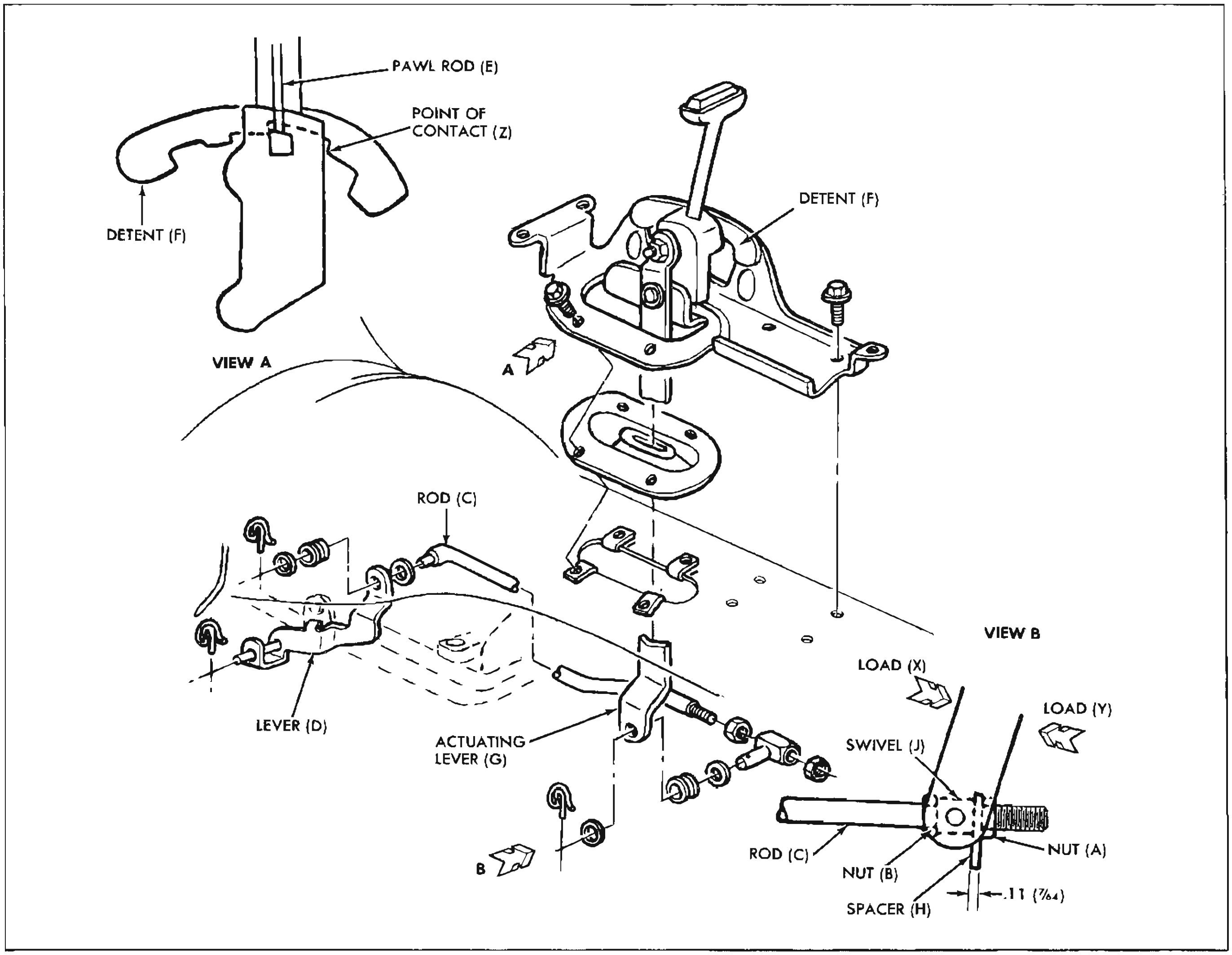


Fig. 4PG—Chevrolet Floor Shift Linkage Adjustment

CAUTION: Any inaccuracies in the above adjustment may result in premature failure of the transmission due to operation without controls in full detent. Such operation results in reduced oil pressure and in turn partial engagement of the affected clutches. Partial engagement of the clutches with sufficient pressure to cause apparent normal operation of the vehicle will result in failure of the clutches or other internal parts after only a few miles of operation.

Floor Shift Linkage

Chevrolet Linkage Adjustment (Fig. 4PG)

1. Loosely assemble Nuts (A) & (B) on Lower Rod (C).
2. Set Transmission Lever (D) in drive position.

   NOTE: Obtain drive position by moving Transmission Lever Counter-clockwise to low detent, then clockwise one detent position to drive.

3. Set Control Pawl Lever Rod (E) in Neutral or drive notch of Detent (F). See View A.
4. Apply load in direction of Arrow (Y) on Actuating Lever (G) until pawl Rod comes in contact with Detent at Contact Point (Z). See View A.
5. Place a .11 Spacer (H) between Nut (A) & Swivel (J), run Nut (A) until it touches spacer. Remove Spacer & apply load in the direction on Arrox (X) until it touches Nut (A). Tighten Nut (B) against Swivel & lock Swivel between Nuts (A) & (B). See View B.

Chevelle Linkage Adjustment (Fig. 5PG)

1. Assemble Nuts (A) and (B) on Lower Rod (C) loosely.
2. Set Transmission Lever (D) in drive position.

   NOTE: Obtain drive position by moving Transmission Lever counter-clockwise to low detent, then clockwise one detent position to drive.

3. Set Control Pawl Lever Rod (E) in the neutral or drive notch of Detent (F). See view A.
4. Apply load in direction of Arrow (Y) on Actuating Lever (G) until pawl Rod comes in contact with Detent at Contact Point (Z). See view A.
5. Place 7/64" Spacer (H) between Nut (A) and Swivel

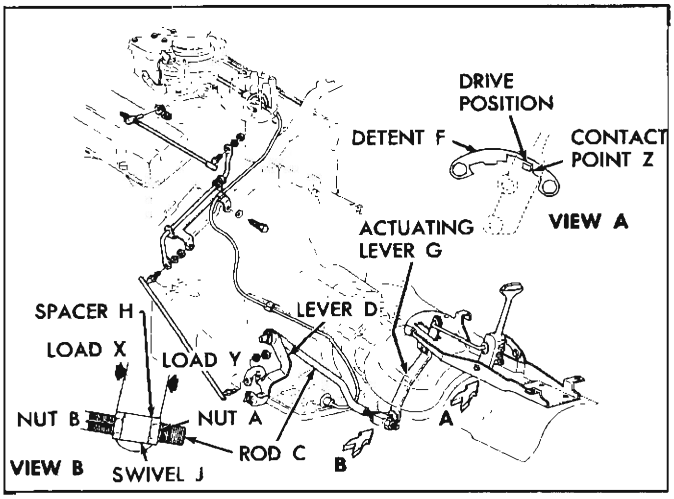


Fig. 5PG—Chevelle Floor Shift Linkage Adjustment

(J), run Nut (A) until it touches Spacer. Remove Spacer and apply load in the direction of Arrow (X) until it touches Nut (A). Tighten Nut (B) against Swivel and lock Swivel between Nuts (A) and (B). See view B.

The foregoing procedure will provide a 3/32" over travel gap in the notches of Detent (F).

Chevy II Linkage Adjustment (Fig. 6PG)

Refer to Figure 6PG and the following procedure:

1. Assemble Nuts (D) and (E) on Rod (C) loosely.
2. Set Transmission Control Actuating Lever (F) in drive position.
3. Set Control Pawl Lever Rod (J) in the neutral and drive notch of Detent (K). See view B.

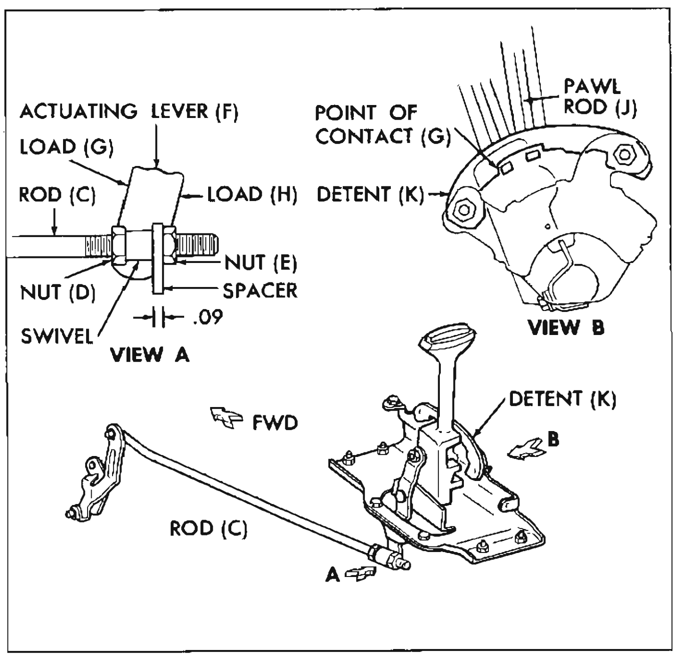


Fig. 6PG—Chevy II Floor Shift Linkage Adjustment

4. Apply load in direction of Arrow (H) on Actuating Lever (F) until Pawl Rod comes in contact with Detent (K) at Contact Point (G). See view B.
5. Place .09 Spacer between Nut (E) and Swivel, run Nut (E) until it touches Spacer. Remove Spacer and apply load in the direction of Arrow (G) until it touches Nut (E). Tighten Nut (D) against Swivel and lock Swivel between Nuts (E) and (D).

The foregoing procedure will provide a .07 over travel gap in the notches of Detent (K).

Floor Mounted Control Lever and Bracket Assembly

If disassembly of this control lever and bracket assembly is necessary, refer to Figure 7PG for parts break down and relative positioning for assembly.

Throttle Valve Linkage Adjustment (See Fig. 8PG)

With accelerator pedal depressed, Bell Crank on L-H and L-6 models or Carburetor Lever on V-8 models must be at wide open throttle position.

Dash Lever (A) must be 1/64"-1/16" off Lever Stop (B) and Transmission Lever (C) must be against transmission internal stop.

Neutral Safety Switch Adjustment

The adjustment at the neutral safety switch is described in the Electrical Section 12.

Throttle Return Check Valve (Dashpot) Adjustment

The adjustment of the throttle return check valve is described in Section 6M for each carburetor installation.

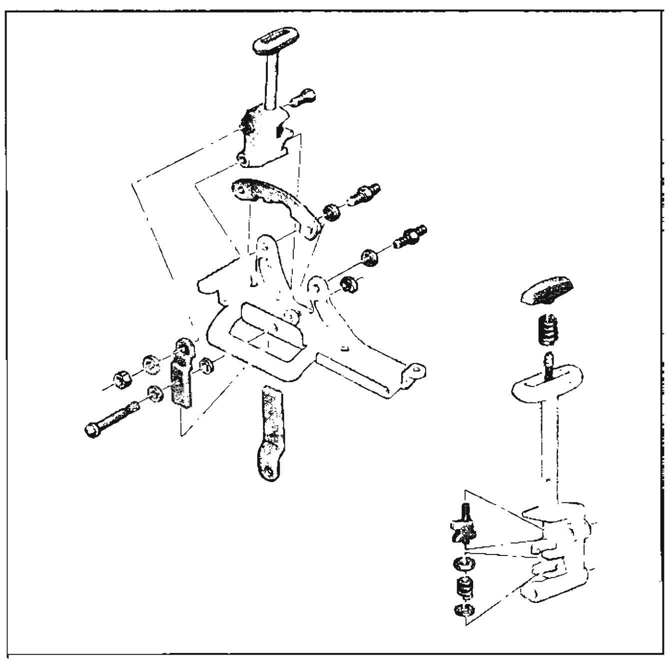


Fig. 7PG—Floor Mounted Control Lever and Bracket Assembly (Chevrolet Shown)

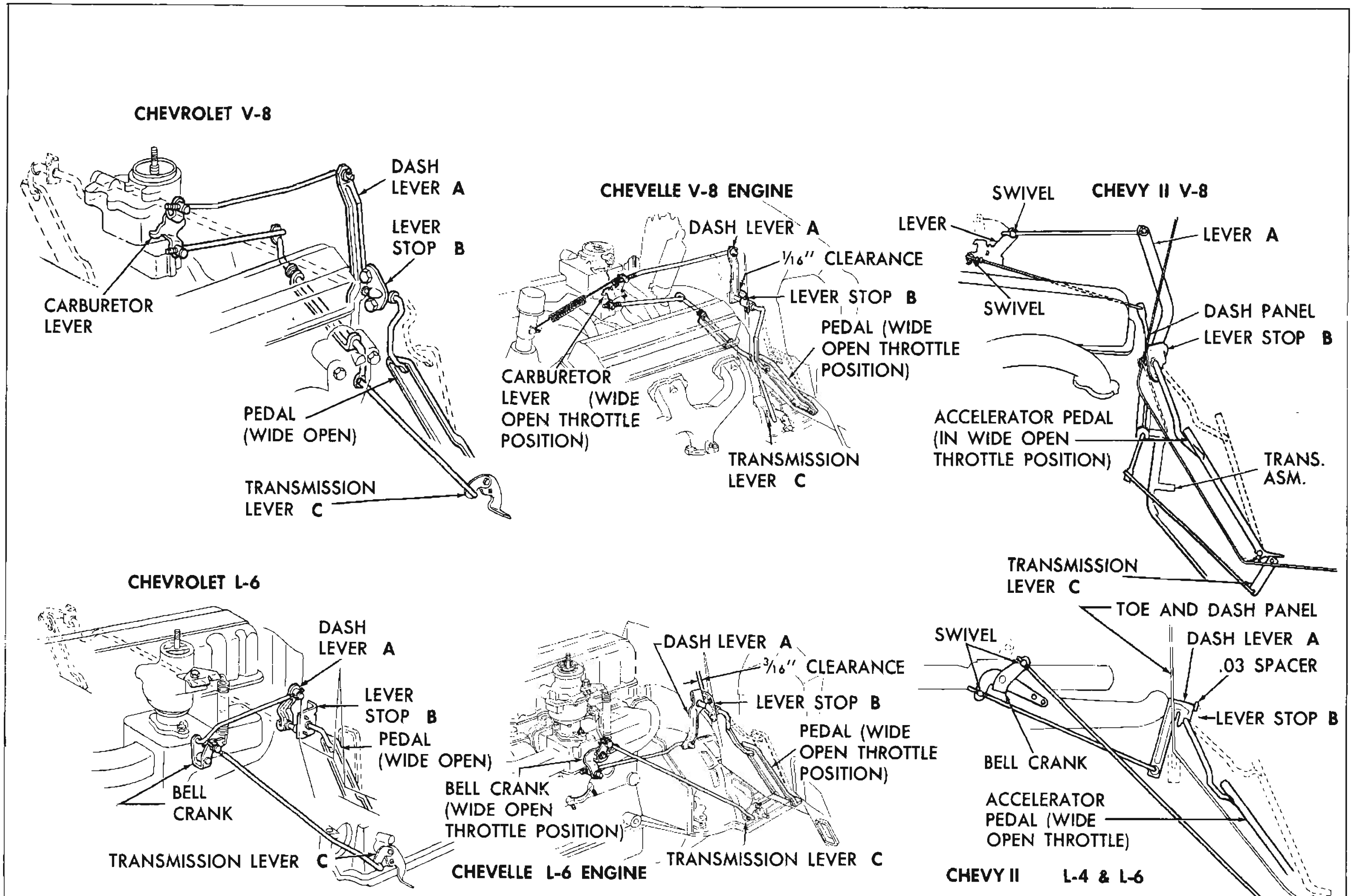


Fig. 8PG—TV Linkage Adjustments

COMPONENT PARTS REPLACEMENT

TRANSMISSION REPLACEMENT

Removal

1. Raise car on hoist (preferably) or on stand jack and remove oil pan drain plug to drain oil.

   NOTE: If desired, the oil may be drained after transmission removal.

2. Disconnect the oil cooler lines (external cooled models), vacuum modulator line and the speedometer drive cable fitting at the transmission. Tie lines out of the way.
3. Disconnect manual and TV control lever rods from transmission.
4. Disconnect propeller shaft from transmission.
5. Install suitable transmission lift equipment to jack or other lifting device and attach on transmission.
6. Disconnect engine rear mount on transmission extension, then disconnect the transmission support crossmember and slide rearward.
7. Remove converter underpan, scribe flywheel-converter relationship for assembly, then remove the flywheel-to-converter attaching bolts.

   NOTE: The "light" side of the converter is denoted by a "blue" stripe painted across the ends of the converter cover and housing. This marking should be aligned as closely as possible with the "white" stripe painted on the engine side of the flywheel outer rim (heavy side of engine) to maintain balance during assembly.

8. Support engine at the oil pan rail with a jack or other suitable brace capable of supporting the engine weight when the transmission is removed.
9. Lower the rear of the transmission slightly so that the upper transmission housing-to-engine attaching bolts can be reached using a universal socket and a long extension. Remove upper bolts.

   CAUTION: On V-8 engines, care must be taken not to lower rear of transmission too far as the distributor housing may be forced against the dash causing damage to the distributor. It is best to have an assistant observe clearance of all upper engine components while the transmission rear end is being lowered.

10. Remove remainder of transmission housing-to-engine attaching bolts.
11. Remove the transmission by moving it slightly to the rear and downward, then remove from beneath the car and transfer to a work bench.

    NOTE: Observe converter when moving the transmission rearward. If it does not move with the transmission, pry it free of flywheel before proceeding.

    CAUTION: Keep front of transmission upward to prevent the converter from falling out. Install converter Tool J-9549 (or a similar tool constructed as shown in Figure 9PG, or, in an emergency, a length of strong wire may be used) immediately after removal from the engine.

Installation

NOTE: The "light" side of the convert is denoted by a "blue" stripe painted across the ends of the converter cover and housing. This marking should be aligned as closely as possible with the "white" stripe painted on the engine side of the flywheel outer rim, denoting the "heavy" side of the engine.

1. Mount transmission on transmission lifting equipment installed on jack or other lifting device.
2. Remove converter holding tool.

   CAUTION: Do not permit converter to move forward after removal of holding tool.

3. Raise transmission into place at rear of engine and install transmission case to engine upper mounting bolts, then install remainder of the mounting bolts. Torque bolts to 25-30 ft. lbs.
4. Remove support from beneath engine, then raise rear of transmission to final position.
5. Through flywheel cover opening align as closely as possible the "white" flywheel balance mark stripe and the "blue" painted stripe on the end of converter cover and housing. If scribed during removal, align scribe marks on flywheel and converter cover. Install converter to flywheel attach-bolts. Torque bolts to 15-20 ft. lbs.
6. Install flywheel cover.
7. Reinstall transmission support crossmember to transmission and frame.
8. Remove transmission lift equipment.

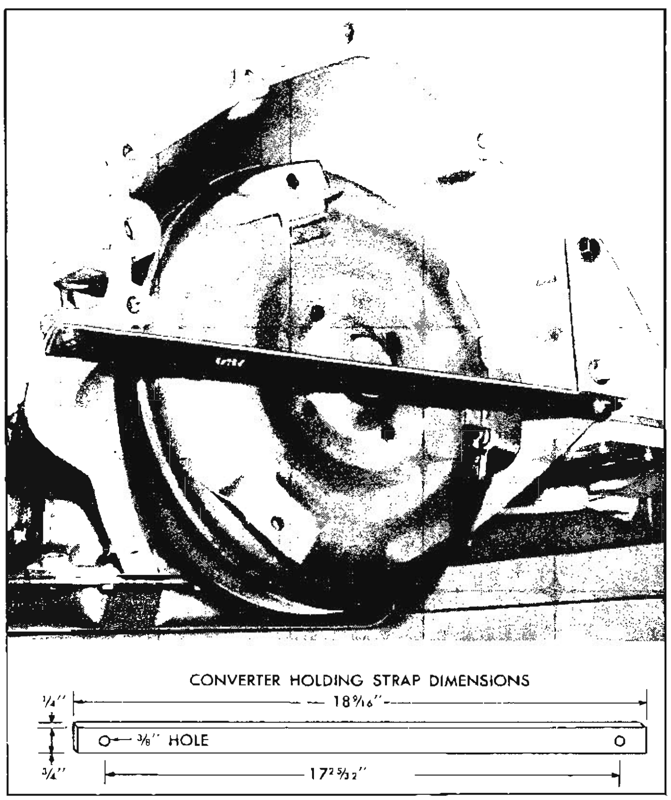


Fig. 9PG—Converter Holding Tool

9. Connect propeller shaft to transmission.
10. Connect manual and TV control lever rods to transmission.
11. Connect oil cooler lines (if so equipped), vacuum modulator line, and speedometer drive cable to transmission.
12. Refill transmission through filler tube, using Funnel J-4264 and following the recommended procedure provided earlier in this section.
13. Check transmission for proper operation and for leakage. Check and, if necessary, adjust linkage.

OTHER SERVICE OPERATIONS

Although certain operations, such as oil pan or gasket replacement, valve body, governor, rear oil pump and wear plate, speedometer drive gear, case extension "O" ring and rear oil seal, vacuum modulator, and servo cover or gasket service may be performed from underneath the vehicle without removing the Powerglide; their service procedure is covered in the Passenger Overhaul Manual and is not repeated here. Refer to the Powerglide Section of the Passenger Overhaul Manual for all other service operations not covered here.

DIAGNOSIS

Proper operation of the Powerglide transmission may be affected by a number of factors, all of which must be considered when trouble in the unit is diagnosed.

Proper trouble diagnosis can only be accomplished when performed in a thorough step by step procedure. The following procedure has been devised and tested and is recommended for all trouble diagnosis complaints and if the service man will follow this checking procedure, accurate and dependable diagnosis may be accomplished. This will result in a savings of time, not only to the service man, but to the customer as well.

WARMING UP TRANSMISSION

Before attempting to check and/or correct any complaints on the Powerglide transmission it is absolutely essential that the oil level be checked and corrected if necessary. An oil level which is either too high or too low can be the cause of a number of abnormal conditions from excessive noise to slippage in all ranges.

It must be remembered that cold oil will slow up the action of the hydraulic controls in the transmission. For this reason a trouble or oil leak diagnosis should not be attempted until the transmission has been warmed up by either of the following procedures:

Shop Warm Up

1. Connect tachometer to engine.
2. Set parking brake tight and start engine.
3. Place selector lever in "D" (drive) range.
4. Adjust carburetor idle speed adjusting screw to run engine at approximately 750 rpm and operate in this manner for two minutes. At the end of two minutes of operation, the transmission will be sufficiently warmed up for diagnosis purposes.

NOTE: At this point, readjust the engine idle speed to 450-475 rpm in "D" range.

Road Warm Up

Drive the car approximately 5 miles with frequent starts and stops.

NOTE: At this point, make sure the engine idle speed is set to 450-475 rpm in "D" range.

CHECKING FLUID LEVEL

After transmission has been warmed up, check the fluid level with the engine idling, parking brake set and control lever in "N" (neutral). If the fluid level is low, add fluid to bring level up to the full mark on gauge rod.

CAUTION: If fluid level is too high, fluid may be aerated by the planet carrier. Aerated fluid will cause turbulence in the converter which will result in lost power, lower stall speed and lower pressures in control circuits. Lower fluid level to full mark, then shut off engine to allow air bubbles to work out of fluid.

BASIC PRESSURE CHECKS

Four basic pressure checks are used for diagnosis and operational checks for the Aluminum Powerglide transmission. All checks should be made only after thoroughly warming up the transmission.

- Wide Open Throttle Upshift Pressure.
- Idle Pressure in "Drive" Range.

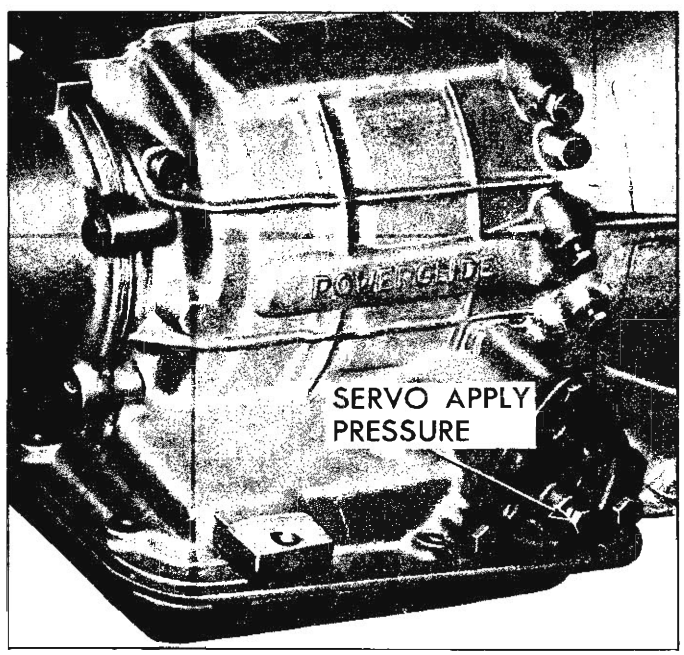


Fig. 10PG—Pressure Test Plug

- Manual "Low" Range Pressure.
- "Drive" Range Overrun (Coast) Pressure.

It is not recommended that stall tests be conducted which would result in engine vacuum falling below 10" Hg.

Pressure gauge hose connections should be made at the low servo apply (main line) test point (fig. 10PG). Run the gauge line into the driving compartment by pushing aside the mast jacket seal. Tie line out of the way of the drivers feet and connect to pressure gauge J-21867.

• Wide Open Throttle Upshift Pressure Check

Refer to the pressure check chart for upshift pressure points as indicated on the low servo apply (main line) gauge.

• Idle Pressure in "Drive" Range

In addition to the oil pressure gauges, a vacuum gauge is needed for this check.

With the parking brake applied and the shift selector lever in "Drive", low servo apply (main line) pressure should be as shown on the pressure check chart.

If pressures are not within these ranges, the following items should be checked for oil circuit leakage:

1. Pressure regulator valve stuck.
2. Vacuum modulator valve stuck.
3. Hydraulic modulator valve stuck.
4. Leak at low servo piston ring (between ring and bore).
5. Leak at low servo piston rod (between rod and bore).
6. Leak at valve body to case gasket.
7. Leak at valve body gaskets.
8. Front pump clearances.
9. Check passages in transmission case for porosity.

• Manual "Low" Range Pressure Check

Connect a tachometer, apply the parking brake, place the selector lever in "Low" range, and adjust the engine speed to 1000 rpm with the car stationary.

Low servo apply (main line) pressure should be as shown on the pressure check chart.

Pressures not within this range can indicate the following possibilities:

1. Partially plugged oil suction screen.
2. Broken or damaged ring low servo.
3. Pressure regulator valve stuck.
4. Leak at valve body to case gasket.
5. Leak between valve body gaskets
6. Leak at servo center.
7. Front pump clearances.

• Drive Range Overrun (Coast) Pressure

With the vehicle coasting in "Drive" range at 20-25 MPH with engine vacuum at approximately 20" Hg., low servo apply (main line) pressure should be as shown on the pressure check chart.

POWERGLIDE BASIC PRESSURE (MAINLINE) CHECK CHART

Wide Open Throttle Upshift (psi)	Idle Speed "Drive" Range @ 16" Hg. & 10" Hg.		Manual "Low Range" @ 1000 RPM	Drive Range Overrun (Coast) @ 20-25 MPH 20" Hg. Approx.	Engines
89-103	49-53	62-70	108-115	49-53	L-153
89-103	49-53	62-70	108-115	49-53	L-194
102-107	61-72	93-100	118-126	49-53	L-230
102-107	61-72	93-100	118-126	49-53	L-292
97-104	61-72	93-100	118-126	49-53	V-8 283
106-117	63-72	90-99	127-136	49-53	V-8 327
86-105	63-72	90-99	127-136	49-53	V-8 327 Hi Perf.
106-117	63-72	90-99	127-136	49-53	V-8 409

POWERGLIDE SHIFT POINTS

Chevrolet Models

Engine	*230 L-6		*283 V-8		*327 V-8		**327 V-8 Hi-Perf.	
Throttle Position	Up	Down	Up	Down	Up	Down	Up	Down
Closed	14-18	13-17	14-18	13-17	15-18	14-17	14-18	13-17
Detent Touch	41-52	22-35	46-50	15-25	48-60	16-26	50-62	17-24
Through Detent	55-58	46-54	55-63	51-59	60-67	56-64	62-70	59-67

*3.08 Axle **3.36 Axle

Chevelle Models						
Engine	194 L-6		283 V-8		327 V-8	
Throttle Position	Up	Down	Up	Down	Up	Down
Closed	14-17	13-16	14-17	13-16	14-18	13-17
Detent Touch	40-51	22-34	45-55	15-24	47-58	15-25
Through Detent	49-57	45-53	54-61	50-58	58-65	54-62
Chevy II Models						
Engine	153 L-4		194 L-6		283 V-8	
Throttle Position	Up	Down	Up	Down	Up	Down
Closed	13-16	12-15	13-16	12-15	14-17	13-16
Detent Touch	37-47	21-32	37-47	21-32	45-55	15-24
Through Detent	45-52	42-49	45-52	42-49	54-61	50-58

NOTE: Shift points as indicated on the speedometer are not affected by tire size.

SPECIAL TOOLS

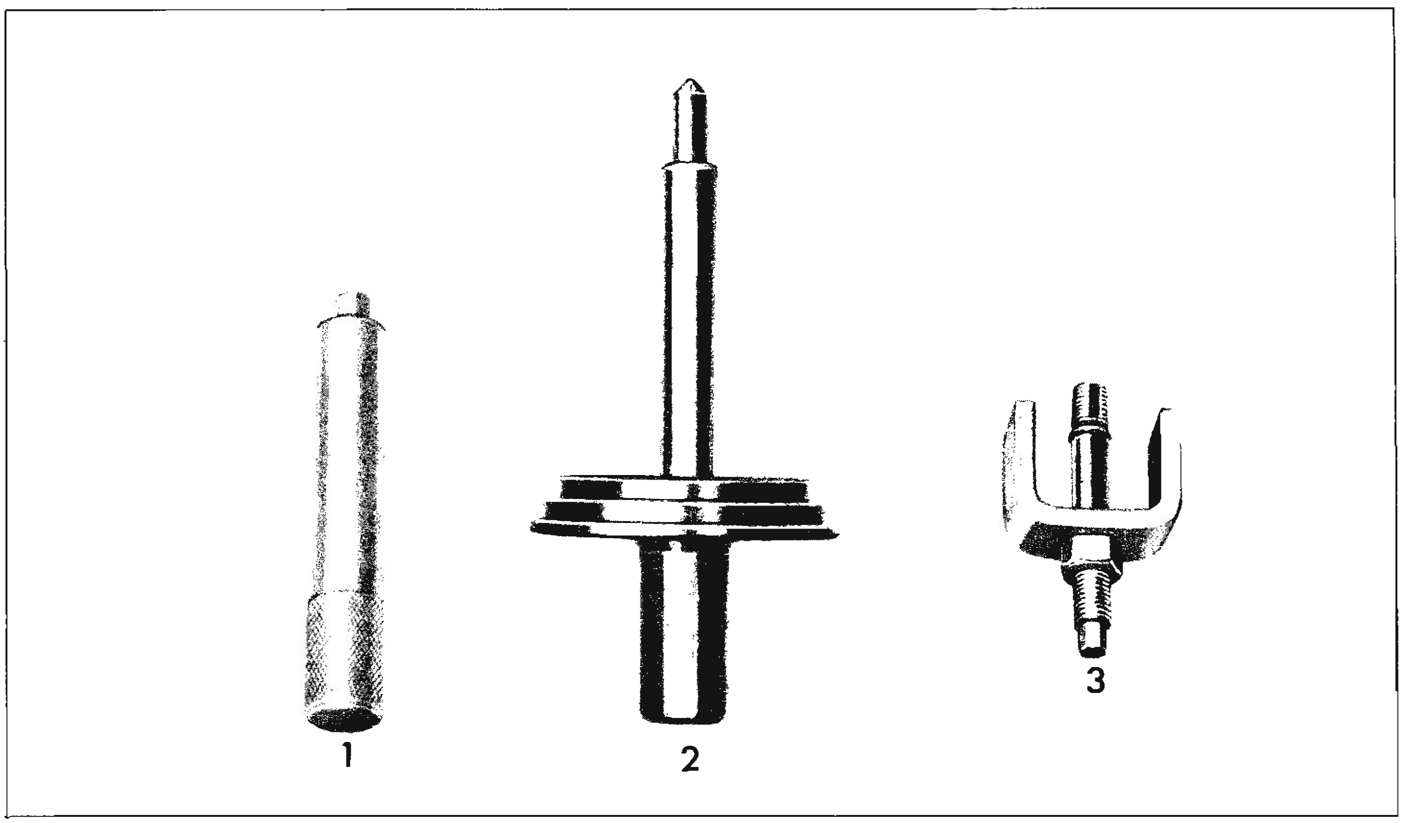


Fig. 11PG—Clutch Special Tools

1. J-1522 Pilot Bearing Driver
2. J-5824 Clutch Pilot Tool
3. J-1448 Pilot Bearing Puller

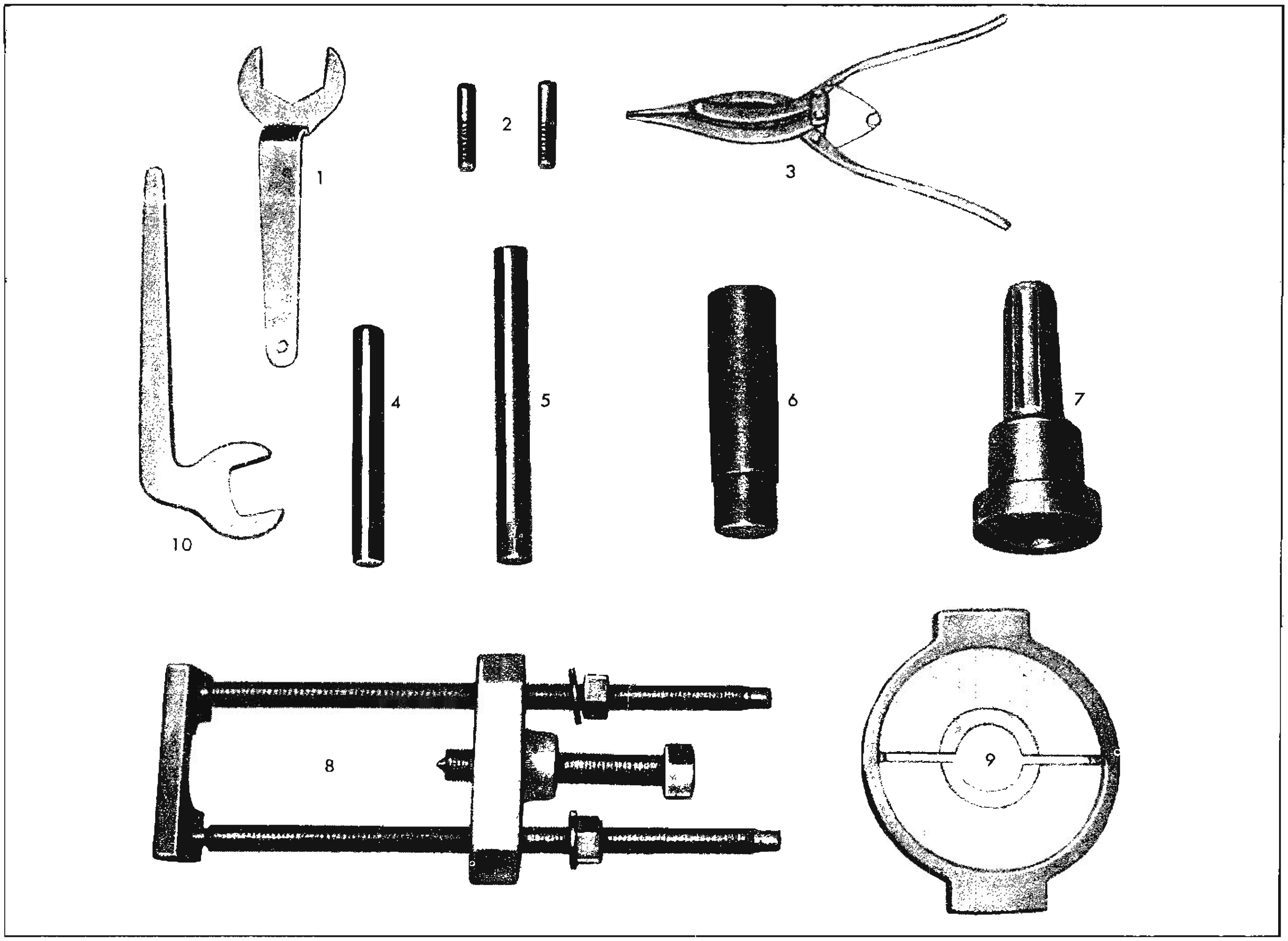


Fig. 12PG—Manual Transmission Special Tools

1.	J-0933	Clutch Gear Bearing Retainer Wrench	7. J-5154	Extension Housing Seal Installer
2.	J-1126	Transmission Guide Pins	8. J-5814-15	Speedometer Drive Gear Remover
3.	J-8059	Retainer Snap Ring Pliers	9. J-1453-01	Speedometer Drive Gear Press Plates
4.	J-5777	Countergear Loading Tool (3-Speed)	J-358-1	Press Plate Holder
5.	J-5589	Countergear Loading Tool (4-Speed)	10. J-4653	Overdrive Governor Wrench
6.	J-5778	Extension Housing Bushing Remover and Installer		

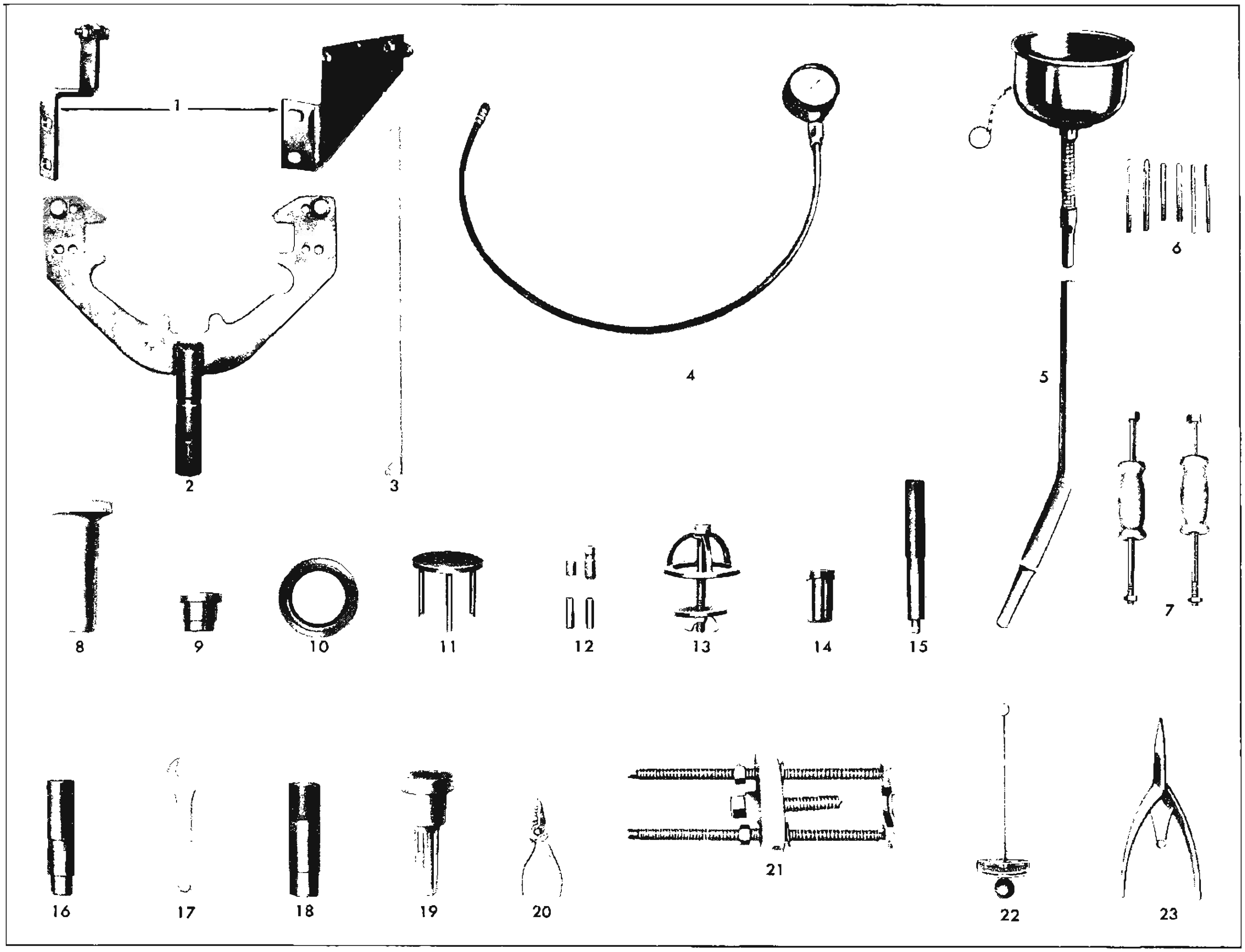


Fig. 13PG—Aluminum Powerglide Special Tools

1.	J-9506	Holding Fixture Adapters
2.	J-3289-01	Holding Fixture (Use with J-3289-20 Base)
3.	J-9549	Converter Safety Strap
4.	J-21867	Transmission Pressure Gauge and Hose
5.	J-4264	Oil Filler Tube and Funnel
6.	J-3387	Pilot Stud Set
7.	J-9539	Front Pump Puller Bolts (Use with weights from Slide Hammers J-6585)
8.	J-6839	Front Pump Seal Driver
9.	J-9546	Clutch Drum Bushing Remover and Installer
10.	J-7782	Clutch Spring Compressor Adapter Plate
11.	J-5133	Clutch Spring Compressor
12.	J-4599	Planet Pinion Assembly Tool Set
13.	J-9542	Reverse Piston Spring Compressor
14.	J9557	Transmission Case Rear Bushing Remover and Installer and Rear Pump Bushing Remover
15.	J-7079	Handle
16.	J-6582	Rear Pump Bushing Installer
17.	J-9543	Vacuum Modulator Wrench
18.	J-5778	Extension Bushing Remover and Installer
19.	J-5154	Extension Oil Seal Installer
20.	J-5403	Snap Ring Pliers
21.	J-5814	Speedometer Drive Gear Remover and Installer
22.	J-5853	Torque Wrench
23.	J-8039	Snap Ring Pliers
	J-8001	Dial Indicator (Not Illustrated)
	J-5492	Dial Indicator Support Strap (Not Illustrated)
	J-6585	Slide Hammers (Not Illustrated)
	J-6585-3	Slide Hammer Adapters (Not Illustrated)
	J-9534	Bushing Remover (Not Illustrated)

SECTION 8

FUEL TANK AND EXHAUST SYSTEMS

CONTENTS OF THIS SECTION

CHEVROLET

FUEL TANKS

INDEX

GENERAL DESCRIPTION

All models except station wagons (fig. 1 and 2) use a 20 gallon capacity fuel tank mounted between the frame rails behind the rear axle. The fuel tanks are held in place by two straps attached individually to the underbody at each end. The straps hinge at the forward end and secure the tank at the rear with a nut and bolt. Anti-squeak material is cemented to the tank at the strap locations. A vent line from the forward-right side of tank extends over a clip on the upper portion of wheelhouse.

The station wagon fuel tank has a 23.8 gallon capacity. The tank is located at the back of the left rear quarter wheelhouse area. The front of the tank is enclosed with a protective shield (fig. 3).

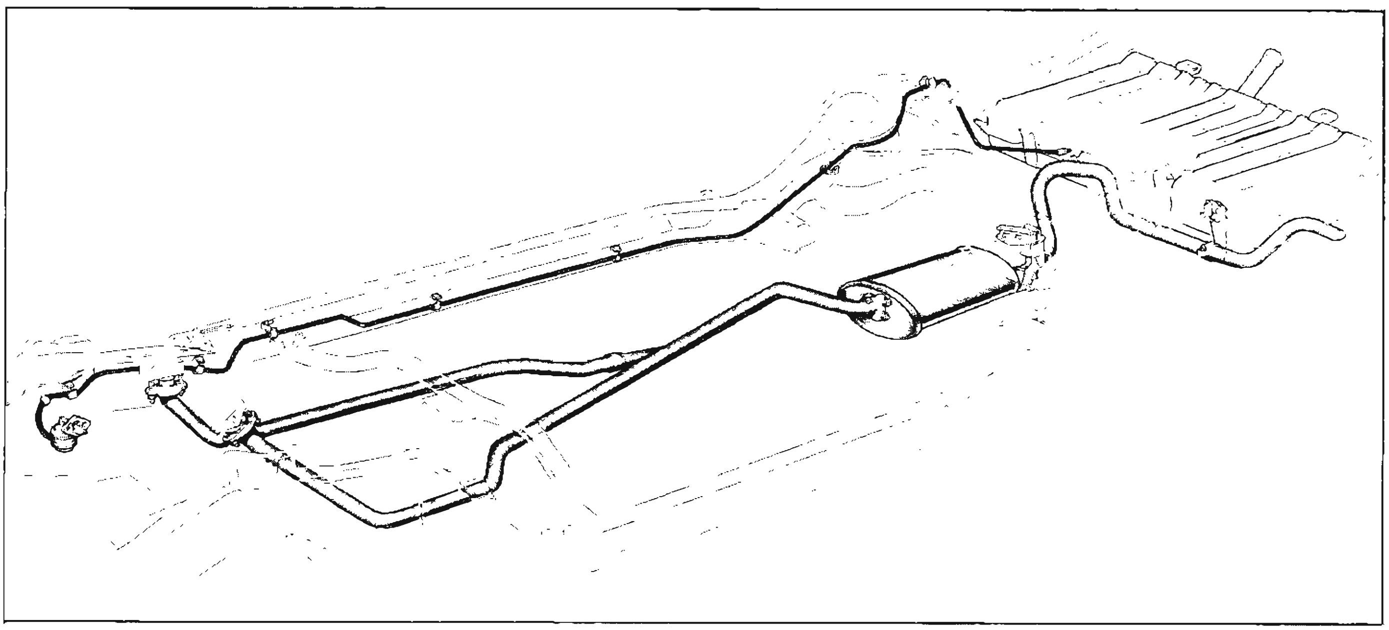


Fig. 1—Fuel and Exhaust System

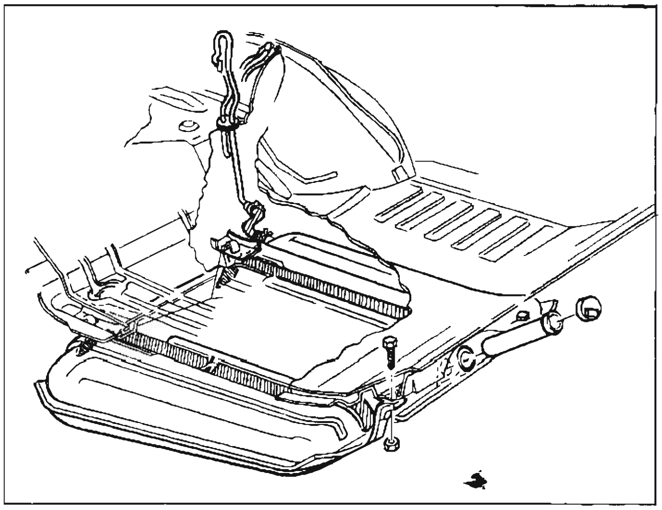


Fig. 2—Fuel Tank (Except Station Wagon)

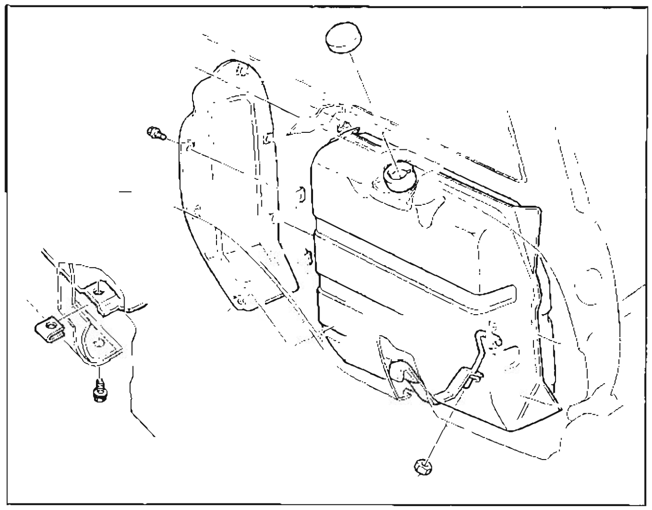


Fig. 3—Fuel Tank (Station Wagon Only)

COMPONENT PART REPLACEMENT

FUEL TANK

Draining Tank

The absence of a drain plug in the gas tanks makes it necessary to siphon fuel from the tank when draining is needed. The following procedure is recommended.

1. Obtain approximately 10 feet of 3/8" I.D. hose and cut a flat-type slit 18" from one end. Make this cut on the hose in the direction toward the shorter end (See Figure 4).
2. Insert a small pipe nipple (slightly larger O.D. than the hose I.D.) into the opposite end of hose.
3. Insert the nipple end of the siphon hose into the fuel tank filler neck with the natural curl of the hose pointing down. Insert until the hose is heard to strike bottom of the tank.

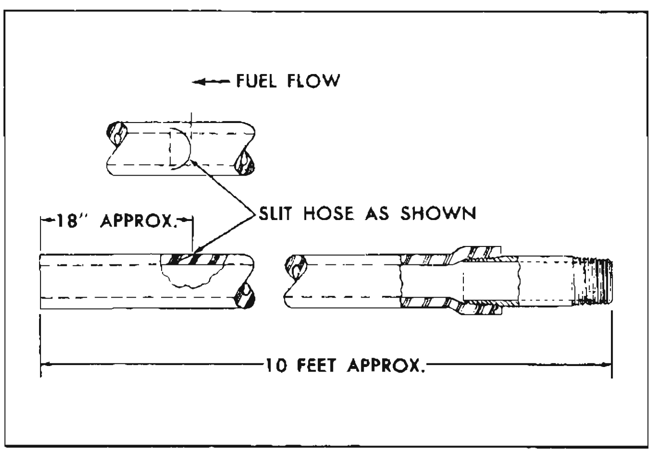


Fig. 4—Siphon Construction

4. With the opposite end of the hose in a suitable container insert an air hose in downward direction in the flap-type slit and trigger the flow of fuel.

CAUTION: Always drain gasoline from complete fuel system including carburetor, fuel pump and all fuel lines and fuel tank if the vehicle is to be stored for any appreciable length of time. This precaution will prevent accumulation of gum formation and resultant poor engine performance.

Removal and Installation (Except Station Wagon)

1. Drain fuel tank.
2. Raise vehicle.
3. Disconnect fuel pickup line and gauge wire from tank unit.
4. Disconnect vent pipe hose.
5. Remove tank support straps and lower tank carefully.
6. To install, reverse the removal procedure.

Removal and Installation (Station Wagon)

1. Drain fuel tank.
2. Raise vehicle.
3. Remove gas tank shield at the back of the left rear wheel; remove all screws including the screw attachment at the bottom of the quarter panel.
4. Disconnect fuel pickup line and gauge wires from tank unit.
5. Remove strap assembly nut and carefully lower tank.
6. Reverse removal procedure to install.

FUEL LINES (FIG. 5)

The fuel lines extend from the fuel tank pickup to fuel pump are routed on the underside of the right side of the vehicle. The fuel lines should be occasionally inspected for leaks, kinks or dents. If evidence of dirt is found in the carburetor or fuel pump and disassembly, the lines should be disconnected and blown out. Check the fuel

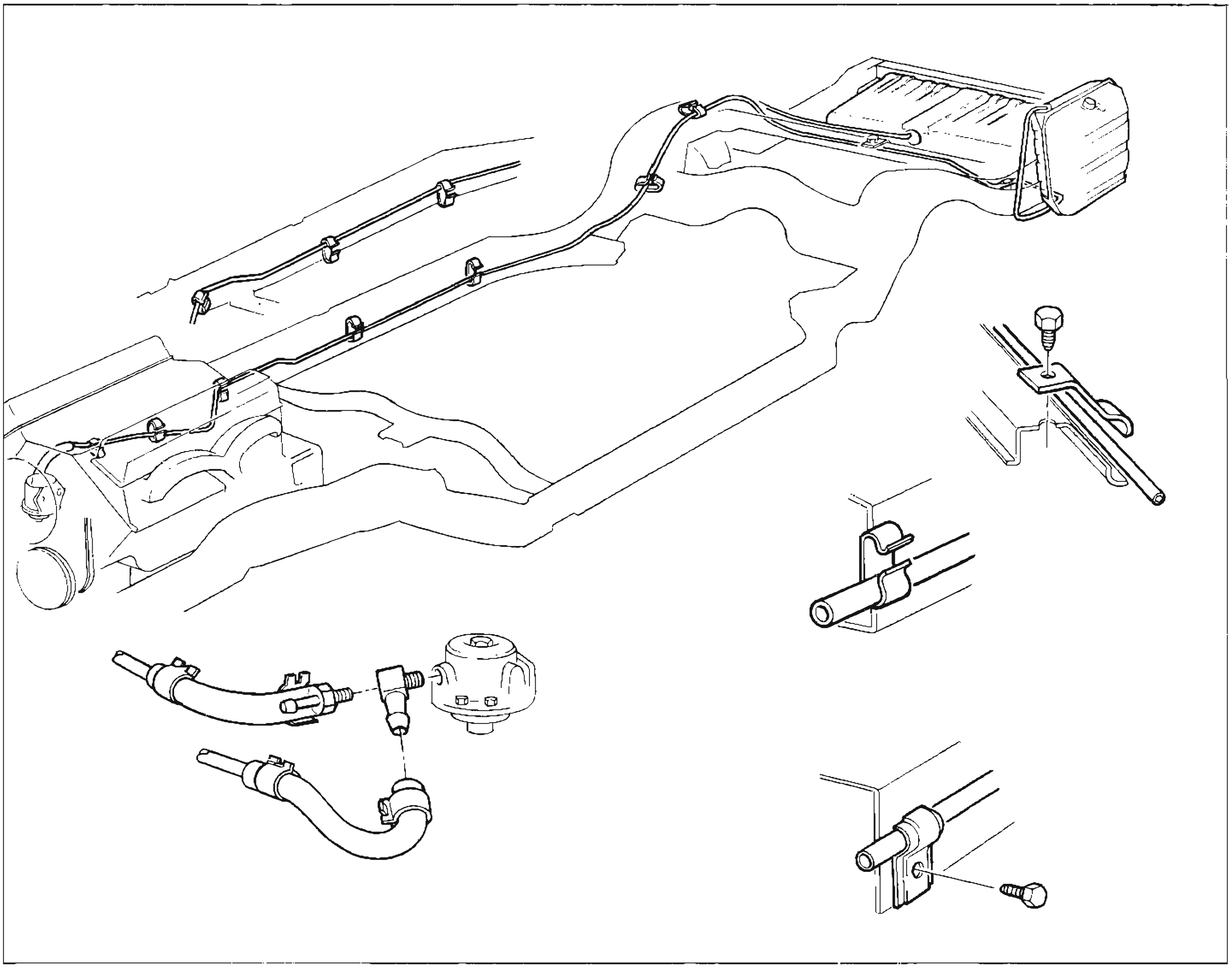


Fig. 5—Fuel Lines

tank strainer for damage or omission. Note position of fuel line clips for convertible models.

FUEL TANK VENT LINE

Sedan model fuel tanks are vented to the atmosphere at the top right forward edge of the tank. The vent line is connected by a rubber hose with two clamps one at the tank and the other at the vent pipe which is secured to the underbody. A rubber grommet around the vent pipe acts as a seal to prevent gasoline fumes from entering the passenger compartment.

IMPORTANT: It is important to note that the gas tank cap is non-vented. It is necessary to be assured that the vent line is free from dirt, etc., and open at all times. If gasoline fumes are detected, the rubber grommet should be checked.

Station wagon models use a vented, anti-surge type gas cap.

GAUGE UNIT AND FUEL STRAINER

Removal and Installation (Fig. 6) (Except Station Wagon)

1. Drain tank to a level below the unit.
2. Disconnect fuel pickup line and gauge unit wire.
3. Use Special Tool J-8950 (revised) to remove cam lock.
4. Remove unit and rubber gasket.
5. Reverse procedure to install.

Removal and Installation (Station Wagon)

1. Follow above tank removal procedure.
2. Use Special Tool J-8950 to remove cam lock.
3. Carefully remove meter assembly.
4. Reverse procedure to install.

EXHAUST SYSTEMS

INDEX

GENERAL DESCRIPTION

The 1965 Chevrolet has a single exhaust system (fig. 7) for L-6 and V-8 engines. A crossover pipe extends and attaches to the exhaust pipe for V-8 engines (fig. 8). An RPO dual exhaust system is available with resonators for the V-8, 327 cu. in. engines. The base 327 cu. in. engine has a 2-1/2 inch single exhaust system.

COMPONENT PART REPLACEMENT

Care should be taken to have the exhaust pipe, muffler or tail pipe in proper relation with each other. Incorrect alignment frequently causes annoying rattles due to incorrect clearances. Refer to Clearances in Figure 7.

MUFFLER ASSEMBLY

Remove and Replace

1. Remove "U" bolt clamp at center mounting.
2. Remove "U" bolt clamp at forward end of muffler pipe.
3. Remove complete muffler assembly.
4. Three-fourths inch clearance should be allowed between the muffler bracket (hanger) and crossmember at installation.
5. Install the flat side of the muffler showing.

EXHAUST PIPE (CROSSOVER WITH V-8 ENGINE)

Remove and Replace

1. Remove two nuts, extension and packing--separate pipe from manifold.
2. Disassemble "U" clamp from muffler and remove pipe.
3. Attach pipe to muffler, then secure to manifold. Note clearances for the standard and automatic control linkages, underbody and crossmember. Contact of exhaust pipe to engine panrail is permissible.
4. Tighten nuts uniformly.

TAIL PIPE

Remove and Replace

1. Remove "U" clamp attachment at muffler.
2. Remove screw attachment at tail pipe rear hanger assembly.
3. Remove tail pipe.
4. Replace tail pipe at muffler, then install at hanger. Do not secure attachments until clearances have been checked. Check position of hanger so that interplates are parallel.
5. Torque nuts 7-9 ft. lbs. at hanger and 10-15 ft. lbs. at muffler.

RESONATORS (FIG. 9)

Resonators are available on dual exhaust systems located in back of the rear tires under the right and left rear fenders.

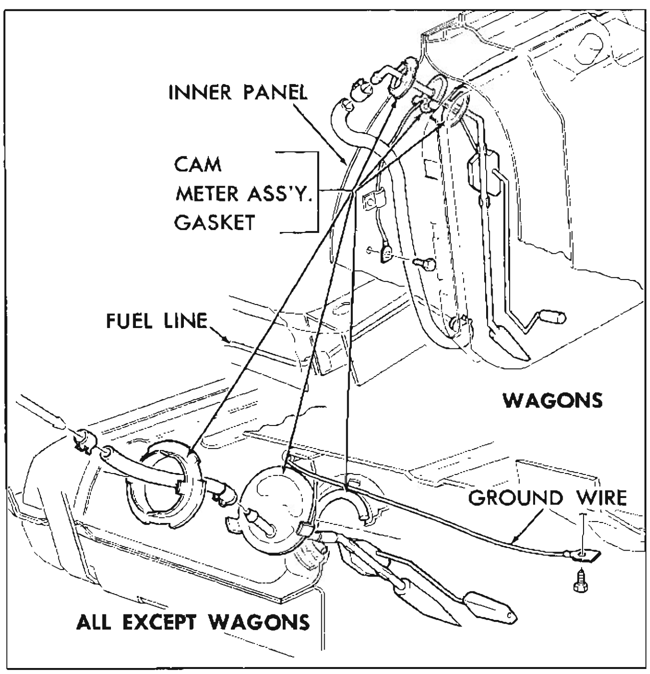


Fig. 6—Gauge Unit Assembly

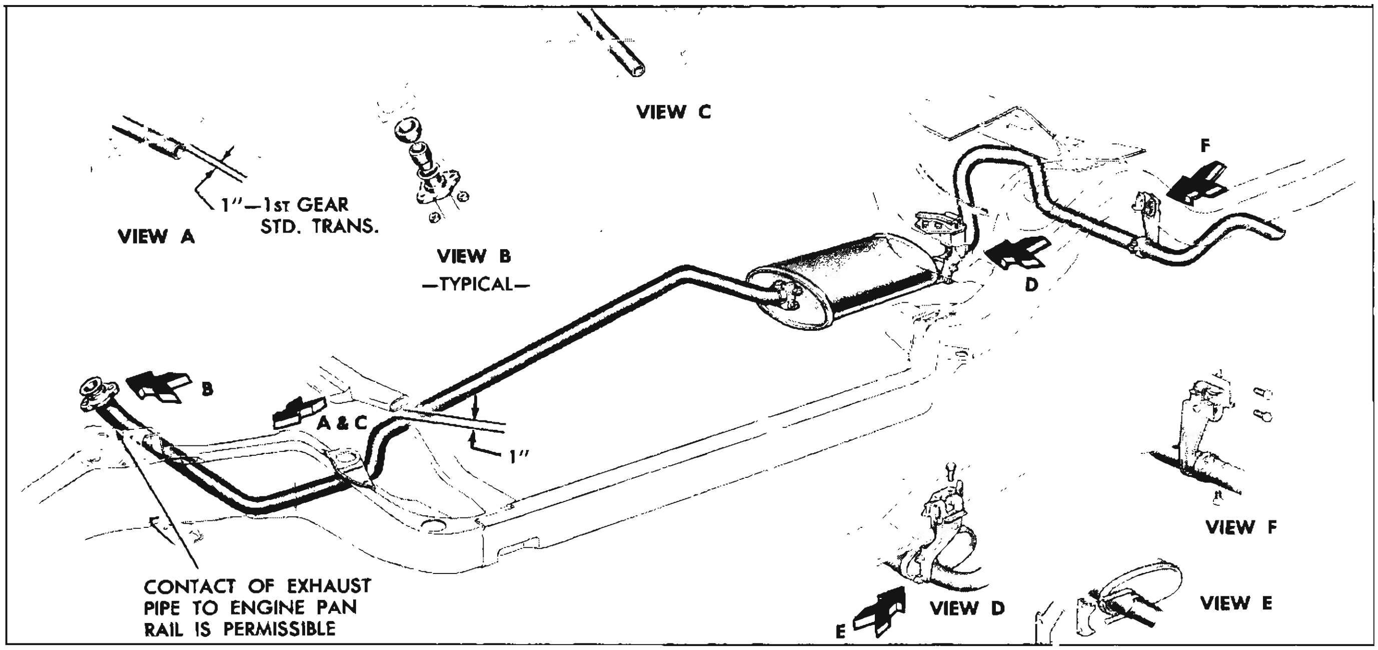


Fig. 7—Exhaust System (Except V-8)

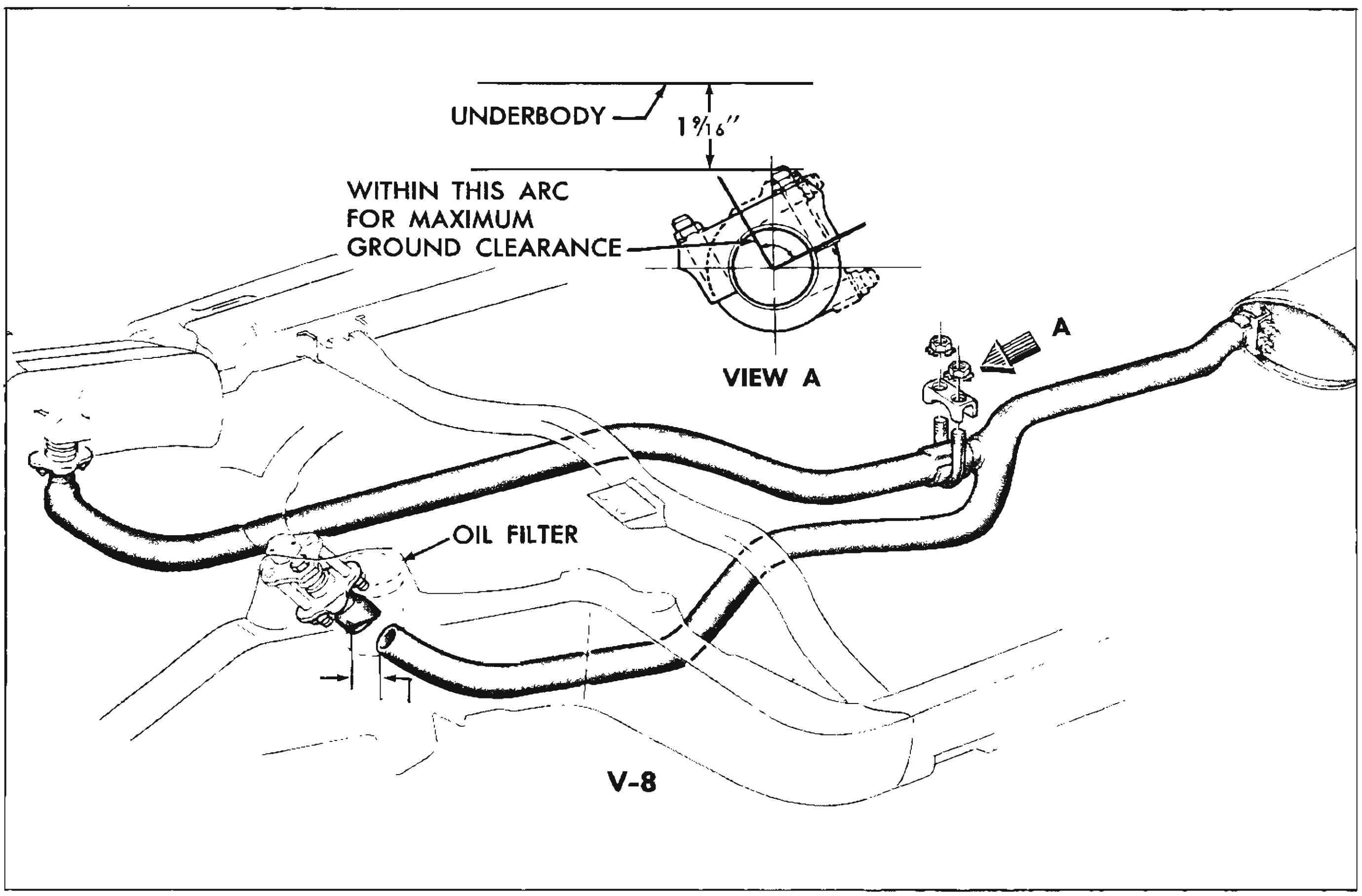


Fig. 8—Exhaust System (V-8 Only)

CHEVELLE FUEL TANKS

INDEX

GENERAL DESCRIPTION

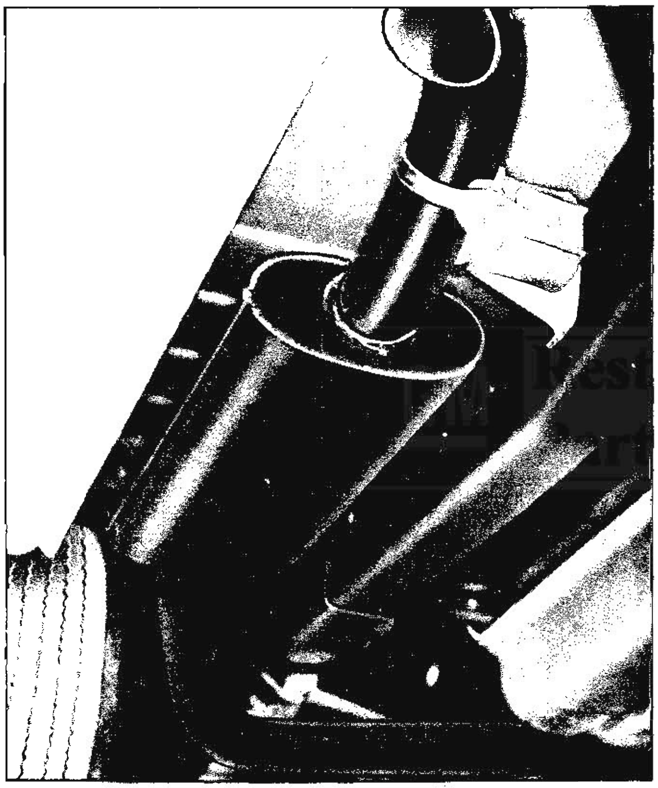


Fig. 9—Dual Exhaust System Resonator

All models use a 20 gallon capacity fuel tank mounted between the frame rails behind the rear axle. The fuel tanks are basically the same for sedan, 2-seat station wagon and pickup models except for filler neck location and venting (figs. 10 and 11).

All fuel tanks are vented to the atmosphere. Sedan model tanks have an external vent hose and pipe assembly (fig. 10) and use a non-vented fuel cap. Station wagon and pickup model tanks are vented through a hose and vent pipe assembly to the filler neck (fig. 12) and use a vented, anti-surge type gas cap. The fuel caps are two different designs conforming to SAE standards and are not interchangeable.

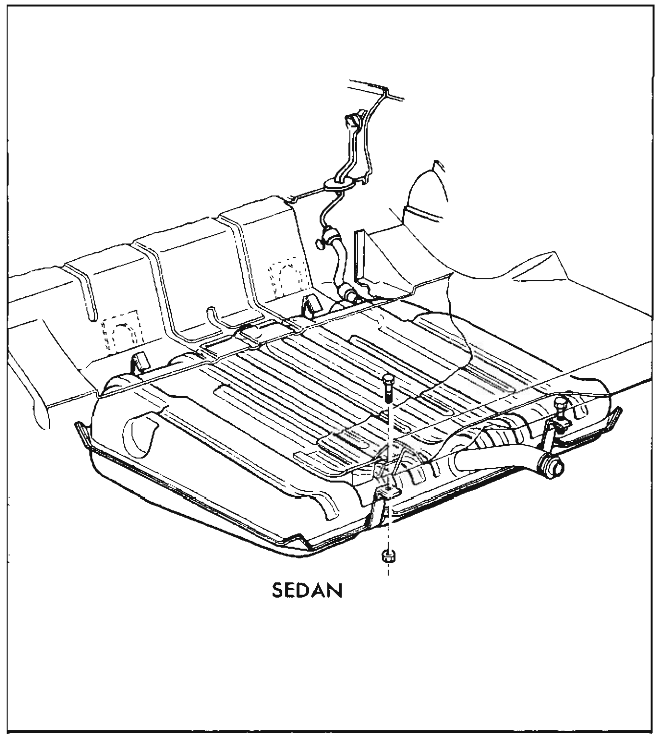


Fig. 10—Fuel Tank (Except Station Wagon and Pickup)

The filler neck assembly on sedan models is a rear fill design located behind the center bar of the bumper. Station wagon and sedan pickup model filler neck assemblies are located in the left rear quarter panel.

The fuel pickup pipe is built integrally with the tank gauge, located at the top-front center of the tank. A fine mesh screen is located at the bottom end of the fuel pickup pipe to prevent the entrance of foreign material into the fuel system.

The sedan fuel tanks are held in place by two metal straps attached individually to the underbody at each end. The straps hinge at the forward end and secure the tank at the rear with an adjustable bolt and nut assembly.

The station wagon and pickup models have a frame mounted fuel tank secured with straps to front and rear supports.

COMPONENT PART REPLACEMENT

FUEL TANK

Draining Tank

The absence of a drain plug in the gas tanks makes it necessary to siphon fuel from the tank when draining is needed. The following procedure is recommended.

1. Obtain approximately 10 feet of 3/8" I.D. hose and cut a flap-type slit 18" from one end. Make this cut on the hose in the direction toward the shorter end (See Figure 13).
2. Insert a small pipe nipple (slightly larger O.D. than the hose I.D.) into the opposite end of hose.
3. Insert the nipple end of the siphon hose into the fuel tank filler neck with the natural curl of the hose pointing down. Insert until the hose is heard to strike bottom of the tank.
4. With the opposite end of the hose in a suitable container, insert an air hose in downward direction in the flap-type slit and trigger the flow of fuel.

CAUTION: Always drain gasoline from complete fuel system including carburetor, fuel pump and all fuel lines and fuel tank if the vehicle is to be stored for any appreciable length of time. This precaution will prevent accumulation of gum formation and resultant poor engine performance.

Removal and Installation (Except Station Wagon and Pickup)

1. Raise vehicle.
2. Drain fuel tank.
3. Disconnect fuel pickup line and gauge wires from tank unit.
4. Disconnect vent hose from tank.
5. Remove tank support straps and lower tank carefully.
6. To install, reverse the removal procedure.

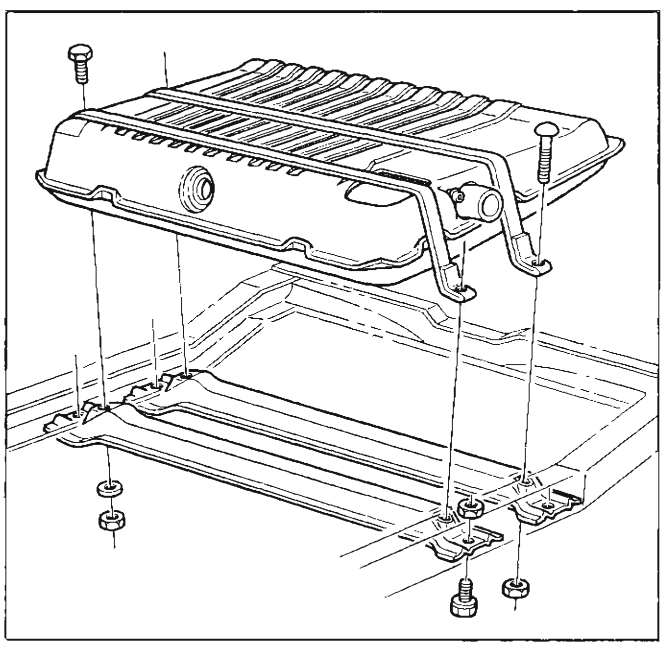


Fig. 11—Fuel Tank (Station Wagon and Pickup)

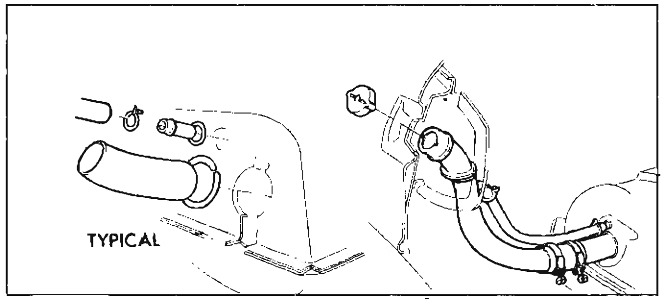


Fig. 12—Filler Neck and Vent Assemblies

Removal and Installation (Station Wagon and Pick-Up)

1. Follow above three steps.
2. Remove tank support straps.
3. Remove frame screw attachments from the front support (fig. 11).
4. Guide tank forward and remove.
5. To install, reverse removal procedure.

FUEL LINES

The fuel lines, extending from fuel tank to fuel pump, are routed on the underside of the underbody along the right side of the vehicle opposite the single exhaust system. The fuel lines should occasionally be inspected for leaks, kinks, or dents. If evidence of dirt is found in the carburetor or fuel pump on disassembly, the lines should be disconnected and blown out. Check the fuel tank strainer for damage or omission. Fuel lines are of 5/16" diameter tubing with beaded type ends for connections of hoses.

FUEL PIPE RETAINER CLIP

Removal and Installation

If fuel pipes and retainer clips are removed, Tool J-7777 should be used to install new retainer clips (fig. 14). After removal of the old clip from the frame, position the new clip in the location of the old clip. Index the

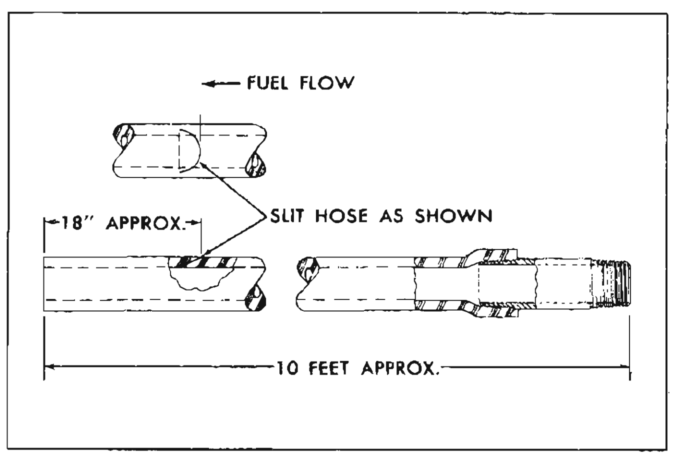


Fig. 13—Siphon Construction

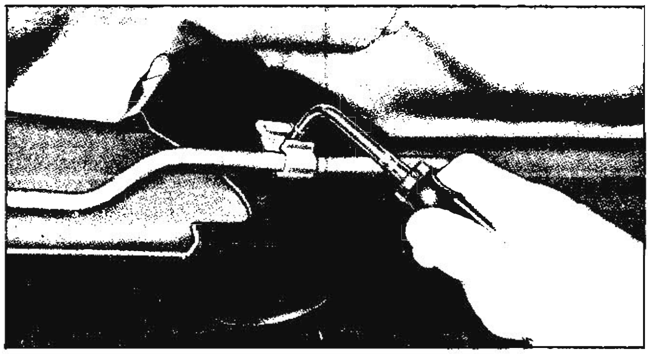


Fig. 14—Installing Fuel Line Retainer Clip

"blind rivet" and press hard (hand pressure should do) to expand rivet.

GAUGE UNIT AND FUEL STRAINER

Removal and Installation (Fig. 15)

1. Drain tank to a level below the unit.
2. Disconnect fuel pickup line and gauge unit wire.
3. Use special Tool J-8950 to remove cam lock. Remove unit and rubber gasket.

   CAUTION: Carefully remove unit so as not to damage screen on the end of the pipe.
4. Clean screen by blowing out with compressed air.
5. Reverse procedure to install.

FUEL TANK FILLER NECK CAPS

The fuel tank filler neck caps are non-vented with an anti-surge feature. Station wagons have vented caps. (Refer to "Fuel Tank Vent Lines").

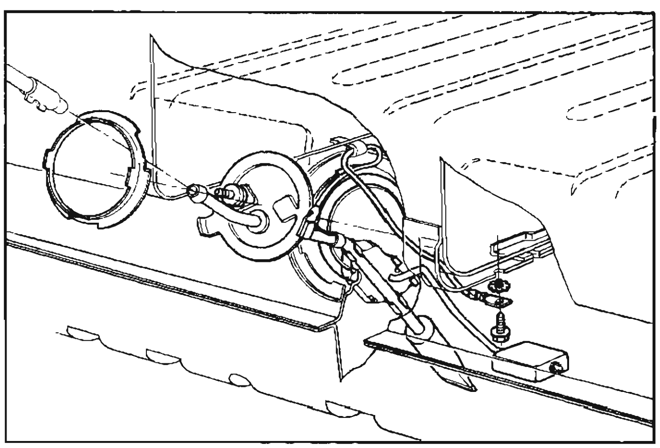


Fig. 15—Gauge Unit Assembly (Typical)

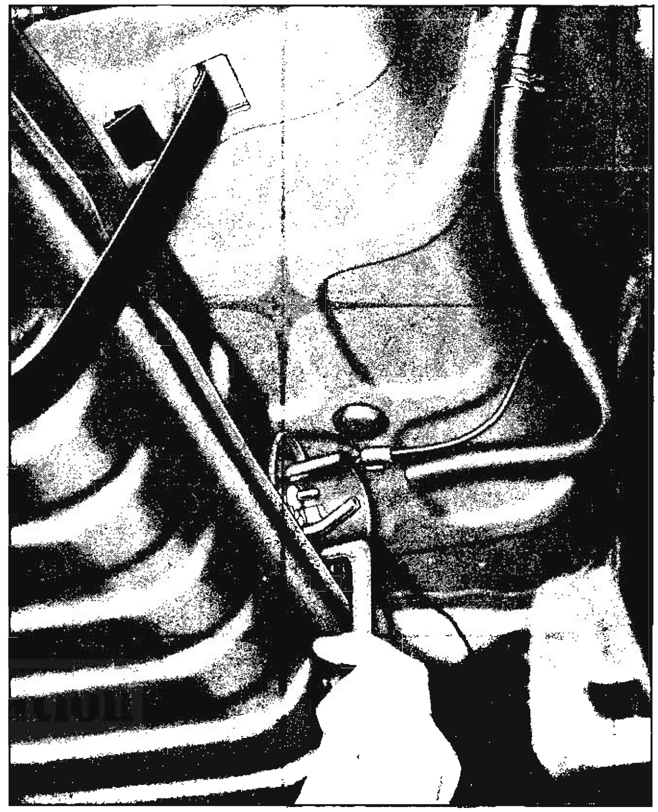


Fig. 16—Fuel Tank Gauge Unit Removal

FUEL TANK VENT LINE

Sedan model fuel tanks are vented to the atmosphere at the top right forward edge of the tank. The vent line is connected by a rubber hose with two clamps one at the tank and the other at the vent pipe which is secured to the underbody as shown in Figure 10. A rubber grommet around the vent pipe acts as a seal to prevent gasoline fumes from entering the passenger compartment.

> ***IMPORTANT:*** It is important to note that the gas tank is not vented at the cap; therefore, it is necessary to be assured that the vent line is free from dirt, etc., and that the gas tank vent line is open at all times. If gasoline fumes are detected, the rubber grommet should be checked.

Station wagon and pickup model tanks are vented from the tank to the filler neck (fig. 11) and use a vented cap. The vent outlet pipe on the tank is connected to the vent inlet pipe on the filler neck by a rubber hose. The hose is secured with two wire clamps.

EXHAUST SYSTEM

INDEX

GENERAL DESCRIPTION

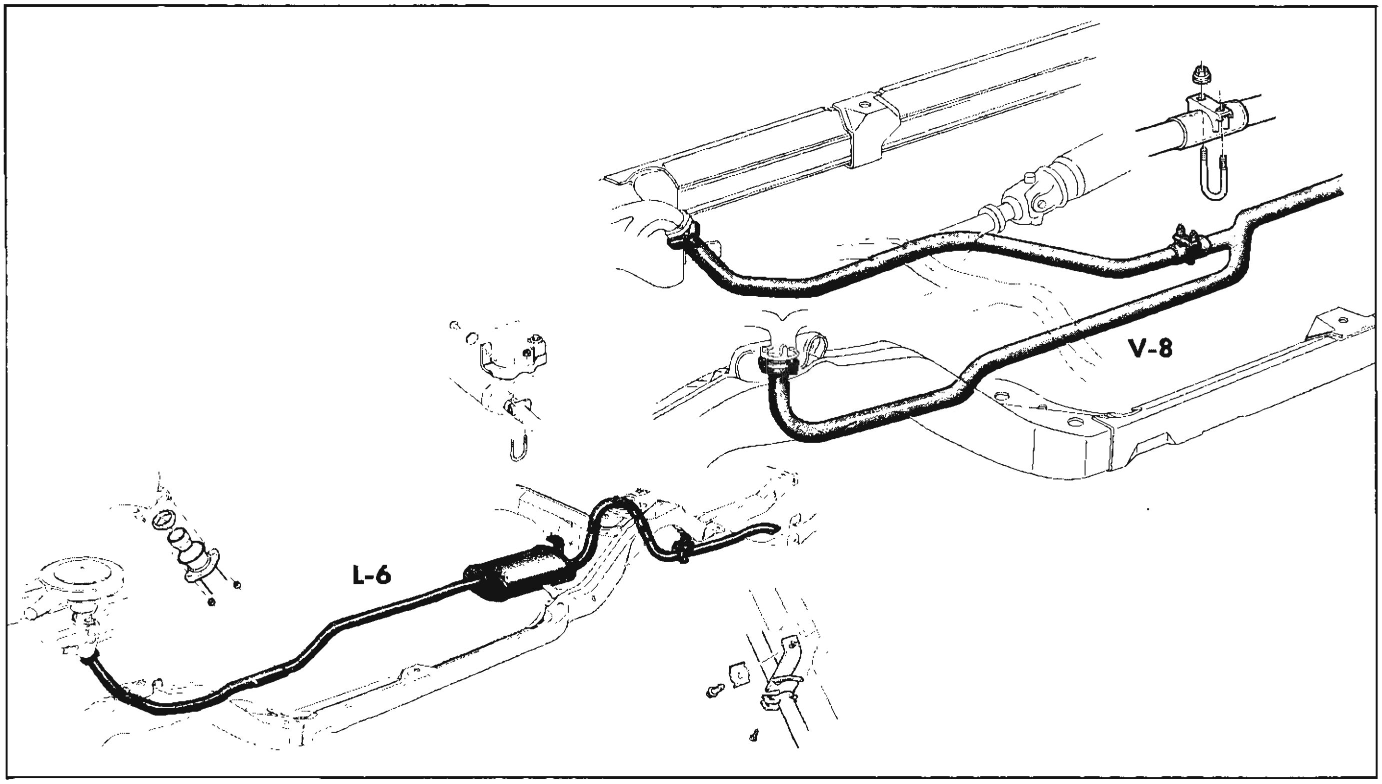


Fig. 17—Single Exhaust Systems

The single exhaust system used on all six cylinder engine models consists of an exhaust pipe, muffler and tail pipe (fig. 17). An exhaust crossover pipe is added on V-8 engine single exhaust models to connect the exhaust manifolds to the system. An optional dual exhaust system, available on V-8 engine models equipped with 4-barrel carburetor, includes two exhaust pipes, mufflers, and tail pipes and attaching hardware (fig. 18). All systems are suspended on brackets with insulators for rattle free operation.

The mufflers are a seam rolled construction with spot welded baffles, with a capacity for muffling the exhaust and at the same time, minimizing back pressure for maximum engine efficiency. The internal parts of the muffler are spot welded in position while external parts are electric arc-welded to eliminate a chance of premature failure or rattle.

The exhaust system center mounting at the muffler location (fig. 17) consists of an underbody bracket, an insulator and a clamp. The clamp holds the muffler and tail pipe with a "U" bolt and at the same time secures the muffler and pipe to the body.

The exhaust system mounting at the end of the tail pipe secures the pipe to a bracket assembly and insulator attached to an existing underbody bracket (fig. 17).

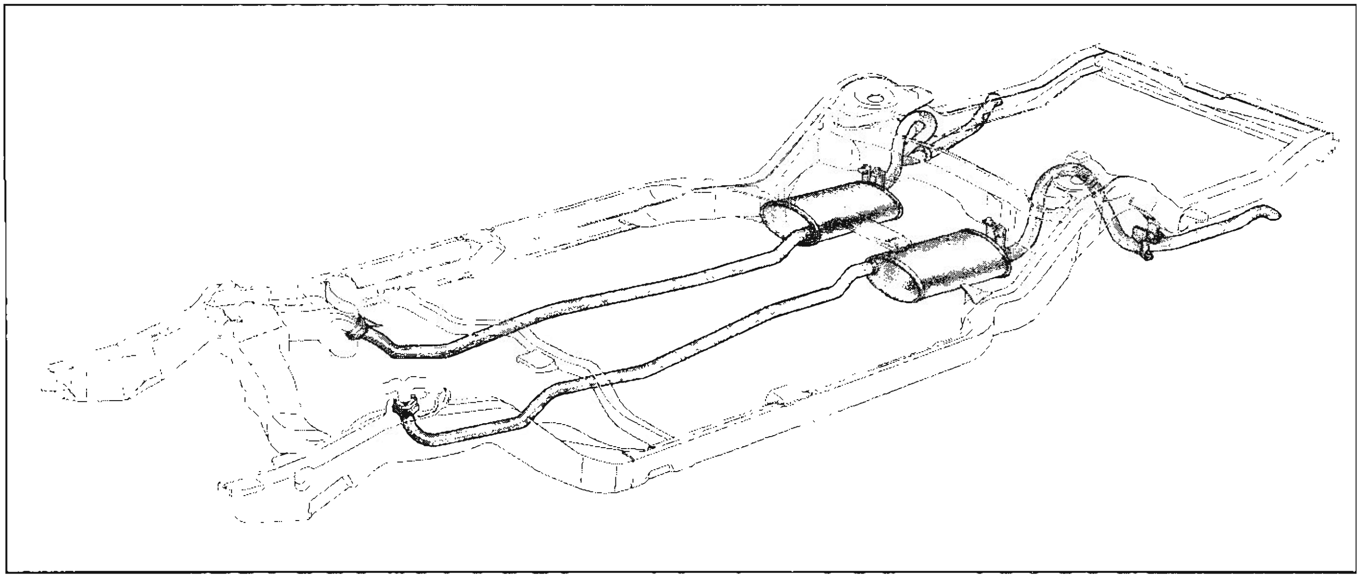


Fig. 18—Dual Exhaust System

COMPONENT PART REPLACEMENT

MUFFLER ASSEMBLY

Replacement (Service)

1. Cut the exhaust pipe near the muffler to allow sufficient pipe for muffler replacement:

   CAUTION: Before cutting the exhaust pipe measure service muffler exhaust pipe extension and make certain to allow 1-1/2" for engagement of exhaust pipe into muffler extension.

2. Remove "U" bolt clamp at center mounting and disengage muffler from tail pipe.
3. Install new muffler and secure with new "U" bolt clamps.
4. Realign and check clearances before finally tightening all hardware.

   NOTE: If bracket mounting insulators (tire carcass mountings) are fatigued, replace to insure a secure exhaust system.

EXHAUST PIPE

Replacement

On V-8 single exhaust models, if the left exhaust pipe has to be replaced it will be necessary to replace both the exhaust pipe and muffler with service replacement parts. The right exhaust crossover pipe may be replaced without replacing the entire system as follows:

1. Remove nuts attaching left and right exhaust pipes to exhaust manifolds.
2. Remove "U" bolt clamp retaining right exhaust pipe to exhaust system and remove pipe.
3. Using new manifold flange gaskets, install new exhaust pipe.

   NOTE: Check all clearances before tightening hardware.

TAIL PIPE

Replacement

1. Install tail pipe to rear of muffler.
2. Position tail pipe to obtain proper clearance to rear spring bracket and underside of frame rail.
3. Install tail pipe clamp over rear hanger and position on pipe to maintain vertical position of insulator without twist.
4. Tighten nuts on U-bolt clamp at rear of muffler, then secure rear tail pipe clamp.

CHEVY II FUEL TANKS

INDEX

GENERAL DESCRIPTION

All Chevy II Models have 16 gallon capacity fuel tanks mounted between the frame rails to the rear of the rear axle (fig. 19). The fuel tanks are basically the same for the passenger car and two-seat, six passenger station wagon models. The tanks are held in place by two metal straps attached individually to the underbody at each end. The straps hinge at the forward end and secure the tank at the rear with an adjustable bolt and nut assembly. The tank rests against the rear compartment pan reinforcement. The two-seat station wagon gas tank is secured to the contour of forward and rear underbody brackets. The filler neck is accessible by removal of a fender gas cap at the rear left fender location.

A fine mesh screen is located at the end of the fuel pick-up pipe to prevent the entrance of dirt into the system. The tank can be drained by siphoning at the filler neck or by removing the gauge sending unit and siphoning at the tank opening.

CAUTION: Care should be exercised to avoid denting or puncturing the fuel tank when installing or removing.

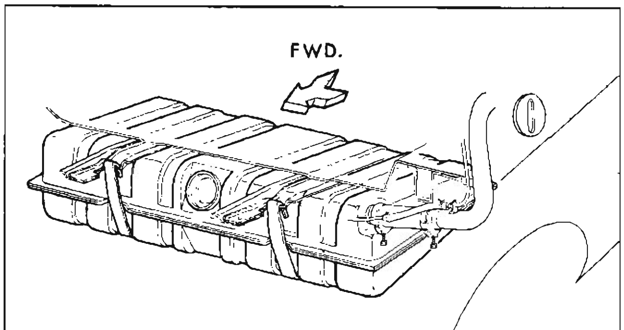


Fig. 19—Chevy II Fuel Tanks

COMPONENT PART REPLACEMENT

FUEL TANKS

Draining Tank

The absence of a drain plug in the Chevy Model gas tanks makes it necessary to siphon fuel from the tank when draining is needed. The following procedure is recommended.

1. Obtain approximately 10 feet of 3/8" I.D. hose and cut a flap-type slit 18" from one end. Make this cut on the hose in the direction toward the shorter end (See Figure 20).
2. Insert a small pipe nipple (slightly larger O.D. than the hose I.D.) into the opposite end of hose.
3. Insert the nipple end of the siphon hose into the fuel tank filler neck with the natural curl of the hose pointing down. Insert until the hose is heard to strike the bottom of the tank.
4. With the opposite end of the hose in a suitable container, insert an air hose in the flap-type slit in a downward direction and trigger the flow of fuel.

Removal and Installation

1. Drain fuel tank.
2. Raise vehicle.
3. Disconnect filler neck inlet hose and vent connection.
4. Remove the gas tank sending gauge unit access hole cover on station wagons.

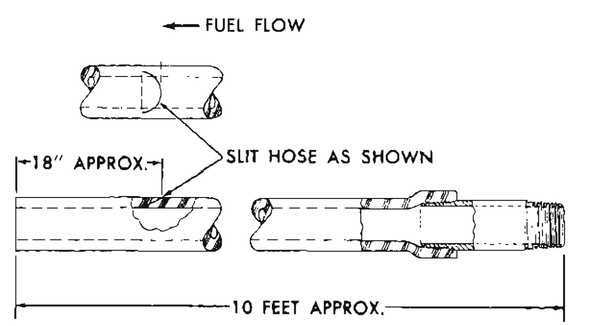


Fig. 20—Siphon Construction

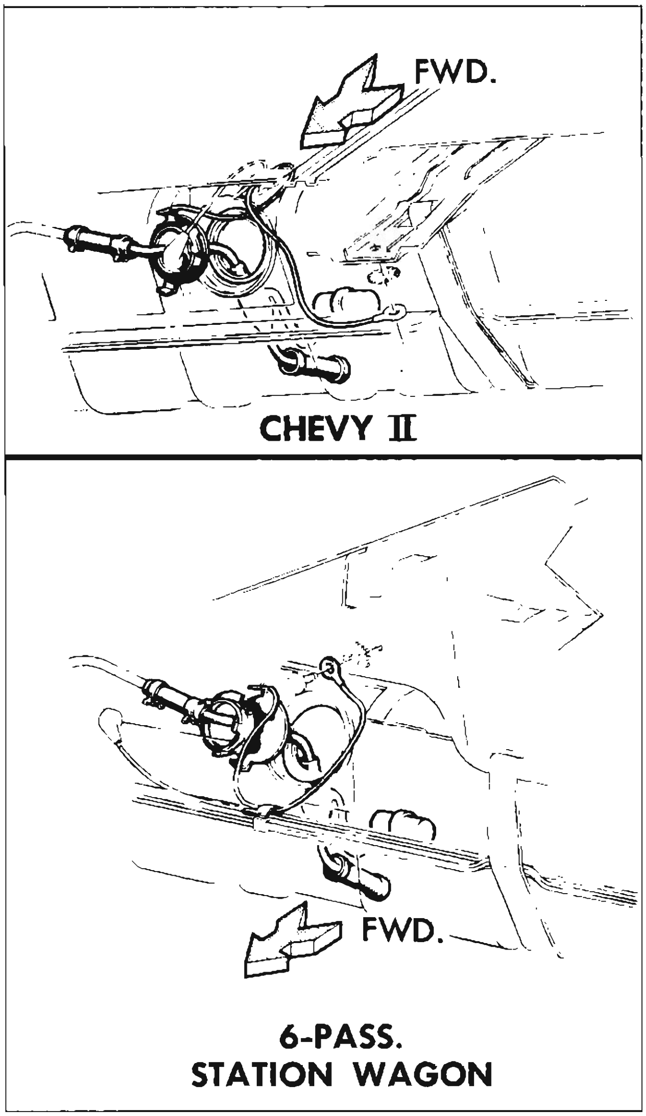


Fig. 21—Fuel Tank Gauge sending Units and Strainers

5. Disconnect fuel tank gauge sending unit with special spanner Tool J-8950, detach wire and fuel pick-up line at the gas tank.
6. Remove tank support straps and lower tank carefully.
7. Reverse procedure to install.

The sending units are located on the top forward end of the gas tanks (fig. 21). The fuel strainer is located at the end of these sending units (See Figure 21).

FUEL TANK GAUGE SENDING UNIT AND FUEL STRAINER

Replacement

1. Drain tank to a level below the unit.
2. Disconnect fuel pick-up line and gauge unit wire.
3. Use special Tool J-8950 to remove cam lock. Remove unit and rubber gasket.

CAUTION: Carefully remove unit so as not to damage screen on the end of the pipe.

4. Clean screen by blowing out with compressed air.
5. Reverse procedure to install.

FUEL LINES

The gasoline lines are routed on the underside of the underbody prop shaft tunnel off center, on the right side, opposite the single exhaust system. The lines (fig. 22) extend from the fuel tank, join the brake lines on dual clip assemblies, and then to the right side of the engine to the fuel pump and over the front of the engine to the carburetor. The fuel lines extend around the right side to the rear of the gas tank on the three-seat station wagon models.

Maintenance

CAUTION: Always drain gasoline from complete fuel system including carburetor, fuel pump and all fuel lines and fuel tank if the vehicle is to be stored for any appreciable length of time. This precaution will prevent accumulation of gum formation and resultant poor engine performance.

The fuel lines should occasionally be inspected for leaks, kinks, or dents. If evidence of dirt is found in the carburetor or fuel pump disassembly, the lines should be disconnected and blown out. Check the fuel tank strainer for damage or omission. Fuel lines are of 5/16" diameter tubing for regular installation with beaded-type ends for connections to hoses and flared ends for secure line connections.

FUEL TANK VENT LINE

The gas tanks are vented from the filler neck near the filler neck opening with 3/16" tubing which extends underneath the vehicle to the front of the gas tank (fig. 23).

IMPORTANT: It is important to note that the gas tank is not vented at the cap; therefore, it is necessary to be assured that the vent line is free from dirt, etc., and that the gas tank vent line is open at all times.

At the filler neck the vent line is wedged into an opening and secured by a snap-on clamp. The vent line is connected by a rubber hose with two wire clamps at the gas tank location and routed to the gas tank hinge strap access hole where the tubing end is protected by a rubber grommet and a screw and shield secured in the hole at the strap end.

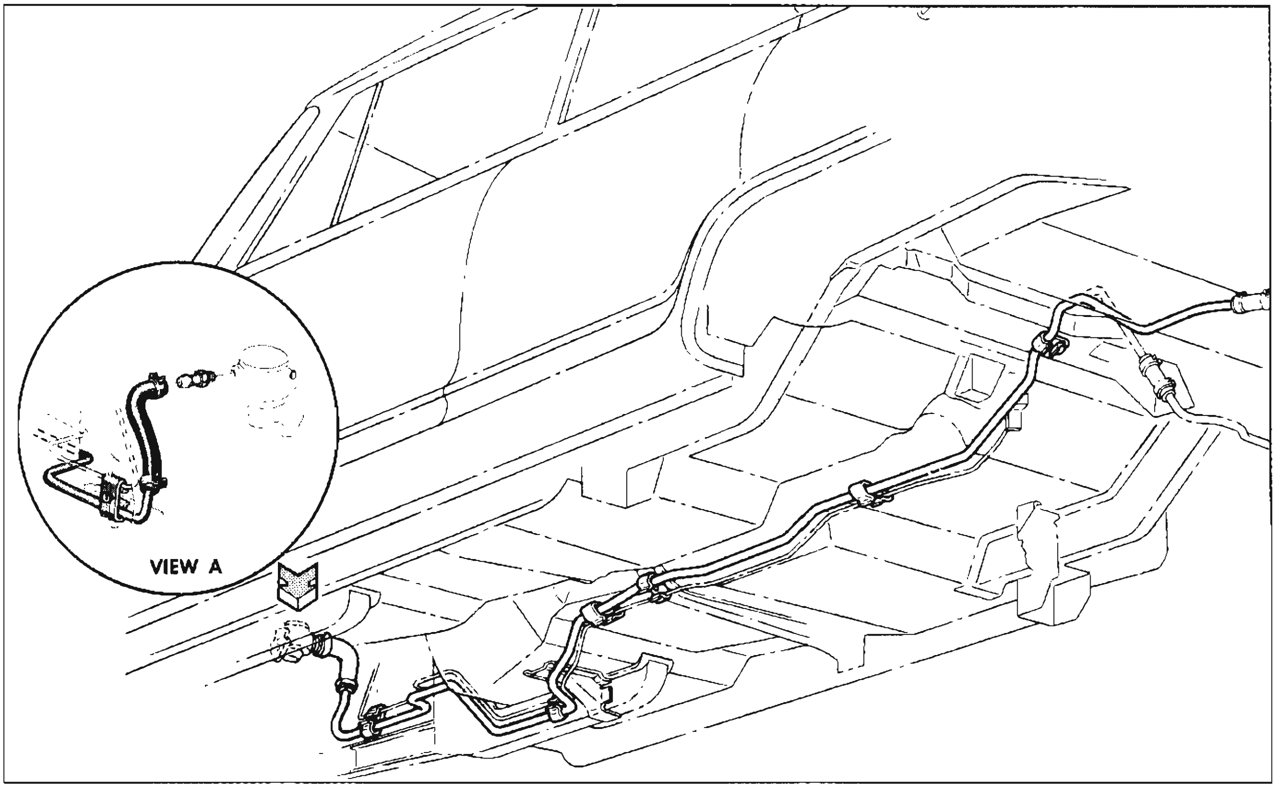


Fig. 22—Fuel Lines

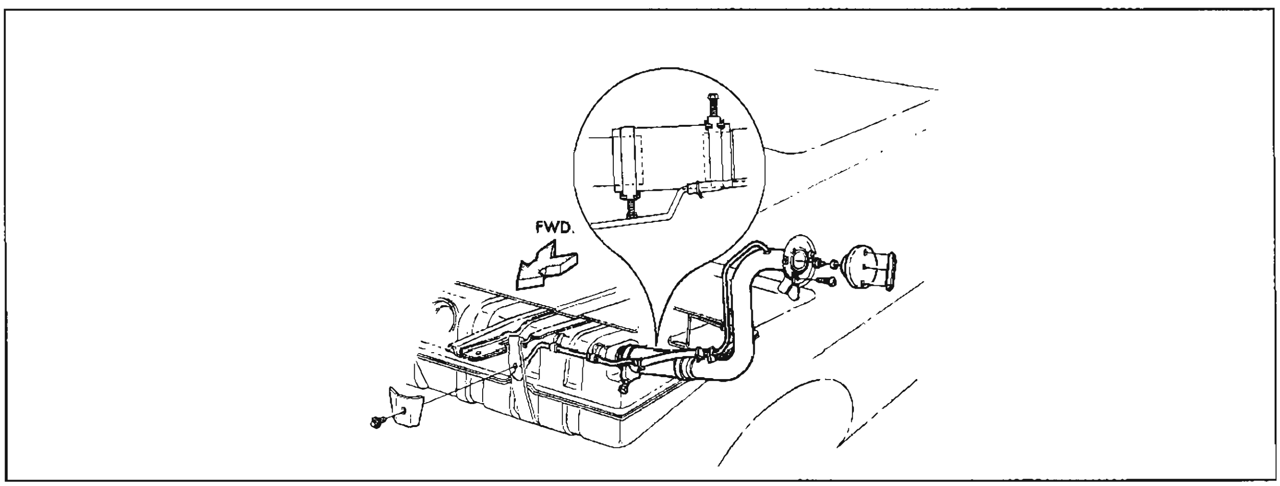


Fig. 23—Fuel Tank Vent Lines

EXHAUST SYSTEM

INDEX

GENERAL DESCRIPTION

The single exhaust system on all Chevy II Models for both four and six cylinder engines consist of an exhaust pipe, muffler and tail pipe. The system is secured to the engine at the exhaust manifold, to the center mounting at the muffler location and adjacent to the gas tank at the end of the tail pipe. The system is suspended on brackets with insulators for rattle free operation (fig. 24). The muffler is an all-welded construction with a capacity for muffling the noise and at the same time, minimizing back pressure for maximum engine efficiency. The internal parts of the muffler are spot welded in position while external parts are electric arc welded to eliminate a chance of premature failure or rattle (fig. 25).

The exhaust system center mounting at the muffler location (fig. 26) consists of an underbody bracket, an insulator and a clamp. The clamp holds the muffler and tail pipe with a "U" bolt and at the same time secures the muffler and pipe to the body.

The exhaust system mounting at the end of the tail pipe secures the pipe to a bracket assembly and insulator attached to an existing underbody bracket (fig. 27).

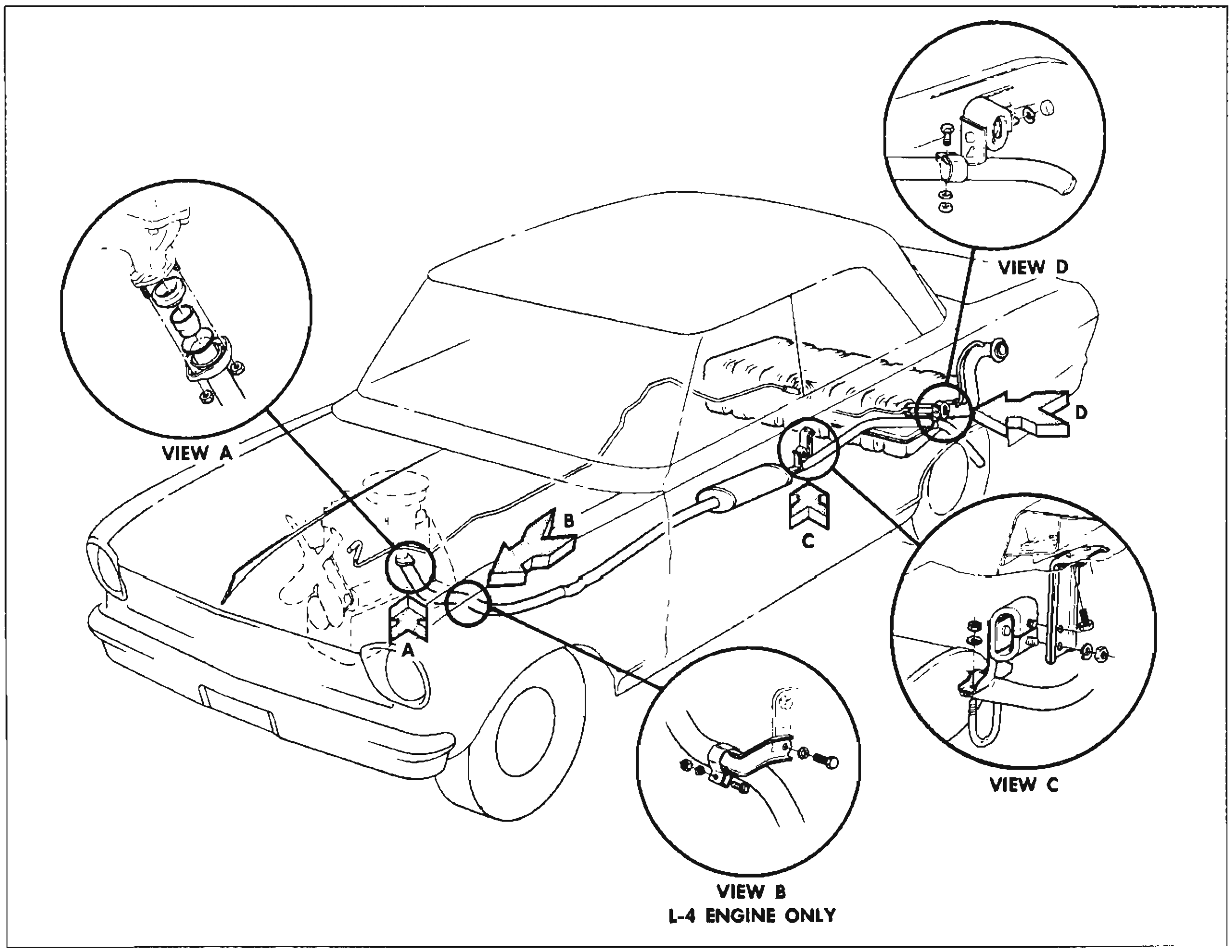


Fig. 24—Chevy Single Exhaust System

COMPONENT PART REPLACEMENT

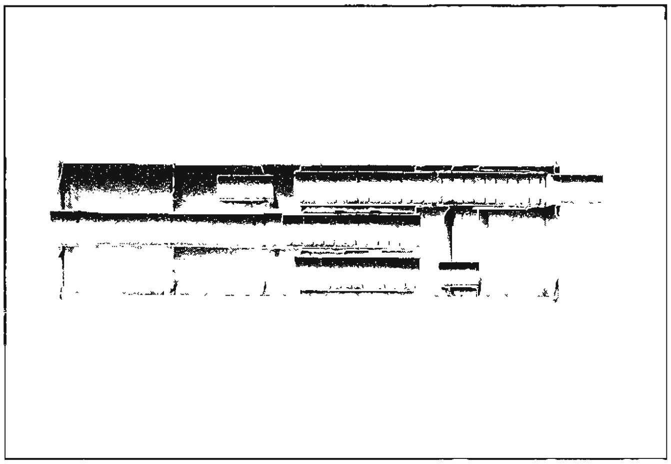


Fig. 25—Muffler

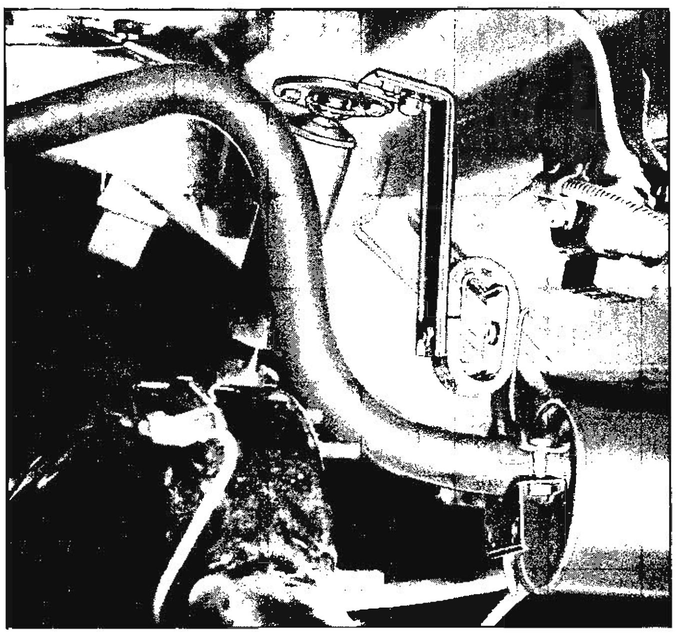


Fig. 26—Exhaust System Mounting at Muffler

Installation of an exhaust system should have the parts in proper relationship with each other for carefree operation.

Annoying rattles are usually a result of incorrect alignment of the exhuast system due to incorrect clearances. Unusual noises which are hard to locate are sometimes directly caused by improper mountings which change or obstruct normal flow of engine exhaust gases.

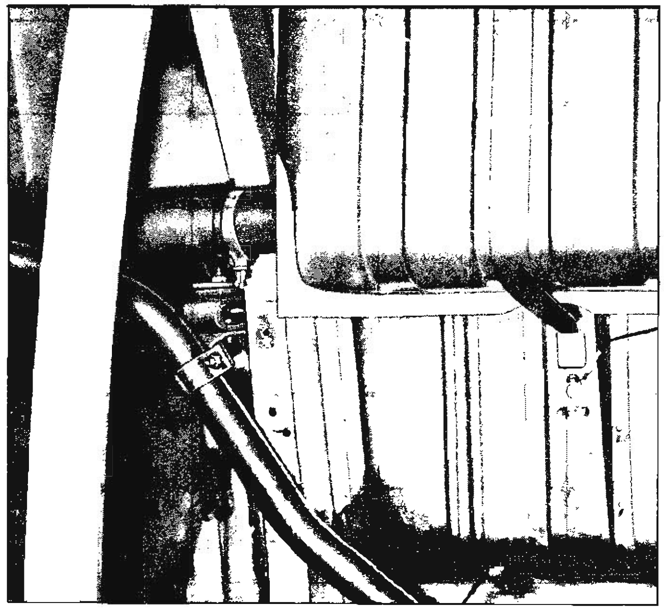


Fig. 27—Exhaust System Mounting at End of Tail Pipe

MUFFLER ASSEMBLY

Remove and Replace (Service)

1. Remove "U" bolt clamp at muffler mounting.
2. Remove muffler from exhaust pipe by cutting the pipe with a cutting torch or hacksaw. Cut cleanly and close to the muffler inlet for adequate surface for muffler replacement.
3. Remove the muffler from the tail pipe with a hammer.
4. Replace with a new muffler and/or tail pipe and exhaust pipe, as required.
5. Use existing hardware for replacement, plus a new "U" bolt and two nuts to secure the muffler to the tail pipe.
6. Attach a new clamp assembly to the muffler and exhaust pipe.
7. Realign and check clearances before finally tightening all hardware.

NOTE: If bracket mounting insulators (tire carcass mountings) are fatigued, replace to insure a secure exhaust system.

EXHAUST AND TAIL PIPES

Refer to Muffler assembly and Figures 25 and 27 for replacement.

SPECIAL TOOLS

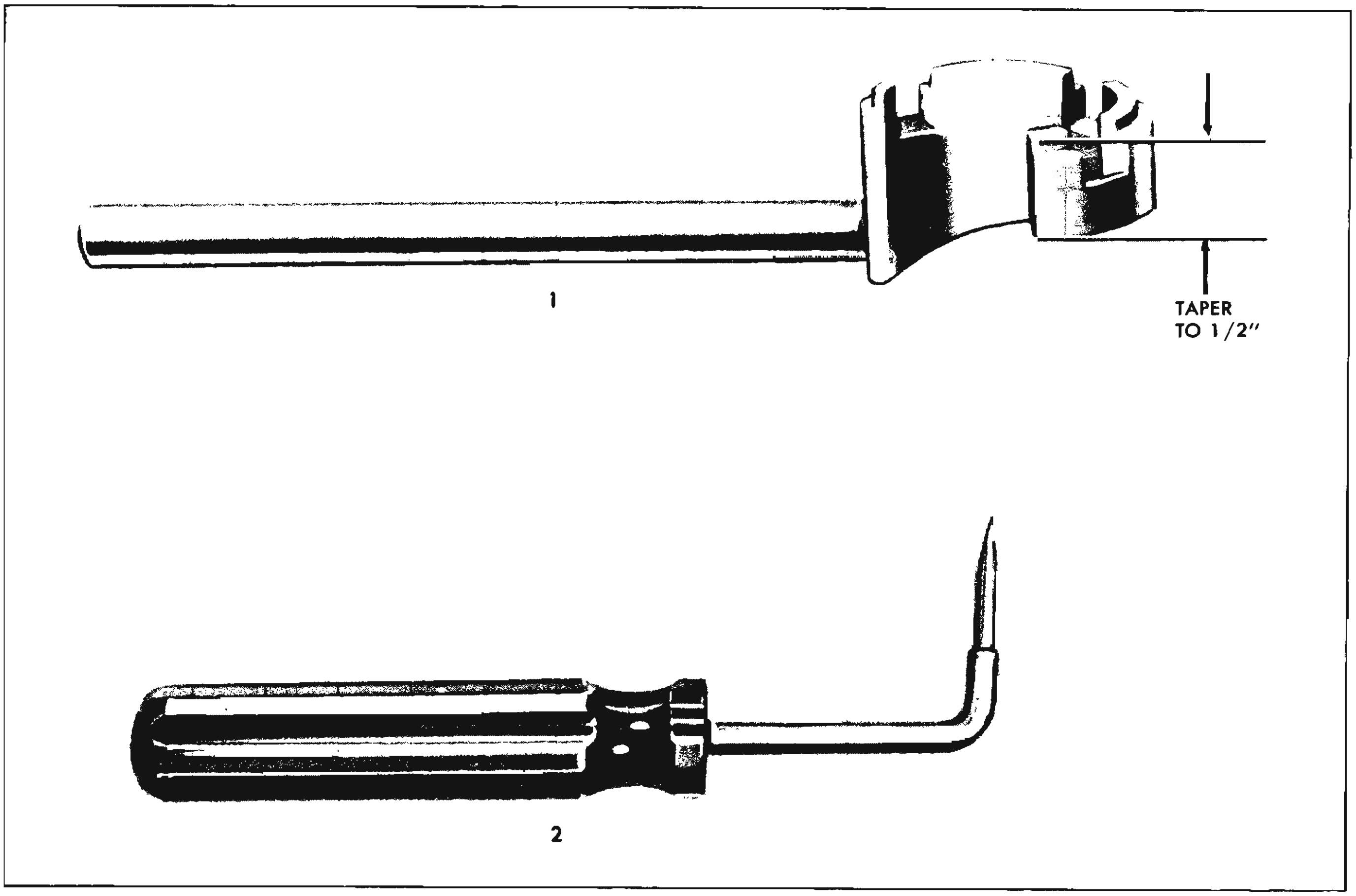


Fig. 28—Special Tools

1. J-8950 Fuel Tank Gauge Unit Spanner
2. J-7777 Fuel Line Clip Installer

SECTION 9
STEERING

CONTENTS OF THIS SECTION

STANDARD STEERING

INDEX

GENERAL DESCRIPTION

The regular production steering gear is the recirculating ball type. This gear provides for ease of handling by having forces transmitted from worm to sector gear through ball bearings. The steering linkage is of the relay type, and extended interval lubrication design, with the pitman arm connected to one end of the relay rod. The other end of the relay rod is connected to an idler arm which is connected to the frame side rail opposite the steering gear. Pivoting at the connections at each end of the idler arm is accomplished in rubber insulated plastic bushings for Chevrolet and Chevelle and rubber bushings for the Chevy II. Connecting the relay rod to the steering arms are two adjustable tie rods with self adjusting ball and socket type joints.

The hole for lubrication fittings in the replacement tie rod sockets, front suspension ball studs, steering connecting rods and various other parts will not be threaded. This will make it necessary to use the self threading type lubrication fittings where applicable.

MAINTENANCE AND ADJUSTMENTS

LUBRICATION

The steering gear is filled at the factory with a water resistant grease. Seasonal change of this lubricant is unnecessary and the housing should not be drained. The steering gear lubricant level should be checked every 36,000 miles. Whenever required, additions should be made using a water resistant EP Chassis Lubricant. Check and fill steering gear as follows:

1. Remove lower and outboard cover retaining screws (fig. 1).
2. Insert filling device in lower screw hole.
3. Inject lubricant until it appears in outboard screw hole; gear is now filled to correct level.

The steering linkage should be lubricated with water resistant EP Chassis Lubricant every 6,000 miles or 6 months, whichever occurs first. Lubrication points and additional information on the chassis lubricant to be used can be found in Section 0 - General Information and Lubrication.

ADJUSTMENTS

Steering Gear

Before any adjustments are made to the steering gear in an attempt to correct such conditions as shimmy, loose or hard steering and road shocks, a careful check should be made of front end alignment, shock absorbers, wheel balance and tire pressure for possible causes.

Correct adjustment of steering gear is very important. While there are but two adjustments to be made, the following procedure must be followed step-by-step in the order given.

NOTE: If vehicle is equipped with a Tilt steering column it will be necessary to disconnect the steering coupling to obtain a torque reading of the steering column. This torque should then be subtracted from any reading taken on the gear.

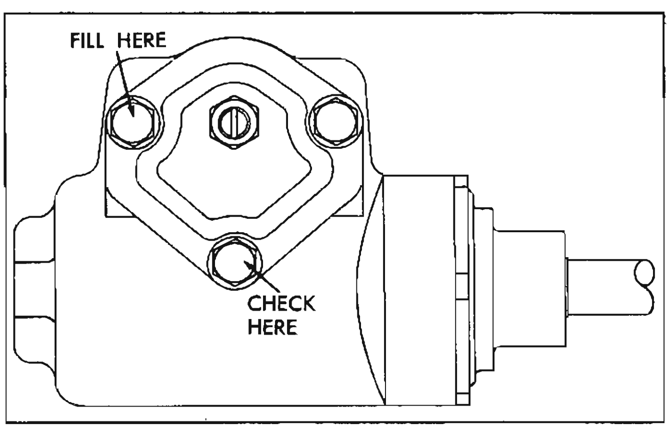


Fig. 1—Side Cover Attaching Bolts—Chevy II Shown

1. Remove pitman arm nut and mark relation of pitman arm position to sector shaft. Remove pitman arm with Tool J-6632 as shown in Figure 2.
2. Loosen the pitman shaft lash adjuster screw locknut and turn the adjuster screw a few turns in a counterclockwise direction (fig. 3). This removes the load imposed on the worm bearings by the close meshing of rack and sector teeth. Turn steering wheel gently in one direction until stopped by gear, then back away about one turn.

CAUTION: Do not turn steering wheel hard against stops when steering relay rod is disconnected as damage to ball guides may result.

3. Disconnect horn wire at chassis wiring connector to mast jacket.
4. Remove horn cap or ornament and using an inch pound torque wrench and socket on the steering wheel nut measure the torque required to keep the wheel in motion. See specifications for proper worm bearing preload.

NOTE: If the pull necessary to move the wheel does not lie between the limits given, adjustment of worm bearings is necessary.

5. To adjust worm bearings, loosen worm bearing adjuster locknut and turn worm bearing adjuster shown in Figure 3 until there is no perceptible end play in worm. Check pull at steering wheel nut, readjusting if necessary to obtain proper pull. Tighten locknut and recheck pull. If the gear feels "lumpy" after adjustment of worm bearings, there is probably damage in the bearings due to severe impact or to improper adjustment and the gear must be disassembled for replacement of damaged parts.

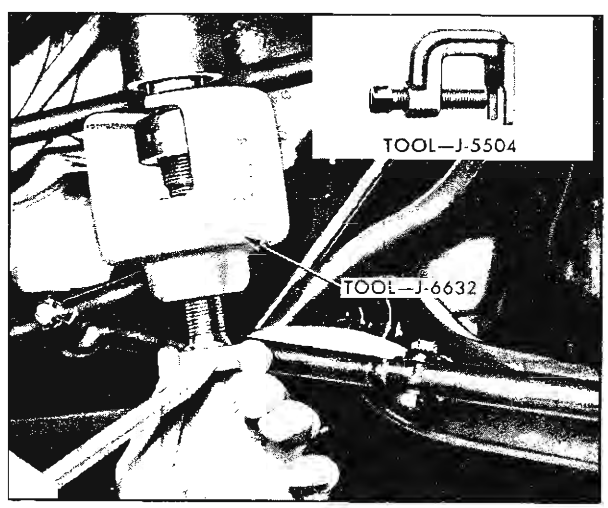


Fig. 2—Removing Pitman Arm

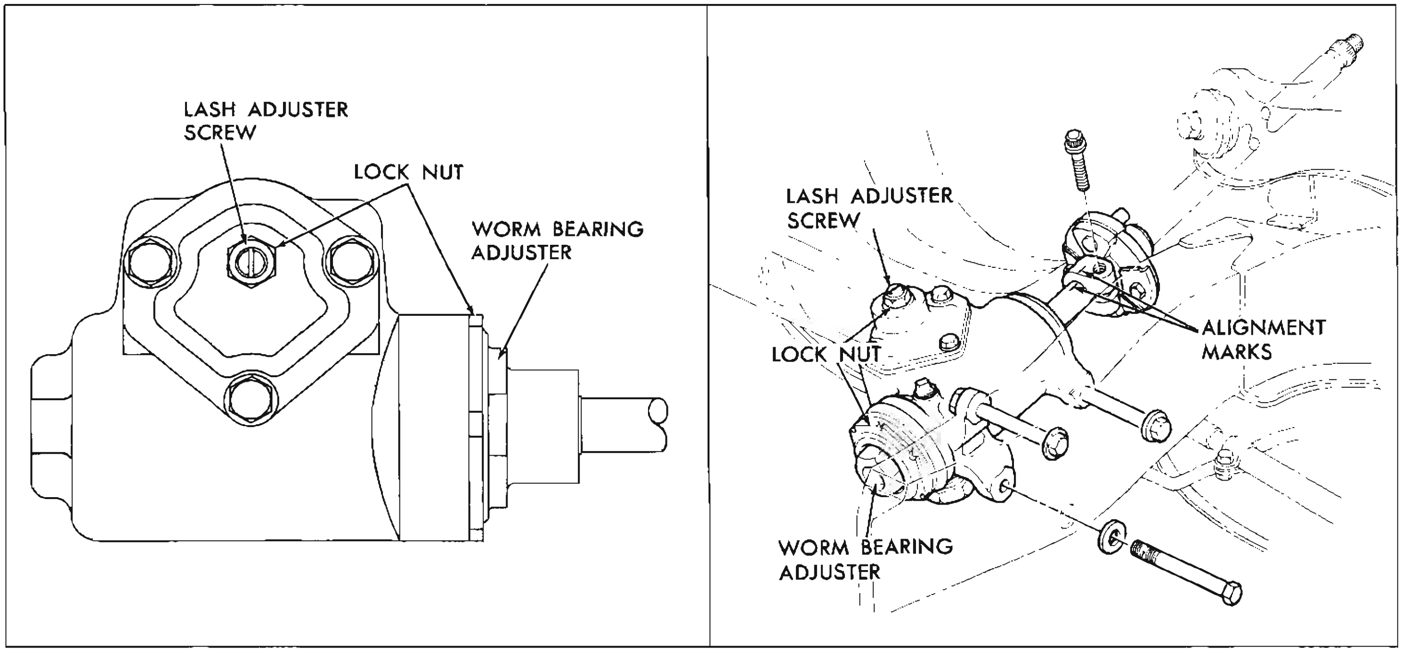


Fig. 3—Steering Gear Adjustment Points

6. After proper adjustment of worm is obtained, and all mounting bolts securely tightened, adjust lash adjuster screw. First turn the steering wheel gently from one stop all the way to the other, carefully counting the total number of turns. Then turn wheel back exactly half way, to center position. Turn lash adjuster screw clockwise to take out all lash in gear teeth, and tighten locknut. Check pull at steering wheel nut with torque wrench, taking highest reading as wheel is turned through center position. See Specifications for proper sector lash adjustment. Readjust if necessary to obtain proper pull.

   NOTE: If maximum specification is exceeded, turn lash adjuster screw counter-clockwise, then come up on adjustment by turning the adjuster in a clockwise motion.

7. Tighten locknut then recheck pull as it must lie between specified limits.
8. Reassemble pitman arm to sector shaft, lining up marks made on disassembly. Torque nut to 100-125 ft. lbs.
9. Install horn cap or ornament and connect horn wire at chassis connector.

Steering Wheel Alignment and High Point Centering

1. Set front wheels in straight ahead position. This can be checked by driving vehicle a short distance on a flat surface to determine steering wheel position at which vehicle follows a straight path.
2. With front wheels set straight ahead, check position of mark on wormshaft designating steering gear high point. This mark should be at the top side of the shaft at 12 o'clock position and lined up with the mark in the coupling lower clamp.
3. If gear has been moved off high point when setting wheels in straight ahead position, loosen adjusting sleeve clamps on both left and right hand tie rods, then turn both sleeves an equal number of turns in the same direction to bring gear back on high point.

   CAUTION: Turning the sleeves an unequal number of turns or in different directions will disturb the toe-in setting of the wheels.

4. Readjust toe-in as outlined in Section 3 (if necessary).
5. With wheels in a straight ahead position and the steering gear on highpoint check the steering wheel alignment by measuring the distance from each spoke to the horizontal centerline of the steering wheel (fig. 4). If the difference in dimension is greater than 1-1/8 inches the wheel should be removed and centered. (See Steering Wheel Removal in this section.)

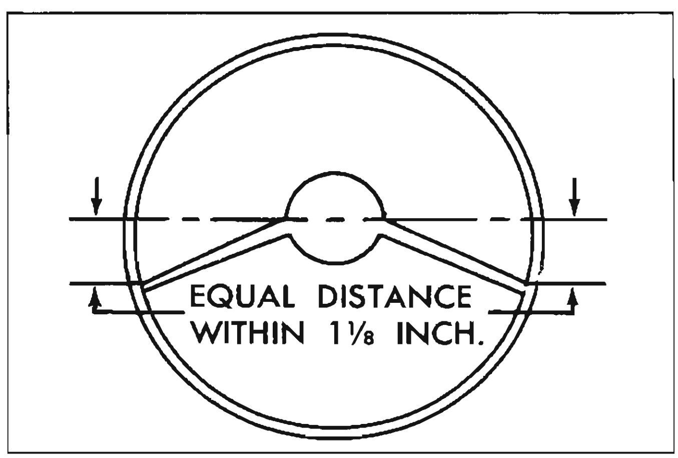


Fig. 4—Steering Wheel Alignment

Mast Jacket Lower Bearing Adjustment

(Chevrolet Only)

1. Loosen spring clamp bolt.
2. Position clamp to allow .005 min. to .030 max./axial movement of steering shaft.
3. Tighten clamp bolt to 15 to 20 ft. lbs.
4. Check to see that there is at lease 1/8" clearance between the clamp and the mast jacket to avoid any interference.

Toe-In Adjustment

A procedure for adjusting. the steering linkage for proper toe-in setting is described in Section 3.

COMPONENT REPLACEMENT AND REPAIRS

STEERING WHEEL

Regular Production

Removal

1. Disconnect directional signal switch harness from chassis wiring harness at connector.
2. Pull out horn button on standard series models. On remaining models pull out center ornament from horn ring.
3. Remove three screws from the receiving cup or horn ring.
4. Remove the receiving cup or horn ring, belleville spring, bushing and on deluxe wheel the pivot ring.
5. Remove the steering wheel nut and washer.
6. Using Tool J-2927 install centering adapter on steering shaft, thread puller anchor screws into threaded holes provided in steering wheel. Turn center bolt of tool clockwise to remove steering wheel. (fig. 5)

NOTE FOR CHEVELLE ONLY: Before installing steering wheel make certain that steering shaft stop clamp at bottom of mast jacket is secured and that steering shaft is 1-3/4 inches above the top of directional housing (fig. 8).

CAUTION: Direction signal control assembly must be in neutral position when assembling steering wheel to prevent damage to cancelling cam and control assembly (fig. 9).

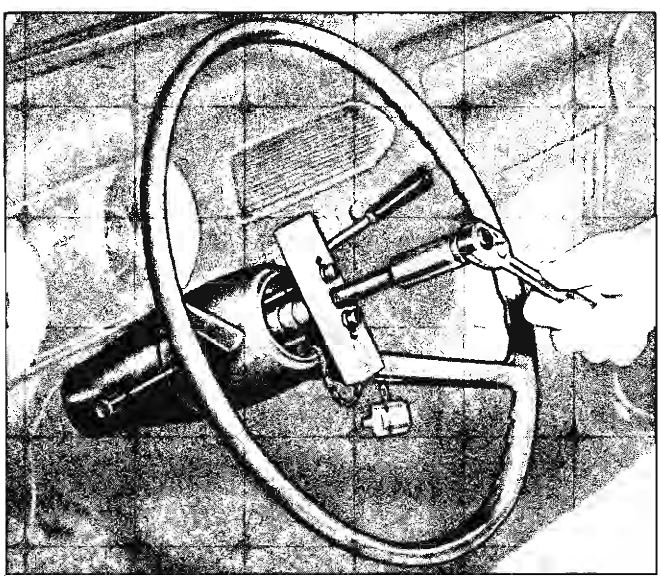


Fig. 5—Removing Steering Wheel with J-2927

1. With directional cancelling cam and horn contact assembly in place, set wheel on to steering shaft (on Chevelle only be sure cancelling cam tower enters hole provided in steering wheel). Secure with washer and nut and torque to 35 to 40 ft. lbs.
2. Install belleville spring (with dish of spring up), pivot ring (on deluxe wheels), horn ring or cup assembly, bushing and screws (tighten securely).
3. Install horn cap or horn ring ornament.
4. Connect directional wiring harness to chassis wiring harness.

Simulated Wood (Fig. 10)

Removal

1. Disconnect directional signal switch harness from chassis wiring harness at connector.
2. Remove horn cap assembly by pulling up.
3. Remove steering wheel nut and washer.
4. Remove three contact assembly attaching screws and remove contact assembly.
5. Remove remaining six screws from steering wheel and remove wheel from hub assembly.
6. Using Tool J-2927 install centering adapter on steering shaft, thread puller anchor screws into threaded holes provided in hub assembly. Turn center bolt of tool clockwise to remove hub assembly.

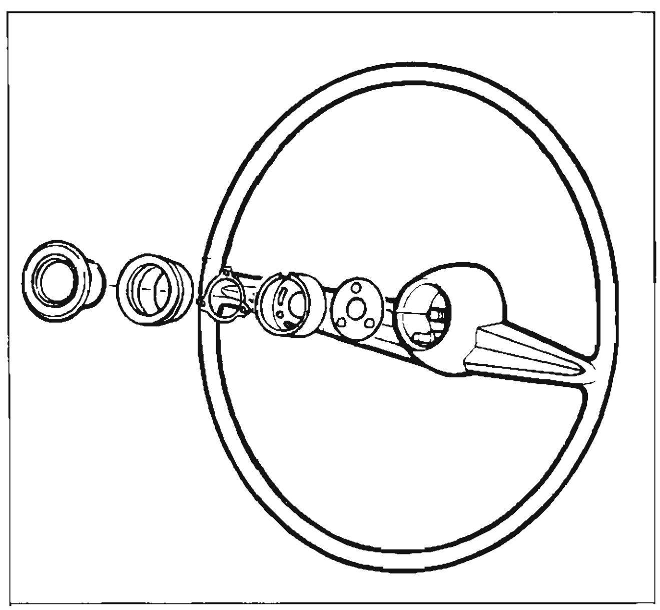


Fig. 6—Horn Button Attachments—Typical

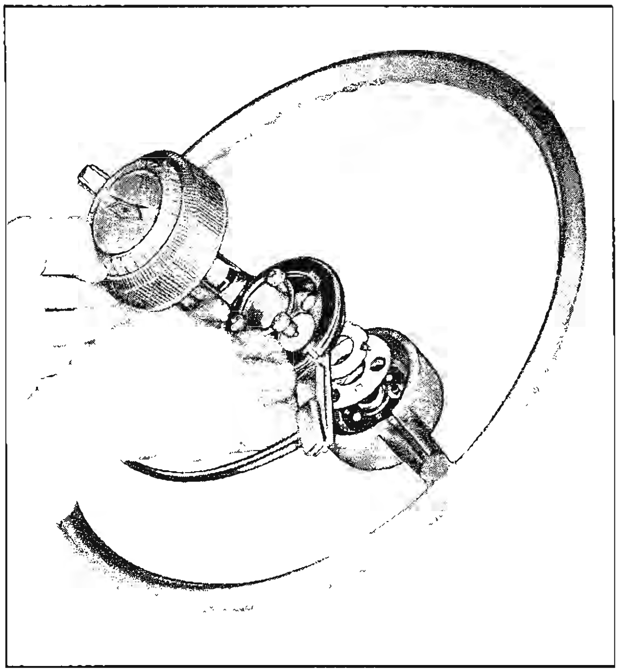


Fig. 7—Horn Ring Attachments—Typical

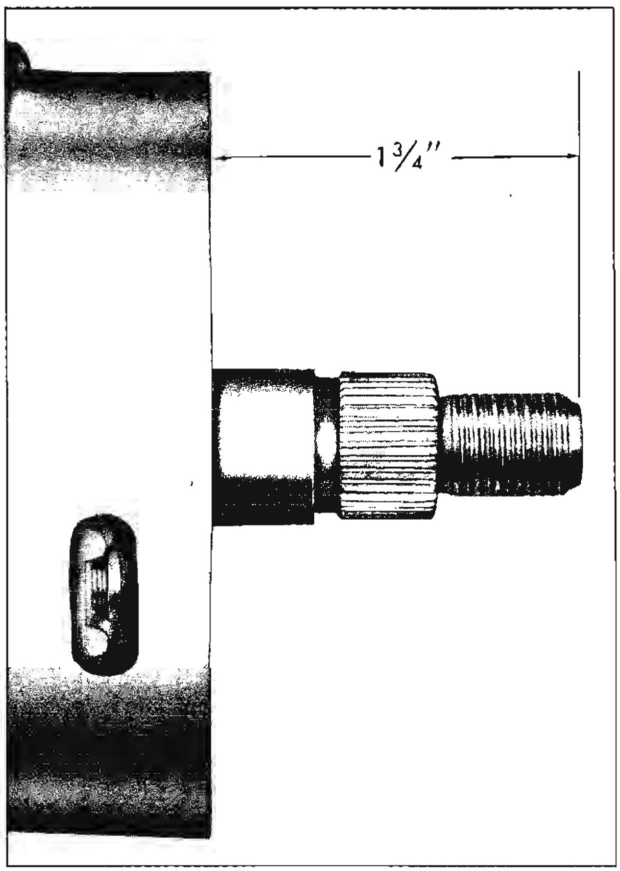


Fig. 8—Steering Shaft Position (Chevelle only)

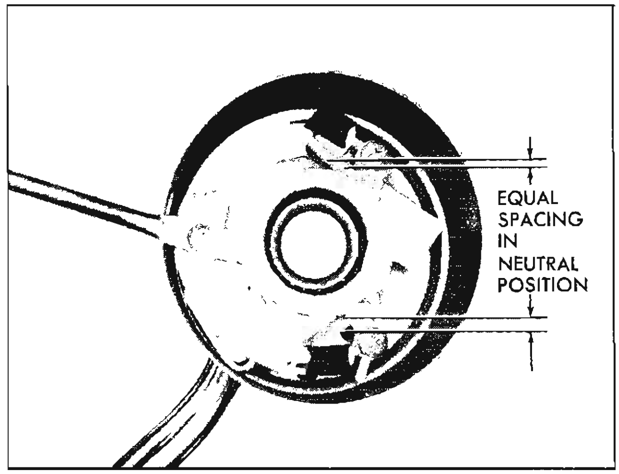


Fig. 9—Turn Signal Lever Position Before Installing Wheel (Chevrolet Shown)

Installation

NOTE FOR CHEVELLE ONLY: Before installing hub assembly make certain that steering shaft stop clamp at bottom of mast jacket is secured and that steering shaft is 1-3/4 inches above the top of directional housing (fig. 8).

CAUTION: Directional signal control assembly must be in neutral position when assembling hub assembly to prevent damage to cancelling cam and control assembly (fig. 9).

1. With directional cancelling cam and horn contact in place, install hub assembly on steering shaft (on Chevelle only engage cancelling cam tower into hole provided in hub assembly). Secure with washer and nut and torque to 35 to 40 ft. lbs.
2. Attach steering wheel to hub assembly with the six attaching screws and tighten securely.
3. Place horn contact assembly on steering wheel, attach with three screws and tighten securely.
4. Snap horn button in place.
5. Connect directional switch harness to chassis wiring harness.

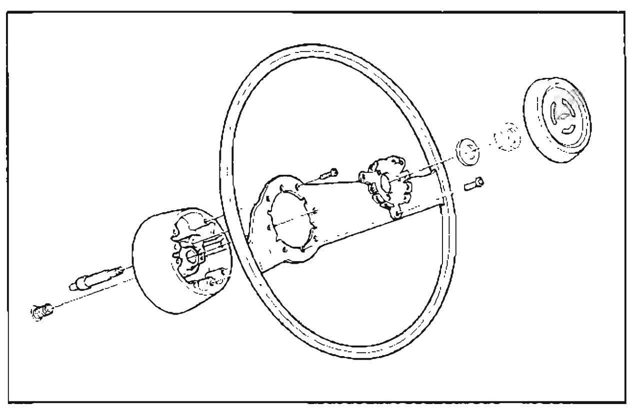


Fig. 10—Simulated Wood Steering Wheel and Attaching Parts

STEERING COUPLING

Removal (Chevrolet & Chevelle)

Before removing the steering coupling, either the steering gear must be lowered from its proper position or the steering gear shaft must be loosened and pulled upward far enough to permit the coupling to be removed from the wormshaft. The upper half of the coupling is an integral part of the steering shaft except on Tilt wheel models.

1. Remove bolt from coupling clamp.

   NOTE: This is a special bolt and will require a 12 pt. socket or box wrench.

2. Tap with a soft mallet to remove coupling from wormshaft. The coupling is splined to the steering wormshaft.
3. Remove the two retaining nuts, bolts, reinforcements, and lock washers (fig. 11). Separate the lower "split-clamp" and, remove the wafer type coupling and two locking pins.

Installation

1. If disassembled, first set the flexible coupling in place then match up the large locking pin with the large slot in the flange. Install and tighten the attaching bolts, nuts, washers and retainers. Torque units to 15-20 ft. lbs.
2. Align the "split clamp" to the lower steering gear shaft and install the coupling.
3. Install the special bolt into the clamp and tighten to 25-35 ft. lbs. torque.

UPPER MAST JACKET BEARING

(Chevrolet and Chevy II)

Removal

1. Remove steering wheel as outlined in this section.
2. Remove directional signal handle by removing attaching screw.

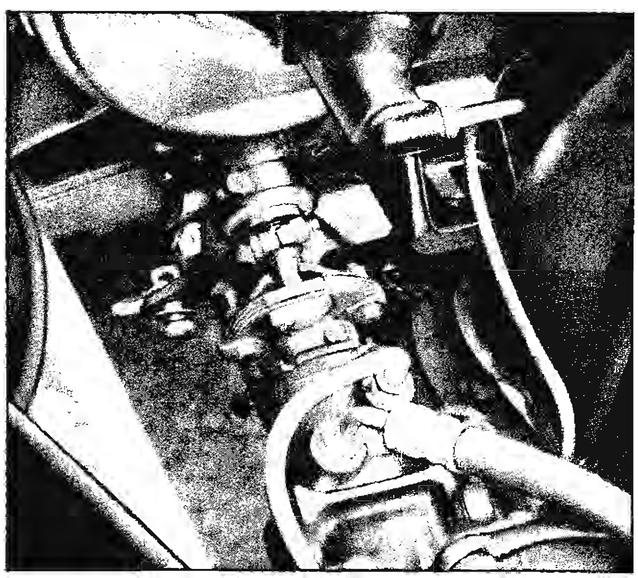


Fig. 11—Steering Coupling

3. Remove three directional signal switch attaching screws.
4. Guide directional wiring while pulling out directional switch assembly far enough to clear steering shaft.
5. Carefully pry out horn contact plate from directional signal switch.

   CAUTION: Contact plate will bend easily.

6. Pull upper mast jacket bearing from directional signal switch assembly.

Installation

1. Position bearing into directional signal switch and press by hand into place.
2. Place horn contact plate into directional switch, with the horn contact terminal engaging the horn wire connector, and press into position by hand.
3. Position directional signal switch over steering shaft and into housing. Secure with the three attaching screws. Be sure to pull directional wiring at lower end lightly while performing this operation.
4. Install directional signal handle and secure with attaching screw.
5. Install steering wheel as outlined in this section.

Chevelle

Removal

1. Remove steering wheel as outlined in this section.
2. Remove horn contact spring assembly, spring and directional switch cancelling cam.
3. Remove directional signal switch lever and attaching screw.
4. Remove the three directional signal switch attaching screws.
5. Remove directional signal wiring cover.
6. Guide directional wiring up through housing while pulling out directional signal switch far enough to clear steering shaft.
7. Remove two upper mast jacket bearing retaining screws and pull bearing out of signal switch.

Installation

1. Position bearing into signal switch, (be sure to align notches and tangs) secure with the two retaining screws.
2. Position directional signal switch over steering shaft and into housing. Secure with the three attaching screws.
3. Install directional signal switch lever and attaching screw.
4. Install directional signal wiring cover.
5. Install directional switch cancelling cam, spring and horn spring contact assembly.
6. Install steering wheel as outlined in this section.

MAST JACKET

Chevrolet (Fig. 12)

Removal

1. Disconnect transmission linkage from shift levers if so equipped.
2. Remove the steering coupling to wormshaft clamp bolt.
3. From inside the vehicle remove the mast jacket toe panel trim plate by removing the two attaching screws.

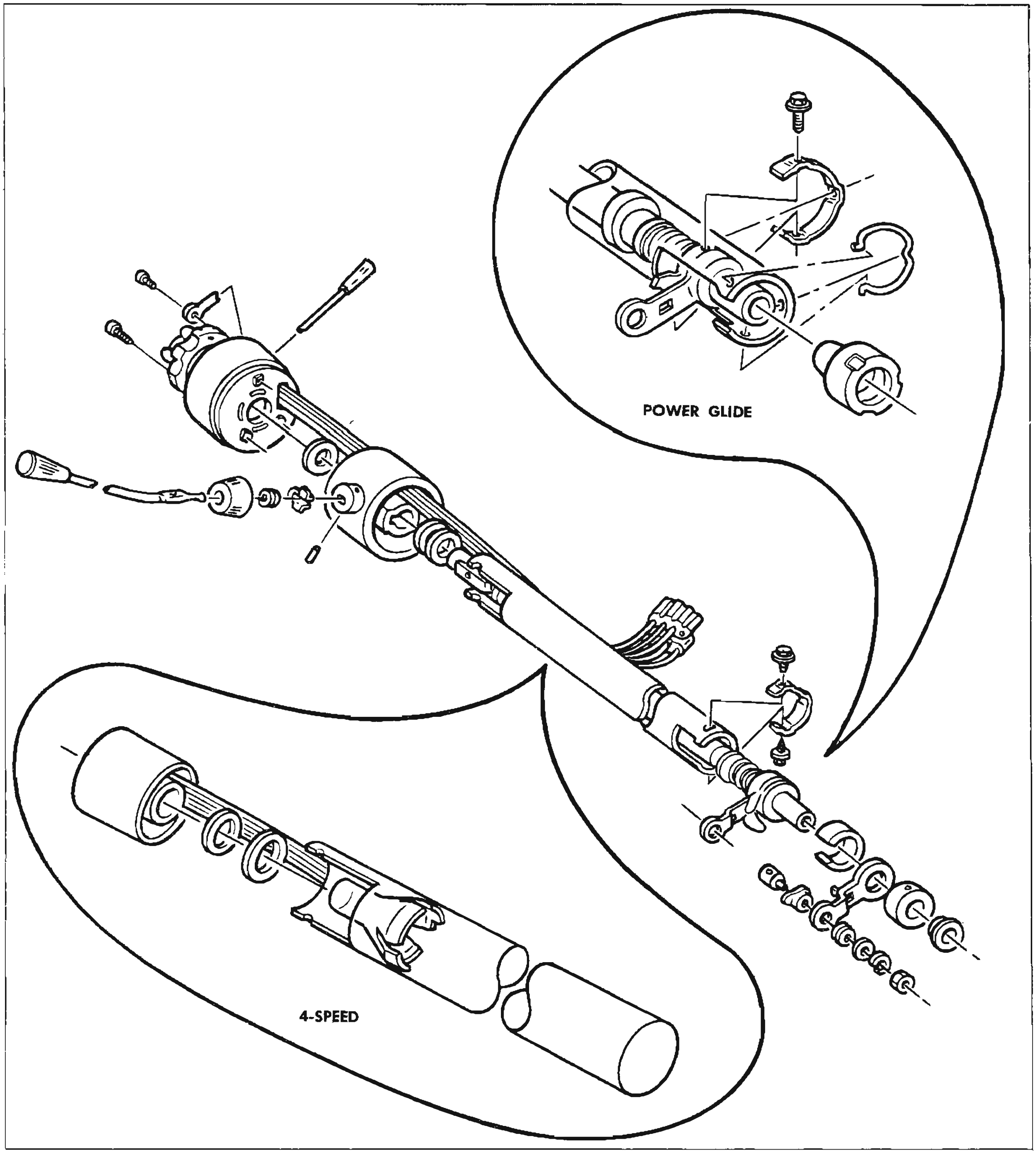


Fig. 12—Mast Jacket—Chevrolet

4. Remove the four screws from the mast jacket lower bracket.
5. At the upper end of the mast jacket remove the jacket lower trim cover by removing the two attaching screws.
6. On Powerglide models only, loosen the allen set screw and remove the transmission shift indicator.
7. Disconnect directional signal wiring harness at chassis connector, (Also disconnect back up light

wires and neutral safety switch wires at the switch if so equipped).
8. Remove the mast jacket to dash panel clamp by removing the two attaching nuts and washers.
9. Adjust the front seat to the rear as far as possible.
10. Slowly remove the mast jacket up through the floor panel while guiding the shift levers through the opening.

Disassembly

1. Remove steering wheel as described under "Steering Wheel Removal" in this section.
2. Remove neutral safety switch or back up light switch from the mast jacket assembly if so equipped.
3. Slide gearshift lever rubber boot back from support housing and using a punch, drive out the shift lever pin. Remove lever, clip and anti-rattle spring. (Disregard this step for 4 spd. trans. models).
4. Remove directional signal lever and attaching screw.
5. Remove directional switch wiring clips. The lower clip by removing the one attaching screw and the upper clip by carefully prying up one side and turning it out of the way.
6. Remove the three directional switch attaching screws, and turn directional housing counter-clockwise against stops to remove switch and housing together.
7. The switch may be removed from the housing by feeding the wire connectors up through the housing opening one at a time.
8. Remove shifter housing and washer from shift tube.

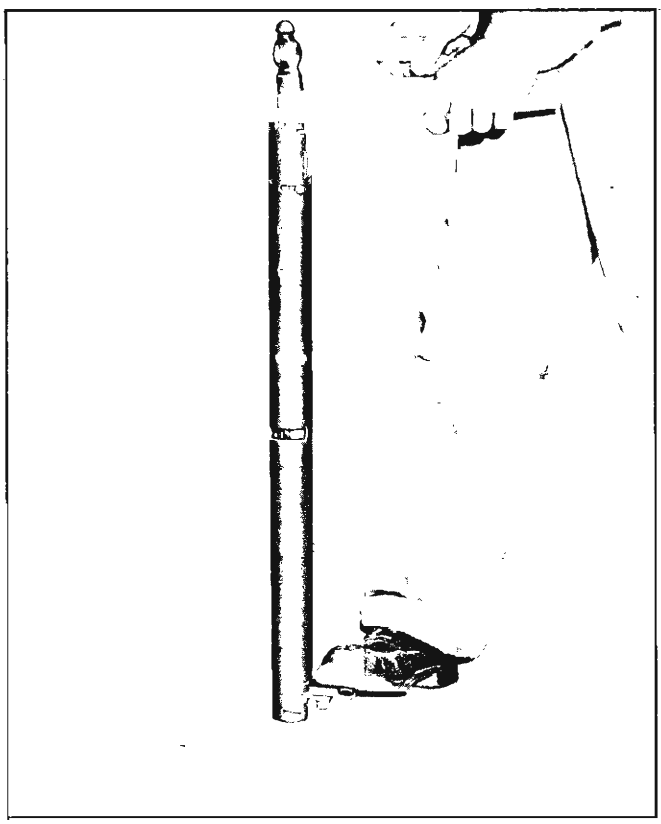


Fig. 13—Removing Shifter Tube

9. Remove spring washer and flat washer from upper end of mast jacket.
10. Three speed models only;
    a. Remove the two lower bearing retaining bolts and retainer.
    b. Remove the lower bearing adapter, first and reverse shift lever and spacer from lower end of mast jacket.
    c. Place mast jacket upright on floor while supporting it with 2 pieces of wood. Push down on second and third shift lever with foot and place block of wood on upper end of tube. Tap on block of wood to remove tube (fig. 13). Withdraw tube from lower end of mast jacket.
11. Powerglide models only;
    a. Remove retaining ring from lower end of mast jacket and remove bearing and adapter assembly.
    b. Remove three retaining screws and retainer from clamping ring.
    c. Remove shift tube assembly from lower end of mast jacket.
12. If necessary, the rubber collar and bracket may be removed from the lower end of mast jacket at this time.

Cleaning and Inspection

1. Clean all metal parts in cleaning solvent and dry them with compressed air.
2. Inspect transmission control lever housing for burrs, scratches and wear.

   NOTE: The clearance is critical between the shifter tube assembly and the lever support housing; there must be no interference between these two working parts (on the three speed transmission models) and any excessive clearance must be corrected by the installation of new parts.

3. Inspect steering shaft bearing and directional signal switch. The bearing may be replaced by carefully prying out the horn contact ring and lifting out the bearing.
4. Inspect directional signal wiring connections and switch.
5. Check directional signal switch for smoothness of operation and freedom from bind. Replace defective parts.
6. Inspect shifter levers and shifter tube assembly (if so equipped) for worn or damaged parts. The shifter tube assembly must be replaced as a unit in event of worn or damaged component parts.
7. Shifter tube (when used) must rotate and slide freely.

   NOTE: The shifter tube assembly on three speed transmission models consists of a shifter tube, second and third shift lever, shifter tube relay lever, shifter tube bearing, keys, felt seal, washers and spring. No shifter tube is used on vehicles equipped with four speed transmission.

Assembly

1. Install rubber collar and bracket over lower end of mast jacket, if removed, and position it approximately 4" from lower end of mast jacket.
2. With felt seal in place on shift tube, insert shift tube into place from lower end of mast jacket.
3. Three speed models only;

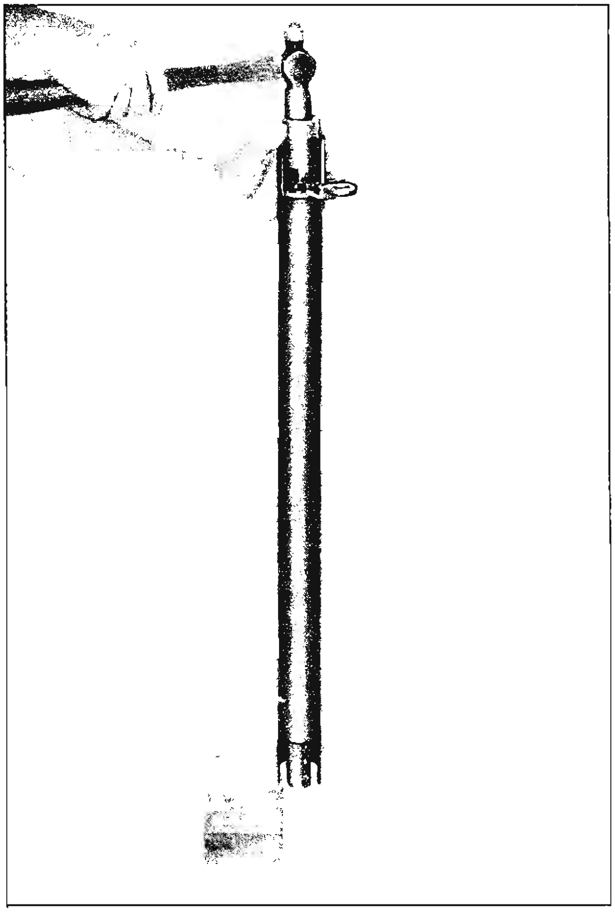


Fig. 14—Installing Shifting Tube

Support mast jacket on wood blocks, place spacer over second and third shift lever and using a suitable socket over the spacer tap shift tube into place until bearing is seated against the three locating tabs (fig. 14). Remove socket and spacer.

4. Powerglide models only;
   Line up holes in clamping ring with mast jacket holes and install retainer and three screws.
5. Position flat washer and spring washer over upper end of shift tube and down against tabs in mast jacket.
6. Install shifter housing over upper end of shift tube engaging cutout of housing with key of shifter tube. Then install spacer washer over shift tube.
7. If removed pass the directional signal wires through the hole provided in directional housing.
8. Pass directional wires through shifter housing but outside of mast jacket, then position directional housing on to mast jacket. Be sure slots in housing engage tangs of mast jacket correctly, then turn housing clockwise against the stops.
9. Position directional signal switch in place and secure with three attaching screws.
10. Position directional wiring in proper position and install the two wiring clips.
11. Three speed models only; install the shift lever spacer, first and reverse shift lever and the bearing adapter. Secure by installing the retainer and 2 attaching bolts. Adjust as previously outlined under Maintenance and Adjustments.
12. Powerglide models only; Install the lower bearing adapter, aligning the locating tabs with mast jacket opening, and secure with retaining ring.
13. Place anti-rattle spring and clip in position on shift lever. Then holding shifter housing opening in the slight down position, insert shift lever into the housing engaging ball of lever in shifter tube. Secure with drive pin, then reposition rubber boot.
14. Reinstall directional lever and neutral safety or back up light switch.
15. Install steering wheel as outlined under "Steering Wheel Installation" in this section.

Installation

1. With front seat adjusted to the rear as far as possible, install mast jacket assembly through the floor pan opening. Rotate the jacket as necessary to clear shift levers.

   CAUTION: Be sure steering shaft coupling engages wormshaft correctly.

2. Install mast jacket to dash panel clamp and secure with nuts and washers.
3. Secure the lower bracket by installing the four attaching screws.
4. Place toe pan trim plate in position and secure with the two attaching screws.
5. On Powerglide models only; install shift indicator needle, adjust to correct position and lock the allen set screw.
6. Connect directional wiring to chassis wiring harness connector, (also connect back up light and neutral safety switch wires if so equipped).
7. Install the mast jacket to dash lower trim plate and attaching screws.
8. Install the steering coupling to wormshaft clamping bolt. Torque to 30 ft. lbs.
9. Connect transmission linkage to shift levers if so equipped.

Chevelle (Fig. 15)

Removal

1. Disconnect transmission shifting rods from levers (two on 3 speed, one on automatic or none on 4 speed).
2. Remove two attaching bolts at steering coupling (fig. 12).
3. Disconnect directional signal switch wiring from chassis wiring harness at connector.
4. Disconnect back up light wiring and/or neutral safety switch wiring at switch if so equipped.
5. Remove clutch pedal rod if so equipped.
6. Remove 4 attaching bolts that secure the firewall opening cover.
7. Remove bolt from upper mast jacket clamp and bend clamp down.
8. With front seat moved rearward as far as possible guide mast jacket assembly up and out of vehicle. The assembly will have to be turned to allow shift levers to pass through the firewall opening.

Disassembly

1. Remove steering wheel as previously outlined in this section.

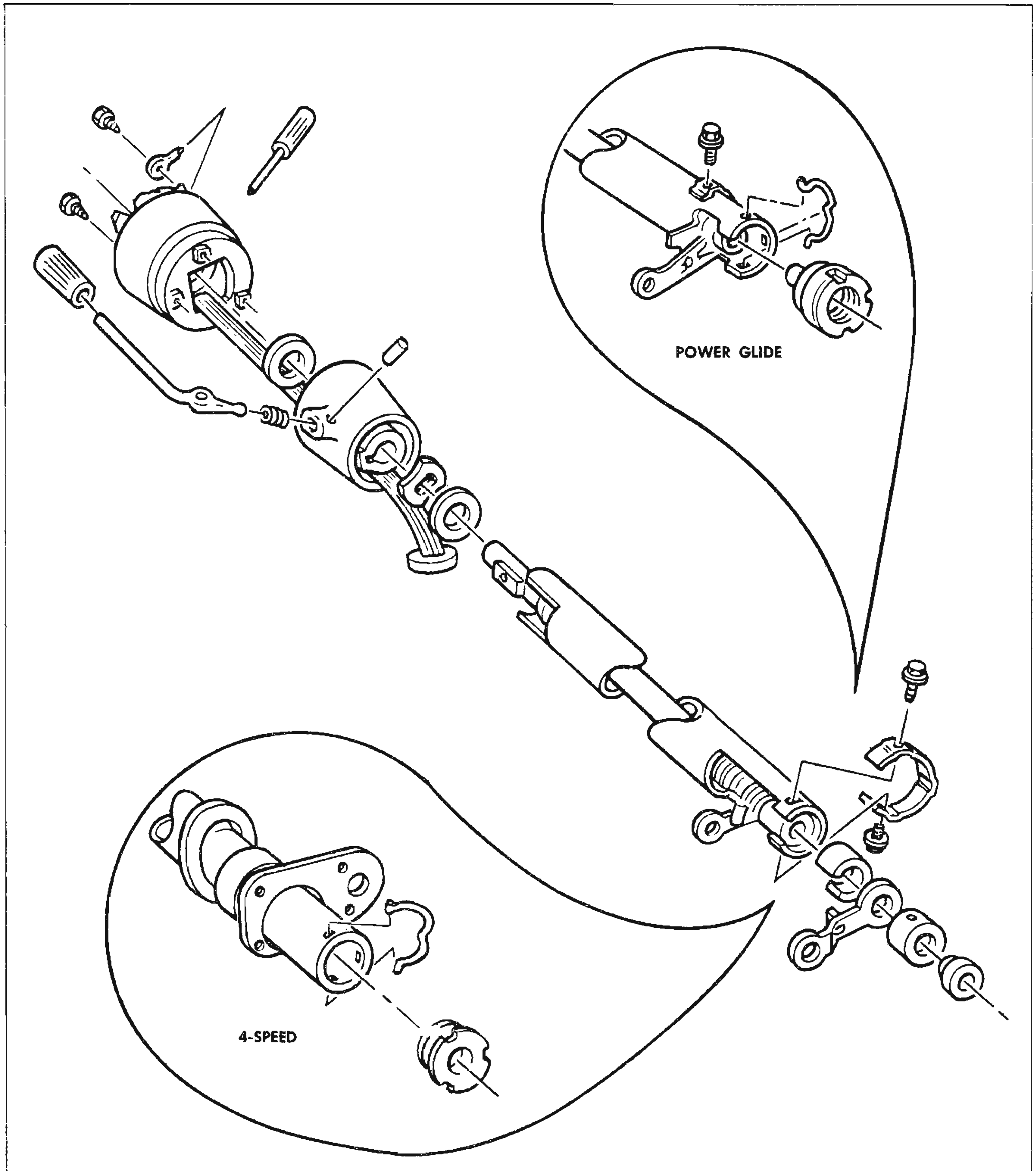


Fig. 15—Mast Jacket Assembly—Chevelle

2. Remove horn spring contact assembly, spring and directional cancelling cam.
3. Pull steering shaft out the bottom of the mast jacket, loosen clamp bolt and remove clamp from shaft.
4. Remove directional signal switch lever and attaching screw.
5. Remove gearshift lever pin, lever and spring, if so equipped.

6. Remove directional switch wiring cover by prying out bottom end and pulling it out from under housing.
7. Remove the three directional signal switch attaching screws. Turn directional housing counter-clockwise and remove from mast jacket, at the same time center shifter housing and remove. These three pieces can now be separated.
8. Remove back up light switch or neutral safety switch, if so equipped.
9. Remove retaining ring from lower end of mast jacket and remove bearing and adapter assembly.
10. Three Speed only:
    a. Turn shifter tube counter-clockwise and pull out from top of mast jacket slowly while removing the wave washer, two shift levers and spacer.
    b. Remove the special flat washer and spring washer from upper end of shift tube.
11. Powerglide only:
    a. Remove the three screws and clamp ring from the lower end of mast jacket.
    b. Slide shifting tube out bottom end of mast jacket.
    c. Remove spring washer and flat washer from upper end of mast jacket.
12. If it is necessary to remove bracket from the mast jacket, BE SURE to measure the exact position of the rubber collar and the bracket in relation to the end of the mast jacket. The bracket and the rubber collar can then be removed individually.

Cleaning and Inspection

1. Clean all metal parts in cleaning solvent and dry them with compressed air.
2. Inspect transmission control lever housing for burrs, scratches and wear.

   NOTE: The clearance is critical between the shifter tube assembly and the lever support housing. There must be no interference between these two working parts (on the three-speed transmission models) and any excessive clearance must be corrected by the installation of new parts.

3. Inspect steering shaft bearing in direction signal switch. The bearing may be replaced by removing the two retaining screws and prying it out of position and installing a new bearing.
4. Inspect direction signal wiring connections and switch.
5. Check directional signal switch for smoothness of operation and freedom from bind. Replace defective parts.
6. Inspect shifter levers and shifter tube assembly (if so equipped) for worn or damaged parts. The shifter tube assembly must be replaced as a unit in event of worn or damaged component parts.
7. Shifter tube (when used) must rotate and slide freely in bearing.

   NOTE: The shifter tube assembly on the three-speed transmission models consists of the shifter tube, second and third shift lever, shifter tube relay lever, shifter tube bearing, keys, felt seal, washers and spring. No shifter tube is used on vehicles equipped with four-speed transmission.

Assembly

NOTE: Upon assembly lubricate all contact surfaces.

1. Slide rubber collar onto mast jacket to the exact measured location noted on disassembly. Position bracket over rubber collar in the exact measured position noted on disassembly.

   NOTE: Be sure the rubber collar does not move from its position when installing bracket.

2. Three Speed models only;
    a. Start tube into mast jacket from upper end.
    b. Insert second and third lever into slot provided in mast jacket followed by the spacer, first and reverse lever (with offset towards bottom of mast jacket), and spring washer. Push shift tube down through these parts until key in tube is all the way into the second and third lever. Then turn shift tube clockwise as far as possible.
3. Powerglide models only;
   Install tube into mast jacket from bottom end. Secure by installing adjusting ring plate and screws.
4. Install back up light switch or neutral safety switch if so equipped, (be sure shift tube tab engages in notch of switch).
5. Install special flat washer and then spring washer into the top of mast jacket and position them down against the stops provided.
6. Feed directional signal switch wiring through directional housing and shifter housing and then install shifter housing onto mast jacket.
7. Install flat spacer washer on shift tube on top of shifter housing.
8. Place directional housing onto mast jacket down past locking tabs and turn clockwise to secure.
9. Position directional signal switch in place, making sure wiring is kept free, and secure with the three attaching screws.
10. While holding directional wiring in place slide wiring cover up under shifter housing and snap bottom of cover into the holes provided in mast jacket.
11. Install shift lever and retaining pin (if so equipped).
12. Install directional signal switch lever and attaching screw.
13. Install clamp, lower bearing, adapter and seal on steering shaft. Insert shaft into lower end of mast jacket, tamp seal into shifter tube approximately 3-1/2 inches and install lower bearing with adapter and retain with ring.
14. Adjust clamp to position upper end of steering shaft 1-3/4 inches above the top of the directional signal switch housing (fig. 8).
15. Install directional signal switch cancelling cam, spring and horn spring contact.
16. Install steering wheel as outlined in this section.

Installation

1. To install the mast jacket replace all components parts in the reverse order of removal.

Chevy II (Fig. 16)

Removal

NOTE: It will be necessary to remove power brake cylinder and/or clutch push rod if car is so equipped.

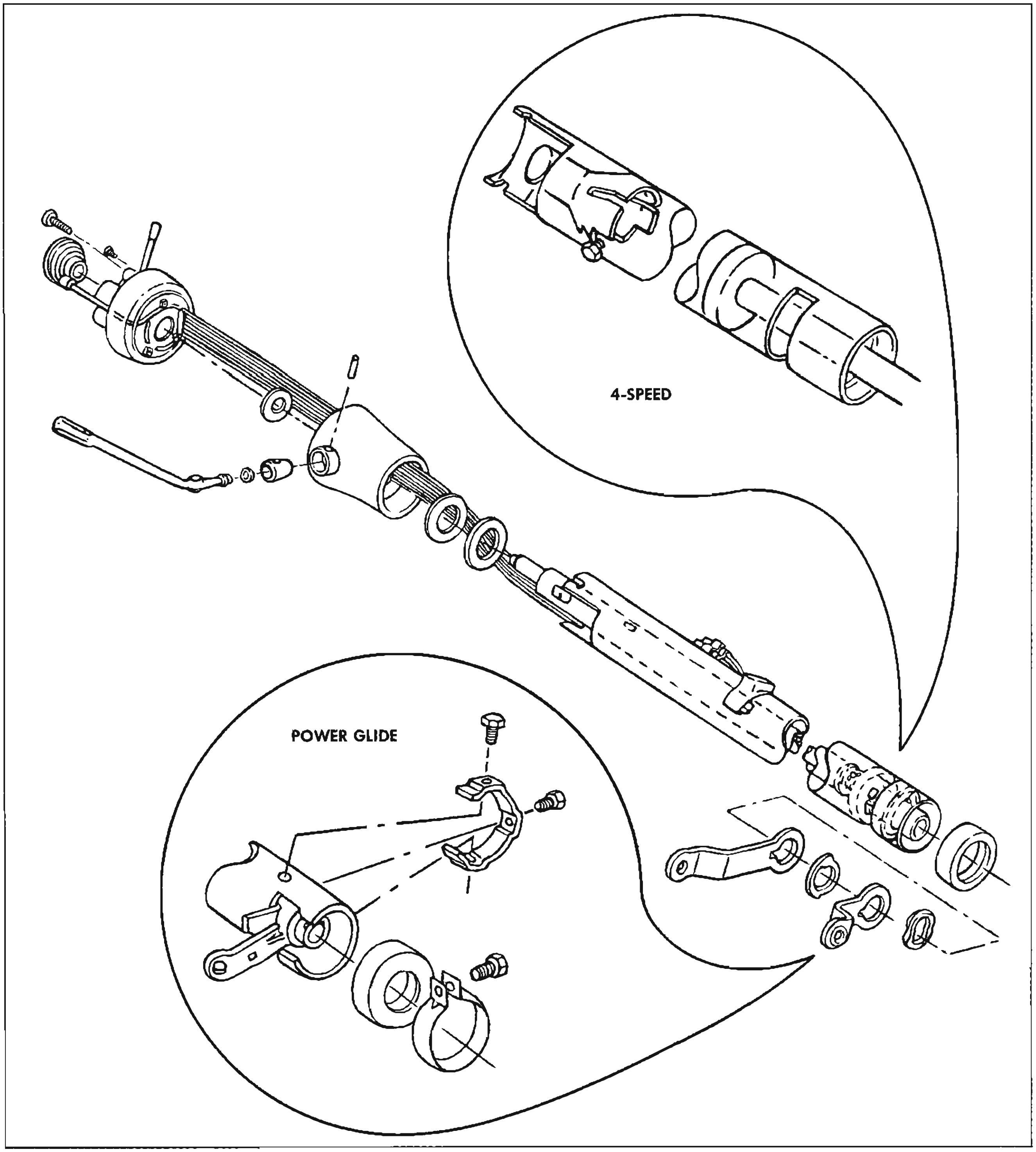


Fig. 16—Exploded View of Mast Jacket—Chevy II

1. On 3-speed or Powerglide models disconnect transmission linkage from shift lever.
2. Remove the two upper steering gear to frame mounting bolts. On Powerglide models also remove the mast jacket to steering gear clamp bolt.
3. Disconnect chassis wiring harness from directional signal harness and back up lamp or neutral safety switch wires at switch. (If so equipped).
4. Remove steering wheel as outlined in this section.
5. Remove mast jacket cover at toe pan opening.

6. Remove the three mast jacket lower bracket attaching bolts.
7. Remove the upper mast jacket to dash clamp and nuts.
8. Move mast jacket steering gear assembly downward and away from dash, pivoting on the remaining steering gear mounting bolt. Move front seat to rear as far as adjusting mechanism will allow and pull mast jacket assembly towards you rotating it so that shift levers will pass through toe pan opening.

NOTE: On 3-speed transmission models it will be necessary to again rotate the mast jacket after levers clear toe pan opening to the down position to clear foot pedals.

Disassembly

1. On 3-speed or Powerglide models, lay assembly on bench, resting lever boss on socket so that roll pin is over socket bore. Drive out roll pin with pin punch. Pull lever from housing.
2. Remove directional signal lever and directional wiring clip.
3. Remove neutral safety or back up lights switch if so equipped, and remove directional wiring cover.
4. Remove the directional signal switch with three attaching screws and lift the directional housing and switch off the mast jacket.
5. Remove spacer washer and shifter housing from mast jacket.
6. Remove spring washer and special flat washer from the upper end of shifter tube.
7. On 3-speed transmission models only:
   a. Holding both levers against end of opening in mast jacket, rotate shifter tube counter-clockwise (as viewed from upper end) until shifter tube boss passes through loading slot in mast jacket. The shifter tube, being spring loaded, "will pop" out of mast jacket slightly when the boss slot engagement is made, and may then be withdrawn from the mast jacket.
   b. After removing shifter tube, take both low-reverse and second-high levers and their spacer out of mast jacket tube, completing the disassembly.
8. On Powerglide models only:
   a. Remove the three tab screws securing the shifter tube bushing to the mast jacket.
   b. Remove shifter tube assembly from the mast jacket, passing actuating lever and quadrant through gate in lower end of jacket tube.
9. On 4-speed transmission models only:
   a. Remove upper filler tube from turn signal housing.
   b. Pull lower filler tube from mast jacket. Felt seal may be removed from lower end of jacket for inspection, if desired.
10. Dust shield, dust shield retainer and grommet may be removed from mast jacket at this time, if necessary.

Cleaning and Inspection

1. Clean all metal parts in cleaning solvent and dry them with compressed air.
2. Inspect transmission control lever housing for burrs, scratches and wear.

NOTE: The clearance is critical between the shifter tube assembly and the lever support housing. There must be no interference between these two working parts (on the three-speed transmission models) and any excessive clearance must be corrected by the installation of new parts.

3. Inspect steering shaft bearing in direction signal switch. The bearing may be replaced by removing the two retaining screws and prying it out of position and installing a new bearing.
4. Inspect direction signal wiring connections and switch.
5. Check directional signal switch for smoothness of operation and freedom from bind. Replace defective parts.
6. Inspect shifter levers and shifter tube assembly (if so equipped) for worn or damaged parts. The shifter tube assembly must be replaced as a unit in event of worn or damaged component parts.
7. Shifter tube (when used) must rotate and slide freely in bearing.

NOTE: The shifter tube assembly on the three-speed transmission models consists of the shifter tube, second and third shift lever, shifter tube relay lever, shifter tube bearing, keys, felt seal, washers and spring. No shifter tube is used on vehicles equipped with four-speed transmission.

Assembly

NOTE: Upon assembly lubricate all contact surfaces.

1. Install grommet, dust seal retainer and dust seal on mast jacket, if removed.
2. Three speed models only; with the shift levers held against end of mast jacket opening, press shifter tube inward with moderate force at the same time rotating it until shifter tube boss engages loading slot. When boss and loading slot align, the tube will proceed into mast jacket, at which time the tube should be rotated clockwise (as viewed from upper end) as far as possible.
3. Powerglide models only;
   Install shifter tube assembly into lower end of mast jacket. Align the 3 tapped holes in shifter tube bushing with holes in mast jacket, install and align clamp band and install cap screws.
4. Four speed models only;
   a. Install felt seal in mast jacket between the two lower openings.
   b. Insert lower filler tube into upper end of mast jacket aligning so short flange contacts stop screw.
   c. Insert upper filler tube into direction signal housing so that upper edge is flush with bottom inner surface of housing.
5. Install special flat washer and then spring washer into the top of mast jacket and position them down against the stops provided.
6. Feed directional signal switch wiring through directional housing and shifter housing and then install shifter housing onto mast jacket.
7. Install flat spacer washer on shift tube on top of shifter housing.

8. Place directional housing onto mast jacket down past locking tabs and turn clockwise to secure.
9. Position directional signal switch in place, making sure wiring is kept free, and secure with the three attaching screws.
10. Install back up light switch or neutral safety switch if so equipped, (be sure shift tube tab engages in notch of switch), also install directional wiring cover.
11. Install directional signal switch lever and attaching screw.
12. Install shift lever and retaining pin (if so equipped).

Installation

1. With steering gear seal and lower mounting clamp (Powerglide only) in position, slide mast jacket assembly down over end of steering shaft, rotating as necessary, to pass transmission control levers through hole in toe pan. Continue sliding mast jacket down until mast jacket lower seal passes over collar of steering gear housing.
2. Position mast jacket in mast jacket-to-dash brace clamp spacer, rotating so that tab on clamp spacer engages slot in mast jacket. Place clamp support over mast jacket and onto clamp bolts; install lock washers and nuts but do not tighten.
3. Install steering wheel as outlined in this section.
4. Install two steering gear mounting bolts, nuts and lock washers removed previously. Force mast jacket up into clamp spacer by hand while an assistant tightens the steering gear-to-frame mounting bolt nuts. Do not restrict lateral movement of mast jacket during tightening operation. Torque mounting bolt nuts 25 to 35 ft. lbs.
5. Slide mast jacket up or down to obtain .08" clearance between direction signal housing and steering wheel and tighten clamp nuts. Reconnect all electrical terminals.

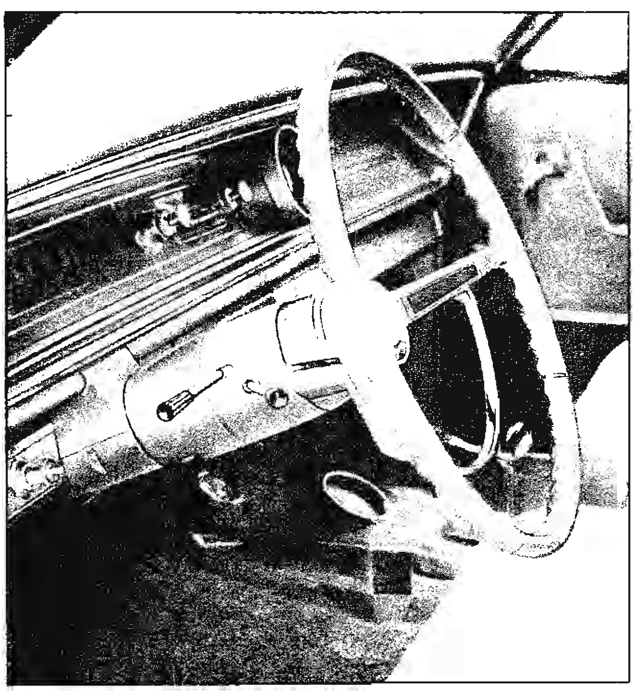


Fig. 17—Tilt Wheel Assembly in Vehicle—Chevrolet Shown

TILT WHEEL ASSEMBLY AND MAST JACKET

The service operations which follow mast jacket removal will be covered as bench operations. However, with the exception of the automatic transmission shift tube removal, all operations may be performed as well with the mast jacket on the vehicle.

Removal

1. Disconnect transmission linkage from shift levers if so equipped.
2. Remove the steering coupling to wormshaft attaching bolts.
3. From inside the vehicle remove the mast jacket toe panel trim plate by removing the two attaching screws.
4. Remove the four screws from the mast jacket lower bracket.
5. At the upper end of the mast jacket remove the jacket lower trim cover by removing the two attaching screws.
6. On Chevrolet Powerglide Models only; remove the screw and lock washer and remove the transmission shift indicator.
7. Disconnect directional signal wiring harness at the switch, (also disconnect back up light wires and neutral safety switch wires at the switch if so equipped).
8. Remove the mast jacket to dash panel clamp by removing the two attaching nuts and washers.
9. Adjust the front seat to the rear as far as possible.
10. Slowly remove the mast jacket up through the floor panel while guiding the shift levers through the opening.

Disassembly

1. Remove the turn signal switch, neutral safety switch, if so equipped.
2. Remove the steering wheel (if not previously removed) using Tool J-2927.
3. With the column in the centered position, remove the turn signal lever and the tilt lever.
4. Remove the turn signal cover using Tool J-21486 with slide hammer J-6585 and puller bolt J-9539. Tap cover off carefully (fig. 19).
5. Pry out the horn contact assembly from the turn signal actuator housing and remove the contact and wire assembly.
6. Bend lock washer tabs away from nut and remove the nut, metal washer, seat, inner race and steering shaft upper bearing.
7. Remove the turn signal actuator yoke, detent spring, turn signal cable clamp attaching screw and on the Chevelle, the dial indicator light screw. Disconnect the cable from the turn signal bell crank.
8. Install the tilt release lever and move it so the tilt mechanism swings to its fully "up" position.

   CAUTION: The unit will "snap" to the up position. Keep fingers clear.

9. Using Tool J-21181 and a screw driver, unseat the upper ends of the tilt return springs (fig. 20).
10. Using Tool J-21179, remove the two pivot pins as follows: Install the nut and washer on the stud as

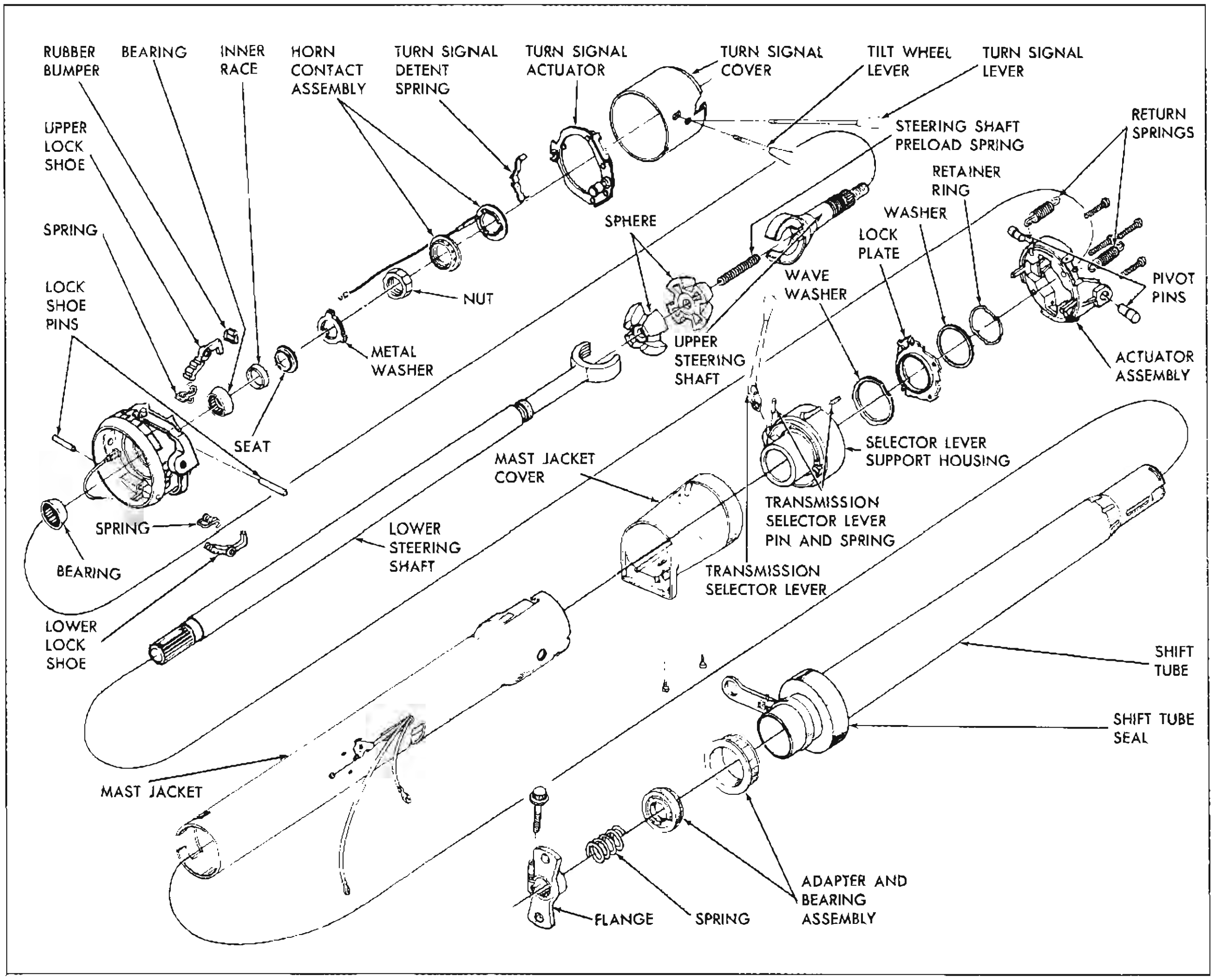


Fig. 18—Exploded View of Tilt Wheel Steering Column (as used with Powerglide)

shown and place the stud into the tool so it extends through the chamfered end of the hole in the tool. Position the tool between the locating bosses on the support assembly and thread the stud into the pivot pin. Hold the stud and turn the nut to remove the pin. Remove the second pin in the same manner (fig. 21).

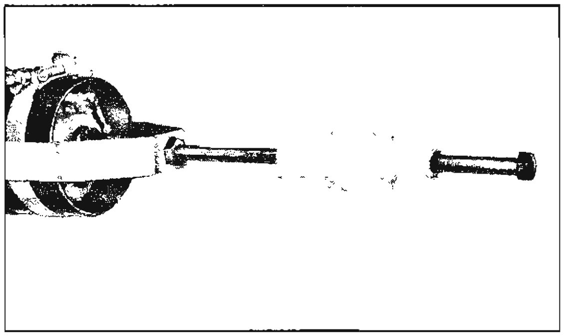


Fig. 19—Removing the Turn Signal Cover

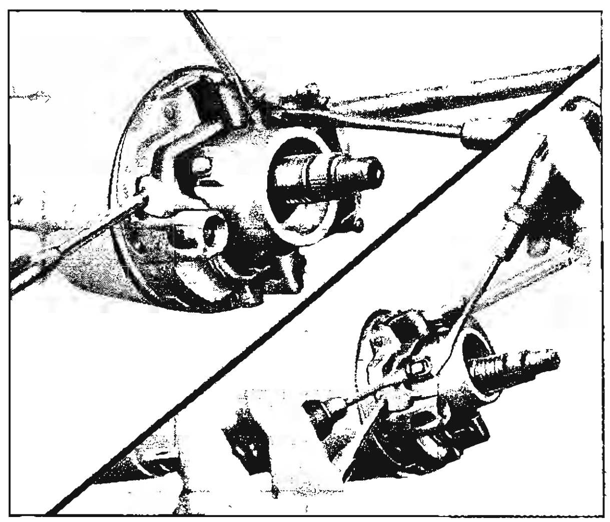


Fig. 20—Unseating Return Spring

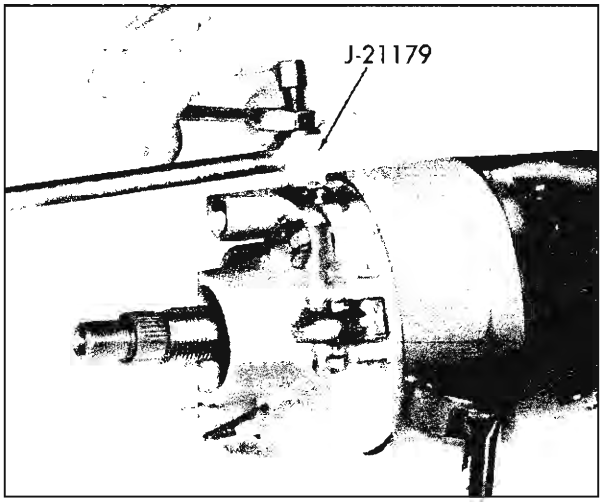


Fig. 21—Removal of Pivot Pins

11. Tie a 4' length of string to the lower end of the horn wire to facilitate reassembly.
12. Lift the tilt lever to disengage the lock shoes from the support locking pins, (fig. 22) pull actuator assembly away from actuator support, then release tilt lever and remove actuator assembly with horn wire and shift indicator lamp wire, leaving the turn signal cable in the mast jacket. Also untie the string from the horn wire and leave the string in the mast jacket.
13. Remove the tilt springs from the support.
14. Carefully remove the lower bearing from the upper steering shaft taking care that bearing does not catch on threaded portion of shaft.
15. Remove the flange attaching bolt at the lower end of the steering shaft and remove flange and spring.

NOTE: On Chevelle Models, an additional clamp is used to hold the spring in place. It will be necessary to remove the flange and the clamp to remove the spring.

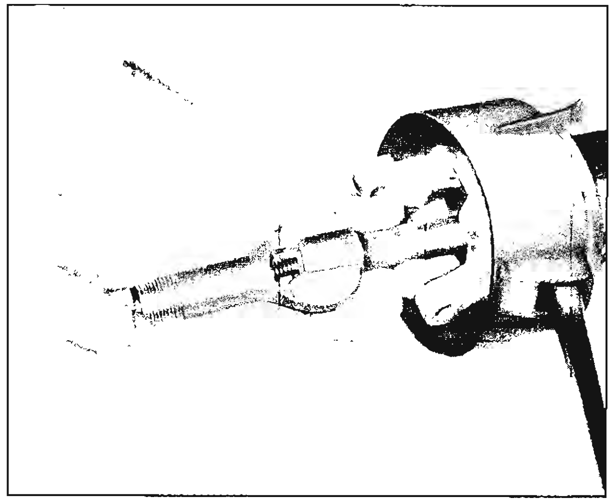


Fig. 23—Removing the Steering Shaft

16. Remove the steering shaft assembly upward through the mast jacket (fig. 23).
17. Remove the four actuator support screws and the support from the mast jacket (fig. 24).
18. From the top of the shift tube, remove the shift tube retainer ring and washer (fig. 25).
19. From the lower end of the mast jacket, remove the shift tube bearing retainer (fig. 25).
20. Remove the shift tube downward through the column as follows: support the mast jacket on the edge of a wood block and drive against the inner end of the lower shift lever with a hammer and metal rod. Perform this operation carefully so that the shift lever is not bent or distorted (fig. 26).
21. Remove the lock plate, wave washer and selector lever support housing from the upper end of the mast jacket (fig. 27).
22. If desired, the selector pivot pin and lever may be removed from the selector lever support housing.
23. Remove the mast jacket cover on Chevelle Models.

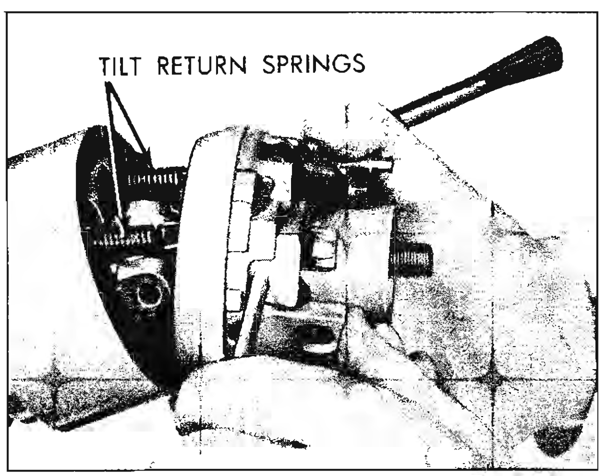


Fig. 22—Removing the Actuator Assembly

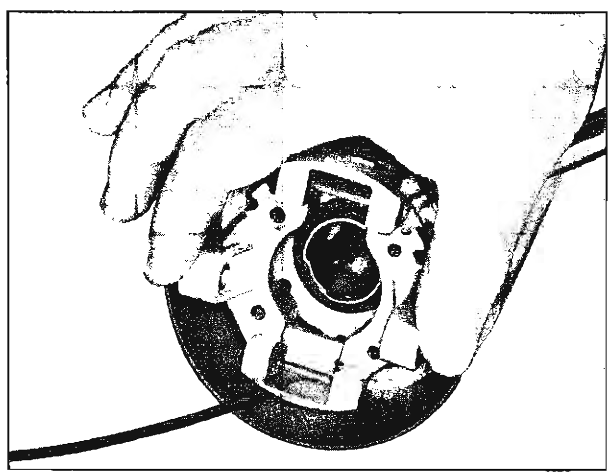


Fig. 24—Actuator Support

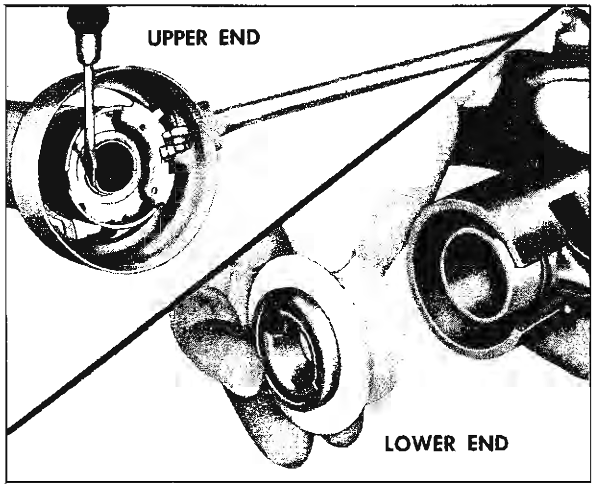


Fig. 25—Shift Tube Retainer Ring, Washer and Lower Bushing

Repairs

Actuator Housing

1. Back up the lock shoe pivot pin boss in the actuator housing, with a suitable support, inboard of the pivot pins.
2. Drive the upper and lower lock shoe pivot pins from the actuator housing with an 1/8" straight punch.
3. Remove the lock shoes and springs by pushing the upper end of the lock shoe through the openings in the actuator housing (fig. 28).

NOTE: The upper shoe may be identified by the rubber bumper installed on it and by its three notches. There are four notches in the lower shoe.

The actuator assembly should be disassembled no further. The shoe release actuator and the turn signal bellcrank must be serviced as part of the actuator assembly.

4. To reassemble the lock shoes and springs, install the springs on the upper end of the lock shoes, then install shoes in the actuator assembly and retain with the dowel pins.

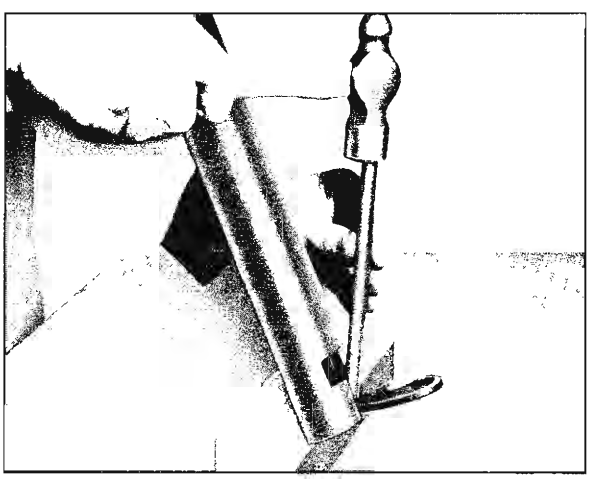


Fig. 26—Removing the Shift Tube

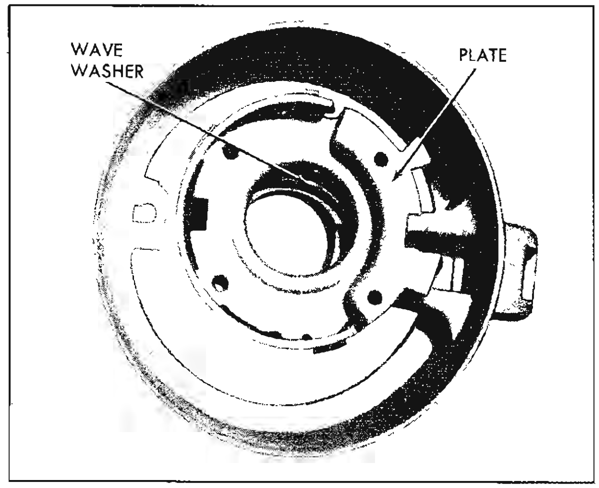


Fig. 27—Lock Plate, Wave Washer and Shift Lever Support Housing

Steering Shaft

1. Clamp the steering shaft in brass jawed vise.
2. Move the upper shaft fully from center line of lower shaft.
3. Using two narrow bladed screw drivers through the coils of the spring, compress spring enough to remove the upper end from the upper seat (fig. 29).
4. Move the upper shaft to the opposite side and allow the spring to snap out of the opening between the shaft and the sphere. Remove the spring.
5. Turn the upper shaft 90° from the center line of the lower shaft and remove the upper shaft and sphere from the lower shaft.
6. Remove the sphere from the upper shaft by rotating so flats on sphere align with socket.

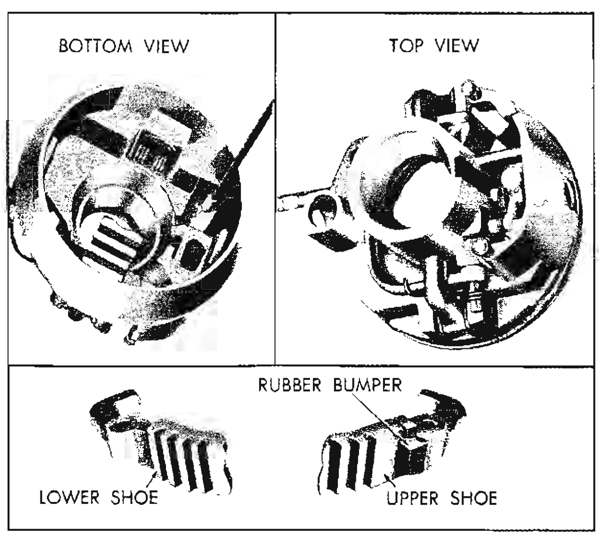


Fig. 28—Actuator Housing and Lock Shoes

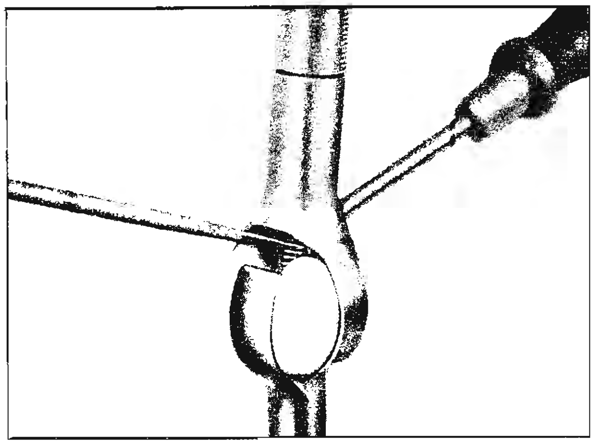


Fig. 29—Removing Spherical Joint Spring

7. Apply front wheel bearing lube to the centering spheres and the steering shaft sockets and place the spheres in the upper shaft socket.
8. Turn the spheres so the lower shaft may be installed over the grooves.

   NOTE: The locating mark on the end of the upper shaft should be on the same side as the flat on the lower shaft.

9. Insert the joint preload spring through the spheres into the lower shaft. Then, using the upper shaft to hold the spring in place, carefully feed the spring into the upper shaft joint with a narrow bladed screw driver (fig. 30).

Assembly

When assembling the steering column apply a thin coating of bearing lube to all friction parts.

1. If removed, install the selector lever spring, lever and retaining pin.
2. Loosely install mast jacket cover and slide the lower seal assembly over the lower end of the mast jacket.
3. Install the selector lever support housing on the mast jacket, place the wave washer over the mast jacket and slide the lock plate into position so the tang on the locking plate engages the slot in the mast jacket (fig. 31).
4. Slide the shift tube assembly, felt seal in place, into the mast jacket from the lower end. With the shift tube properly lined up with the keyway in the support housing, tap shift tube into place. Install washer and retainer.
5. Install the actuator support on the upper end of the mast jacket. Torque attaching screws to 30-40 in. lbs. (fig. 32).
6. Install the steering shaft assembly into the upper end of the mast jacket (fig. 33).
7. At the lower end of the mast jacket install the lower bearing assembly carefully, taking care not to damage the bearing as it passes over the splines on the shaft.
8. Install the lower bearing on the upper shaft (fig. 34).
9. Place the horn contact assembly on the actuator assembly and insert wires through the actuator and pull through the mast jacket along with the turn

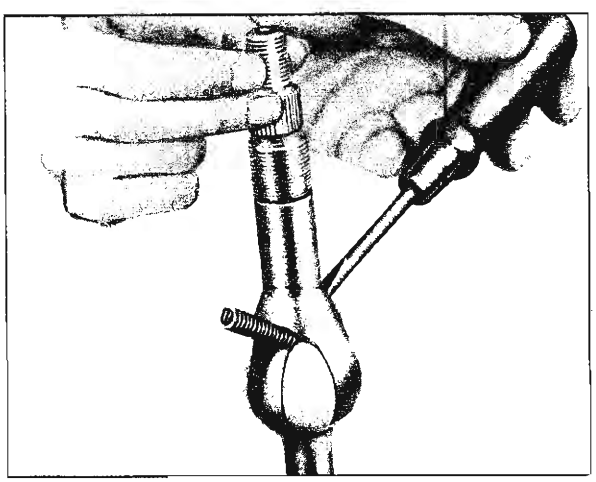


Fig. 30—Installing Spherical Joint Spring

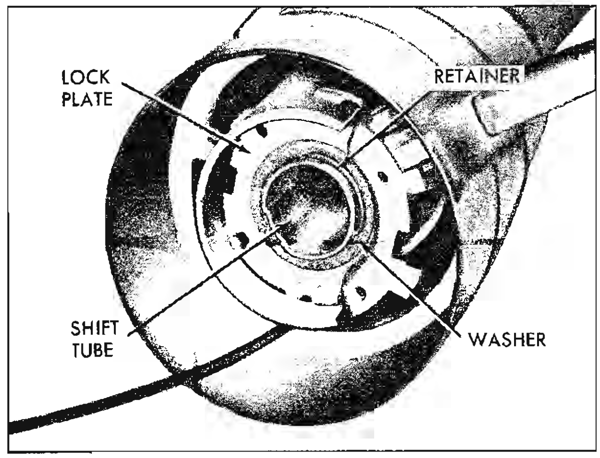


Fig. 31—Lock Plate Installed

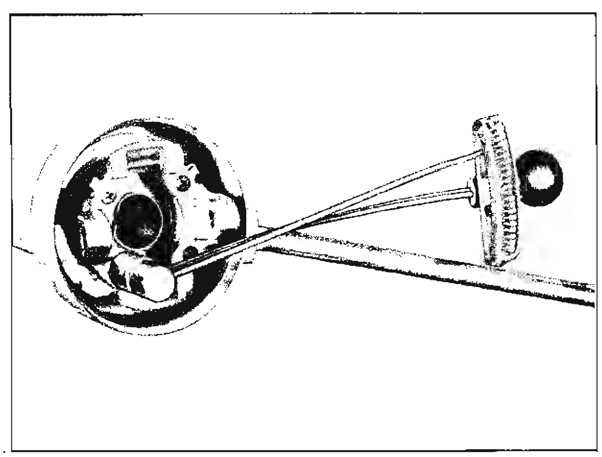


Fig. 32—Installing Actuator Support

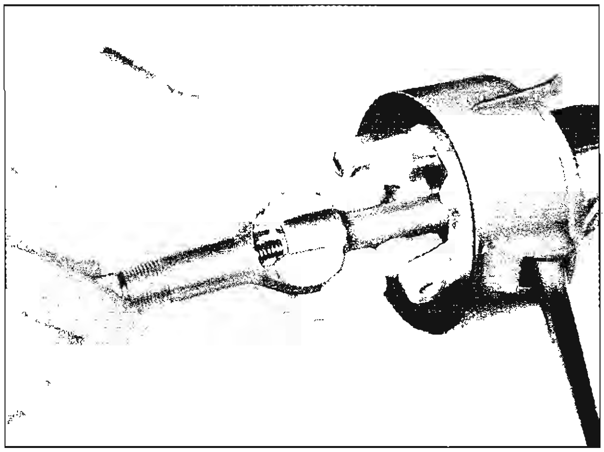


Fig. 33—Steering Shaft Installation

signal control cable with the string that was left in the mast jacket.

10. Install two return springs in the support.

    NOTE: If the return springs were distorted during their removal it is best to discard them and reinstall new springs.

11. Install the tilt lever and, holding the lever back to prevent lock shoes from engaging the locking pins, install actuator carefully over shaft, then release lever (fig. 34).
12. Align the actuator assembly pivot pin holes with the pin holes in the support assembly and install the pivot pins flush with the surface of the actuator assembly.
13. With the tilt wheel mechanism tilted fully "up", install the upper ends of the return springs on the actuator using Tool J-21181 and then set tilt wheel mechanism in center position (fig. 35).
14. Install the steering shaft upper bearing, inner race, seat, washer and nut. Tighten nut until end thrust is out of shaft. Take reading of torque required to keep shaft in motion then tighten nut to provide an additional 25-30 inch ounces for manual steering

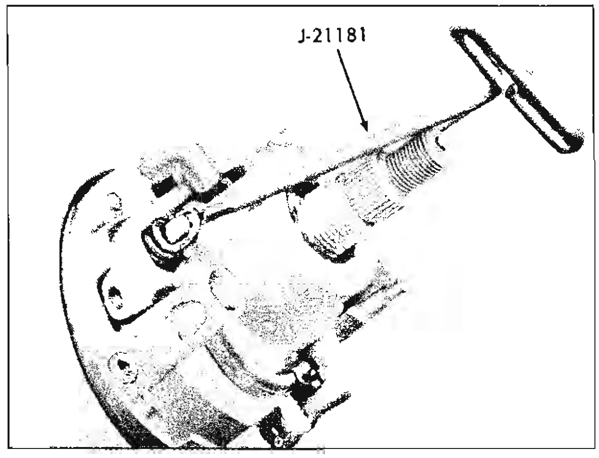


Fig. 35—Installing Return Springs

or 15-20 in. oz. (new bearings), 10-15 in. oz. (old bearings) on the power steering models. Total amount of torque required to turn shaft should not exceed 40 inch ounces. Secure nut by bending tabs of lock washer tightly against sides of nut.

15. Place mast jacket cover in position and secure with 2 attaching screws.
16. Install spring and flange on lower end of steering shaft and secure with attaching bolt. Lock flange attaching bolt and torque to 25-35 ft. lbs.

    NOTE: On Chevelle Models, a clamp is used to compress the spring and a flange is attached at the end of the steering shaft.

17. Seat the horn contact assembly in the actuator. Coat the contact ring with lubriplate or equivalent.
18. Install the turn signal yoke assembly and detent spring. Be sure the cable is attached to the bell crank (with the coil end toward bell crank) and that the other end of the bell crank is properly engaged in the yoke assembly bracket.
19. Remove the tilt release lever and, after aligning the turn signal cover properly, tap it into place using a block of wood (fig. 36).

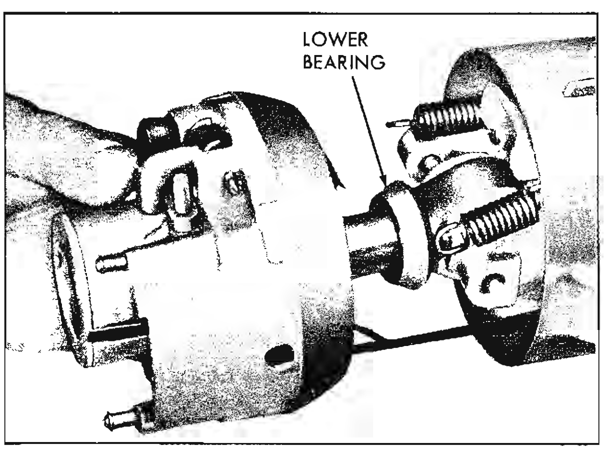


Fig. 34—Installing Actuator

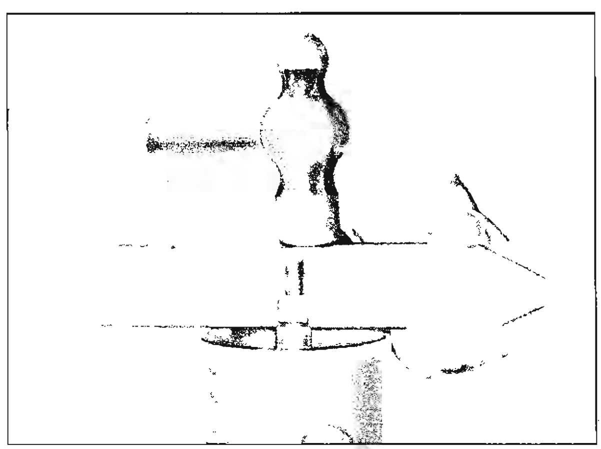


Fig. 36—Installing Turn Signal Cover

20. Install the turn signal switch, the neutral safety switch and the backup light switch if present.
21. Install the turn signal lever and the tilt levers.

Installation

To install this unit reverse the removal procedure.

> **NOTE:** When positioning mast jacket to instrument panel be sure to maintain a 200" to .250" clearance between the shifting bowl and the mast jacket upper trim cover. This is to provide clearance for the lower trim cover.

STEERING GEAR

Chevrolet and Chevelle

Removal

1. Remove steering coupling lower clamp bolt and spread clamp slightly.
2. Remove pitman arm retaining nut, scribe mark on arm and shaft and remove arm using Tool J-5504 (fig. 2).
3. This step for Chevelle only.
   a. Remove stabilizer bar to frame mounting brackets.
   b. Remove left front bumper arm to frame rear attaching bolt, mark eccentric washer to frame location and loosen front attaching bolt enough to release eccentric washer from notches in arm.
4. While supporting steering gear remove the three gear to frame mounting bolts and plain washers, then lower the assembly down and out of the vehicle.

Installation

1. Position gear in place, making sure the wormshaft enters the steering coupling, and secure with the three mounting bolts (with plain washers under the heads) and torque to 60-75 ft. lbs.
2. Install pitman arm (align marks made on removal), and secure with retaining nut (torque to 100-125 ft. lbs.).
3. This step for Chevelle only.
   a. Holding front bumper in place install bumper arm to frame rear bolt. Do not tighten.
   b. Position eccentric washer in notches of bumper arm (align marks that were made on removal) and tighten both mounting bolts.
   c. Install stabilizer bar to frame mounting brackets.
4. Install steering coupling clamp bolt and torque to 30 ft. lbs.

Chevy II

Removal

1. Remove mast jacket as outlined in this section under "Mast Jacket Removal".
2. Remove the remaining gear to frame mounting bolt and pull gear assembly out of vehicle through engine compartment.

> **NOTE:** It will be necessary to move the steering gear towards the engine in order to allow the steering shaft to clear the front seat cushion.

Installation

1. Insert steering shaft through dash opening and position gear over mounting holes in frame. Insert mounting bolt through lower gear mounting ear and frame. Install lock washer and install nut finger tight.
2. Proceed as outlined in this section under Mast Jacket—Installation.

Sector Shaft Seal Replacement

A faulty seal may be replaced without removal of steering gear from car by removing pitman arm as outlined under Maintenance and Adjustments—Steering Gear Adjustments and proceed as follows:

1. Loosen lash adjuster lock nut and turn lash adjuster screw several turns counter-clockwise.
2. Remove three cap screws holding side cover to gear housing.
3. Pull side cover and sector shaft from gear housing as a unit. Do not separate side cover from sector shaft.
4. Pull sector shaft seal from gear housing using hooked tool or pliers.
5. Coat new seal wih chassis grease and position in sector shaft bore.
6. Place a socket or piece of pipe of suitable diameter on top of seal and drive seal into bore by tapping pipe or socket with soft hammer.
7. Install sector shaft side cover assembly, being careful not to damage new seal with splines on end of shaft; splines may be wrapped with a few turns of tape to prevent this.
8. Install new side cover gasket and align side cover on gear housing and install cap screw.
9. Perform steering gear adjustment and install pitman arm as outlined under Maintenance and Adjustments.

STEERING LINKAGE (Fig. 37)

Tie Rods

There are two tie rod assemblies used on all models. Each assembly is of three piece construction, consisting of a sleeve and two tie rod ends. The ends are threaded into the sleeve and locked with clamps. Right and left hand threads are provided to facilitate toe-in adjustment and steering gear centering.

The tie rod ends are self adjusting for wear and require no attention in service other than periodic lubrication and occasional inspection to see that ball studs are tight. Replacement of tie rod ends should be made when excessive up and down motion is evident or if any lost motion or end play at ball end of stud exists.

Removal

1. Remove cotter pins from ball studs and remove castellated nuts.
2. To remove outer ball stud, tap on steering arm at tie rod end with a hammer while using a heavy hammer or similar tool as a backing (fig. 38). If necessary pull downward on tie rod to remove from steering arm.
3. Remove inner ball stud from relay rod using same procedure as described in Step 2.
4. To remove tie rod ends from tie rods loosen clamp bolts and unscrew end assemblies.

Installation

1. If the tie rod ends were removed, lubricate the tie rod threads with EP chassis lube and install ends on tie rod making sure both ends are threaded an equal distance from the tie rod.

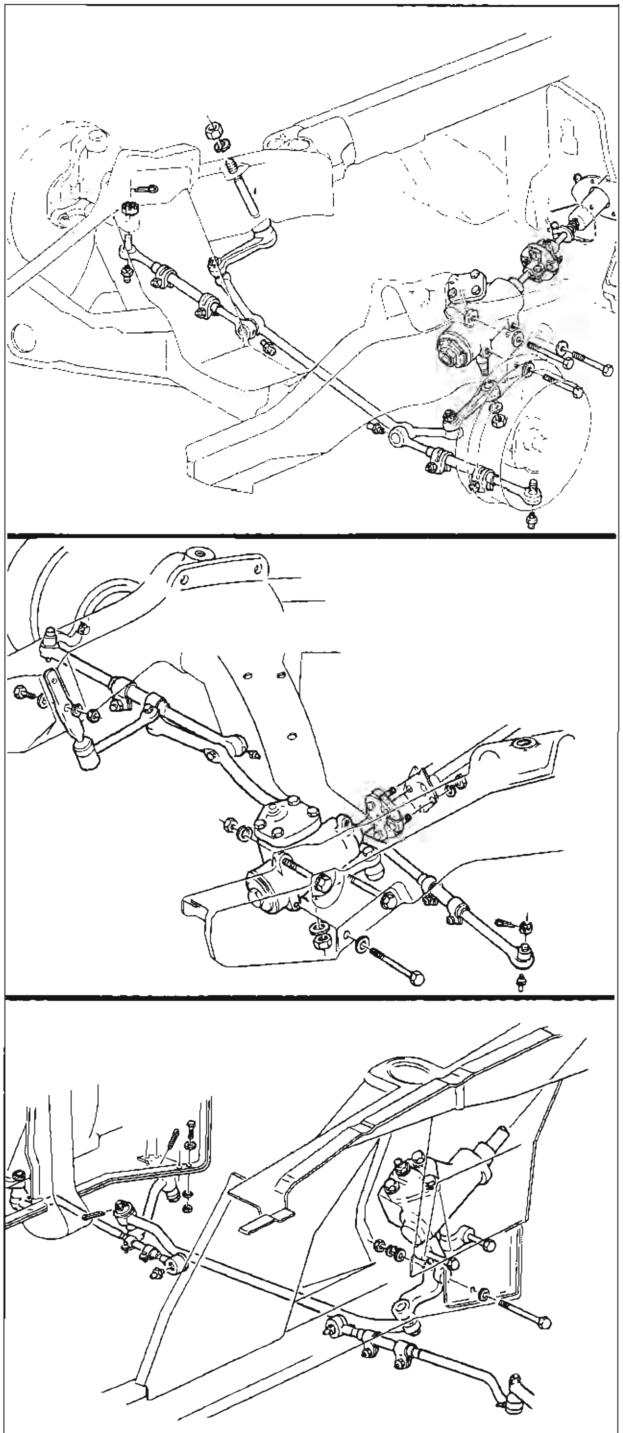


Fig. 37—Steering Linkage

2. Make sure that threads on ball studs and in ball stud nuts are perfectly clean and smooth. Install neoprene seals on ball studs.

NOTE: If threads are not clean and smooth, ball studs may turn in tie rod ends when attempting to tighten nut.

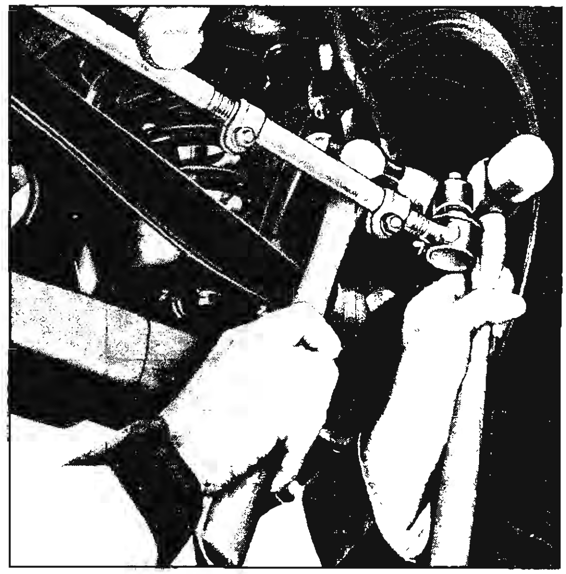


Fig. 38—Freeing Ball Stud

3. Install ball studs in steering arms and relay rod.
4. Install ball stud nut, tighten to 35 ft. lbs. and install cotter pins. Lubricate tie rod ends.
5. Adjust toe-in as described in Section 3.

NOTE: Before locking clamp bolts on the rods, make sure that the tie rod ends are in alignment with their ball studs (each ball joint is in the center of its travel). If the tie rod is not in alignment with the studs, binding will result.

Relay Rod

Removal

1. Remove inner ends of tie rods from relay rod as described under Tie Rod - Removal.
2. Remove cotter pin and nut from relay rod ball stud attachment at pitman arm.
3. Detach relay rod from pitman arm. Shift steering linkage as required to free pitman arm from relay rod.
4. Remove cotter pin and nut from idler arm and remove relay rod from idler arm.

Installation

1. Install relay rod to idler arm, making certain idler stud seal is in place, then install and tighten nut to 45 ft. lbs. Advance nut just enough to align castellation with cotter pin hole and install pin.
2. Raise end of rod and install on pitman arm. Secure with nut and cotter pin.
3. Install tie rod ends to relay rod as previously described under Tie Rods. Lubricate tie rod ends.
4. Adjust toe-in (see Section 3) and align steering wheel as described previously in this section under Steering Wheel Alignment and High Point Centering.

Idler Arm

Chevrolet (Fig. 37)

Removal

1. Remove idler arm to frame nut and lock washer.

2. Remove cotter pin and nut from idler arm to relay rod ball stud.
3. Remove relay rod from idler arm by tapping relay rod with a hammer while using a heavy hammer as a backing.
4. Remove idler arm from frame.

Installation

1. With seal in position on idler arm stud position stud up through frame and secure with lock washer and nut. Torque to 110-160 ft. lbs.
2. Install relay rod to idler arm, making certain seal is on stud. Install nut and tighten nut to 29 to 43 ft. lbs.
3. Install cotter pin to secure.

Chevelle (Fig. 37)

Removal

1. Remove cotter pin and nut from end of idler arm and remove relay rod from idler arm.
2. Remove idler arm from frame.

Installation

1. Position idler arm on frame and install mounting bolts (with special plain washers under heads); tightening nuts to 25-35 ft. lbs.
2. Install relay rod to idler arm, making certain seal is on stud, and install and tighten nut to 45 ft. lbs.
3. Install cotter pin and secure.

Chevy II (Fig. 37)

Removal

1. Remove cotter pin, nut and washer securing idler arm to relay rod.
2. Remove relay rod from idler arm.
3. If equipped with power steering disconnect power cylinder shaft from idler arm bracket.
4. Remove three idler bracket to frame bolts and nuts and remove bracket and idler arm assembly.
5. Remove cotter pin, nut, washer and bolt securing the idler arm to the bracket.
6. Press out the idler arm bushing for replacement.

Installation

NOTE: Installation must be done with front wheels straight ahead or the car will lead to one side.

1. Install idler arm bushing, if previously removed.

   NOTE: Make certain the outer sleeve of the bushing does not protrude above surface of idler arm.

2. Reverse removal procedure and torque all nuts according to specifications.

Pitman Arm

Removal

1. Remove cotter pin from pitman arm ball stud and remove nut.
2. Remove relay rod from pitman arm by tapping on side of rod or arm in which the stud mounts with a hammer while using a heavy hammer or similar tool as a backing. Pull down on relay rod to remove from stud.
3. Remove pitman arm nut from sector shaft and mark relation of arm position to shaft.
4. Remove pitman arm with Tool J-6632 as shown previously in Figure 2.

Installation

1. Install pitman arm on sector shaft, lining up the marks made upon removal.
2. Install sector shaft nut and torque to 120-160 ft. lbs.
3. Position relay rod on to pitman arm. Install nut and torque to 45 ft. lbs. Continue to tighten arm enough to align castellation with hole in stud and install cotter pin.

Steering Arms

If, through collision or other damage, it becomes necessary to remove and replace either steering arm, proceed as follows:

Removal

1. Remove tie rod from steering arm as outlined in this section.
2. Remove front wheel, hub and brake drum as a unit by removing hub cap and dust cap, cotter pin from spindle nut and the spindle nut. Pull assembly toward outside of vehicle. If removal is difficult, it may be necessary to back off brake adjustment to increase brake shoe-to-drum clearance; see Hydraulic Brake Adjustment, Section 5.
3. With wheel and drum assembly removed, steering arm retaining bolt heads are accessible and removal of steering arm from vehicle may be accomplished by removing retaining nuts.

Installation

1. Place steering arm in position on vehicle and install retaining bolts. Note that longer bolt is installed in forward hole.
2. Install nuts and torque to 40-50 ft. lbs. Use only the special locknut listed for this use in the Chevrolet Parts Catalog.
3. Pack wheel bearings using a high quality wheel bearing lubricant. Install bearings and wheel-hub-brake drum assembly removed previously.
4. Install keyed washer and spindle nut. Proceed as outlined under "Front Wheel Bearings - Adjust" in section 3.
5. Install tie rod ball stud in steering arm. Be sure that the dust cover is in place on ball stud.
6. Install castellated nut on ball stud, tighten securely and install cotter pin.
7. Following directions given in Section 3 to check cornering wheel relationship and toe-in; correct as required.

POWER STEERING

INDEX

GENERAL DESCRIPTION

Two types of power steering are used for 1965. One is he conventional linkage type for Chevy II vehicles and he other is the integral gear type for Chevrolet and :hevelle. For both types the hydraulic pressure is pro- 'ided by an engine-driven vane-type pump.

On the Chevy II, or linkage type power steering, hy- lraulic pressure is delivered through two hoses from he pump to a valve which senses the requirement for ›ower assistance and supplies the power cylinder ac- :ordingly. The steering gear used with this power steer- ng is the same basic unit used on manually steered 'ehicles; it is serviced as outlined in the manual steering ›art of this section except for adjustment, which is :overed in the following pages. The steering linkage also s serviced the same as manual counterparts.

The Chevrolet and Chevelle integral gear type power steering has the hydraulic pressure delivered from the ›ump through two hoses to the steering gear. In the ›ower steering gear the steering shaft, hydraulic valve, worm, and rack-piston nut are all in line making a compact and space saving assembly. All oil passages are internal within the gear except the pressure and return hoses.

The steering gear is a recirculating ball system in which steel balls act as a rolling thread between the steering worm and rack-piston nut. The rack-piston nut is all one piece and is geared to the sector of the piston shaft. The valve is contained in the gear housing eliminating the need of bolts or seals to attach a separate valve housing.

The valve is an open-center, rotary-type three way valve. The spool is held in neutral position by means of a torsion bar. The spool is attached by means of the stub shaft to one end of the torsion bar and to the valve body on the other end. Twisting of the torsion bar allows the spool to move in relation to the valve body thereby operating the valve.

MAINTENANCE AND ADJUSTMENTS

ЗLEEDING HYDRAULIC SYSTEM

1. Fill oil reservoir to proper level and let oil remain undisturbed for at least two minutes.
2. Start engine and run only for about two seconds.
3. Add oil if necessary.
4. Repeat above procedure until oil level remains constant after running engine.
5. Raise front end of vehicle so that wheels are off the ground.
6. Increase engine speed to approximately 1500 rpm.
7. Turn the wheels (off ground) right and left, lightly contacting the wheel stops.
8. Add oil if necessary.
9. Lower the car and turn wheels right and left on the ground.
0 Check oil level and refill as required.
1. If oil is extremely foamy, allow vehicle to stand a few minutes with engine off and repeat above procedure.
   a. Check belt tightness and check for a bent or loose pulley. (Pulley should not wobble with engine running.)
   b. Check to make sure hoses are not touching any other parts of the car, particularly sheet metal.
   c. Check oil level, filling to proper level if necessary, following operations 1 through 10 This step and Step "D" are extremely important as low oil level and/or air in the oil are the most frequent causes of objectionable pump noise.
   d. Check the presence of air in the oil. Air will show up as a milky appearing oil. If air is present, attempt to bleed system as described in operations 1 through 10. If it becomes obvious that the pump will not bleed after a few trials, proceed as outlined under Hydraulic System Checks.

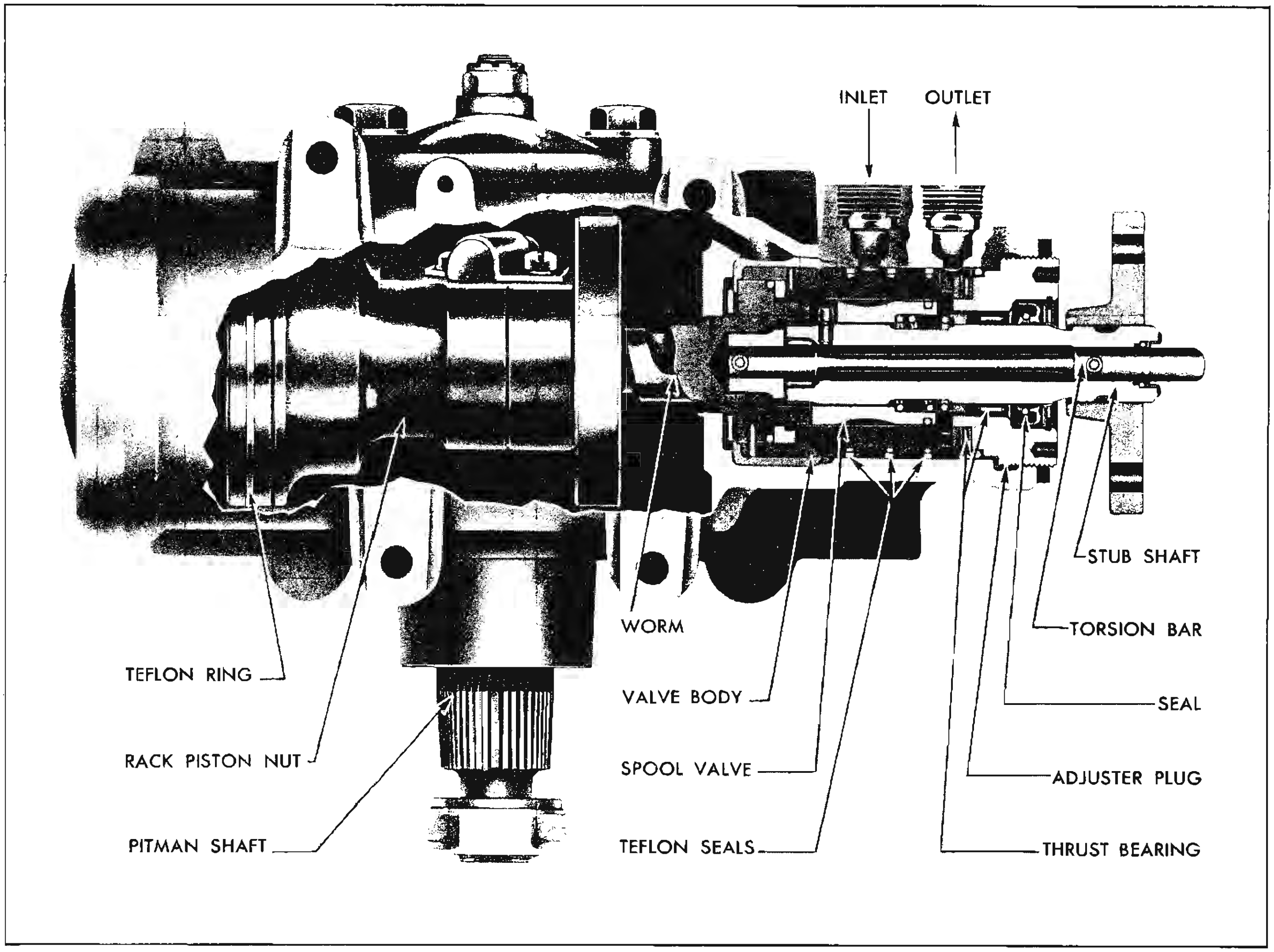


Fig. 39—Power Steering Gear (Chevrolet and Chevelle)

FLUID LEVEL

1. Check oil level in the reservoir by checking the dip stick when oil is hot.
2. Fill, if necessary, to proper level with Automatic transmission fluid "Type A" bearing an "AQ-ATF" mark. This oil is the same as used in the Powerglide Transmission.

ADJUSTMENTS

Chevrolet and Chevelle

The over-center adjustment is the only power steering gear adjustment which can be made on the car; however, in order to make this adjustment, it is also necessary to check the combined ball and thrust bearing preload.

1. Disconnect the pitman arm from the relay rod.
2. Loosen the pitman shaft adjusting screw locknut and thread the adjusting screw out to the limit of its travel through the pitman shaft side cover (fig. 40).
3. Disconnect the horn wire at the relay, then remove, the horn button or ornament from the steering wheel.
4. Turn the steering wheel through its full travel, then locate the wheel at its center of travel.
5. Check the combined ball and thrust bearing preload with an inch-pound torque wrench on the steering shaft nut by rotating through the center of travel. (Approximately 1/4 turn in each direction). Note the highest reading.
6. Tighten the pitman shaft adjusting screw until the torque wrench reads 3 to 6 in. lbs. higher and the total preload not over 18 in. lbs.
7. While holding the pitman shaft adjusting screw, tighten the locknut and recheck the adjustment.
8. Install the horn button or ornament and connect the horn wire. Connect the relay rod to the pitman arm.

Chevy II

The steering gear used with power steering is adjusted in the same manner as the manual steering gear, however be sure to use the proper specifications listed under power steering gear in the specifications chart.

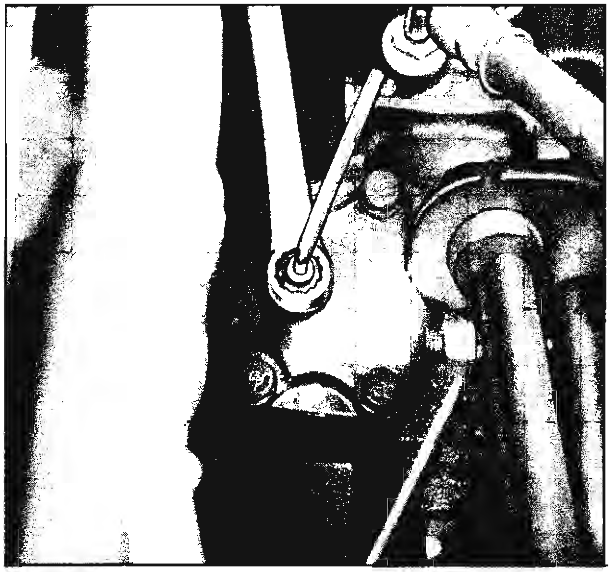


Fig. 40—Over Center Adjustment

PUMP BELT TENSION

Adjustment

1. Loosen nut on pivot bolt and pump brace adjusting nut.

   CAUTION: Do not move pump by prying against reservoir or by pulling on filler neck.

2. Move pump, with belt in place, until belt is tensioned to 75 lbs. strand tension for new belts, and 70 lbs. strand tension for old, as indicated by Tool J-7316 (fig. 41), or so that 15 lbs. of force applied at the midpoint between the power steering pump pulley will cause 1/2" to 3/4" belt deflection (fig. 42).
3. Tighten pump brace adjusting nut; then tighten pivot bolt nut.

HYDRAULIC SYSTEM CHECKS

The following procedure outlines methods to identify and isolate power steering hydraulic circuit difficulties. This test is divided into two parts. Test number one provides means of determining whether power steering system hydraulic parts are actually faulty. If test number one results in readings indicating faulty hydraulic operation, test number two will identify the faulty part. Before performing hydraulic circuit test, carefully check belt tension and condition of driving pulley. Strand tension of belt should be 75 lbs. on new belts and 70 lbs. on old belts, as indicated by Tool J-7316 (fig. 41).

Test Number One—Oil Circuit Open

Engine must be at normal operating temperature. Inflate front tires to correct pressure. All tests are made with engine idling, so adjust engine idle speed to correct specifications listed in Section 6 and proceed as follows:

a. With engine not running, disconnect flexible pressure line from pump and install Tool J-5176 as shown in Figure 43. Gauge must be between shut-off valve and pump. Shut-off valve must be open.
b. Remove filler cap from pump reservoir and check fluid level. Fill pump reservoir to full mark on dip stick. Start engine and, holding steering wheel against stop, check connections at Tool J-5176 for leakage. Bleed system as outlined under Maintenance and Adjustments. Insert thermometer (Tool J-5421) in reservoir filler opening. Move steering wheel from stop to stop several times until thermometer indicates that hydraulic fluid in reservoir has reached temperature of 150° to 170°.

CAUTION: To prevent scrubbing flat spots on tires, do not turn steering wheel more than five times without rolling car to change tire-to-floor contact area.

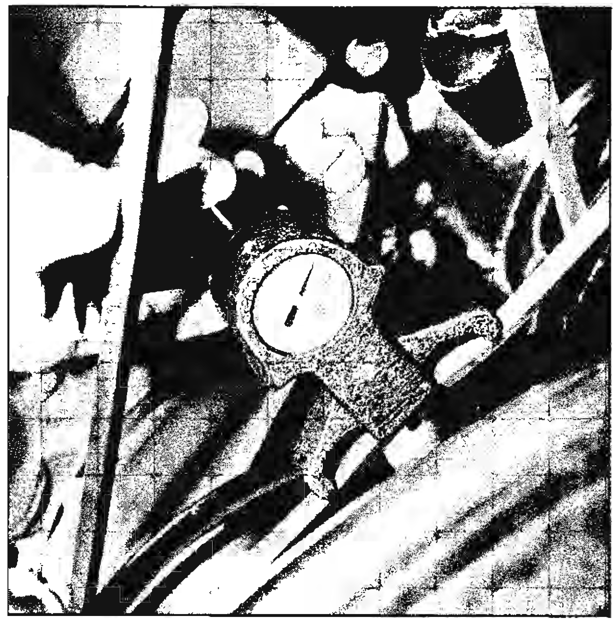


Fig. 41—Checking Belt Tension with Tool J-7316

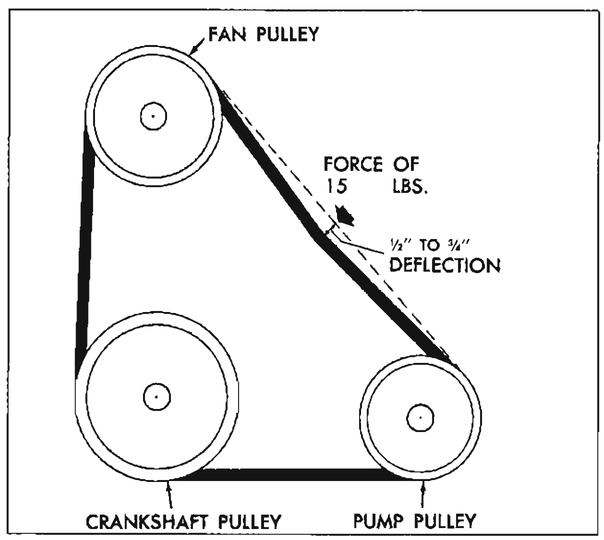


Fig. 42—Checking Belt Tension by Deflection

Fig. 43—Power Steering Diagnosis

c. Hold steering wheel against a stop momentarily and read pressure gauge. If the maximum pressure is below specifications, a faulty hydraulic circuit is indicated. To determine which part is faulty, proceed with test number two.

Test Number Two—Oil Circuit Closed

a. Slowly turn shut-off valve on J-5176 to closed position and read pressure indicated on gauge. Quickly reopen valve to avoid pump damage. If indicated pressure is less than specification, pump output is below requirement and pump may be considered faulty. If pressure indicated is within specifications, it may be safely assumed that the external hoses, connections, valve and adapter or steering gear is at fault.

NOTE: If pump proves faulty in test number two, test should be repeated after pump is repaired and installed in vehicle. This will provide a means of checking the repairs made to the pump and the condition of the steering gear or valve and adapter which may also be faulty.

COMPONENT REPLACEMENT AND REPAIRS

POWER STEERING PUMP

Removal (Fig. 46)

1. Disconnect hoses at pump. When hoses are disconnected, secure ends in raised position to prevent drainage of oil. Cap or tape the ends of the hoses to prevent entrance of dirt.
2. Install two caps at pump fittings to prevent drainage of oil from pump.
3. Remove pump belt.
4. Remove pump and attaching parts and remove pump from vehicle.

   NOTE: On Chevrolet and Chevy II equipped with 283 or 327 engine it may be necessary to remove pump brace.

5. Remove drive pulley attaching nut.
6. Remove pulley from shaft with Tool J-21239. Do not hammer pulley off shaft as this will damage the pump.

Installation

1. Install pump pulley.

   CAUTION: Do not hammer on pump shaft. Use pulley nut to pull pulley on to shaft.

2. Position pump assembly on vehicle (fig. 44) and install attaching parts loosely.
3. Connect and tighten hose fitting.
4. Fill reservoir. Bleed pump by turning pulley backward (counter-clockwise as viewed from front) until air bubbles cease to appear.
5. Install pump belt over pulley.
6. Tension belt as outlined under "Pump Belt Tension--Adjustment" in this section.
7. Bleed as outlined under "Maintenance and Adjustments."

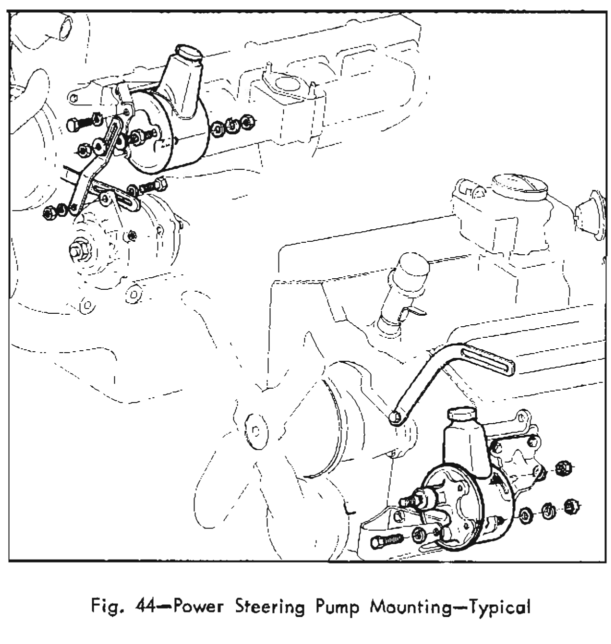


Fig. 44—Power Steering Pump Mounting—Typical

POWER STEERING GEAR

Chevrolet and Chevelle

Removal

1. Disconnect the pressure and return hoses from the steering gear housing and cap both hoses and steering gear outlets to prevent foreign material from entering system.
2. Remove steering shaft coupling clamp bolt.
3. Remove pitman arm retaining nut, scribe mark on arm and shaft and remove arm using Tool J-5504 (fig. 2).
4. This step for Chevelle only.
   a. Remove stabilizer bar to frame mounting brackets.
   b. Remove left front bumper arm to frame rear attaching bolt, mark eccentric washer to frame location and loosen front attaching bolt enough to release eccentric washer from notches in arms.
5. While supporting steering gear remove the three gear to frame mounting bolts and special plain washers, then lower the assembly down and out of the vehicle.

Installation

1. Place gear assembly into position making sure steering coupling engages properly with steering shaft. Secure with the three mounting bolts with special plain washers and torque to 60-75 foot pounds.
2. This step for Chevelle only.
   a. Holding front bumper in place install bumper arm to frame rear bolt. Do not tighten.
   b. Position eccentric washer in notches of bumper arm (align marks that were made on removal) and tighten both mounting bolts.
   c. Install stabilizer bar to frame mounting brackets.
3. Install pitman arm (align marks made on removal), and secure with retaining nut (torque to 100 to 125 foot pounds).
4. Install steering coupling clamp bolt and torque to 20-35 foot pounds.
5. Connect pressure and return hoses to steering gear housing.
6. Bleed system as outlined under Maintenance and Adjustments in this section.

CONTROL VALVE AND ADAPTER ASSEMBLY

Chevy II

Ball Stud Seal Replacement (Fig. 45)

A ball stud seal is used on the power steering control valve. To replace the seal:

1. Remove the pitman arm as outlined under "Steering Linkage" of this manual.
2. Remove clamp by removing nut, bolt and spacer or, if crimped type clamp is used, straighten clamp end and pull clamp and seal off end of stud.
3. Install new seal and clamp over stud so lips on seal mate with clamp. (A nut and bolt attachment type clamp replaces the crimped type for service.)
4. Center the ball stud, seal and clamp at opening in adapter housing, then install spacer, bolt and nut.

Removal

1. Raise the front of the vehicle off the floor and place it on stands.

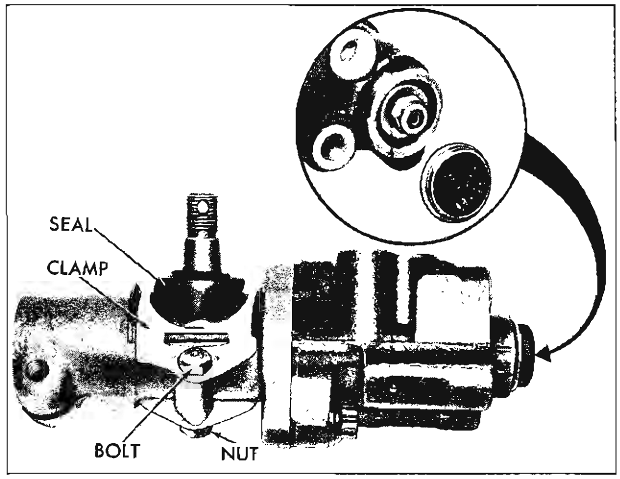


Fig. 45—Control Valve Ball Stud Seal Replacement (Services Type)

2. Remove the relay rod to control valve clamp bolt.
3. Disconnect the two pump to control valve hose connections and allow fluid to drain into a container, then disconnect the two remaining valve to power cylinder hoses.
4. Remove the retaining nut from the ball stud to pitman arm connection and disconnect the control valve from the pitman arm.
5. Turn the pitman arm to the right clear of the control valve and unscrew the control valve from the relay rod.
6. Remove the control valve from the vehicle.

Installation

1. Install the control valve on the vehicle by reversing the removal procedure.
2. Reconnect the hydraulic lines, fill the system with fluid and bleed out air using the procedure outlined under "Maintenance and Adjustments." Grease ball joint.

POWER CYLINDER (Fig. 46)

Chevy II

Removal

1. Disconnect the two hydraulic lines connected to the power cylinder and drain fluid into a container. Do not reuse.
2. Remove cotter pin, nut, retainer and grommet from power cylinder rod attached to the frame bracket.
3. Also remove grommet and retainer from bracket if replacement parts are required.
4. Remove cotter pin, nut and ball stud at relay rod.
5. Remove the power cylinder from the vehicle.

Inspection

1. Inspect the seals for leaks; if leaks are present, replace the seals using the procedure outlined under "Disassembly."
2. Examine the brass fitted hose connection seats for cracks or damage and replace if necessary.
3. For service other than ball seat or seal replacement and ball stud removal, replace the power cylinder.

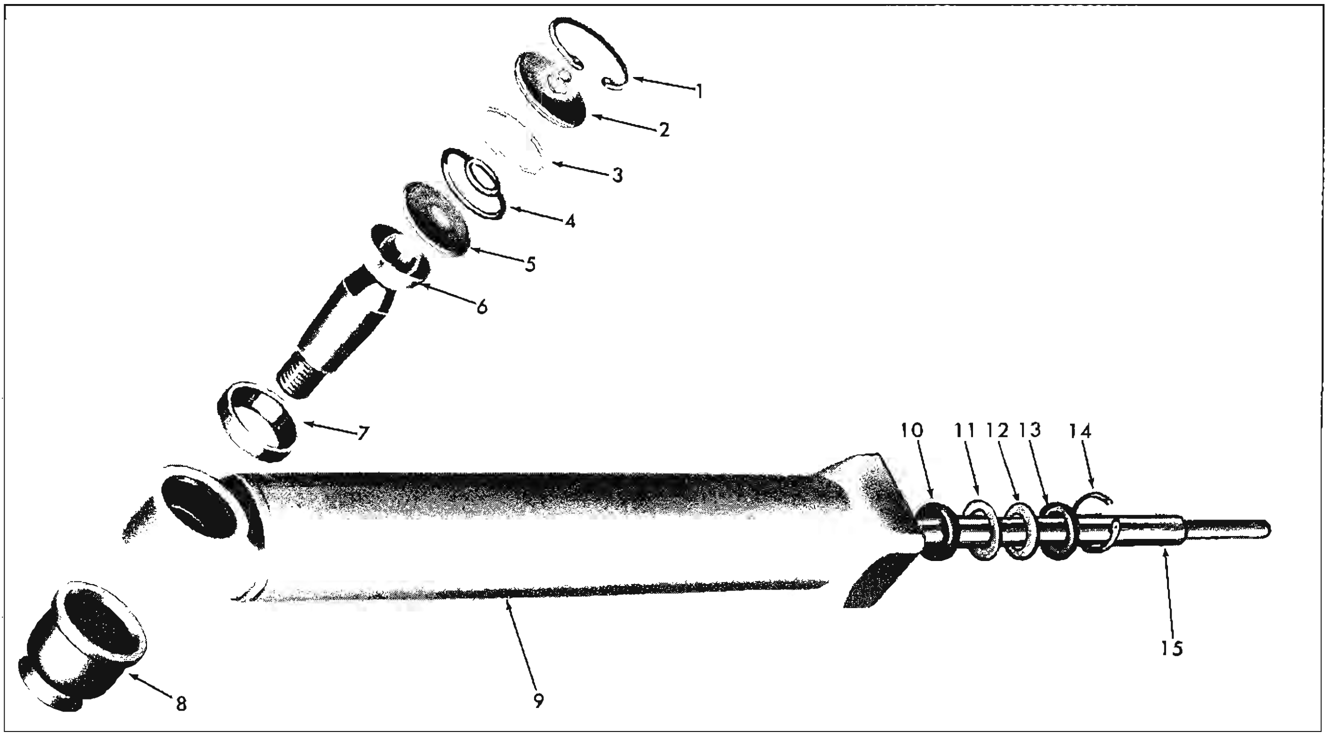


Fig. 46—Power Steering Power Cylinder Components

1. Snap Ring
2. End Plug and Lube Fitting
3. "O" Ring
4. Spring
5. Spring Seat
6. Ball Stud
7. Ball Seat
8. Ball Stud Seal
9. Piston Body
10. Piston Rod Seal
11. Backup Washer
12. Scraper Element
13. Piston Rod Scraper
14. Snap Ring
15. Piston Rod

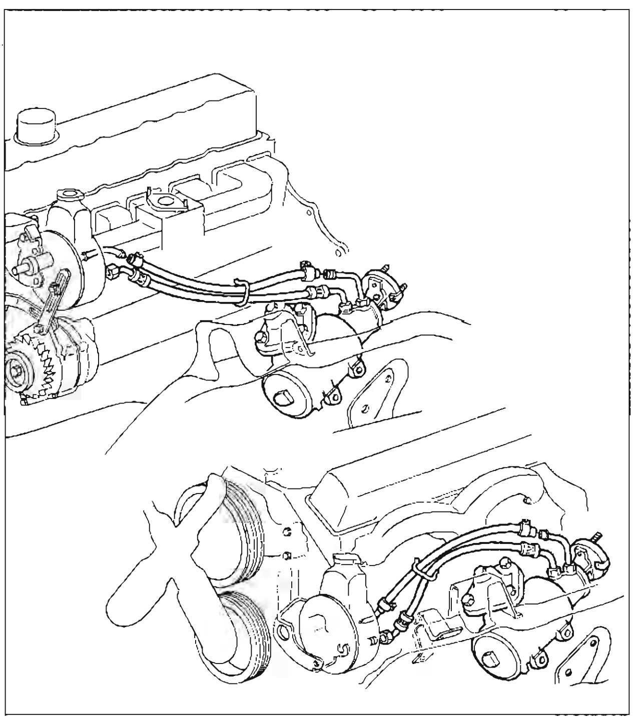


Fig. 47—Power Steering Hose Installation—Chevrolet

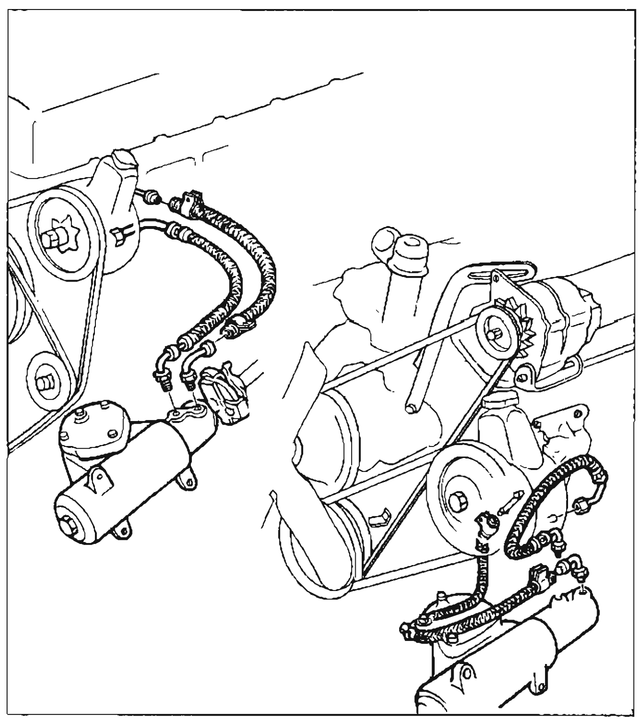


Fig. 48—Power Steering Hose Installation—Chevelle

4. Check the frame bracket parts for wear.

Disassembly

1. To remove the piston rod seal remove the snap ring; then pull out on the rod, being careful not to spray oil.
2. Remove the piston rod scraper and scraper element, back up washer and piston rod seal from the rod.
3. At the ball stud end of the cylinder, remove the ball stud seal.
4. Remove the snap ring retaining the end plug with the lub fitting.
5. Push on the end of the ball stud and remove the end plug, spring, spring seat and ball stud.
6. Remove the "O" ring seal from the top lip of the power cylinder ball stud opening.
7. If the ball seat is to be replaced, it must be pressed out using Tool J-8937.

Assembly

1. Reassemble the piston rod seal components by reversing the disassembly procedure. Apply a thin coat of Lubriplate or equivalent on the inner surfaces of the seal and scraper before assembly.
2. Reverse the disassembly procedure when reassembling the ball stud.
3. In each case be sure that the snap ring is securely seated in the ring groove.

Installation

1. Install the power cylinder on the vehicle by reversing the removal procedure.
2. Reconnect the two hydraulic lines, fill the system with fluid and bleed out air using the procedure outlined under "Maintenance and Adjustments." Grease ball joint.

POWER STEERING HOSES

It is important that the power steering hoses be correctly installed. Hoses installed out of position may be subjected to chafing or other abuse during sharp turns. Always make hose installations with front wheels in straight ahead position. Do not impart any unnecessary twist to hoses during installation.

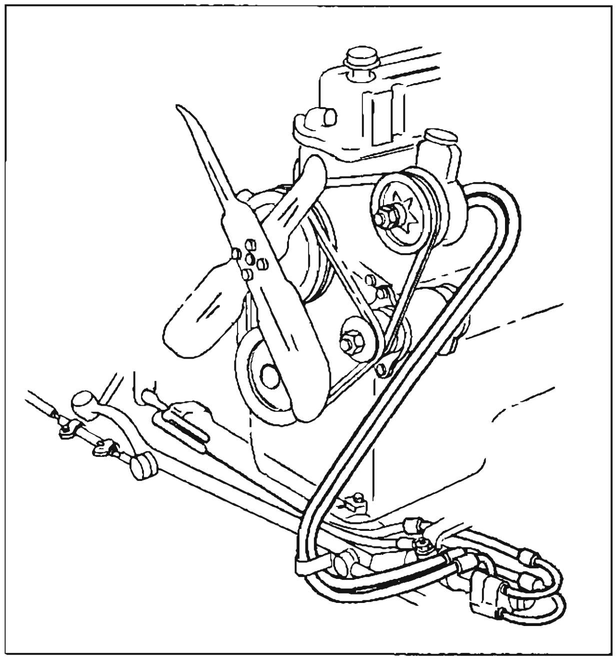


Fig. 49—Power Steering Hose Installation—Chevy II

CAUTION: Do not start engine with any power steering hose removed or disconnected.

When servicing the power steering hoses be sure to align the hoses in their correct position as shown in Figures 47, 48 and 49.

SPECIAL TOOLS

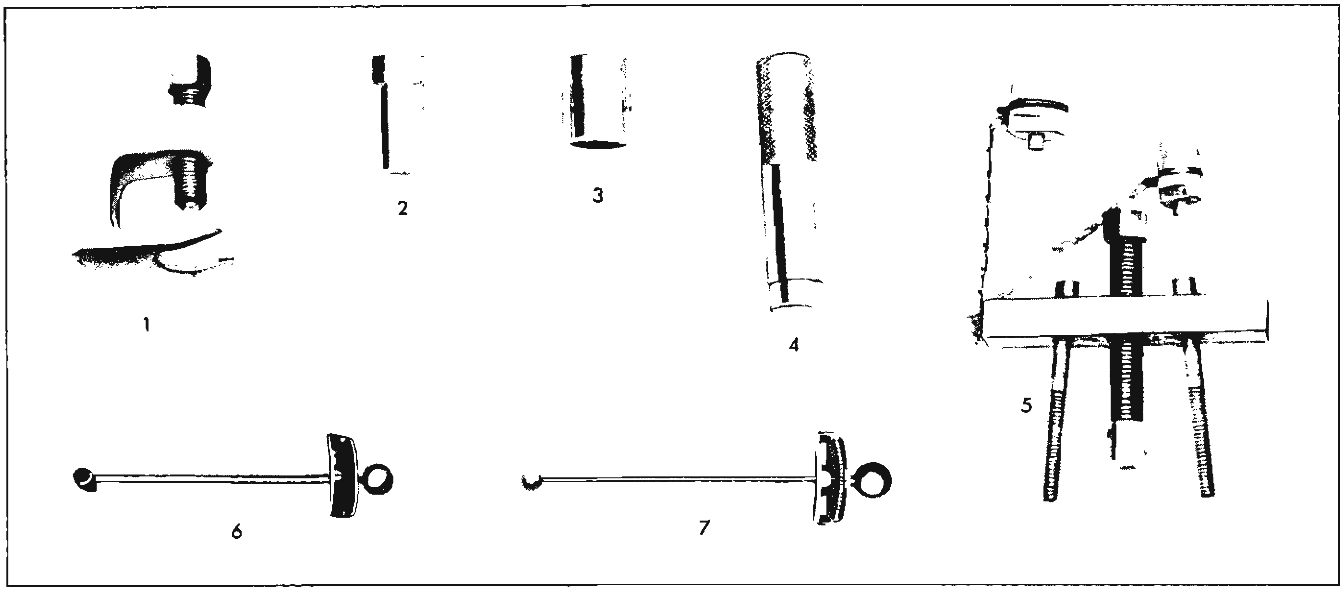


Fig. 50—Special Tools

1. J-6627 Pitman Arm Puller
2. J-8366-1 Sector Shaft Bushing Installer
3. J-8357 Relay Rod Bushing Installer
4. J-8366-2 Sector Shaft Bushing Remover
5. J-2927-A Steering Wheel Puller
6. J-1315 Torque Wrench (In. Lbs.)
7. J-1313 Torque Wrench (Ft. Lbs.)

SECTION 10

WHEELS AND TIRES

INDEX

GENERAL DESCRIPTION

All Passenger Cars - Chevrolet, Chevelle and Chevy II, are equipped with all steel welded wheels. The wheel rims are designed to accept matching size tubeless tires. The wheels are connected to the front wheel hubs and the rear axle shaft flanges with five studs and nuts each. All vehicles have snap-on type hub caps or wheel trim covers.

All Models are equipped with tubeless tires as follows:

TIRE SIZES

Vehicles	Station Wagons and Pickup	All Others	
		Standard	Special Order
Chevrolet	(a)8.25/14	(b)7.35/14	8.25/14 7.75/14
Chevelle	(c)7.35/14	(f) 6.95/14	7.35/14 7.75/14
Chevy II	7.00/13	(d)6.00/13 6.50/13	(e)6.50/13 6.95/14

(a) Also with 409 cu. in. engine.
(b) 7.75/14 with convertibles and models equipped with 327 cu. in. engines.
(c) Also with 327 cu. in. V-8 engines.
(d) 6.95/14 with V-8 engines.
6.00/13 with 4 cylinder engine.
(e) Standard for Nova SS and Models with V-8 engines.
(f) 7.35/14 with 327 cu. in. V-8 engines, or 283 cu. in. V-8 engines with air conditioning.

The spare tire is mounted horizontally in the front section of the trunk compartment on all models except the station wagon, where it is mounted vertically in a well near the inside of the right rear fender. A bumper-type jack with a wide base, and a combination jack handle, wheel nut wrench and hub cap remover are supplied with all models.

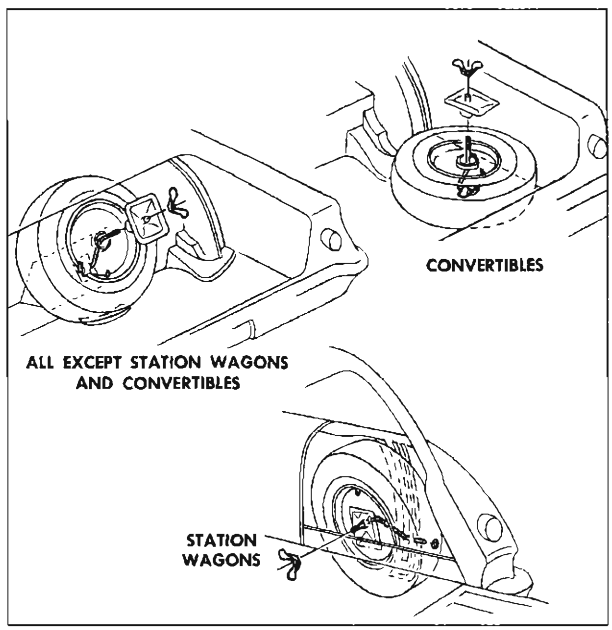


Fig. 1—Chevrolet Spare Tire Stowage

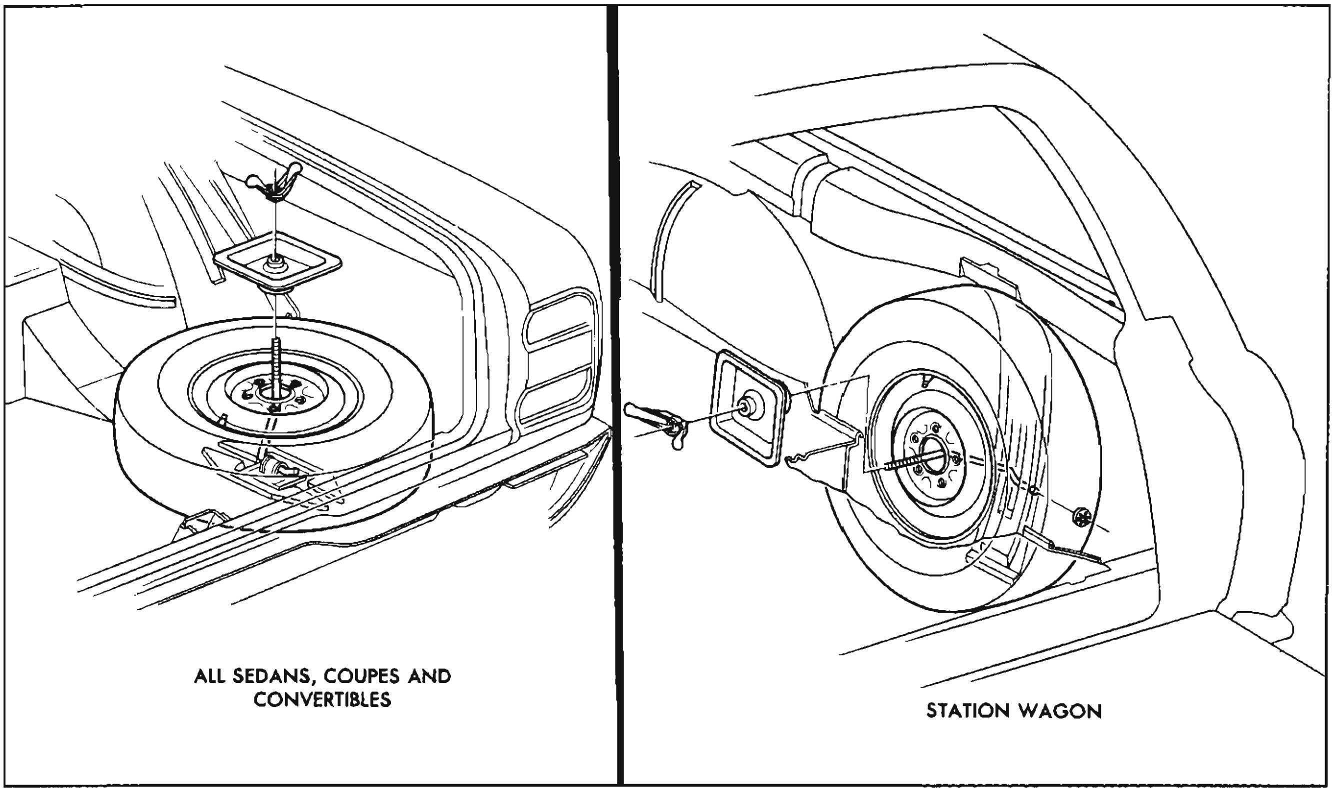


Fig. 2—Chevelle Spare Tire Stowage (except pickup)

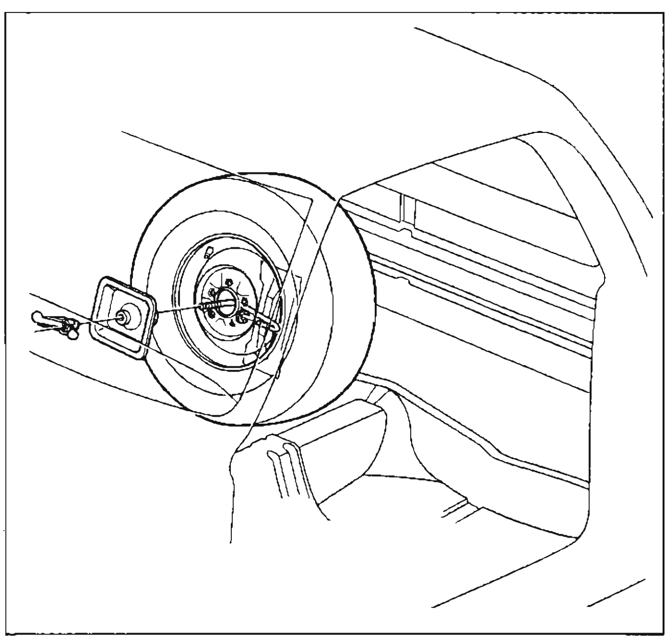


Fig. 3—Chevelle Pickup Spare Tire Stowage

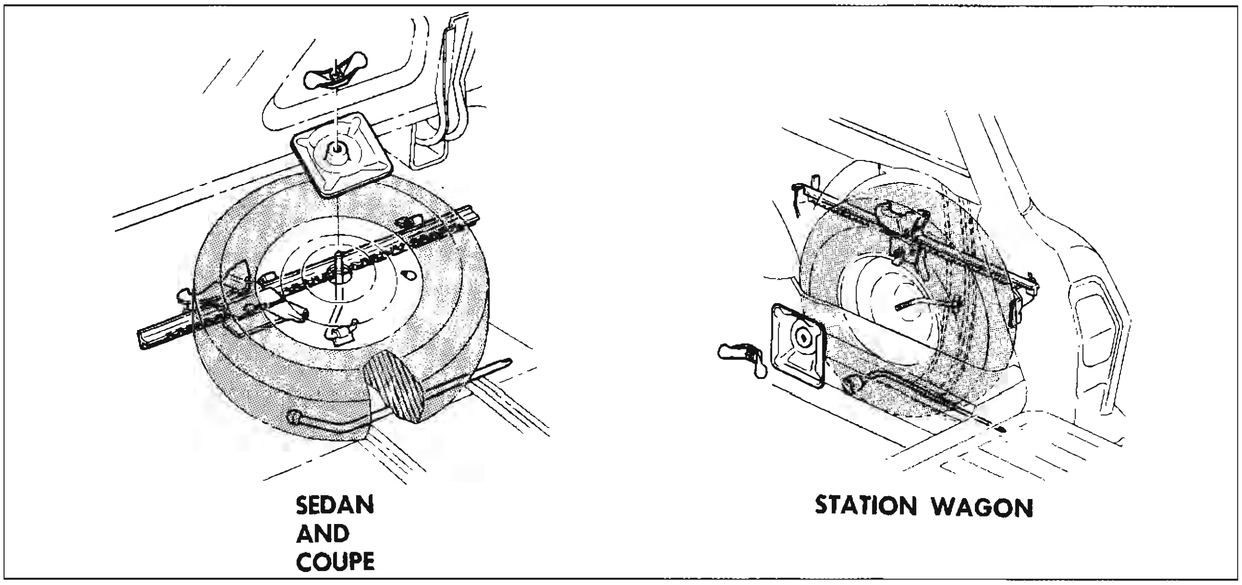


Fig. 4—Chevy II Spare Tire Stowage

MAINTENANCE AND ADJUSTMENT

TIRES

Pressure

Keep tires inflated to the recommended pressures. Overinflation can adversely affect riding comfort and quietness, while underinflation affects vehicle handling and tire life.

Check tire pressures each time a car is brought in for service, not only as a convenience to the owner, but also to reduce owner complaint of riding, steering or tire wear which many times is due to improper tire inflation. Check tires with an accurate gauge.

Always reinstall tire valve caps to keep dust, water and mud out of the valve core.

INSPECTION

Every few thousand miles and at each lubrication, tires should be checked for sharp objects or stones in the tread. If tire is punctured, it should be repaired using one of several repair kits available through tire manufacturers' outlets.

WEAR

Misalignment

This is wear due to excessive toe-in or toe-out. In either case, tires will revolve with a side motion and scrape the tread rubber off. If misalignment is severe, the rubber will be scraped off of both tires (or all four tires if front toe is not correct); if slight, only one will be affected.

The scraping action against the face of the tire causes a small feather edge of rubber to appear on one side of the tread and this feather edge is certain indication of misalignment (fig. 5). The remedy is readjusting toe-in within specifications, or rechecking the entire front end alignment if necessary.

Heel and Toe

This is a saw-toothed effect where one end of each tread block is worn more than the other.

The end that wears is the one that first grips the road when the brakes are applied.

Heel and toe wear is less noticeable on rear tires than on front tires, because the propelling action of the rear wheels creates a force which tends to wear the opposite end of the tread blocks. The two forces, propelling and braking, make for more even wear of the rear tires, whereas only the braking forces act on the front wheels, and the saw-tooth effect is more noticable.

A certain amount of heel and toe wear is normal. Excessive wear is usually due to high speed driving and excessive use of brakes. The best remedy, in addition to cautioning the owner on his driving habits, is to interchange tires regularly.

Side

This may be caused by incorrect wheel camber, underinflation, high cambered roads or taking corners at too high a rate of speed.

The first two causes are the most common. Camber wear can be readily identified because it occurs only on one side of the treads, whereas underinflation causes wear on both sides (fig. 6).

There is, of course, no correction for high cambered roads. Cornering wear is discussed further on.

RECOMMENDED TIRE INFLATION PRESSURES

	Tire Ply Rating	Average Owner Service Up to 5-Passenger Load (Normal Inflation)				Continuous Service with Over 5-Passenger Load (Maximum Inflation)			
		Cold*		Hot**		Cold**		Hot**	
		Front	Rear	Front	Rear	Front	Rear	Front	Rear
		C H E V R O L E T							
All Models Except Station Wagons	4	24	24	29	29	@24	30	@29	35
	8	24	24	29	29	@24	40	@29	45
Station Wagons	4	24	28	29	33	@24	30	@29	35
	8	24	28	29	33	@24	40	@29	45
		C H E V E L L E							
All Models Except Station Wagons and Pick-Up Delivery	4	24	24	29	29	26	30	31	35
Station Wagons	4	24	28	29	33	@24	30	@29	35
Pick-Up Delivery	4	24	24	29	29	@24	30	@29	35
		C H E V Y II							
All Models Except Station Wagons	4	24	24	29	29	@24	30	@29	35
Station Wagons	4	24	28	29	33	@24	30	@29	35

*After car has been parked for 3 hours or more, or driven less than one mile.

**Pressures can rise as much as 7 pounds above cold figures depending on loads carried, length of driving, and car speed prior to checks.

***Pick-Up Delivery average owner service: 2-Passenger 300 lbs. additional load.

@Front tire loads do not increase appreciably with passenger or cargo loading, therefore, the above is recommended for best steering characteristics.

VEHICLE LOADING AND TIRE SELECTION

Full Load Capacity of the Vehicle is:

All Models except Station Wagons . . . . 1100 lbs. Total, 3 Passengers Front Seat
3 Passengers Rear Seat
200 lbs. Luggage

Station Wagons - 2 Seat . . . . 1200 lbs. Total, 3 Passengers Front Seat
3 Passengers Rear Seat
300 lbs. Luggage

Station Wagons - 3 Seat . . . . 1200 lbs. Total, 3 Passengers Front Seat
3 Passengers Second Seat
2 Passengers Third Seat
or 300 lbs.

Pick-Up Delivery . . . . 1250 lbs. Total, 3 Passengers Front Seat
800 lbs. additional load

Manufacturer's original equipment 4-ply rating tires are designed and thoroughly tested to meet all normal requirements of your vehicle as outlined above.

For continuous full load service or heavy duty operation, eight ply rated or oversized tire options are recommended at the above recommended tire pressures. Their use is particularly applicable to Station Wagons.

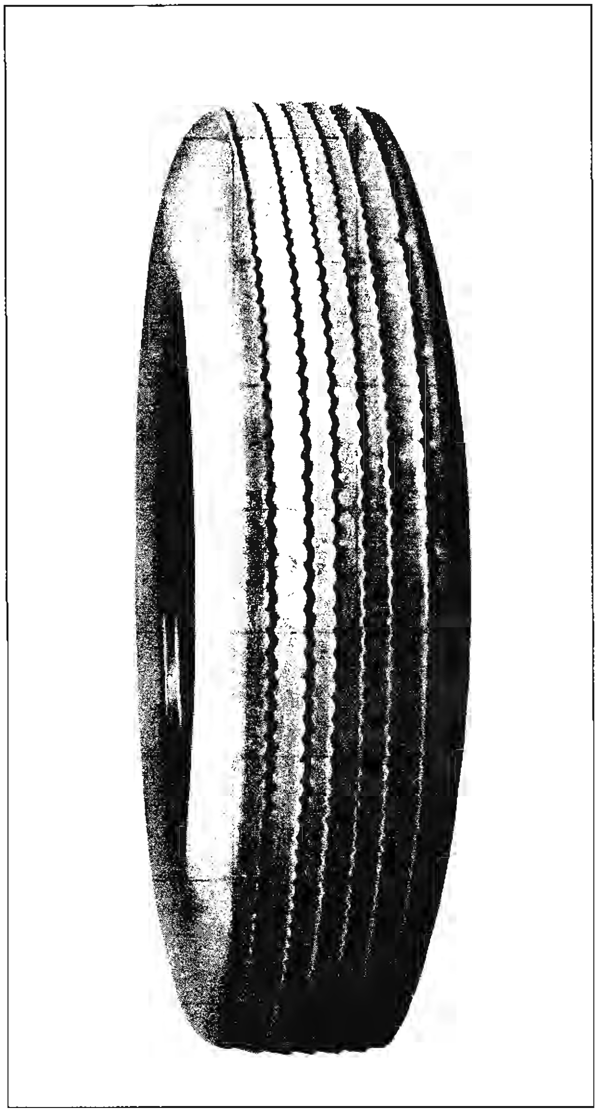


Fig. 5—Toe In or Toe Out Misalignment Wear

Center

This is caused primarily by overinflation of the tire (fig. 6). Invisible fabric damage can also be caused by overinflation.

Uneven

Uneven or spotty wear (fig. 7) is due to such irregularities as unequal caster or camber, bent front or rear suspension parts, out-of-balance wheels, brake drums out-of-round, brakes out-of-adjustment, or other mechanical conditions. The remedy in each case consists of locating the mechanical defect and correcting it.

Cornering

Since the introduction of independent spring front and rear wheels, improvements in spring suspension have enabled drivers to negotiate curves at higher rates of speed with the same feeling of security that they had with the older cars at lower speeds. Consequently,

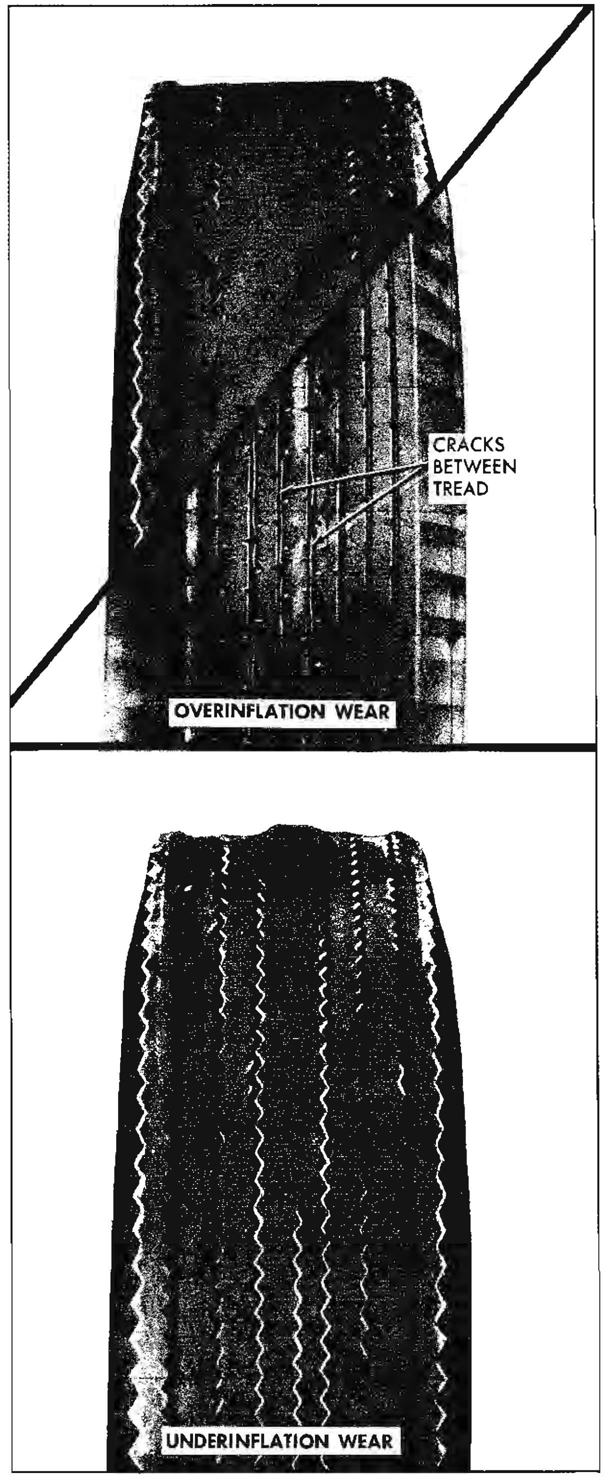


Fig. 6—Over and Under Inflation Wear

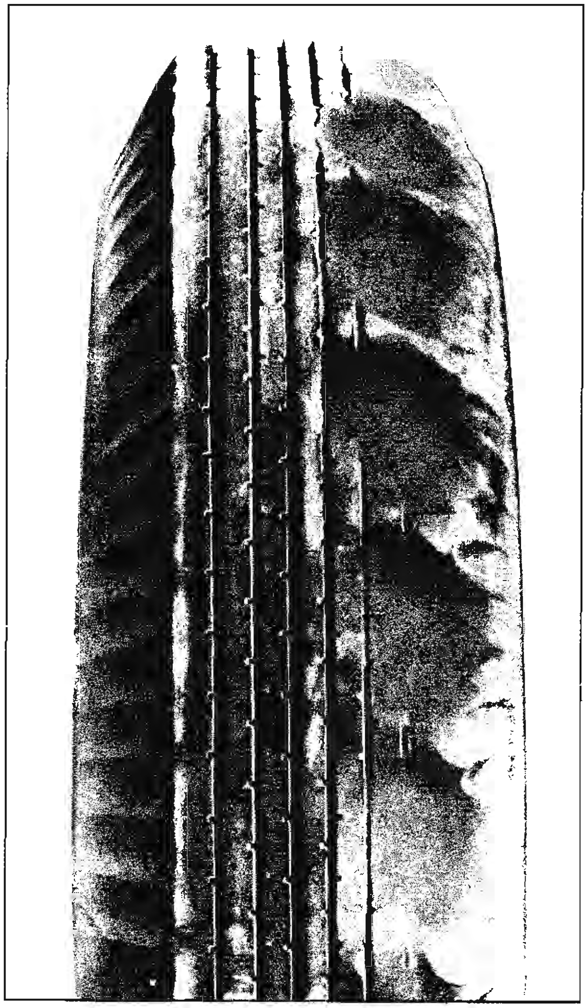


Fig. 7—Spot Wear

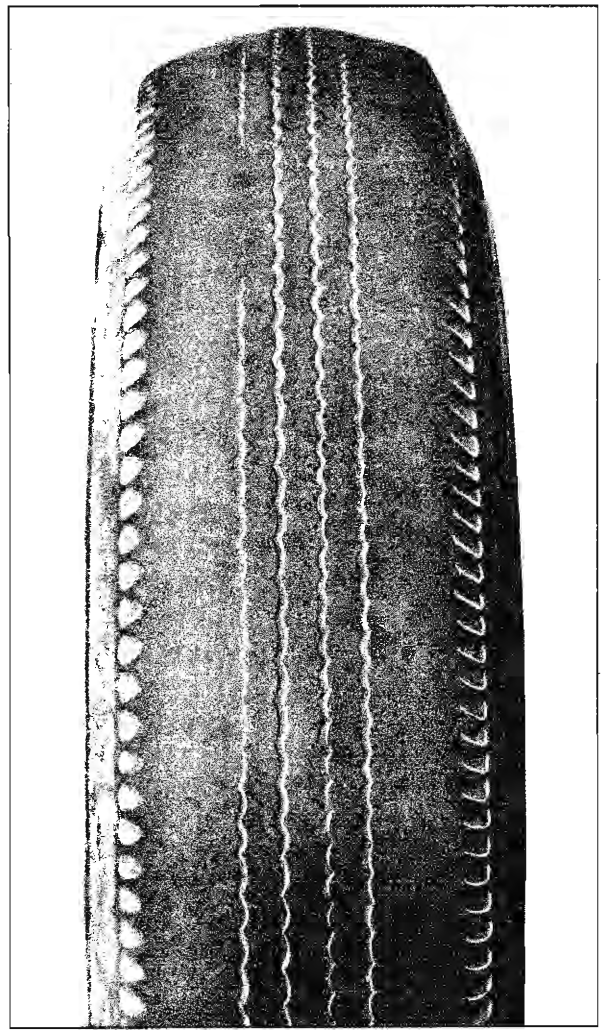


Fig. 8—Cornering Wear

curves are being taken at higher speeds with the result that a type of tire wear called "Cornering Wear" (fig. 8), frequently appears.

When a car makes an extremely fast turn, the weight is shifted from a normal loading on all four wheels to an abnormal load on the tires on the outside of the curve and a very light load on the inside tires due to centrifugal force. This unequal loading may have two unfavorable results.

First, the rear tire on the inside of the curve may be relieved of so much load that it is no longer geared to the road and it slips, grinding off the tread on the inside half of the tire at an excessive rate. This type of tire shows much the same appearance of tread wear as tire wear caused by negative camber.

Second, the transfer of weight may also over-load the outside tires so much that they are laterally distorted resulting in excessive wear on the outside half of the tire producing a type of wear like that caused by excessive positive camber.

Cornering wear can be most easily distinguished from abnormal camber wear by the rounding of the outside shoulder or edge of the tire and by the roughening of the tread surface which denotes abrasion.

Cornering wear often produces a fin or raised portion along the inside edge of each row in the tread pattern. In some cases this fin is almost as pronounced as a toe-in fin, and in others, it tapers into a row of tread blocks to such an extent that the tire has a definite step wear appearance.

The only remedy for cornering wear is proper instruction of owners.

ROTATION

To minimize the possibility of tire noise and to equalize tire wear, it is recommended that tires be interchanged every 6000 miles as shown in Figure 9 or more frequently in the case of extremely heavy wear. Interchanging tires will effectively prevent undue wear on any particular tire. If tire interchanging is followed as recommended above, all tires will have the same number of miles in each wheel position at the end of the

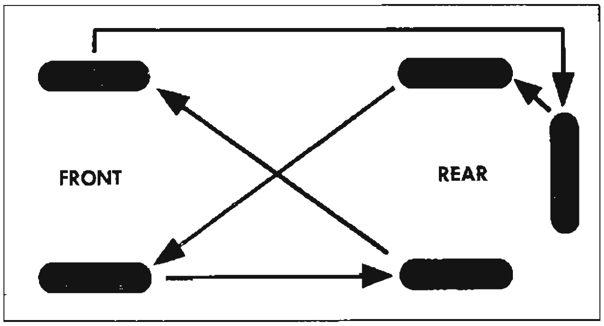


Fig. 9—Tire Rotation

fourth change. The car will have been driven 30,000 miles, but each tire will have only 24,000 miles of use. When interchanging tires, inspect for signs of abnormal wear, bulging, etc., stones, glass, and nails should be removed before reinstallation.

NOISE

Noise caused by the normal action of tire treads on various road surfaces is often confused with rear axle gears or other noises in the car.

The determination of whether tires are causing the noise complained of is relatively simple. The car should be driven at various speeds and note taken of part throttle, and sudden acceleration and deceleration. Axle and exhaust noises show definite variations under these conditions, while tire noise will remain constant. Tire noise is, however, most pronounced at speeds of approximately twenty or thirty miles per hour.

The tires may be further checked by driving the car over smooth pavement with the tires at normal pressure and again over the same stretch of pavement when the tires have been inflated to fifty pounds pressure. Reduce the tires to normal pressure one at a time to determine the faulty tire or tires. This high inflation pressure should immediately be reduced to normal after test. If the noise for which the test is being made is caused by tires, it will noticeably decrease when the tire pressure is increased, whereas axle noise should show no change in volume.

If, on inspection, the tires on the front wheels are found to be creating most of the noise the alignment of the front wheels should be checked. Excessive tire noise usually results from lower than recommended tire pressure, incorrect alignment, uneven tire wear, or defective (thumper) tire.

CLEANING

A great deal of ordinary road dirt which collects on white sidewall tires may be sponged off with clear water or a mild soap solution.

A good brand of whitewall tire cleaner, however, is a quicker and more effective cleaner for removing dirt and stains from whitewall tires and in many cases it will remove stains and discoloration that the simpler method of soap and water will not remove.

Under no circumstances should gasoline, kerosene or any cleaning fluid containing a solvent derived from oil be used to clean whitewall tires. Oil in any form is detrimental to tire rubber and a cleaner with an oil base will discolor or injure whitewall tires.

CHANGE (W/WHEELS)

To change the road wheels using the jack that comes with the car, observe the following procedure:

1. Set hand brake and block front wheels if rear wheel is being changed.
2. Remove hub cap or wheel disc and break wheel mounting nuts loose.
3. Place the jack as directed under, General Information, Section 0 and raise car until wheel clears ground.
4. Remove wheel mounting nuts and remove wheel from hub or drum.
5. To replace road wheel, reverse the above instructions. Proper torque on nuts is 55-65 ft. lbs.

CAUTION: On models equipped with discs, index the pilot hole in the disc on the valve stem. (To insure that the anti-rotation notches in wheel disc register on lugs in wheel rim.)

WHEEL BALANCING

STATIC BALANCING (W/TIRE)

Static Balance (still balance) is the equal distribution of weight of the wheel and tire assembly about the axis of rotation so that the assembly has no tendency to rotate by itself. Static unbalance causes the pounding action of the front wheels that is called "tramp".

To correct static unbalance (front and rear): The quickest and best methods to correct static unbalance are through the use of wheel balancers which are commercially available. Refer to the Information and instructions included with these balancers.

DYNAMIC BALANCING (W/TIRE)

Dynamic Balance (running balance) requires the wheel to be not only in static balance, but balanced and running smoothly while turning on an axis which runs through the centerline of the wheel and tire perpendicular to the axis of rotation.

The quickest and best methods of testing and correcting dynamic unbalance are by the use of dynamic wheel balancers which are commercially available. These balancers include all necessary information on where and how the balancing weights should be placed. The following information, however, will help in the correction of dynamic balance.

NOTE: Before attempting to balance the wheels, check to be certain that no foreign matter has been trapped in the wheel ventilation slots or in the accessory wheel discs. This is especially important if the vehicle has been run in soft mud and then parked in freezing weather.

When a wheel that is statically unbalanced is dynamically in balance the hynamic balance can be retained while correcting the static balance by installing the corrective weights so that half of the weight required is placed on the inner edge of the rim and the other half on the outer edge of the rim.

Dynamic unbalance can be corrected without destroying static balance by installing weights so half of weight required for dynamic balance is placed on the rim opposite the heavy point, while the other half is placed 180° away and on the opposite side of the rim.

RUN OUT (W/O TIRE)

The wheels should not run out (wobble) more than 1/16" as measured on the side of the rim at the base of the tire. Excessive run-out is the result of a bent wheel, an improperly mounted wheel, worn knuckle bearings or steering connections. These parts should be checked for correct adjustment, proper alignment and wear whenever excessive run-out is encountered.

The wheels should also run concentric with the steering knuckle spindle within 1/16 inch as measured on the tire bead seat of the rim with the tire removed.

Wheel run-out, eccentricity and balance are closely associated with steering and front wheel alignment. Further information on these subjects will be found under "Suspension".

SERVICE OPERATIONS

TIRES

Removal

Dismounting tubeless tires presents no problems if the correct procedures are used and the following precautions observed.

1. Remove the valve cap and valve core. Let out all the air.
2. Press the inner side of the tire into the rim well. Use bead loosening tool or if regular tire irons are used, take particular care not to injure or tear the sealing ribs on the bead.

   CAUTION: Never use tire irons with sharp edges or corners.

3. Using tire irons on the opposite side, remove bead, taking small "bites" around the rim.
4. Turn the tire over, and use two tire irons, one between the rim flange and the bead to pry the rim upward, the other iron to pry outward between the bead seat and the bead.

Installation

The general procedure is the same as for tube and tire installation except that extreme care must be exercised to prevent injury to the sealing bead and circumferential bead when forcing tire over rim.

1. Apply a light film of Ruglyde or other suitable rubber lubricant to sealing bead of tire.

   NOTE: The use of excessive lubrication may lead to rim slippage and subsequent breaking of oil seal.

2. Carefully mount the outer bead in usual manner by using tire irons, taking small "bites" around rim, being careful not to injure the tire bead.

   CAUTION: DO NOT use a hammer, as damage to the bead will result.

3. Install the inner bead in the same manner.

   NOTE: If a seal cannot be effected in the foregoing manner with the rush of air it can be accomplished by applying to the circumference of the tire a tire mounting band or heavy sash cord and tightening with the use of a tire iron. On tire mounting machines, bouncing the tire assembly is not required. The tire should be lifted on the rim to force the top tire bead against the top rim flange. The weight of the tire will seat the bottom bead.

Repair

Hot Patch

With this method the patch uses its own fuel to be ignited when vulcanization takes place. This method is recommended for repairing punctures not exceeding 3/16" in diameter. Size of puncture can be determined by size of puncturing object.

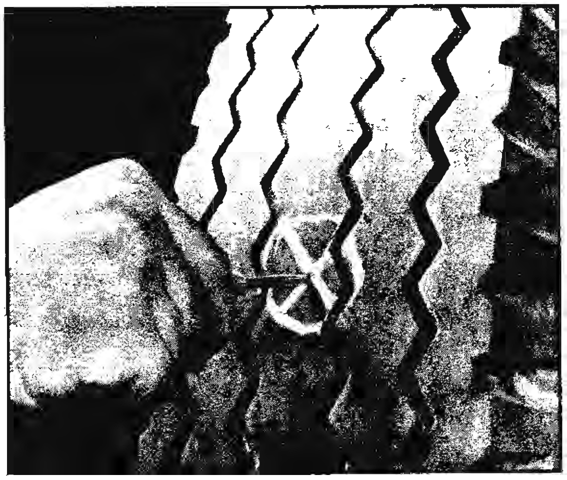


Fig. 10—Cleaning Hole with Awl

1. Clean out the injury with an awl or hand rasp furnished with the tire repair kit (fig. 10).
2. Using sealing gun, fill puncture from outside of tire, see Figure 11.
3. Thoroughly clean inside of tire around injury with a suitable cleaner. Allow the cleaned area to dry.
4. Roughen area around injury with hand buffer or wire brush, see Figure 12.
5. Spread an even coating of a good grade of rubber cement over the puncture, slightly larger than the patch area, and allow to dry for 5 minutes.
6. Prepare patch material for igniting by loosening material slightly with point of a knife blade in then center of each side.
7. Carefully center hot patch over injury and hold in place using special hot patch clamp. Tighten clamp, maximum finger tight. (See Figure 13.)
8. Ignite patch material. Allow to cool 15 minutes or until cool enough to touch.
9. Carefully remove metal cup and blow out any ashes remaining in tire.

Self Vulcanizing

In this method, a chemical action vulcanizes the patch.

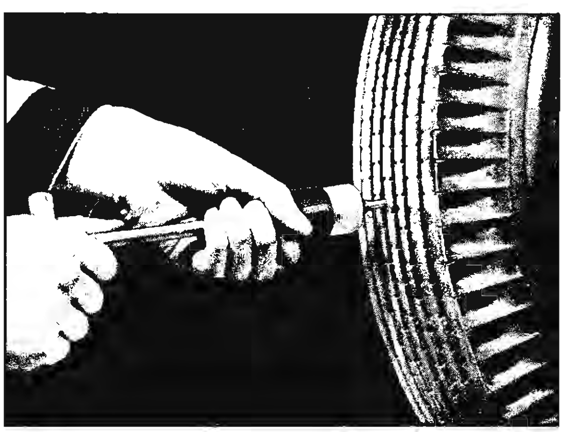


Fig. 11—Filling Hole with Sealing Gun

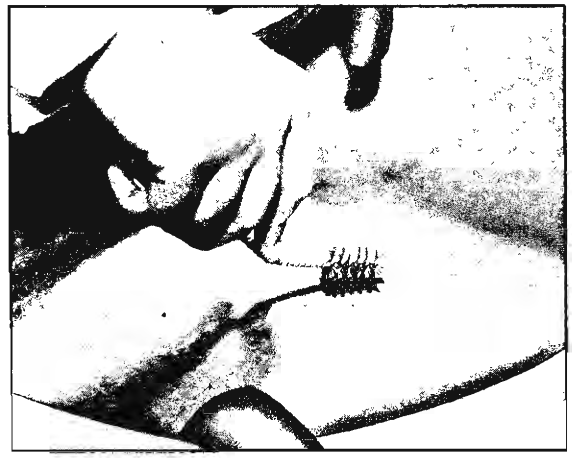


Fig. 12—Roughening Injury Area

Fig. 13—Using Hot Patch Clamp

No external source of heat is necessary. Maximum size of puncture hole must not exceed 3/16" for this method of patching. (Larger size injuries must be repaired with press type vulcanizing equipment.) Many kits are manufactured and may be procured locally.

NOTE: This method should be used only for tires without soft puncture sealing material. The following procedure should be followed in using this kit.

1. Clean out the injury with the awl to remove puncturing object and foreign material.
2. Thoroughly clean the inside of the tire around the injury.
3. Fill the injury with Filler Rubber (Supplied in the kit) using the awl as follows:
   a. Clean awl needle and dip in Self-Vulcanizing Fluid. From inside of tire, force needle through tire until point extends beyond tread (fig. 14).
   b. Remove detachable handle from awl needle. Cut 1/8" by 1" strip of Filler Rubber, remove protective cover and insert into hole of awl needle with end of rubber strip extending beyond the needle (See Figure 15).
   c. Pull needle through tire with pliers. Filler Rubber will remain in the puncture. Cut off excess

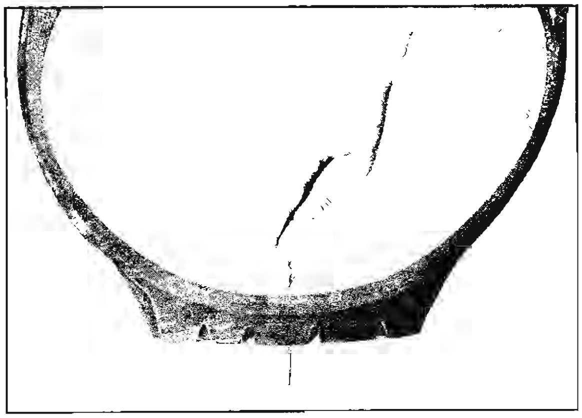


Fig. 14—Installing Needle in Tire Hole

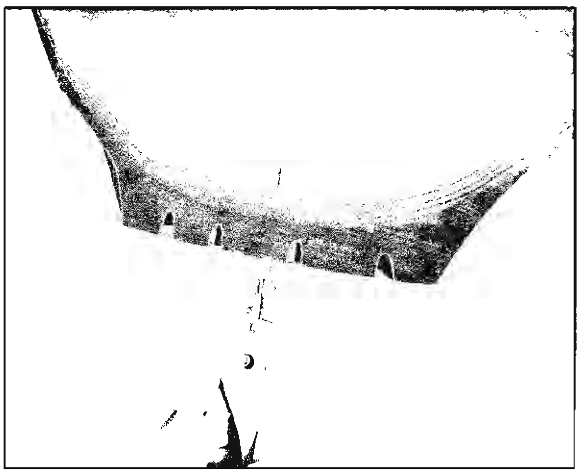


Fig. 15—Installing Filler Rubber in Hole

rubber flush with inside of tire. The injury may also be filled from the outside or inside with a sealant gun. Hold gun tip firmly against puncture and force sealant through until it comes through the other side of the tire.

4. Thoroughly roughen area around puncture, slightly larger than the patch, with wire brush included in kit. Remove all traces of lubricant, foreign matter, etc. Do not use additional solvent after buffing.
5. Apply Self-Vulcanizing fluid over buffed area. Spread evenly with clean finger. Allow to dry for five minutes until no longer tacky. This is important.
6. Remove foil backing from patch. Place over injury and stitch down firmly (fig. 16), especially the edges, with roller tool included in kit. To prevent buckling and insure a good seal, roll patch from the center toward the outer edges. Vulcanization is completed chemically. The repaired tire can be placed back in service immediately.

Self Vulcanizing Plug

Through the use of self-vulcanizing outside plug repair kits currently on the market, passenger cars tubeless

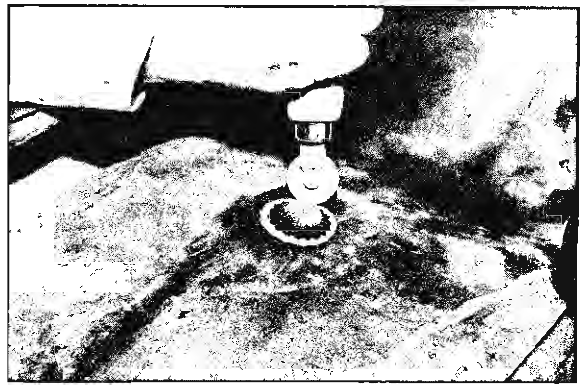


Fig. 16—Stitching Patch

tire punctures can now be permanently repaired without dismounting the tire from the rim and in many cases, without removing the wheel from the car.

Punctures which cannot be repaired, are those which are over 3/16 inch diameter, or leaks caused by incisions or ragged lacerations. Outside plug repairs can be made on all passenger car tubeless tires including those containing soft puncture sealing material.

The following procedure should be followed in using these kits.

1. Inflate tire to approximately 10 pounds pressure to support tire. Satisfactory repairs can be made with lower, or no pressure.
2. Locate puncture. Mark, and note direction of angle of puncture channel when removing puncturing object.
3. With cutter shaft of reaming tool in position, make circular cut (approx. 1/4 in. deep) around puncture hole, using twisting action (fig. 17).
4. Flip the screw-type cleaning needle of reaming tool into position and insert into puncture (fig. 18). Apply light pressure only and turn clockwise into puncture channel right down to the handle of the tool, carefully following the direction of the puncture. Retract tool by continuing to turn clockwise but with slight pulling action. Repeat this operation twice. Clean rubber particles, if any, from round cutter of needle, after each retraction. Make sure the small circular cutout

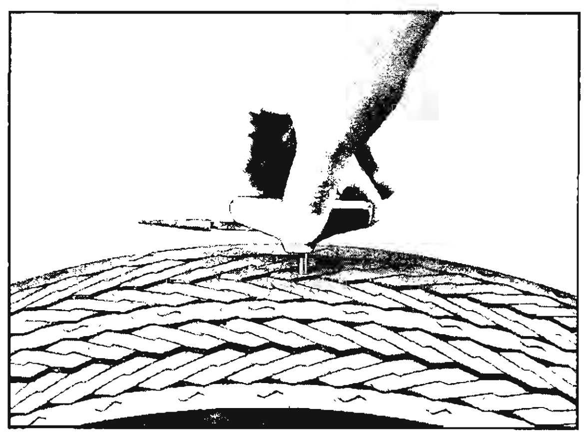


Fig. 17—Making Circular Cut with Reaming Tool

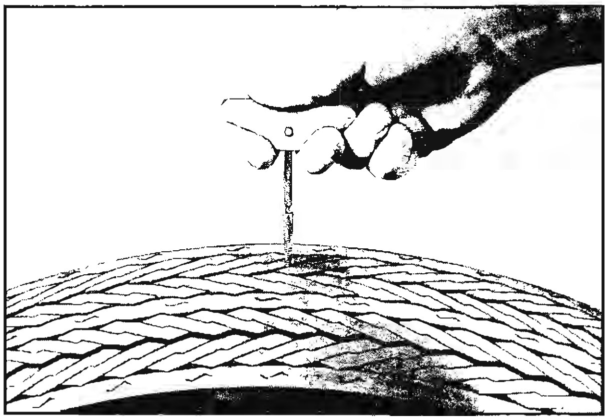


Fig. 18—Cleaning Puncture with Cleaning Needle

resulting from operation shown in Figure 17 has been removed. Leave the needle in the puncture to prevent escape of air.

5. Prepare the plug for insertion into nozzle of the plug-insertion tool by pulling white stem of plug in metal tube until the head of the plug is seated tightly against the end of the tube (fig. 19). Cut off protruding end of plug stem.
6. Prepare the plug-insertion tool for insertion of plug:
   a. Insert cartridge of self-vulcanizing rubber cement into open tool.
   b. Fit plunger into recessed cartridge base.
   c. Remove cleaning needle from the puncture and pierce cartridge with point of needle inserted through the nozzle of the tool. Enlarge the opening by twisting (fig. 20).
7. Press the nozzle of the plug-insertion tool firmly over the puncture hole and squeeze cement from cartridge until red spring on the tool stops the action (fig. 21). This deposits part of the cement. For repairs of punctures between narrow tread grooves attach short extension tube.
8. Insert the metal tube with plug into nozzle of the plug insertion tool, turning to the right until it is locked by the pin inside the nozzle. Lubricate head of plug with rubber cement. Place plug head over puncture hole--holding lower end of metal tube to guide it and prevent bending--and push the entire metal tube into the puncture hole up to the base of the nozzle (fig. 22). Now press red spring stopper and squeeze the balance of cement into the tire (fig. 23). Retract metal tube with continuous clock-

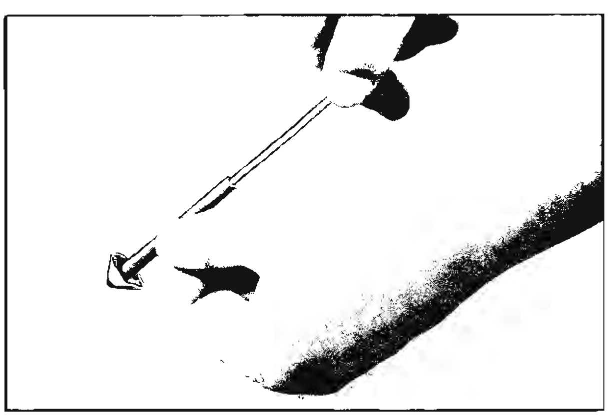


Fig. 19—Preparing Plug for Use

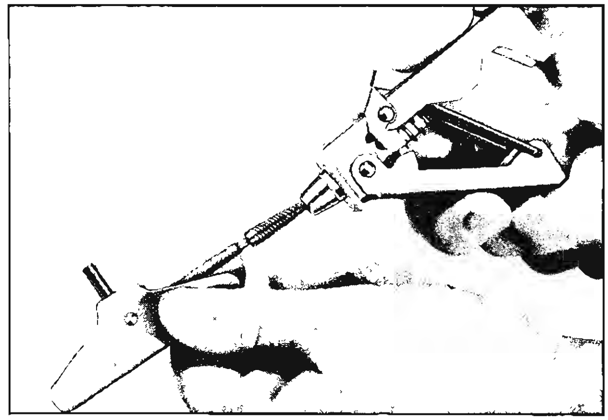


Fig. 20—Piercing Cement Cartridge

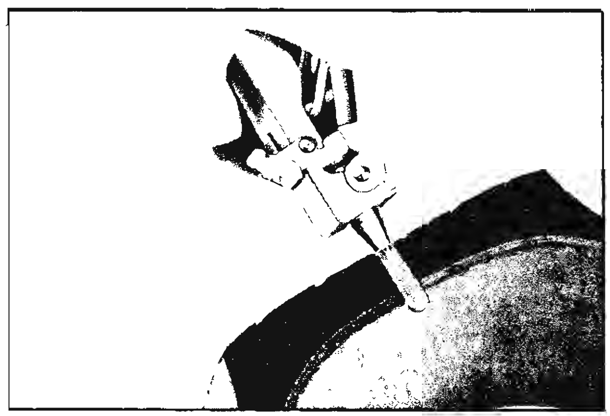


Fig. 21—Inserting Cement in Puncture

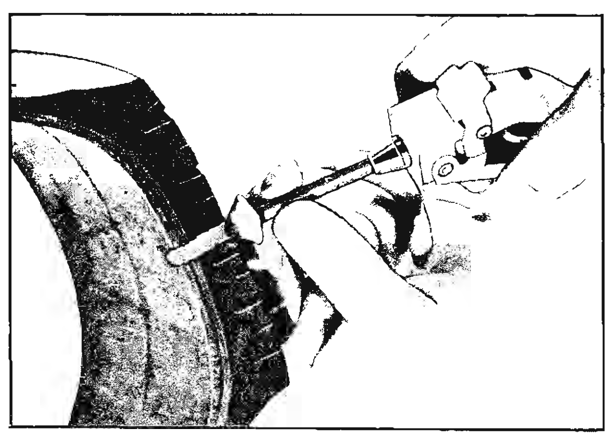


Fig. 22—Starting Plug into Puncture

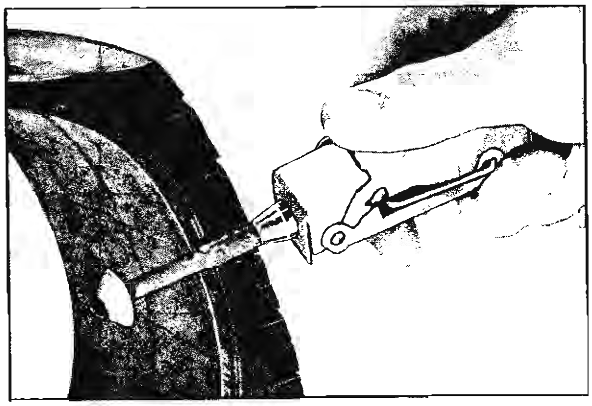


Fig. 23—Applying Remaining Cement with Plug Inserted

wise turning and pulling action (fig. 24). Do not pull, but trim off excess of rubber plug protruding from puncture. The repair is now complete and the tire is ready for immediate use.

9. Clean your tools. Especially remove hardened rubber cement before using the plug-insertion tool for the next repair.

NOTE: If the puncture is an irregular cut that will not seal completely by this method, a self-vulcanizing patch or hot patch repair should be made.

WHEELS

Valve Assembly—Replace

NOTE: Always use new valve assembly when replacing.

1. Cut or drive old valve assembly out of rim.
2. Clean valve hole and surrounding area on inside of flange with steel wool.
3. Coat O.D. of new valve assembly liberally with the mounting compound.
4. Insert assembly through rim from inside (fig. 25). Snap into place, using a pair of slip-joint pliers with one jaw on rim and one jaw on base of valve assembly.

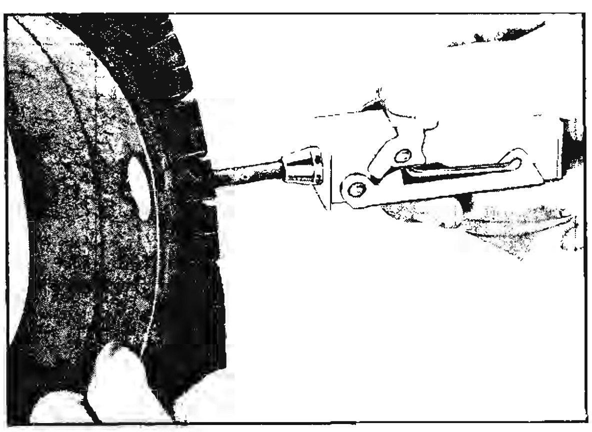


Fig. 24—Seating Plug to Complete Repair

Fig. 25—Installing Valve

Repair

Rim

1. Straighten the rim if it is bent or dented.
2. Clean rim flange thoroughly with small piece of steel wool or sand paper.
3. Inspect the butt-weld in the rim flange area to make certain there is no groove or high spot (fig. 26). Any grooves or high spots must be filed flat and smooth.
4. If air loss occurs at valve it can be corrected by replacing valve core or valve assembly.

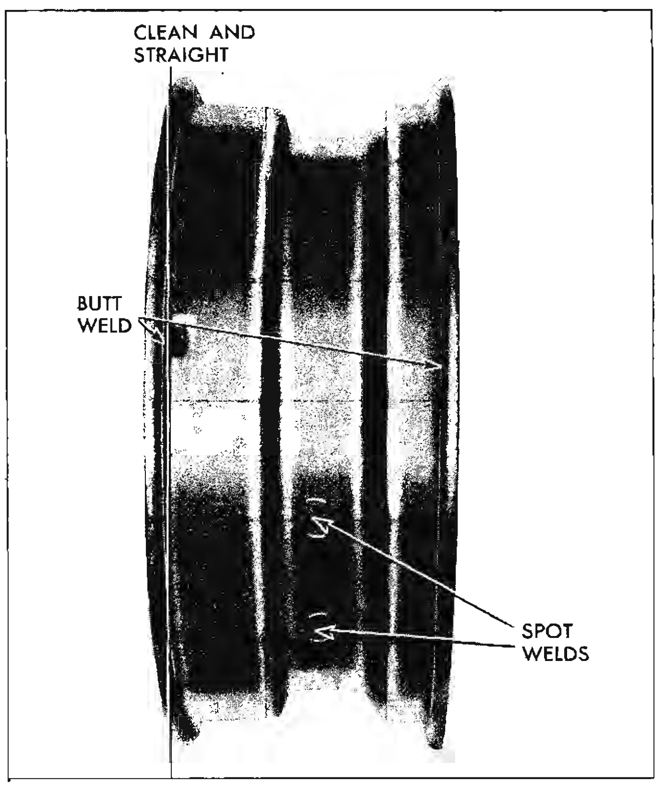


Fig. 26—Rim Inspection

SECTION 11

CHASSIS SHEET METAL

CONTENTS

CHEVROLET

INDEX

GENERAL DESCRIPTION

The all new front end appearance (fig. 1) of the 1965 Chevrolet Passenger Car affects the servicing and replacement of the front fenders, hood assembly and hood lock. The hood lock features a pop-up spring due to hood panel design. Access to hood release lever is through the radiator grille beneath the header panel.

MAINTENANCE AND ADJUSTMENTS

HOOD ADJUSTMENT

The alignment of the hood is controlled by the position of the hood hinges and the height of the two bumpers located one at each side of the radiator support. The adjustment at the hood lock must be made after the hinges and bumpers are positioned to yield the proper clearance.

To align the hood and lock proceed as follows:

HOOD HINGE (Fig. 2)

1. The body mounted portion of the hood hinges are slotted to provide up and down movement. The hood mounted end is slotted to provide forward and rearward movement.
2. Scribe a line around the entire hinge plate to be repositioned.
3. Loosen the appropriate screws and shift the position of the hood on the hinge plate the approximate amount to correct misalignment using the scribe marks to check amount of movement. Check the condition of adjustment by tightening cap screws and closing the hood.

BUMPERS

Hood bumpers should be adjusted so that the hood top surface is flush with the fender top surface and header panel.

CATCH ASSEMBLY AND LOCK BOLT

The hood catch assembly (fig. 3) mounting bolts are slotted to provide adjustment for the hood lock bolt. Adjust the hood lock bolt until hood and header peak the surface line as shown under sheet metal adjustment (fig. 4).

FENDERS

Fenders are adjustable with shims at the cowl and at the rocker panel area (fig. 5).

SHEET METAL ADJUSTMENTS

For proper operation of doors and hood, and for presentable appearance, front sheet metal must fit within the tolerances shown in Figure 4. The sheet metal is adjustable at six points (three on each side of car) by means of spacer shims shown by Figures 5 and 6.

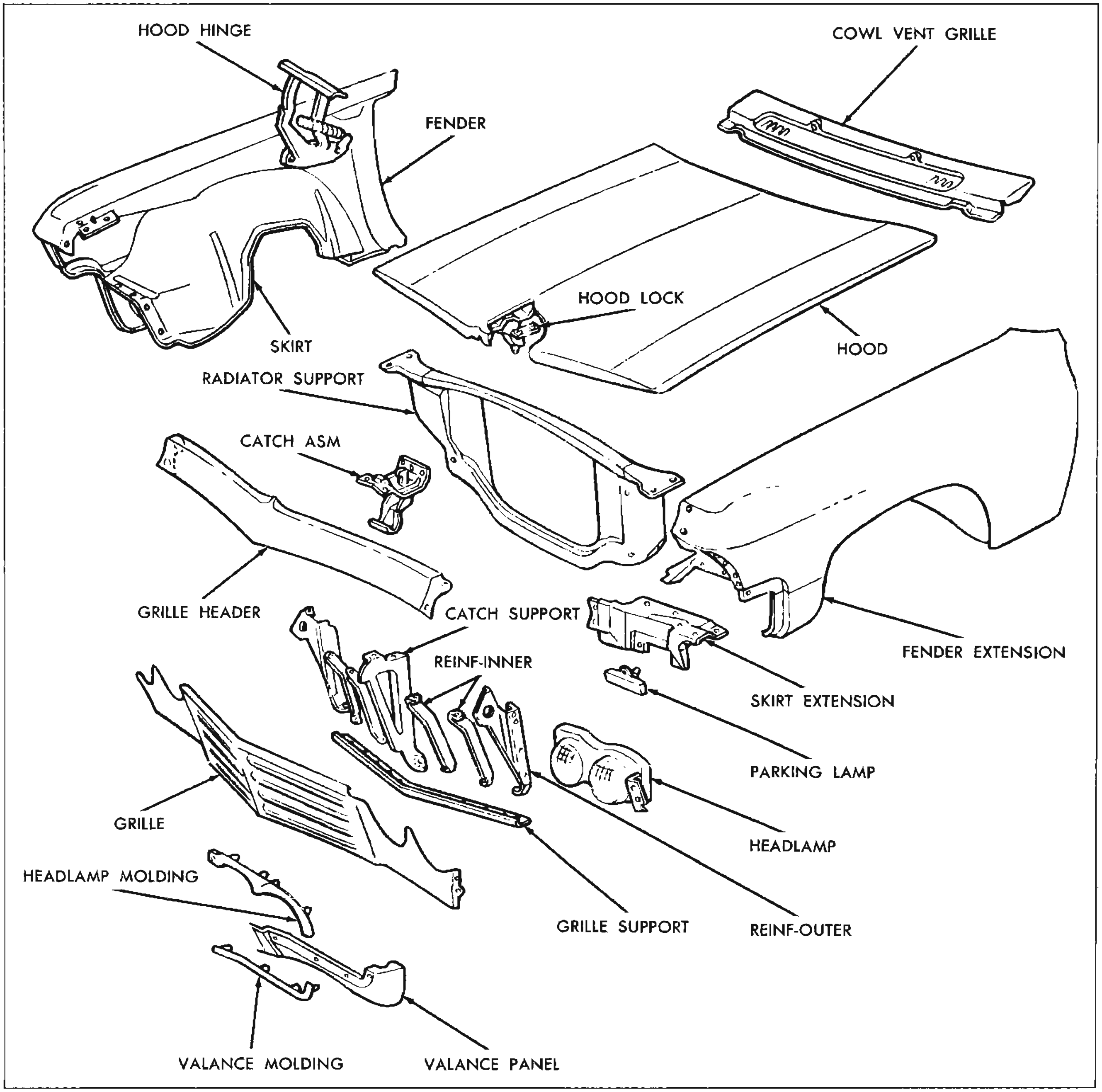


Fig. 1—Front End Sheet Metal

COMPONENT PART REPLACEMENT

BATTERY TRAY

Removal

1. Disconnect battery cables.
2. Remove screw and nut retaining battery hold down assembly and remove battery from vehicle.
3. Remove screws retaining battery tray assembly to fender skirt and radiator support and remove battery tray from vehicle.

Installation

1. Position battery tray on fender skirt and install screw.
2. Place battery in tray and install retainer assembly.
3. Install battery cables.

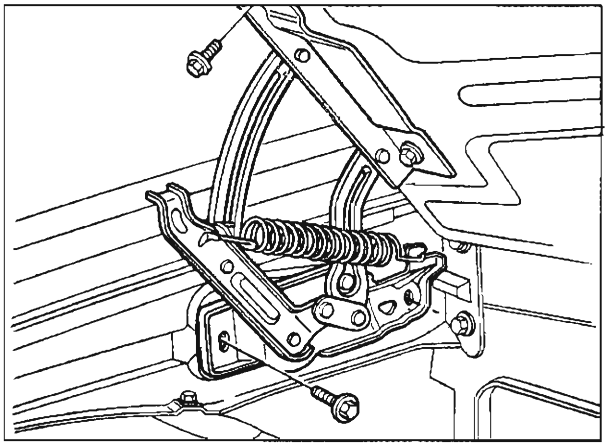


Fig. 2—Hood Hinge (Typical)

RADIATOR SUPPORT

Removal

1. Remove Front Bumpers as per Section 14.
2. Remove Battery and Tray as indicated above.
3. Remove two screws from each of the headlamp bezels. Pull out from the top and remove.
4. Remove catch assembly bolts from radiator support and header panel.
5. Remove grille assembly and attachments as per Section 13.
6. Remove bolt attachment retaining shroud to radiator support (V-8) or radiator to radiator support (L-6) and support in vehicle.

   NOTE: It is not necessary to drain radiator or to disconnect radiator hoses from engine if radiator is supported in vehicle.

7. Remove screws retaining radiator support to forward edge of fender skirt.
8. Remove mounting bolts retaining radiator support to each frame horn. Record number of shims.
9. Spread fenders apart enough to allow radiator support to be removed from vehicle.

Installation

1. Position the radiator support on vehicle, aligning mounting screw and bolt holes with drift punch.
2. Install cap screws and bolts loosely until all are started.
3. Replace all parts removed in reverse sequence under Removal procedure.
4. Aim headlamps as outlined in Section 12.

FENDER ASSEMBLY

Removal

1. Remove two screws retaining fender to radiator support. Record shims.
2. Remove two screws retaining fender to hood hinge. Support hood or remove both sides and hood, if required.
3. Remove screws from fender skirt extension.
4. Remove screws retaining fender to skirt.
5. Remove antenna.

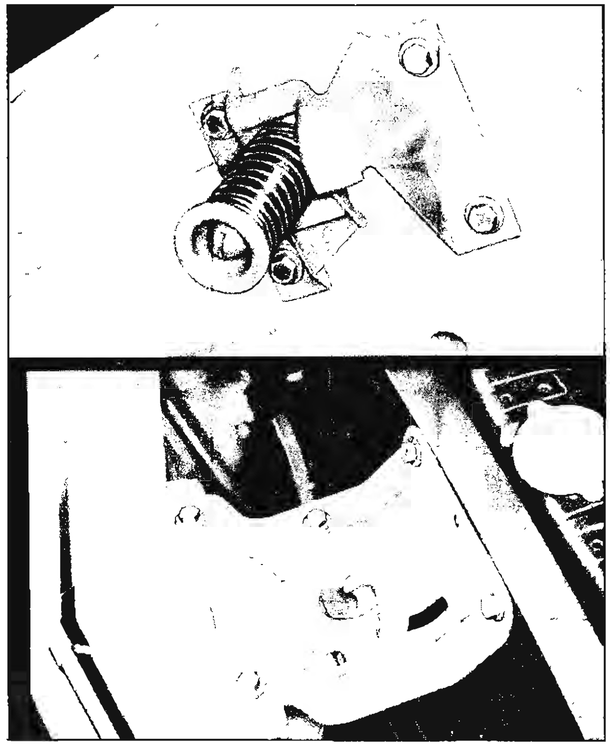


Fig. 3—Hood Catch, Support and Lock Plate

6. Remove two headlamp radiator support and two header panel attachments.
7. Remove one screw retaining fender to rocker panel and record number of shims found at this location. Remove one screw retaining fender to cowl and record number of shims found at this location.
8. Remove fender from vehicle.

Installation

When replacing fender, all screws should be installed loosely. Refer to disassembly procedure for location of screws. The shimmed screws located at rocker panel and cowl should be installed and adjustments should be made before tightening any of the other screws. Always start adjustment with original amount of shims, then add or subtract shims as required.

FENDER TRIM

To gain access to spear molding and wind-split molding retaining nuts, remove skirt assembly as outlined in this section and remove rear fender-to-cowl bolts and pry rear fender out several inches from body.

FENDER SKIRT

Removal

1. Jack up front end of vehicle and remove wheel.
2. Remove all wires, hoses etc. attached to skirt; also remove bolt attaching battery tray bracket to skirt. Remove battery.

   NOTE: It is not necessary to remove the battery tray.

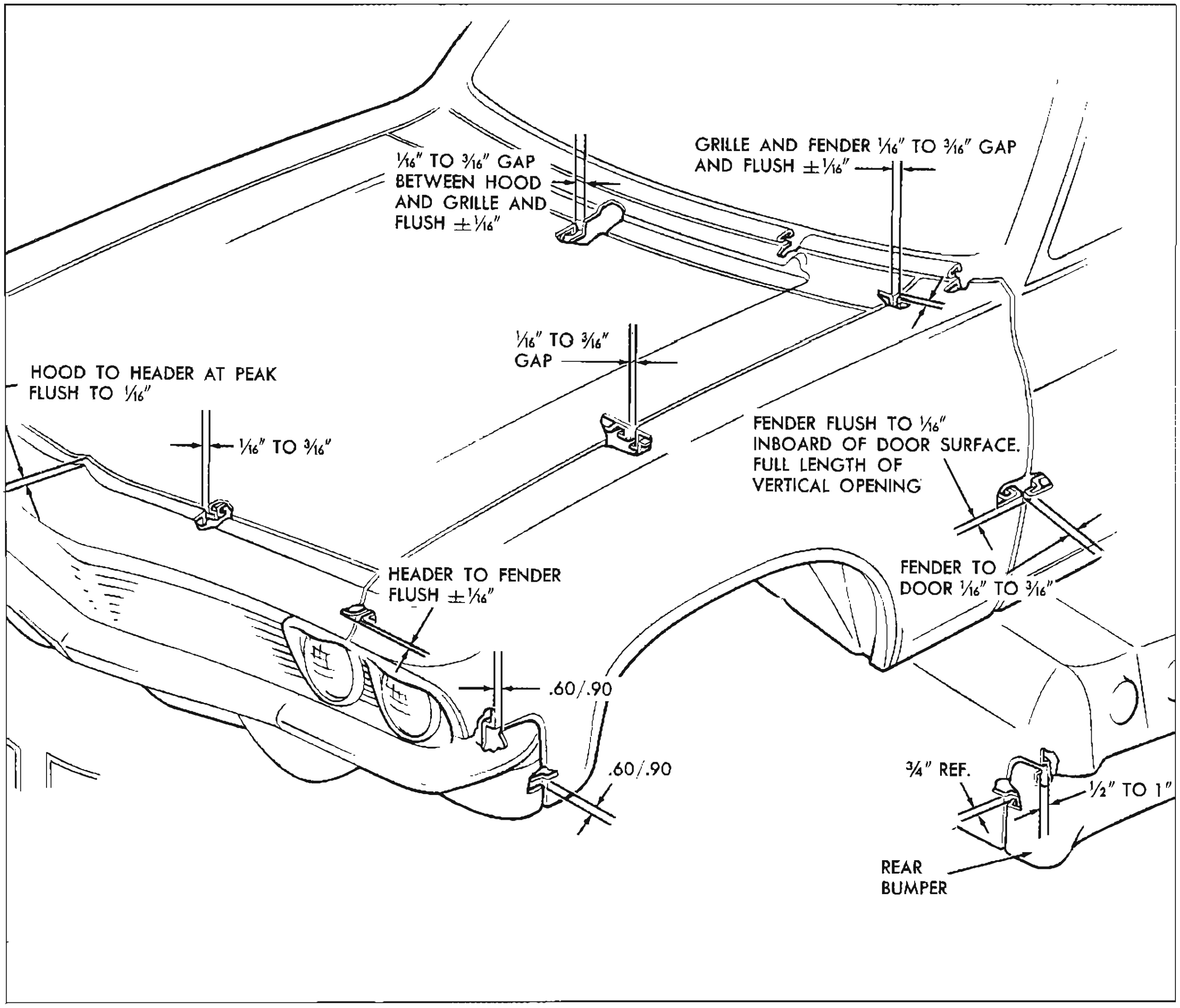


Fig. 4–Sheet Metal Adjustment

3. Remove cap screws retaining fender skirt extension to skirt, skirt to fender and hood hinges (in this order). Scribe line around hinge for replacement purposes. Note the size and shape of screws for proper location replacement.
4. Lower the skirt toward floor, rotate upper portion toward you and remove.

Installation

1. Position skirt on vehicle so that the front flange of the skirt lies between the skirt extension and fender.
2. Align holes and install screws.
3. Install all removed wiring and hoses.
4. Install wheel.

HOOD ASSEMBLY (FIG. 7)

Hood may be removed either with or without hinges. To shorten aligning time, hood hinge plates may be located by scribing a mark on hood and/or hood mounting bracket which outlines entire plate. See "Maintenance and Adjustments--Hood Hinge" for hood adjustment procedure. Hood hinge springs may be easily and safely removed and installed through the use of Tool J-9559 as follows:

1. With hood opened only far enough to allow passage of special tool between hood and fender, insert ends of J-9559 (through bolt removed) between coils of spring until barrel of tool contacts outer diameter of spring.
2. Open hood full while still holding spring (with tool installed) in hand; when hood is in opened position, spring may be removed as shown in Figure 8.
3. As soon as spring is removed, insert long bolt supplied with J-9559 through holes in end of tool (passing it through spring) and install nut on bolt.

Spring may be removed from J-9559 or J-9559 may be installed in a new spring by the following method.

1. Place a closed 6 or 8 inch "C" clamp in a vice or fasten it to a heavy bench top (bench should be fastened to floor).

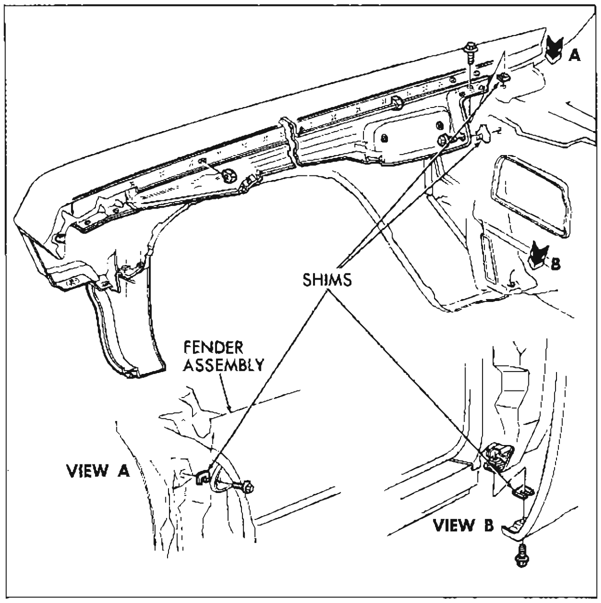


Fig. 5—Fender, Extension and Reinforcement

2. Hook one end of spring in clamp and the other end in hook of chain hoist, "cherry-picker" or equivalent, as shown in Figure 9.
3. Stretch the spring enough to allow insertion of J-9559. Install through bolt if spring is not to be installed on hinge at once.

HOOD LOCK AND CATCH ASSEMBLY (SEE FIG. 3)

Removal

1. Remove catch assembly as follows:

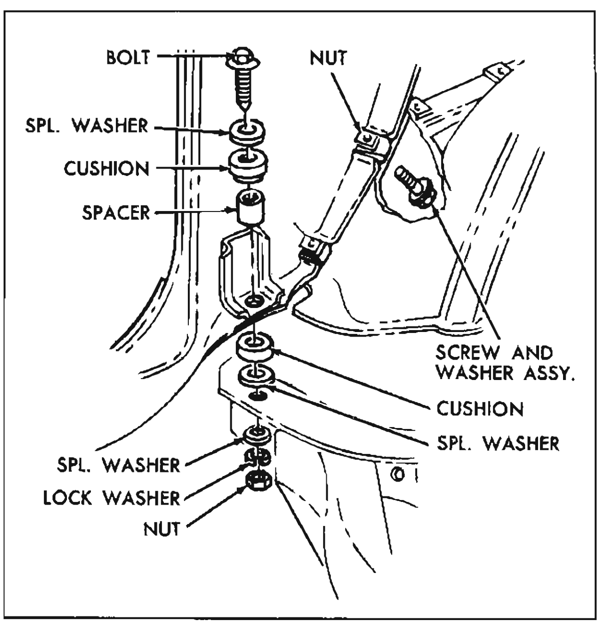


Fig. 6—Frame to Radiator Support Shimming

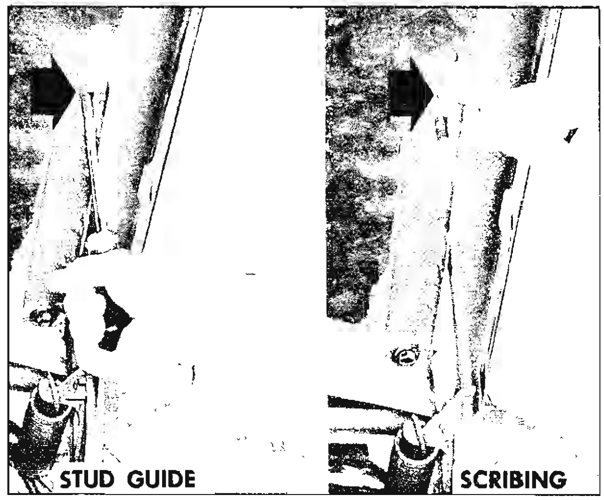


Fig. 7—Hood Replacement

a. Remove two cap screws retaining catch assembly to radiator support and header panel.
b. Remove cap screw retaining catch assembly at bottom of catch support assembly.

2. Before removing hood lock plate from hood, locate position on hood by scribing around "feet" of lock plate. Remove four cap screws retaining lock plate to hood and remove lock plate from vehicle.

Installation

1. Install both catch and lock assemblies in reverse order of removal procedure.
2. Align as outlined under "Maintenance and Adjustments--Hood Catch".

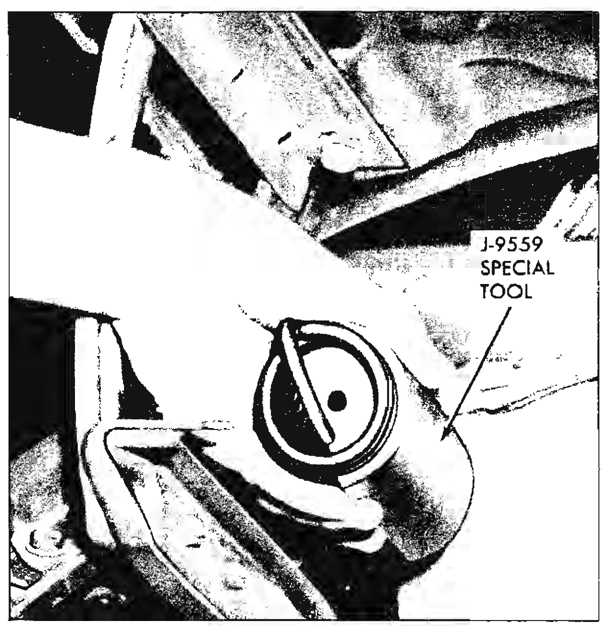


Fig. 8—Removing Spring with J-9559 (typical)

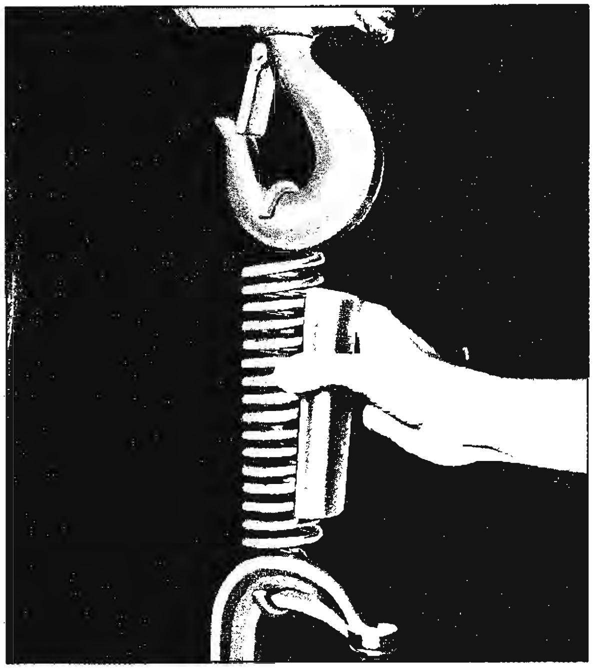


Fig. 9—Installing J-9559 in New Spring

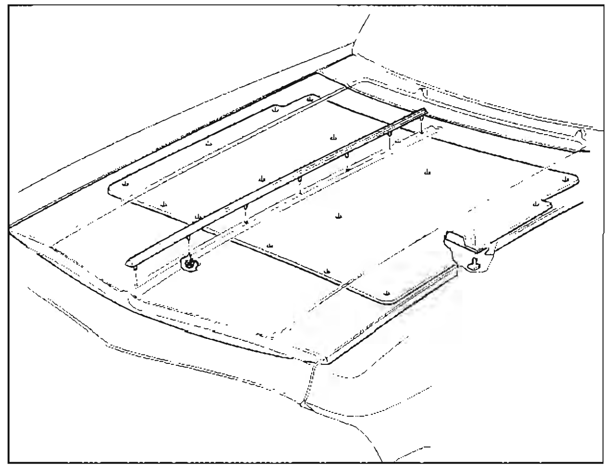


Fig. 10—Hood, Trim and Insulation

HOOD TRIM AND INSULATION (FIG. 10)

Figure 10 shows the installation details of both the hood ornamentation and insulating pads. The hood emblem and molding retaining nuts may be reached from the underside of the hood panel.

CHEVELLE

INDEX

GENERAL DESCRIPTION

NOTE: Refer to Section 13 for Radiator and Grille and Section 14 for Bumpers.

The hood hinge, bumpers and catch, hood and protective inner fender skirts are detailed by Figures 12, 13 and 19. The "double" fender protects the outer fender inner surface from corrosive effects of road slush and mud. A full length member connects the radiator support panel which fastens to the fender and fender skirt for a secure structure. The chassis sheet metal is depicted by the front end sheet metal illustration shown in Figure 11.

MAINTENANCE AND ADJUSTMENTS

HOOD ADJUSTMENT.

The alignment of the hood proper in relation to other sheet metal parts is controlled by the position of the hood hinges and the height of the two bumpers located one at each end of the forward edge of the hood. The adjustments at the hood latch must be made after the hinges and bumpers are positioned to yield the dimensions shown in Figure 14. Latch adjustments are made so that effort required to open and close the hood is reasonable and so that the hood alignment obtained by hinge and bumper adjustment is maintained when the hood is closed. Note that the hood latch is not designed or intended to correct basic hood alignment faults.

To align the hood and lock, proceed as follows:

HOOD HINGE (FIG. 12)

1. Note that the mounting holes in the body mounted end of the hinge are slotted to provide up and down movement of the hood assembly while the hood mounted end is slotted to provide fore and aft movement.
2. Scribe a mark around the entire hinge plate which will be involved in the adjustment.
3. Loosen the appropriate screws and shift the position of the hood on the hinge plate the approximate amount to correct misalignment using the scribed marks to check amount of movement. Check condition of adjustment by tightening cap screws and closing hood.

HOOD BUMPERS

Hood bumpers must be adjusted so that the hood top surface is flush with the fender top surface.

HOOD CATCH (FIG. 13)

Hood lock plate mounting holes are slotted to provide fore and aft adjustment.

LOCK

The hood lock bolt itself is adjustable for up and down positioning of the lock bolt head so that its proper engagement in the catch assembly may be provided for. The distance that the lock bolt protrudes out of the lock plate should be adjusted so that the hood bumpers are slightly compressed by the fully latched hood and so that the effort required to release the hood catch is reasonable.

SHEET METAL ADJUSTMENTS

For proper operation of doors and hood, and for presentable appearance, front sheet metal must fit within the tolerances shown in Figure 14. Sheet metal is adjustable at six points (three on each side of car) by means of spacer shims shown in Figures 15 and 18.

The fender-to-cowl and rocker panel shimming allows adjustment of fender surfaces to door surface and upper cowl surface.

The radiator support shimming provides a means of raising or lowering the forward part of front sheet metal assembly to correct faulty sheet metal-to-front bumper relationship and fender trailing edge-to-door parallelism (cowl and rocker panel shimmed mounts should be loosened before raising or lowering radiator support).

Note that it is possible and sometimes desirable to shift entire front sheet metal assembly to the left or right by loosening these shimmed mounts and applying the necessary force in those cases of extremely poor hood fit, overly wide fender-to-door gap, etc.

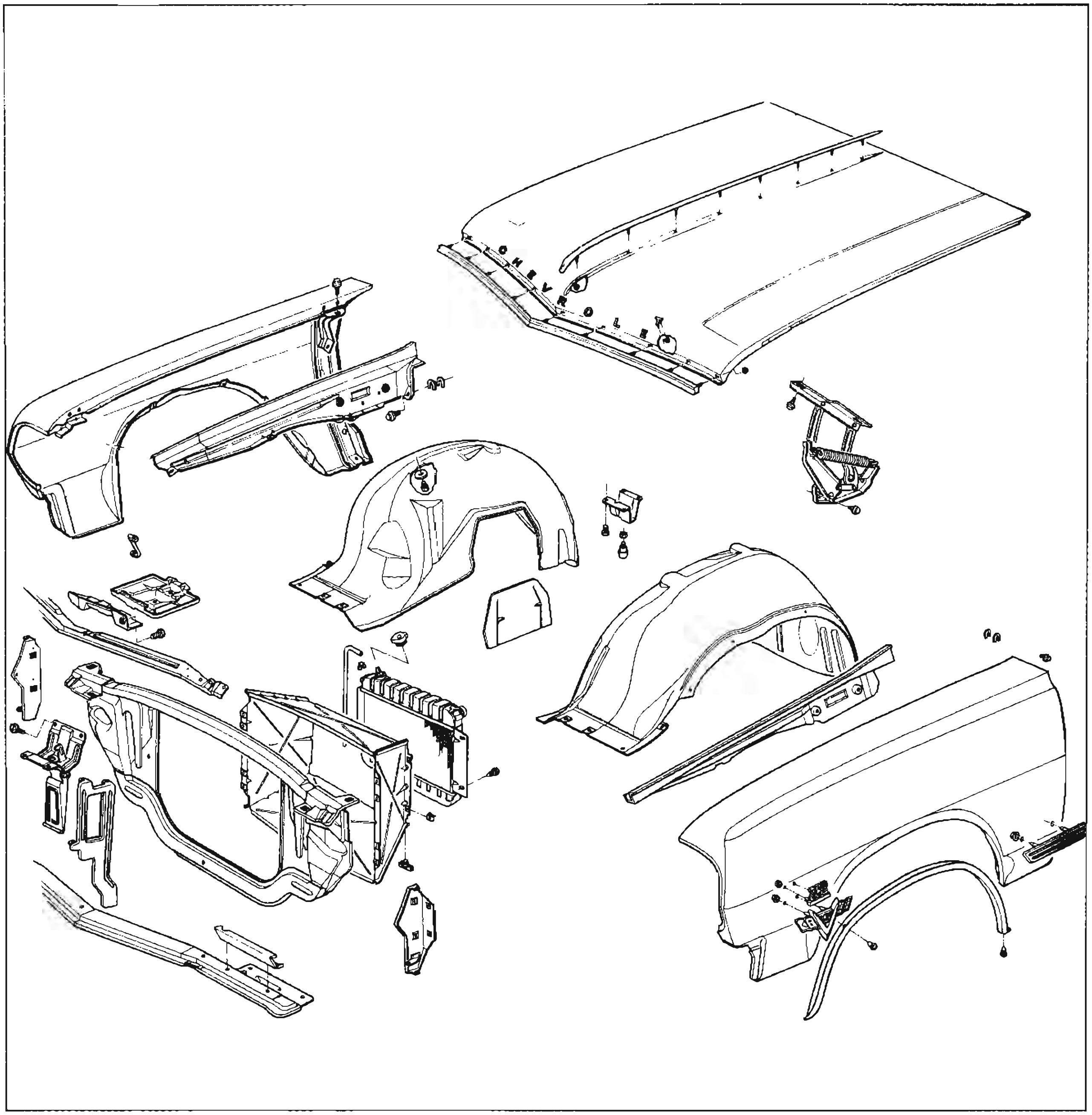


Fig. 11—Front End Sheet Metal

COMPONENT PART REPLACEMENT

BATTERY TRAY

Removal

1. Disconnect battery cables.
2. Remove battery hold-down assembly and remove battery from vehicle.
3. Remove two screws retaining battery tray assembly to radiator support.
4. Remove one screw retaining tray to fender skirt.
5. Remove battery tray.

Installation

Reverse removal procedure.

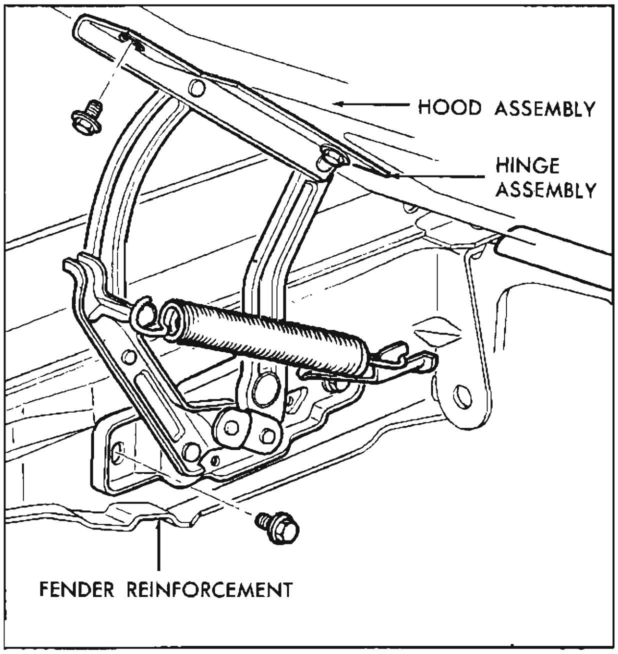


Fig. 12—Hood Hinge

FRONT FENDER ASSEMBLY WITH FENDER SKIRT

Removal

1. Remove antenna attachments, if so equipped.
2. Remove hood.
3. Remove hood hinge assembly (See Figure 12).
4. Remove heater hose at clip.
5. Remove windshield washer jar hose and anti-freeze jar, if so equipped.
6. Remove battery tray to fender skirt bolt.

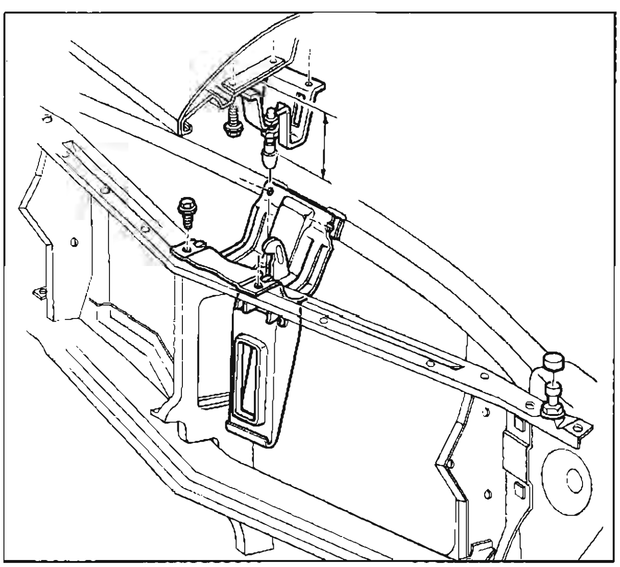


Fig. 13—Hood Catch, Lock Plate and Bumper

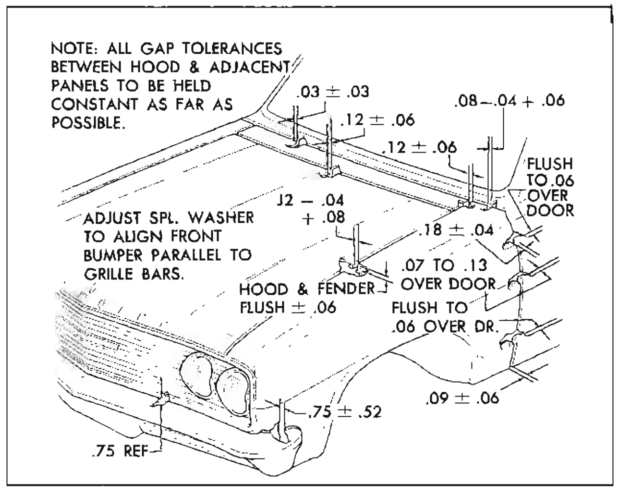


Fig. 14—Sheet Metal Adjustments

7. Remove screw and washer assemblies attaching the fender and fender reinforcement to the Radiator support and tie bar (See Figure 15).
8. Remove one left or right, upper and lower grille moldings (at headlamp) (fig. 16).
9. Remove molding extension.
10. Remove screws attachment at headlight location.
11. Remove fender extension attachment at brace (fig. 17).
12. Remove bumper filler panel attachment.
13. Remove bolts and shims from top of cowl--record shims (fig. 18).
14. Remove one lower bolt at rocker panel--record shims (See Figure 18).
15. Remove one top bolt (at door), attaching fender to cowl--record shims (See Figure 18).
16. Remove fender assembly with fender skirt from vehicle.

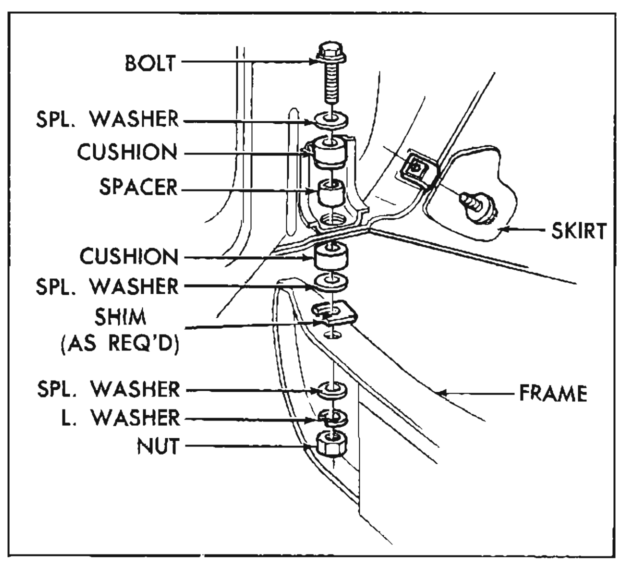


Fig. 15—Fender to Radiator Support and Tie Bar

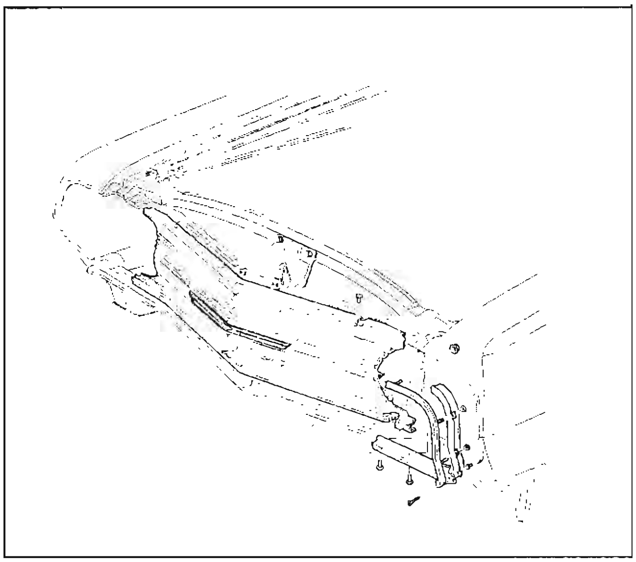


Fig. 16—Grille, Emblem and Molding

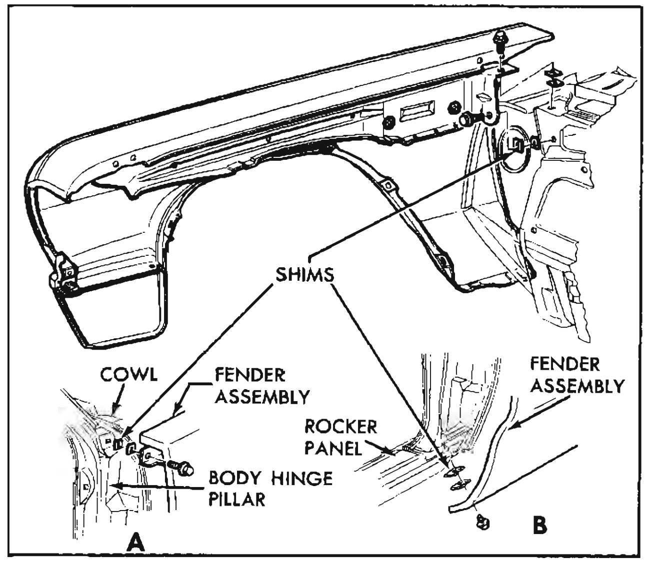


Fig. 18—Fender to Cowl and Rocker Panel Shimming

Installation

Reverse Removal Procedure.

When replacing fender, all screws should be installed loosely. Refer to disassembly procedure for location of screws. The shimmed screws should be installed and adjustments should be made before tightening any of the other screws. Always start adjustment with original amount of shims, then add or subtract shims as required.

FRONT FENDER TRIM

To gain access to spear molding and molding retaining nuts, remove skirt assembly as outlined and remove fender-to-cowl bolts and pry rear of fender out from body.

FRONT FENDER SKIRT ASSEMBLY

Removal (Fig. 19)

1. Jack up front end of vehicle with front suspension hanging free and remove front wheel.
2. Remove all wires, hoses, etc. attached to skirt. Note that it is not necessary to remove battery tray completely if working on right hand side of car.
3. Remove fender skirt extension.
4. Remove one fender skirt to battery tray attaching screw (fig. 20).
5. Remove cap screws retaining skirt to fender and bumper filler panel extension (in that order). Observe length of screws as they are removed; note that those screws installed at top of wheel opening

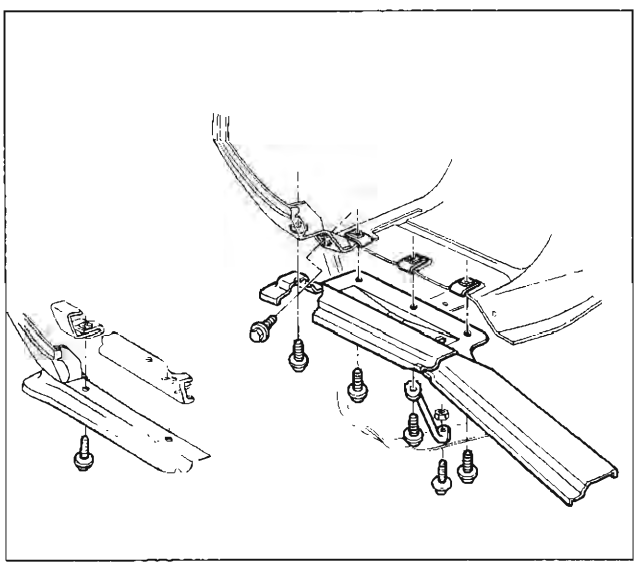


Fig. 17—Bumper Filler Panel to Fender and Skirt

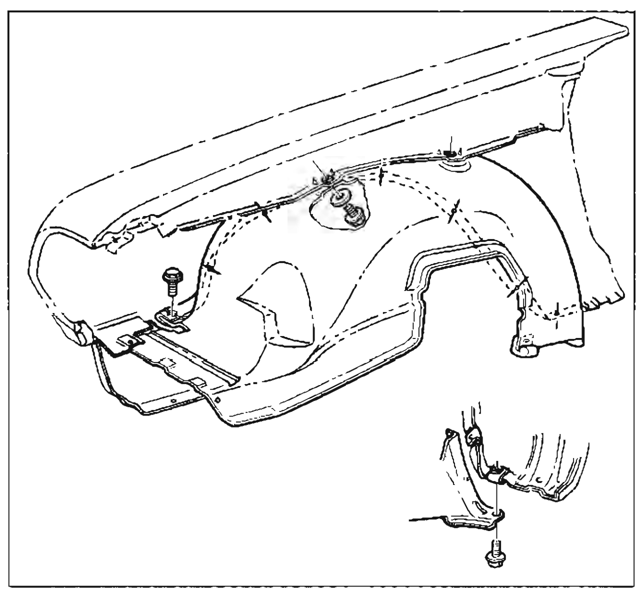


Fig. 19—Fender to Fender Skirt

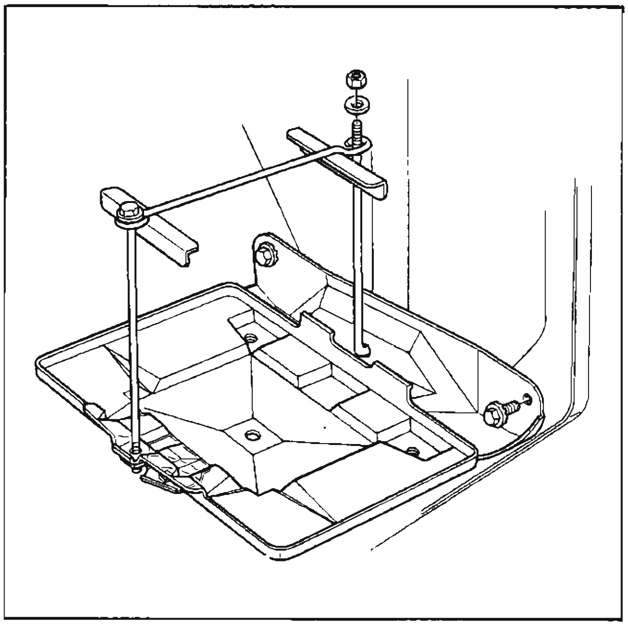


Fig. 20—Battery Tray

are somewhat shorter than the others. Note also the location of pointed screws. Detach fender extension brace at extension (See Figure 17).

6. With all screws removed, lower the skirt toward floor, rotate the upper portion toward you and remove the skirt from the vehicle.

Installation

NOTE: Position skirt on vehicle so that the front flange lies between the fender and bumper filler panel extension flanges.

Reverse removal procedure.

FILLER PANEL

Removal

1. Remove grille assembly (See Section 13), filler, panel flange.
2. Remove lower bolt attachment of headlamp bracket assembly to filler panel.
3. Remove all bolts from underside of filler panel.

RADIATOR SUPPORT

Removal

1. Remove grille assembly (See Section), filler, panel end attachment to fender and skirt extension (fig. 19) and battery tray.
2. Remove two bolts from the lock catch to the radiator support (See Figure 13).
3. Remove tie bar and grille support bracket attachment from radiator support (See Figure 15).
4. Remove radiator support frame bolts, nuts, washers and shims - record shims (See Figure 15).
5. Remove screws retaining radiator to radiator support (L-6) or shroud to support (V-8).

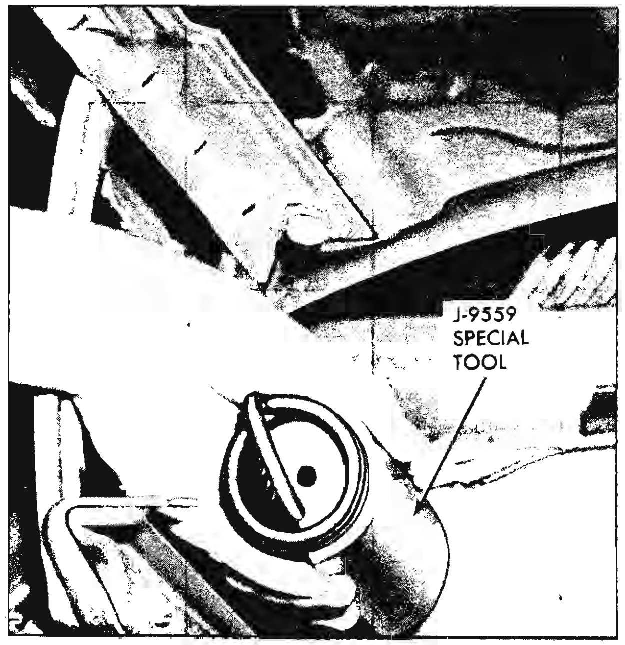


Fig. 21—Removing Spring with J-9559 (Typical)

NOTE: It is not necessary to drain radiator or to disconnect radiator hoses from engine if radiator is supported in vehicle.

6. Disconnect horn wires.
7. Spread fenders apart to allow radiator support to be removed from vehicle.

Installation

1. Install cap screws and bolts loosely until all are started. Reverse removal procedure.
2. Aim headlamps as outlined in Section 12.

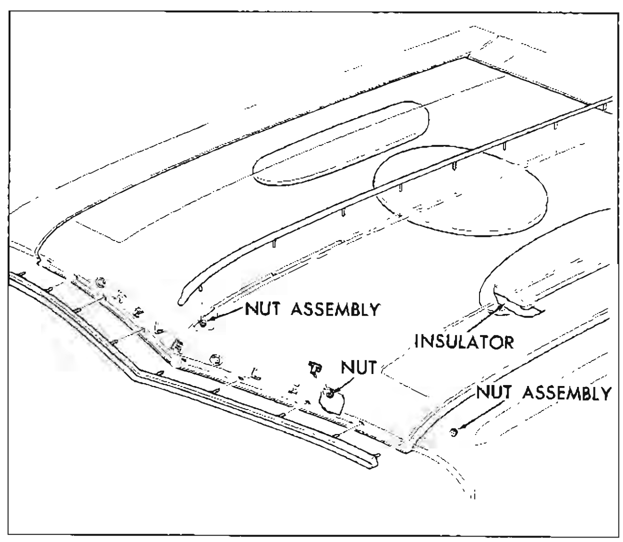


Fig. 22—Hood, Insulator and Molding

HOOD ASSEMBLY

Hood may be removed either with or without hinges. To shorten aligning time, hood hinge plates may be located by scribing a mark on hood and/or hood mounting bracket which outlines entire plate. See "Maintenance and Adjustments - Hood Hinge" for hood adjustment procedure. Hood hinge springs may be easily and safely removed and installed through the use of Tool J-9559 (fig. 21) as follows:

1. With hood opened only far enough to allow passage of mechanic's arm between hood and fender, insert ends of J-9559 (through bolt removed) between coils of spring until barrel of tool contacts outer diameter of spring (fig. 22).
2. Open hood full while still holding spring (with tool installed) in hand; when hood is near fully opened position.
3. As soon as spring is removed, insert long bolt supplied with J-9559 through holes in end of tool (passing it through spring) and install nut on bolt.

Spring may be removed from J-9559 or J-9559 may be installed in a new spring by the following method.

Installing Detached Hood Spring

1. Place a closed 6 or 8 inch "C" clamp in a vise or fasten to a heavy bench top (bench should be fastened to floor).
2. Hook one end of spring in clamp and the other end in hook of chain hoist, "cherry-picker" or equivalent.
3. Stretch the spring enough to allow insertion of J-9559. Install through bolt if spring is not to be installed on hinge at once.

HOOD CATCH AND LOCK ASSEMBLY (SEE FIG. 13)

Removal and Installation

1. Remove catch assembly as follows:
   a. Remove two cap screws retaining catch assembly to radiator support.
   b. Remove cap screw retaining catch assembly to catch support assembly.
   c. Remove remaining two cap screws attaching to the tie bar.
   d. Remove nut from the extension.
   e. Remove catch assembly.
2. Remove hood lock plate as follows:
   a. Scribe around lock plate before removing.
   b. Remove four cap screws retaining lock plate to hood and remove lock plate from vehicle.
3. Reverse removal procedure and align as outlined under "Maintenance and Adjustments" - Hood Catch.

HOOD TRIM AND INSTALLATION

Figure 22 shows the installation details of both the hood ornamentation and insulating pads. The hood emblem and molding retaining nuts may be reached from the underside of the hood panel.

CHEVY II

INDEX

GENERAL DESCRIPTION

The sturdy front end structure is formed by three welded assemblies, the left and right hand fender skirts and the radiator support panel. These units are bolted together and to the dash panel (fig. 23).

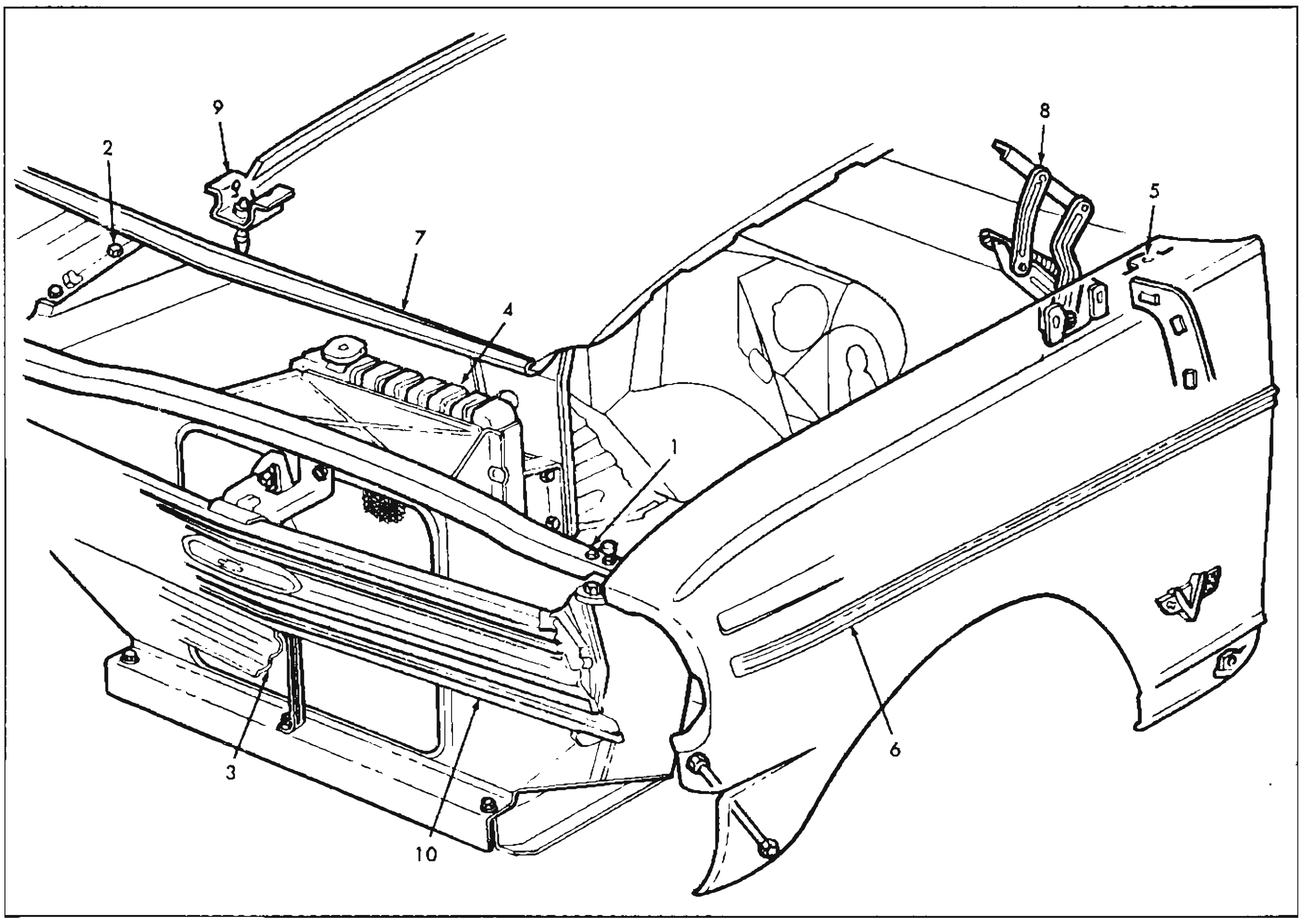


Fig. 23—Front End Sheet Metal

1. Radiator Support to Skirt Headlamp Filler & Fender
2. Fender to Fenderskirt & Radiator Support
3. Bumper Filler Panel
4. Radiator & Fan Shroud L4-L6 V-8
5. Fender to Cowl & Rocker Panel Extension
6. Fender, Molding & Emblem Front Fender Molding & Hole Drilling
7. Hood, Insulator & Molding
8. Hood Hinge
9. Hood Lock, Catch & Support
10. Grille, Bracket & Tie Bar Sheet Metal Checking

Fender skirts, containing spring towers and support brackets for control arms, are welded to the reinforced "closed hat section" side rails. The skirts and rails are fastened at top and bottom to reinforced areas of the dash panel. Each skirt and rail assembly is securely mated to the body with three bolts at the top, and at the stub frame butt plates with a four bolt series. Heavy gauge, formed, reinforcing plates receive the top of the fender skirt and provide a shimming surface for precise alignment of front end and body when assembled.

The one-piece radiator support panel completes a box section when welded to the front crossmember. The panel is formed to add structural strength and rigidity. This strong combination is bolted along the full length of each forward vertical edge of the fender skirts and at the stub frame ends. Additional strength is obtained from rigid diagonal corner braces. These open hat section braces, bolted to side rails and front crossmember, provide mountings for the suspension tension struts.

Conventional front fenders, grille, bumper and brackets all bolt on to the unit front end structure. The hood is connected to the front end with hinges that are attached to the fender skirts.

MAINTENANCE AND ADJUSTMENTS

HOOD ADJUSTMENT

The alignment of the hood in relation to other sheet metal parts is controlled by the position of the hood hinges and the height of the two bumpers, located one at each end of the radiator support. The adjustments at the hood latch must be made after the hinges and bumpers are positioned to yield the dimensions shown in Figure 26. Latch adjustments are made so that effort required to open and close the hood is reasonable and so that the hood alignment obtained by hinge and bumper adjustment is maintained when the hood is closed. Note that the hood latch is not designed or intended to correct basic hood alignment faults.

To align the hood and lock, proceed as follows:

HOOD HINGE (FIG. 24)

1. Note that the mounting holes in the body-mounted end of the hinge are slotted to provide up and down movement of the hood assembly while the hood mounted end is slotted to provide fore and aft movement.
2. Scribe a mark around the entire hinge plate which will be involved in the adjustment.
3. Loosen the appropriate screws and shift the position of the hood on the hinge plate the approximate amount to correct misalignment, using the scribed marks to check amount of movement. Check condition of adjustment by tightening cap screws and closing hood.

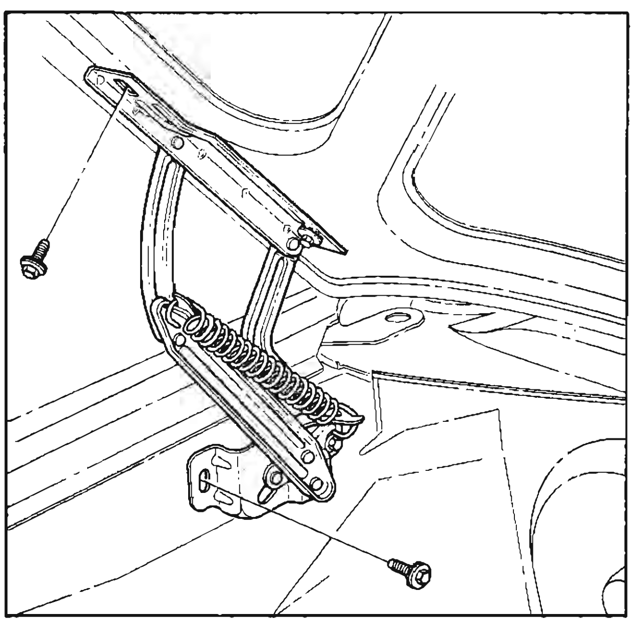


Fig. 24—Hood Hinge

HOOD BUMPERS

Hood bumpers must be adjusted so that the space between the hood and headlamp bezel is 1/8" as shown in Figure 25.

HOOD CATCH AND LOCK

Hood lock plate mounting holes are slotted to provide fore and aft adjustment of the hood lock bolt. The hood lock bolt itself is adjustable for up and down positioning of the lock bolt head so that its proper engagement in the latch assembly may be provided for. The distance that the lock bolt protrudes out of the lock plate should be adjusted so that the hood bumpers are slightly compressed by the fully latched hood and so that the effort required to release the hood catch is reasonable.

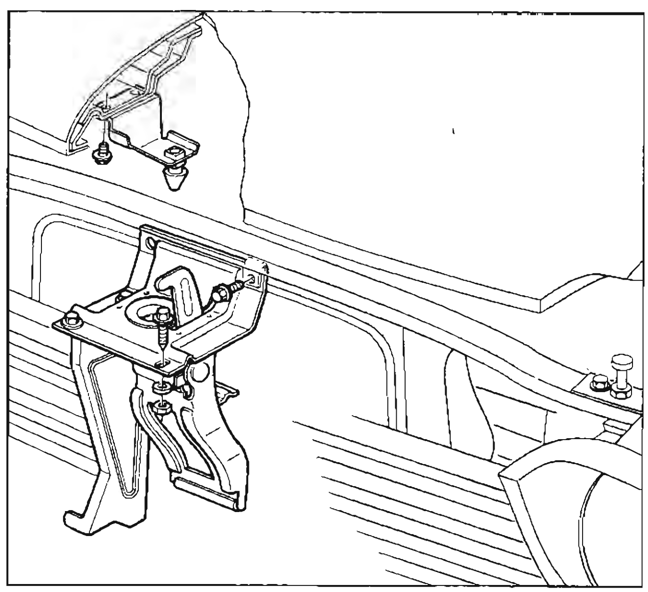


Fig. 25—Hood Lock, Catch and Support

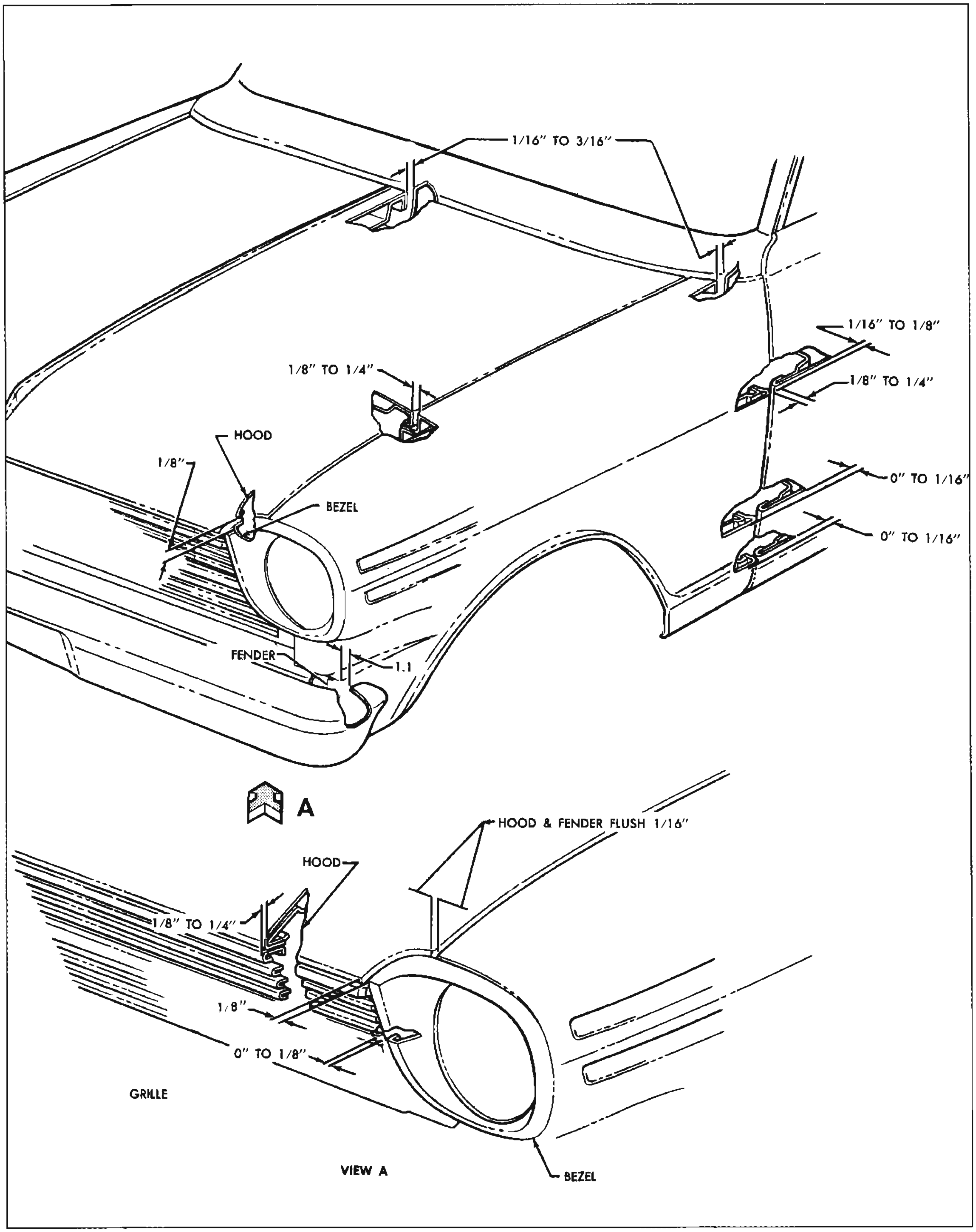


Fig. 26—Sheet Metal Adjustment (Typical)

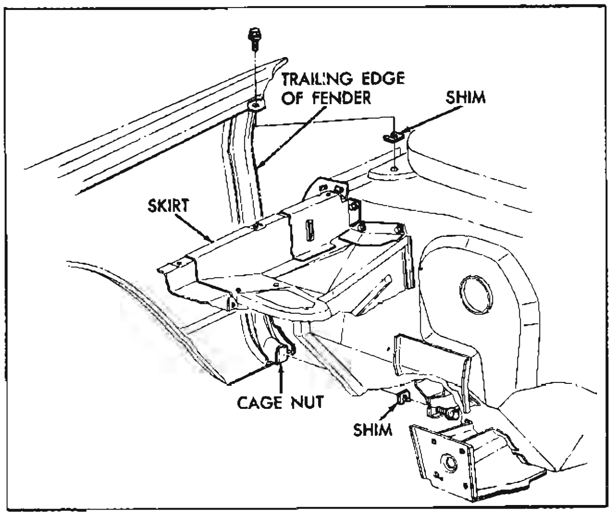


Fig. 27—Front Fender Shimming

FENDER ADJUSTMENT (FIGS. 26 AND 27)

DO NOT CHANGE SKIRT ASSEMBLY-TO-DASH SHIMMING IN AN EFFORT TO ADJUST THE DOOR-TO-FENDER GAP OR ANY OTHER SHEET METAL APPEARANCE ITEM. THESE SHIMS REGULATE THE FRONT END ASSEMBLY RELATIONSHIP TO THE BODY AND SHOULD BE ADJUSTED ONLY AS OUTLINED IN SECTION 2 OF THIS BOOK.

The front fenders are shimmed independently of the skirt assemblies, unlike conventional vehicles on which almost the entire front end sheet metal assembly is shimmed and adjusted as a unit.

Figure 27 shows the locations of front fender shims.

1. The rocker panel extension location allows adjustment to make fender outer surface flush with door outer surface.
2. The upper or plenum chamber location provides a means of adjusting fender upper surface so that it is flush with the upper surface of the cowl.
3. The locations atop the skirt assembly are shimmed to close the gap created between the fender mounting flange and skirt assembly when the plenum chamber location is shimmed; thus keeping the fender mounting bolts from crushing in the fender mounting flange.

If shimming is done without the fenders being disassembled, it is suggested that fender mounting bolts rearward of radiator support be loosened while shims are inserted and sheet metal fit is checked. Tighten shimmed mounting bolts first, then all others.

COMPONENT PART REPLACEMENT

BUMPER FILLER PANEL (FIG. 28)

Removal

1. Remove front bumper as outlined in this section.
2. Remove screws retaining grille center bracket to radiator support and hood lock support assembly.
3. Remove 6 screws (3 each end) retaining filler panel to fender, grille outer bracket and radiator support angle bracket.
4. Withdraw filler panel from vehicle.

Installation

1. Position filler panel in vehicle, aligning "J" nuts with holes at mounting points at each end of panel (3 at each end).
2. Install screws loosely (do not tighten until all are installed).
3. Install grille center bracket with "legs" pointing to right hand side of vehicle.
4. Install retaining screws in bracket. Tighten all retaining screws securely.

RADIATOR SHROUD (FOUR CYLINDER ONLY)

See Figure 29

Removal

1. Remove six cap screws retaining radiator core to shroud. If radiator is supported in position by wiring to skirt or other means, it need not be drained and removed.
2. Remove six cap screws retaining shroud to radiator support.
3. Remove shroud from vehicle.

Installation

Check "J" nuts and replace any which are damaged.

1. Position shroud on radiator support and install cap screws (6).
2. Align radiator on shroud rear surface and install 6 cap screws.
3. Check distance of fan to radiator core which should be .80" minimum as shown in Figure 29.

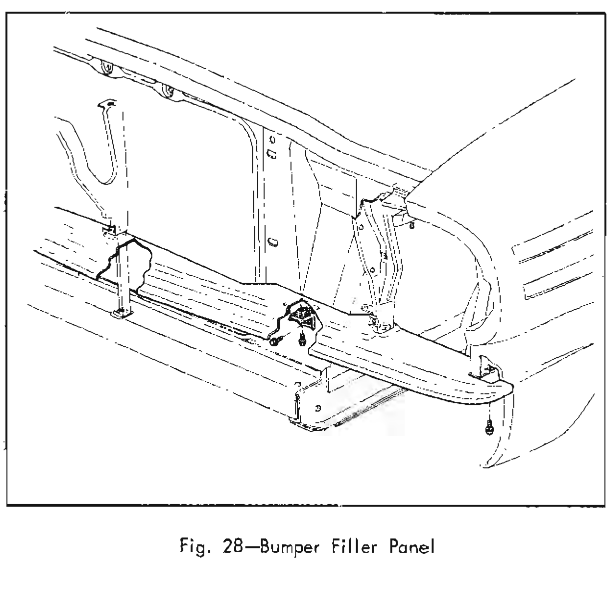


Fig. 28—Bumper Filler Panel

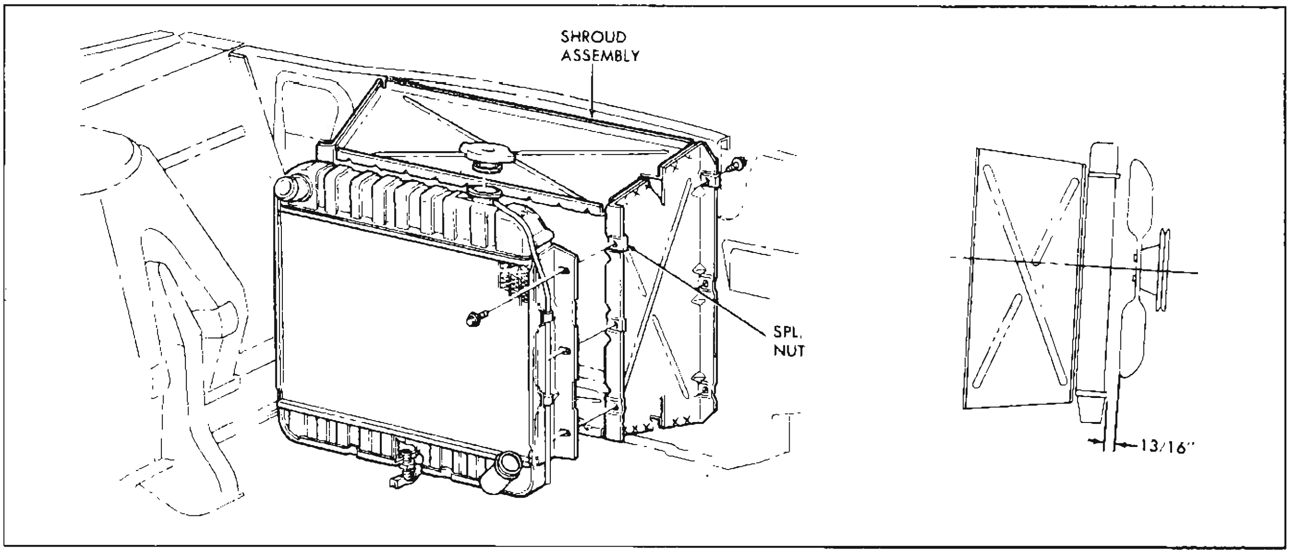


Fig. 29—Radiator Shroud Assembly

BATTERY TRAY (FIG. 30)

Removal

1. Remove both cables from battery.
2. Remove cap screw retaining battery retainer assembly to radiator support. Loosen nut on battery retainer clamp and remove retainer from vehicle.
3. Remove battery from vehicle.
4. Remove four screws retaining tray assembly; to fender skirt and support, and remove tray from vehicle.

Installation

1. Position battery tray on fender skirt and install cap screws.
2. Place battery in tray and install retainer assembly.
3. Install battery cables.

RADIATOR SUPPORT (FIG. 31)

Removal

1. Remove both headlamp door and parking lamp assemblies as outlined in Section 12.
2. Remove horn relay and voltage regulator.
3. Remove bumper assembly, grille assembly, filler panel assembly, hood latch assembly, battery tray assembly and radiator shroud as outlined in this section. Remove six screws retaining radiator to support. Radiator may be wired in position and need not be drained or removed.
4. Remove horns and wiring harness from radiator support.
5. Remove brake line from clip located at underside of bottom channel of radiator support.
6. From front of vehicle:

   a. Remove four cap screws retaining radiator support to each skirt inner flange.
   b. Remove two cap screws and one bolt retaining radiator support to each frame horn.
   c. Remove hood bumper and cap screw located at outboard ends of radiator support top surface.
   d. Remove two cap screws located inside headlamp recess on upper surface.
7. From under fenders, remove three cap screws retaining radiator support to fender.
8. Remove radiator support from vehicle as shown in Figure 32.

Installation

1. Position radiator support on vehicle, aligning mounting screw and bolt holes with drift punch.
2. Install cap screws and bolts loosely until all are started; refer to Disassembly for location.
3. Replace brake line in clip on underside of radiator support bottom channel.

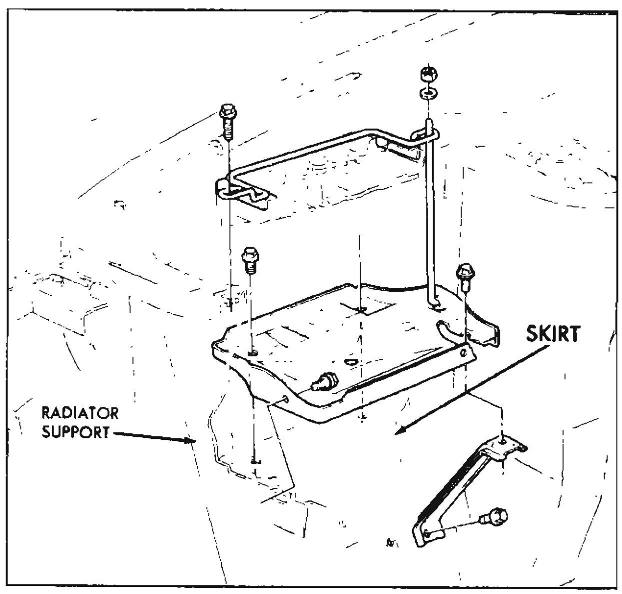


Fig. 30—Battery Tray

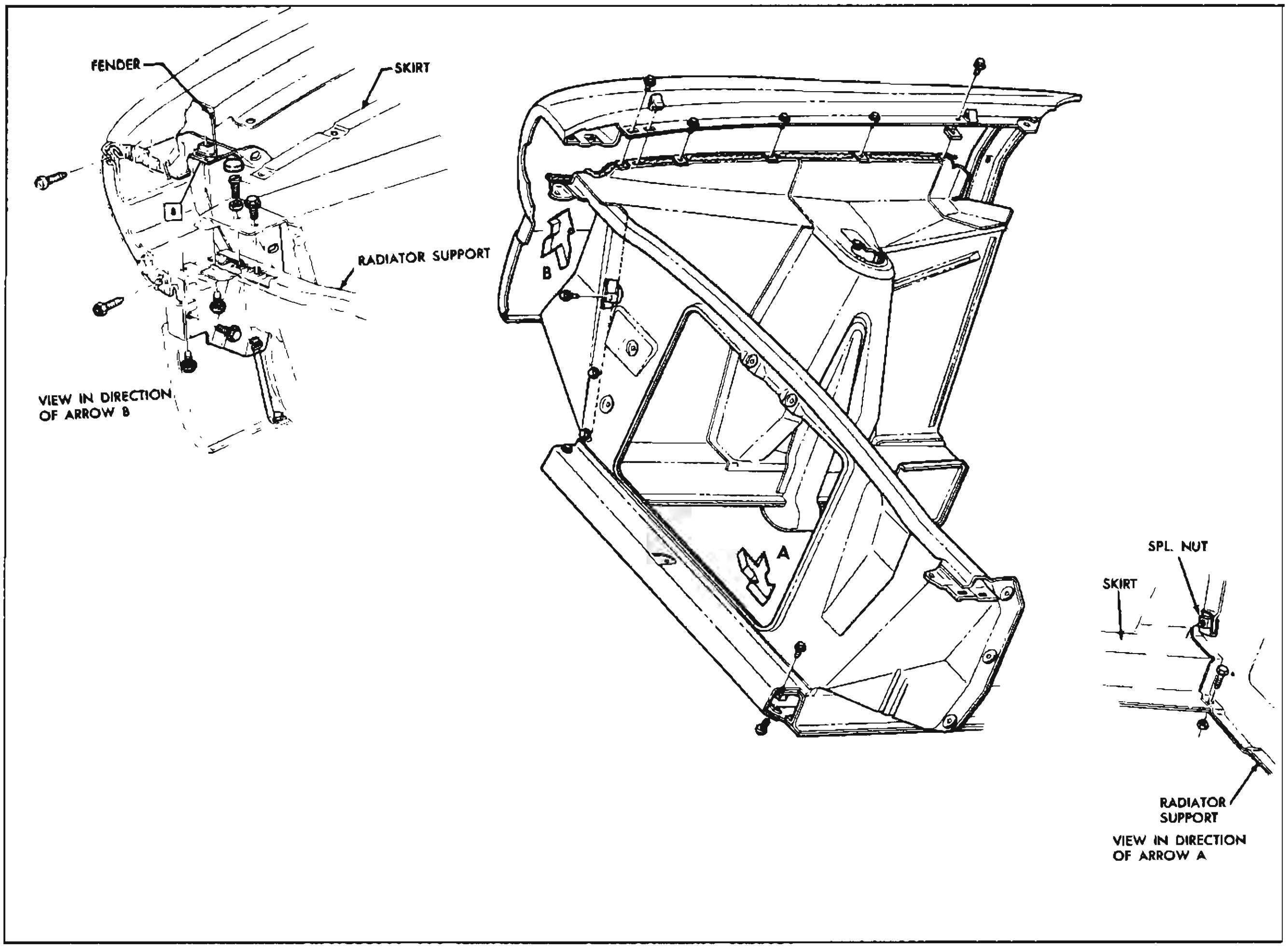


Fig. 31—Radiator Support Assembly

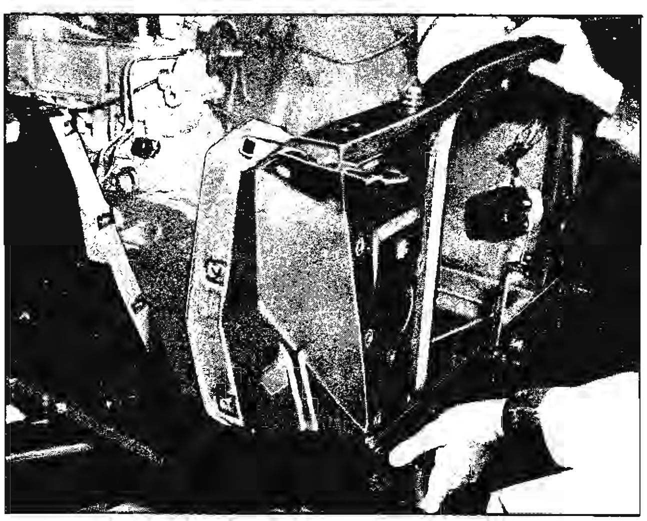


Fig. 32—Removing Radiator Support from Vehicle

4. Replace all parts removed in Operations 4, 3, 2 and 1 (in that order) as outlined in Disassembly, referring to write-up for part involved.
5. Aim headlamps as outlined in Section 12 of this book.

FRONT FENDER ASSEMBLY

Removal

1. Remove headlamp door and parking lamp assemblies as outlined in Section 12.
2. Open hood and remove six cap screws joining fender top flange to skirt (fig. 32). Remove, and record number of; shims at first and second cap screw forward of windshield (fig. 33).
3. Remove two cap screws located on upper surface of headlamp cavity.
4. From under forward end of fender, remove three screws retaining fender to radiator support.
5. From inboard side of rocker panel extension, remove one cap screw retaining fender to extension. Remove, and record number of, shims (fig. 33).
6. Remove fender from vehicle.
7. Separate headlamp filler panel from fender by removing remaining screws (fig. 34).

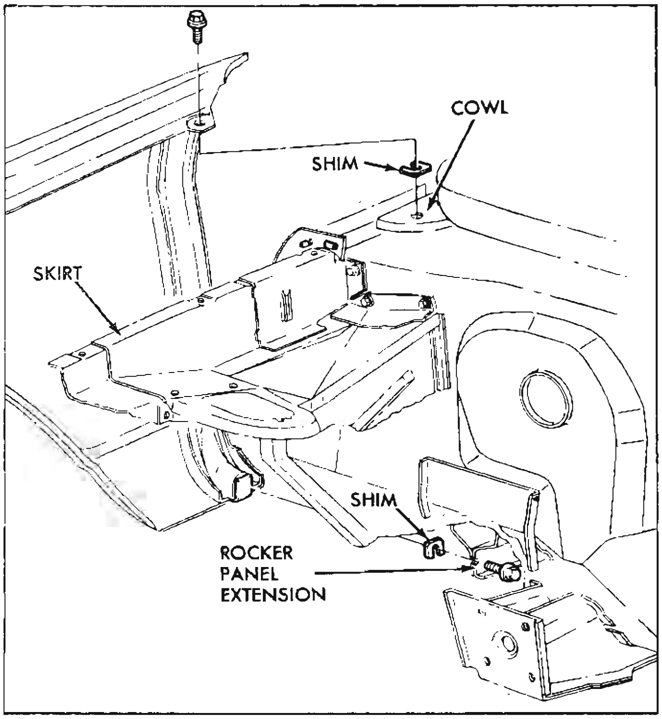


Fig. 33—Fender Mounts

Installation

1. Inspect condition of cowl-to-fender seal and replace, if necessary, as shown in Figure 35.
2. Install headlamp filler panel on fender.
3. Position fender on vehicle. Note that cowl-to-fender seal must be positioned so that outer edge points toward front of vehicle. Align all mounting screw and bolt holes with drift punch and install all screws and bolts loosely. Do not tighten any screws or bolts until all are started. Refer to removal procedure for screw and bolt locations.
4. Replace shims taken out when fender was removed from vehicle and continue as outlined under Maintenance and Adjustments -- Fender Adjustment.
5. Install headlamp door and parking lamp assemblies, and check headlamp aiming as outlined in Section 12.

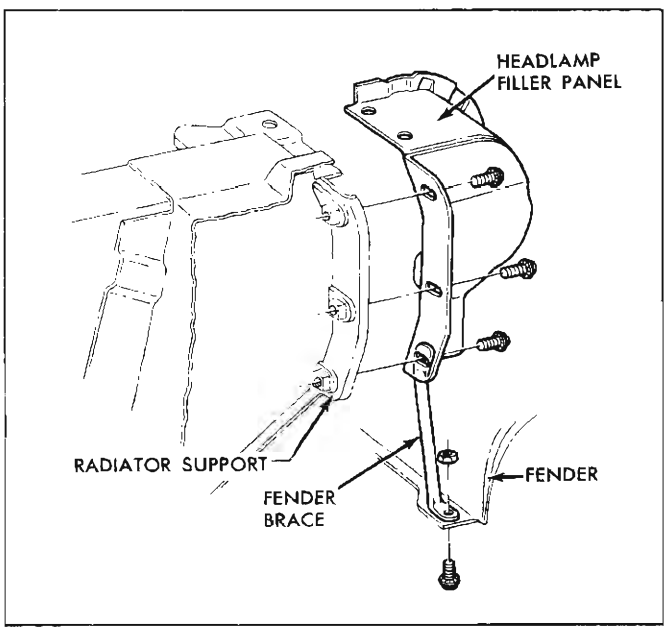


Fig. 34—Headlamp Filler Panel

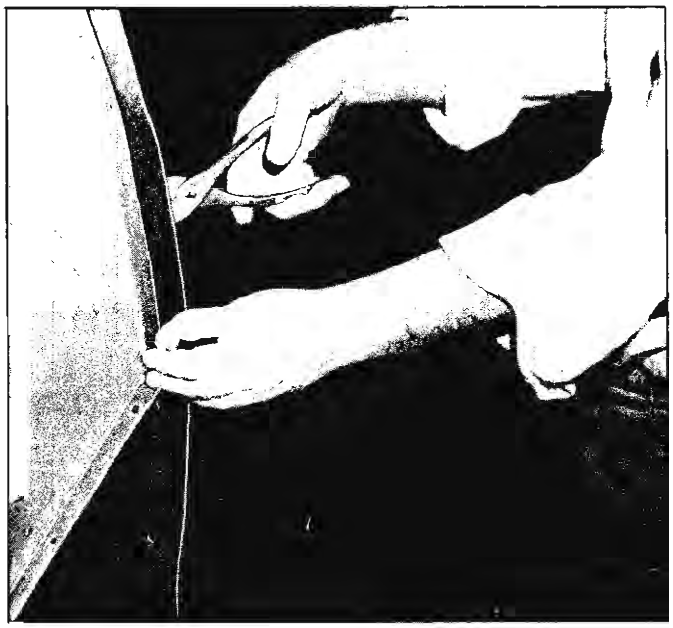


Fig. 35—Replacing Fender Seal

FRONT FENDER TRIM

If fender spear molding is to be replaced without removing fender from vehicle, proceed as follows:

1. Perform Operations 2 and 5 only of Front Fender Assembly--Removal.
2. Pull rear end of fender away from body far enough to insert a short piece of 2 x 4 between lower rear corner of fender and rocker panel extension.
3. It should now be possible to gain access to first and second retaining nuts forward of rear end of fender. All other nuts can be reached from front wheel opening.

SKIRT ASSEMBLY

Removal

1. Remove hood and hinge assemblies as outlined in this section.
2. Remove fender assembly as outlined in this section.
3. Remove grille and radiator support as outlined in this section.
4. Raise car from floor and place jack stands under rocker panel extension.
5. Remove suspension bumper support, shock absorber, front spring and stabilizer link as outlined in Section 3.

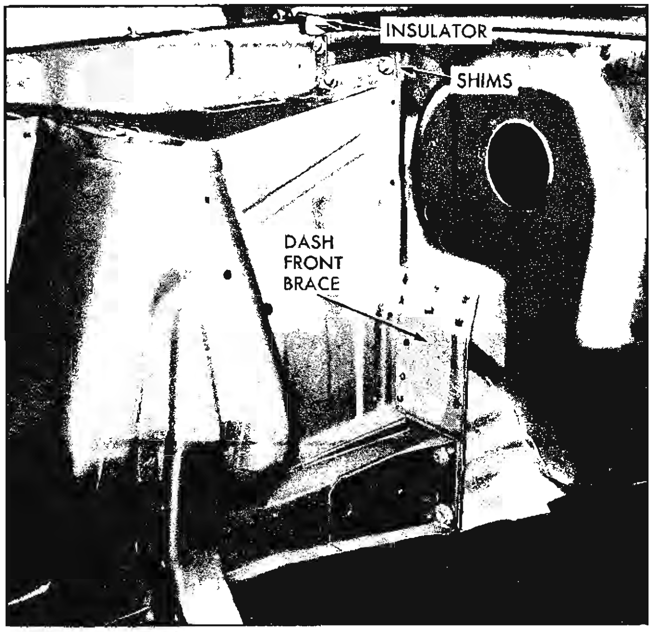


Fig. 36—Skirt Mounting Bolts

6. If removing left skirt assembly, remove steering gear mounting bolts, power steering hose clamp (if so equipped) and outer (left) clutch cordon shaft bracket (if so equipped).
7. Remove tie rod ball stud from steering arm as outlined in Section 9.
8. Support engine and remove engine mount cushion as outlined in Section 6.
9. Remove spring clip from brake line junction which passes through skirt and remove junction from skirt (see Section 5).
10. Remove four bolts retaining front crossmember to skirt.
11. Remove four bolts retaining skirt assembly to dash front brace. Remove 3 bolts retaining upper end of skirt to dash (fig. 36); record shims removed.
12. Remove skirt assembly with remaining suspension parts attached as shown in Figure 37.
13. Suspension parts may be detached as outlined in Section 3.

Inspection

If car has been involved in a collision, it is advisable to carefully inspect cowl and dash area for damage. Check front of dash area following directions in Section 2. Pay particular attention to welds, cage nuts, weld nuts and skirt mounting surfaces. Cage and weld nuts may be repaired by outright replacement (the best method); or by the installation of spiral thread inserts. If the spiral inserts are used, follow the instructions furnished by the manufacturer.

Installation

Skirt installation is written for the installation of a stripped skirt, with suspension and other parts added after skirt is attached to vehicle. Proceed as follows:

1. Position skirt assembly on vehicle with insulator, shown in Figure 36, in place and original shims installed at top dash mount.
2. Install the three bolts at top mount and four bolts at lower dash brace.
3. Install front crossmember, replacing the four bolts and nuts removed previously.
4. Replace engine mount cushion; refer to Section 6.
5. Install front suspension parts as outlined in Section 3. Connect stabilizer link to stabilizer (if so equipped) and connect tie rod end to steering arm as outlined in Section 9.
6. Install radiator support, fender assembly and grille as outlined in this section.
7. If left skirt was removed, proceed as follows:
   a. Install steering gear. Carefully follow outline under Steering Gear - Installation in Section 9. Do not fail to perform adjustments listed under Mast Jacket Installation in that section.
   b. Install clutch cordon shaft (if so equipped).
   c. Install power steering hose clamp (if so equipped).
8. Install brake lines and bleed brakes as outlined in Section 5.
9. Install hood and adjust as outlined in this section.
10. Perform following checks and adjustments:
    a. Check and adjust front body section alignment as outlined in Section 2.
    b. Check and adjust front wheel alignment as outlined in Section 3.
    c. Check and adjust headlamp aiming as outlined in Section 12.

HOOD ASSEMBLY

Hood may be removed either with or without hinges. To shorten aligning time, hood hinge plates may be located by scribing a mark on hood and/or body which outlines entire plate. See Maintenance and Adjustments - Hood Hinge for hood adjustment procedure. Hood hinge springs may be easily and safely removed and installed through the use of Tool J-9559 as follows:

1. With hood opened only far enough to allow passage of mechanic's arm between hood and fender, insert

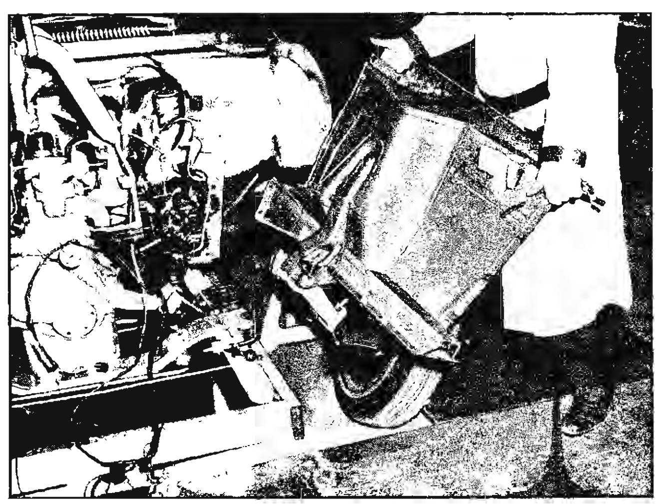


Fig. 37—Removing Skirt Assembly

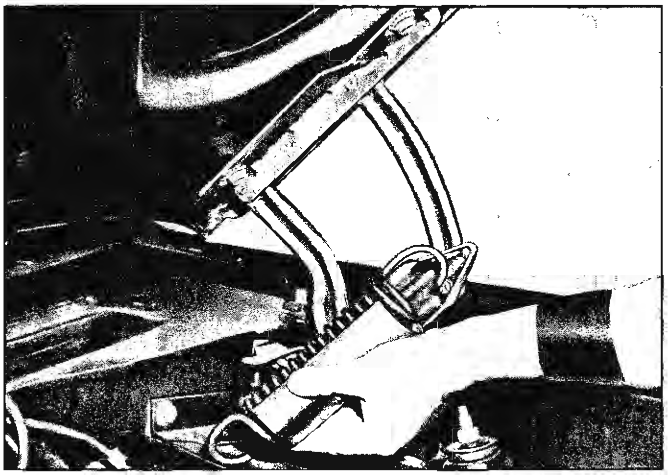


Fig. 38—Hood Spring Removal

ends of J-9559 (through bolt removed) between coils of spring until barrel of tool contacts outer diameter of spring.

2. Open hood fully while still holding spring (with tool installed) in hand; when hood is near fully opened position, spring may be removed as shown in Figure 38.
3. As soon as spring is removed, insert long bolt supplied with J-9559 through holes in end of tool, passing it through spring, and install nut on bolt.

Spring may be removed from J-9559 or J-9559 may be installed in a new spring by the following method:

1. Place a closed 6 or 8 inch "C" clamp in a vise or fasten it to a heavy bench top (bench should be fastened to floor).
2. Hook one end of spring in clamp and the other end in hook of chain hoist, "cherrypicker" or equivalent, as shown in Figure 39.
3. Stretch the spring enough to allow insertion of J-9559. Install through bolt if spring is not to be installed on hinge at once.

HOOD CATCH AND LOCK ASSEMBLY (SEE FIG. 25)

Removal

1. Remove catch assembly as follows:
   a. Remove two cap screws retaining catch assembly to radiator support.
   b. Remove two cap screws retaining catch assembly to catch support assembly.
   c. Remove two screws retaining catch assembly to grille upper bar.
2. Before removing hood lock plate from hood, locate position on hood by scribing around "feet" of lock plate. Remove four cap screws retaining lock plate to hood and remove lock plate from vehicle.

Installation

1. Install both catch and lock assemblies in reverse order of removal procedure.
2. Align as outlined under Maintenance and Adjustments - Hood Catch.

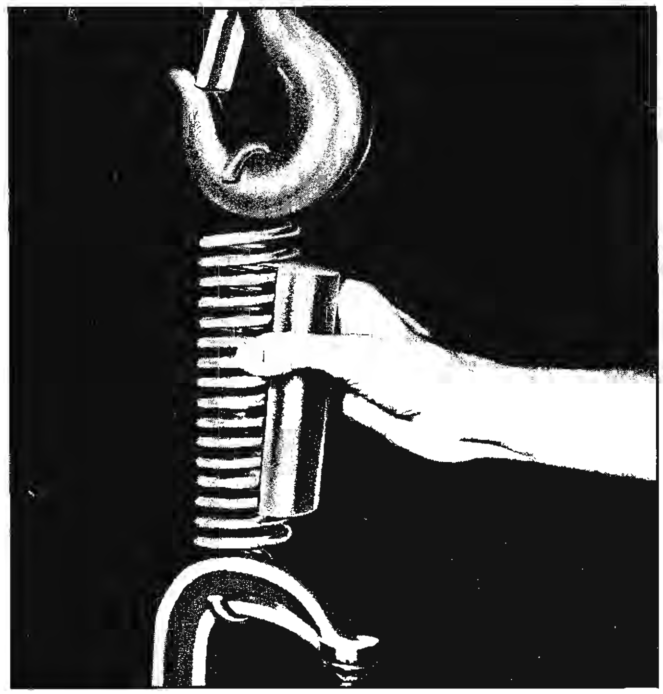


Fig. 39—Installing Tool J-9559 in New Spring

HOOD TRIM

Crown Molding

Hood crown molding is retained by six clips installed on underside of hood. Clips may be removed by carefully pressing them off molding mounting studs with screw driver.

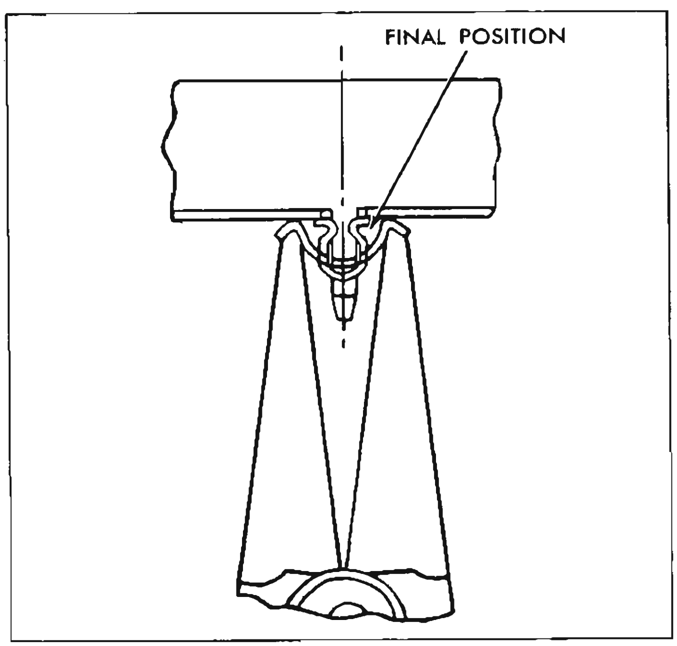


Fig. 40—Installing Hood Molding Clip

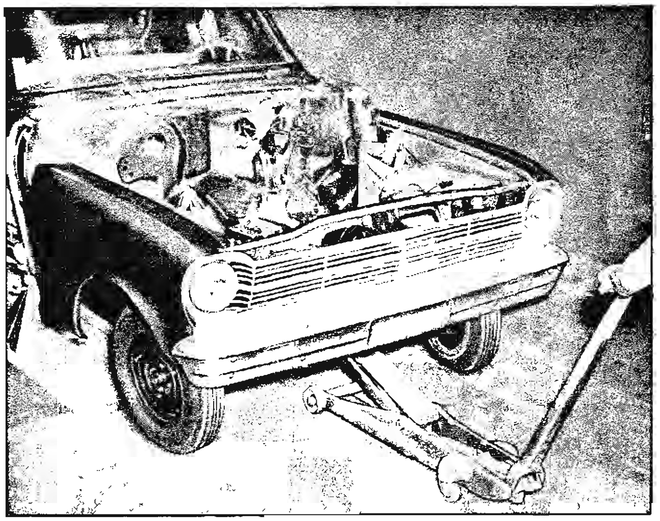


Fig. 41—Transporting Front End Assembly

When installing a new molding, force clips onto mounting studs as far as possible and then clench clips with long-nosed pliers to eliminate gap between molding and hood, as shown in Figure 40.

Emblem

The hood emblem is retained by four nuts which are accessible from under the hood.

FRONT END ASSEMBLY

The Chevy II front end body design allows for removal of the entire front end of the vehicle without disassembly of front suspension or sheet metal. Figure 41 illustrates the ease with which one man may remove and transport the front end assembly, using only a floor jack placed under the crossmember and the vehicle front wheels. Figure 42 illustrates the assembly in process of removal with jack stand in position under rocker panel. Proceed with removal as follows:

Removal

1. Remove hood assembly as outlined in this section.
2. Remove engine assembly as outlined in Section 6. On 4 cylinder models, replace crossmember.
3. Raise car from floor and install jack stands as shown in Figure 42.
4. Remove pitman arm from steering gear as outlined in Section 9.
5. Remove steering gear mounting bolts from skirt assembly.
6. Remove 4 bolts securing each skirt assembly to lower dash brace.
7. Remove fender-to-rocker extension mounting screws and record shimming.
8. Remove brake hydraulic line and fuel line from right hand skirt.
9. Position floor jack or equivalent under front crossmember.

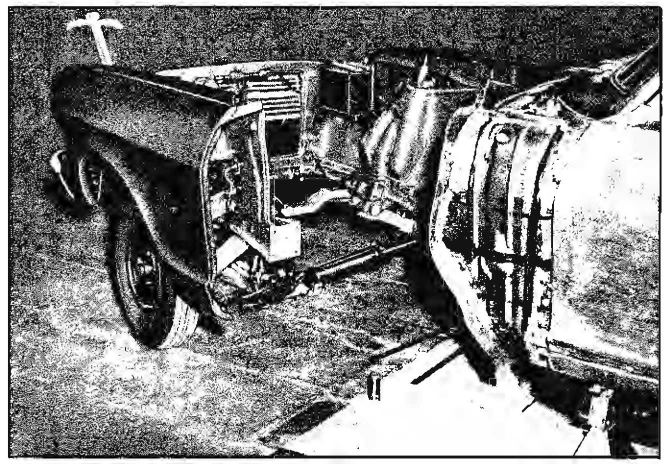


Fig. 42—Removing Front End Assembly from Vehicle

10. Remove hydraulic line from main cylinder.
11. Remove fender-to-cowl mounting screws and record shimming.
12. Remove upper skirt-to-dash mounting screws and record shimming.
13. Remove front end from vehicle as shown in Figure 41.

Inspection

If car has been involved in a collision, it is advisable to carefully inspect cowl and dash area for damage. Check front of dash area following directions in Section 2. Pay particular attention to welds, cage nuts, weld nuts and skirt mounting surfaces. Cage and weld nuts may be repaired by outright replacement (the best method), or by the installation of spiral thread inserts. If the spiral inserts are used, follow the instructions furnished by the manufacturer.

Installation

1. Position front end assembly at upper dash mounts and lower dash support, align screw holes with drift punch and install all mounting screws and bolts loosely; do not tighten until all screws and bolts are started. Replace original shimming.
2. Install all fender mounting screws, replacing original shimming. Refer to removal procedure for screw location.
3. Install hydraulic lines at main cylinder and right hand skirt. Install fuel line at right hand skirt.
4. Install steering gear as outlined in Section 9. Do not fail to perform adjustment procedure listed under Mast Jacket - Installation.
5. Install pitman arm as outlined in Section 9 under Maintenance and Adjustments - Steering Gear Adjustments.
6. Remove jack stands and jack.
7. Bleed brakes as outlined in Section 5.
8. Perform body alignment as outlined in Section 2.

SPECIAL TOOLS

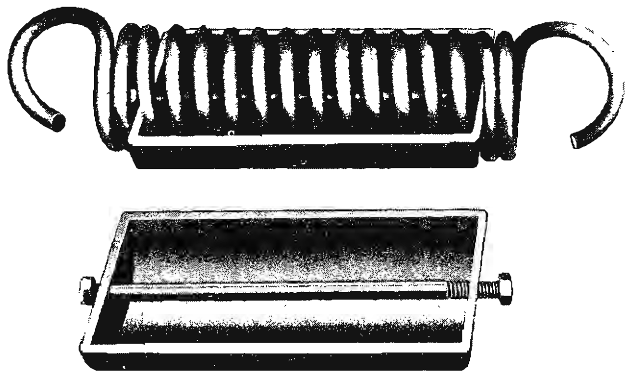


Fig. 43—Special Tools - Chevrolet, Chevelle and Chevy II

J-9559 Hood Spring Tools

SECTION 12
ELECTRICAL—BODY AND CHASSIS

CONTENTS OF THIS SECTION

LIGHTING SYSTEM

INDEX

GENERAL DESCRIPTION

The lighting system includes the main lighting switch, stop light and dimmer switches, headlamps, parking lamps, stop, tail and directional signal lamps, license lamps, instrument illumination and indicator lamps, and the necessary wiring to complete the various circuits. A fuse panel provides convenient power take offs and fuse clips for appropriate circuits (fig. 1).

Increased life No. 2 type sealed beam units and increased life bulbs for parking, backing, stop, tail license and directional signal lamps, and cluster illumination and indicator lamps are used with the 1965 lighting system. Replacement of the headlamp units and lamp bulbs should conform to the released specifications included at the end of this manual.

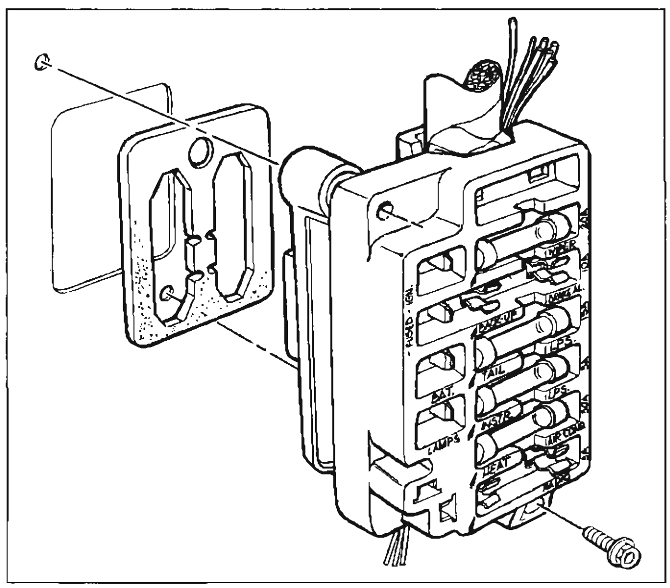


Fig. 1—Fuse Panel Assembly

MAINTENANCE AND ADJUSTMENTS

Maintenance of the lighting units and wiring system consists of an occasional check to see that all wiring connections are tight, that the lighting units are tightly mounted to provide a good ground, that the wiring is not pinched or damaged, and that the headlamps are properly adjusted.

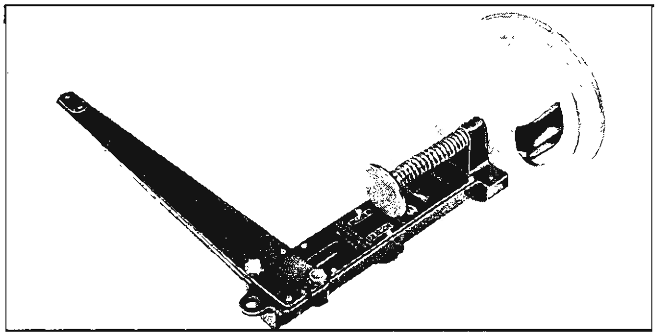


Fig. 2—T-3 Safety Aimer

HEADLAMP ADJUSTMENT— T-3 HEADLAMPS

CAUTION: Check and tighten upper grille retaining bolts prior to attempting headlamp aiming. Distorted grille or supports in this area will hinder proper aiming of headlamps.

When aiming headlamps, vehicle should be filled to capacity with gas, oil, and water but no load. Tires should be uniformly inflated to recommended pressure.

The T-3 Safety Aimer-Type B (fig. 2), is used for the headlamp aiming description that follows. An adapter is required with the Type B T-3 Aimer when adjusting the 7 inch headlamp used on the Chevy II vehicle.

1. Drive vehicle onto selected aiming area. Bounce vehicle several times and allow to settle.
2. Remove headlamp bezels.
3. Mount the T-3 Aimers on either the No. 1 or No. 2 pair of headlamps so that the points of the headlamps engage the smooth inner ring of the aimers.

   NOTE: In the dual headlamp installation, the inboard unit is designated No. 1 and the outboard unit is designated No. 2.

4. Secure the aimers to the headlamp units by firmly pressing knob at center of each aimer (fig. 3). Rotate crossarms inboard to approximate horizontal position.

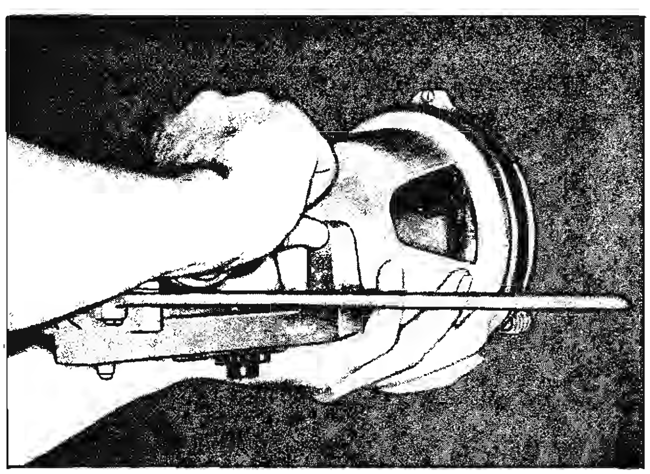


Fig. 3—Installing Aimer on Headlamp Unit

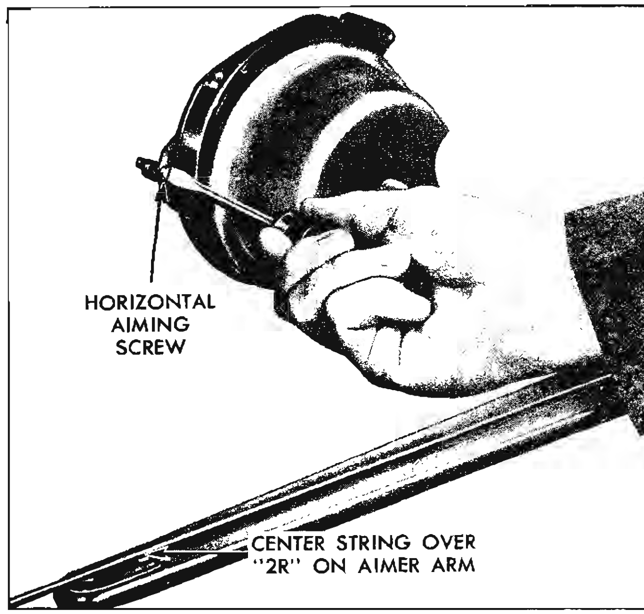


Fig. 4—Headlamp Horizontal Adjustment

   NOTE: Moisten suction cups slightly to obtain maximum holding force.

5. With both aimers in place, knot both ends of elastic string and, using slots provided, fasten string across horizontal crossarms of each aimer.
6. Rotate both aimers so that the string just clears the points on the crossarms.

HORIZONTAL ADJUSTMENT

7. a. Turn horizontal aiming screw, Figure 4 on left-hand lamp until the string is positioned over the crossarm centerline. Turn the screw clockwise in making the final adjustment to take up play in the headlamp mechanism.
   b. Repeat the above procedure on the right-hand lamp to complete the horizontal adjustment of the headlamps.

VERTICAL ADJUSTMENT

8. a. Numeral "2" (fig. 5) should appear in the "down" window of each aimer. If not, loosen knob at underside of aimer arm and slide back and forth until the numeral does appear.

   NOTE: This setting will give a 2" drop of the headlamp high beam spot centerline on a screen placed 25 feet forward of the vehicle. Check state laws for proper vertical setting.

   b. Turn headlamp vertical aim screw (fig. 5) on left-hand unit counter-clockwise until the bubble is at the inner end of the glass tube. Then turn screw clockwise until bubble is centered in tube.
   c. Repeat this procedure on right-hand headlamp unit to complete vertical adjustment of lamps.
9. Recheck the string at the ends of each crossarm for correct setting and the bubble on each aimer for centered position.

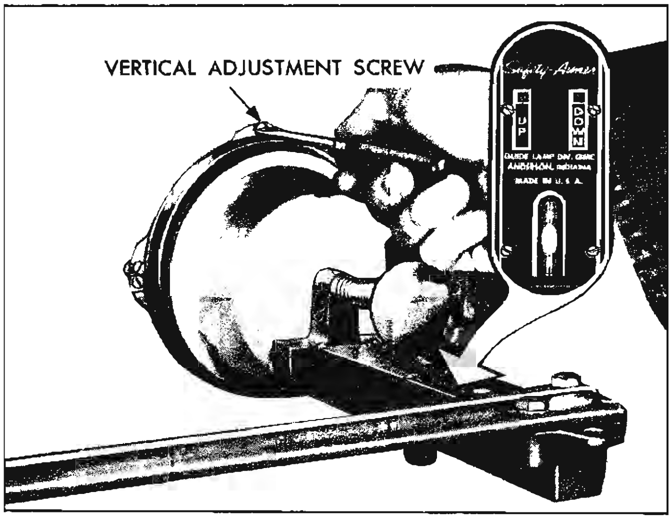


Fig. 5—Headlamp Vertical Adjustment

10. Remove the aimers by pulling on the suction cup tabs through the openings in the aimers (fig. 6).
11. With headlamps properly aimed, replace headlamp bezels.

HOW TO SELECT A LEVEL AIMING AREA

1. Select area you believe to be level.
2. Remove headlamp bezels and install Aimers on each headlamp (fig. 3) making sure aiming lugs engage smooth inner ring of the Aimer. To install Aimer, press firmly on the knob extending out from the center of the Aimer base. This forces the suction cup into place on the Sealed Beam unit.
3. Loosen the slider knob beneath the aimer arm and set the numeral "2" in the DOWN view window (fig. 7). Back vertical lamp adjuster out on each lamp until bubble is outside of black line of vial, then center bubble in between black line of vial by turning clockwise.
4. After both bubbles are centered, turn the car around end for end, making sure the tires rest in the spots made on the floor before the car was moved.

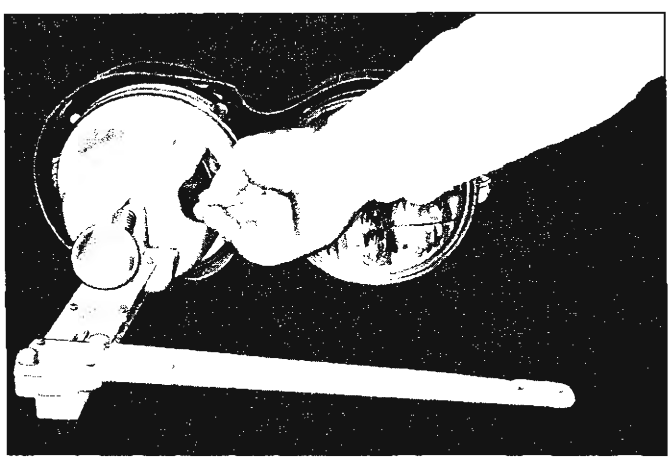


Fig. 6—Removing Aimer from Headlamp

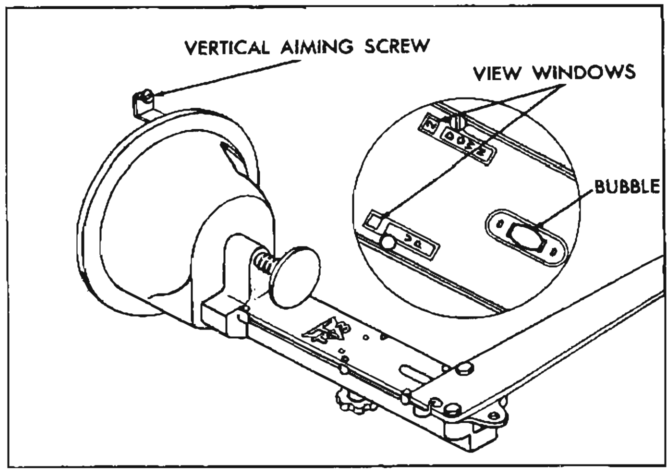


Fig. 7—Selecting Level Aiming Area

5. If the bubbles are still within the two outside black marks on the vials, the floor is level enough to use the Aimer as it comes from the factory.

NOTE: A quick level check can be made by using the T-3 Safety-Aimer as a level. Use with a true eight to ten foot two by four as an extension. Make sure pads on base of Aimer are used. Place the board where you expect the wheels to be and take readings as outlined above.

6. If either bubble moves outside the black lines of the vial there is too much slant to the floor. Try driving

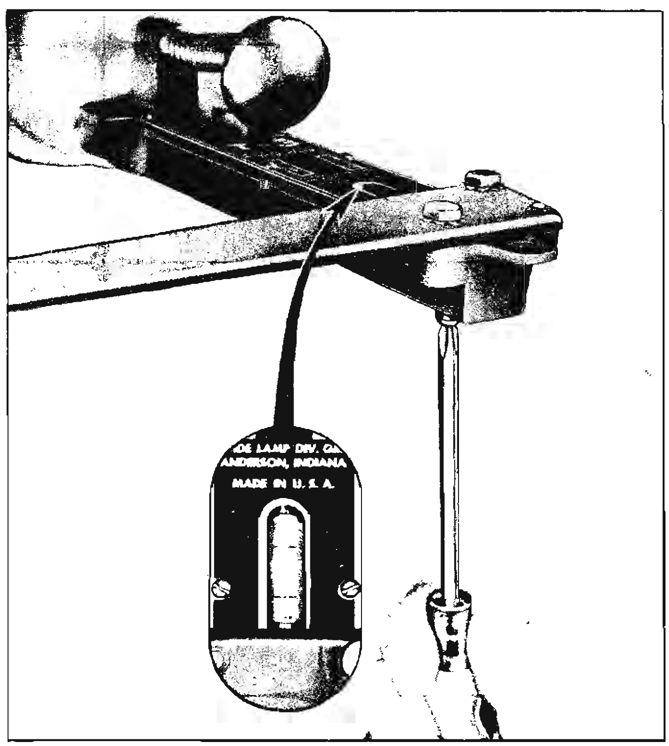


Fig. 8—Turning Level Adjusting Screw to Calibrate Aimer

the car in at different angles onto the aiming area. If bubbles can not be centered follow procedure under "How to Compensate for Unlevel Floor."

NOTE: When level portion of floor is obtained, mark tire spots on floor so spots can be used next time without calibrating Aimer.

TO COMPENSATE FOR UNLEVEL FLOORS

If your floor is not level within the limits specified, the T-3 Aimer can be calibrated to compensate for the error in the floor. Follow this procedure with both aimers.

1. Drive the car onto the area for which you wish to compensate the aimers, and install the aimers in place on the headlamps.
2. Loosen knob beneath the aimer arm and move the slider until the bubble is centered.
3. Record the numeral in the view window. (This numeral is to be used only for recalibration.)
4. Move the slider to a position halfway between this recorded numeral and the numeral "2" in the DOWN window. (This numeral is used only in recalibration and not for headlamp aiming.)
5. Recalibrate aimers by turning screw shown in Figure 8 until the bubble is centered.
6. The T-3 Aimers are now calibrated for the selected area. All future aiming must be done in the same area and with the car pointed in the same direction. Mark the tire spots on the floor so that future cars can be located in the same position.

SERVICE OPERATIONS

SEALED BEAM UNIT REPLACEMENT

1. Remove headlamp bezel retaining screws and bezel (fig. 9).
2. Disengage retaining spring from unit. Turn lamp unit slightly to disengage unit from headlamp adjusting screws.

NOTE: Do not disturb adjusting screw setting.

3. Pull headlamp unit forward and disconnect unit from wiring harness connector.
4. Remove retaining ring and headlamp from mounting ring.
5. Position new sealed beam unit in mounting ring and install retaining ring to unit.

NOTE: The number molded into lens face must be at the top.

6. Attach wiring harness connector to new unit and install headlamp unit in sub body, twisting slightly to engage mounting ring tabs with adjusting screws.

NOTE: In the dual headlight installation the inboard unit is No. 1, the outboard unit, No. 2. No. 1, unit takes a double connector plug, the No. 2 unit a triple connector plug.

7. Install retaining spring to mounting ring, check operation of unit, and replace bezel.

LIGHTING SWITCH REPLACEMENT

Refer to Figure 10.

1. Disconnect battery ground cable.
2. Pull control knob out to headlamp ON position.
3. Reach under instrument panel and depress the switch shaft retainer (fig. 11) and remove knob and shaft assembly.
4. Remove the retaining ferrule nut using Tool J-21932 (Chevrolet) or J-4880 (Chevelle and Chevy II). Remove switch assembly from instrument panel.
5. Disconnect the multi-plug connector from the lighting switch. A screw driver may be inserted in the side of the switch to pry the connector from the switch.

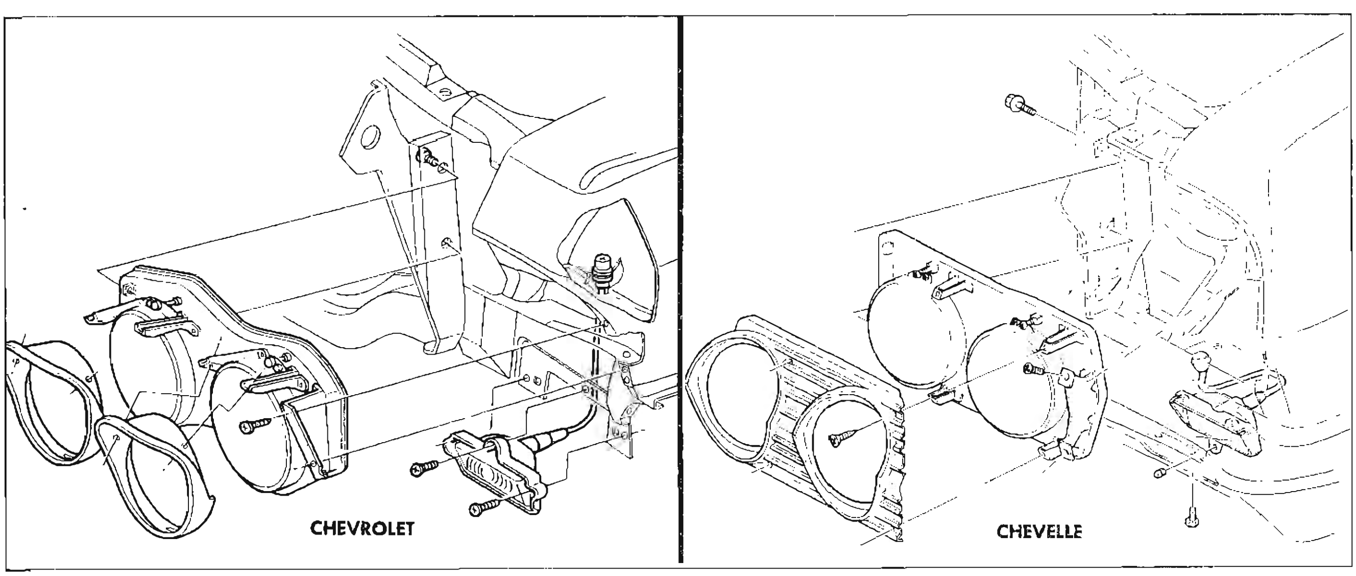


Fig. 9—Headlamp Assemblies

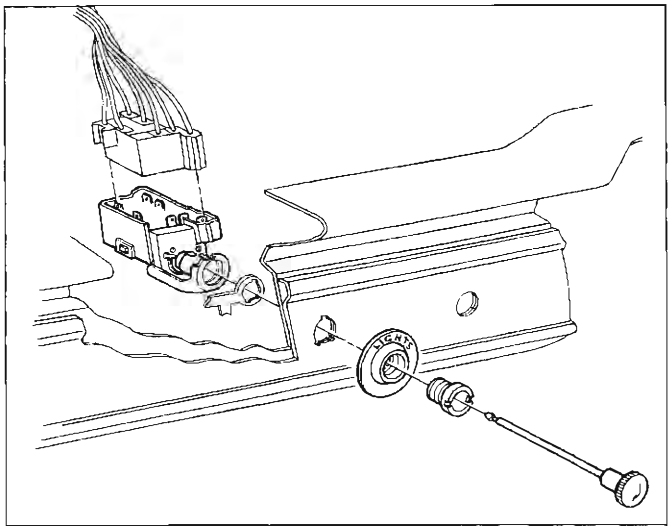


Fig. 10—Lighting Switch Assembly (Chevrolet Shown)

6. Connect the multi-plug connector to the new light switch. Connect battery cable to battery terminal and check operation of the light switch in all positions.

NOTE: Ground switch to check dome lamp operation.

7. Position switch in panel mounting hole and install and ferrule nut.
8. Insert switch control knob and shaft assembly into switch until retainer engages shaft.

STOPLIGHT SWITCH REPLACEMENT

Chevrolet and Chevy II (Fig. 12)

1. Disconnect the two wiring harness connectors from the switch.

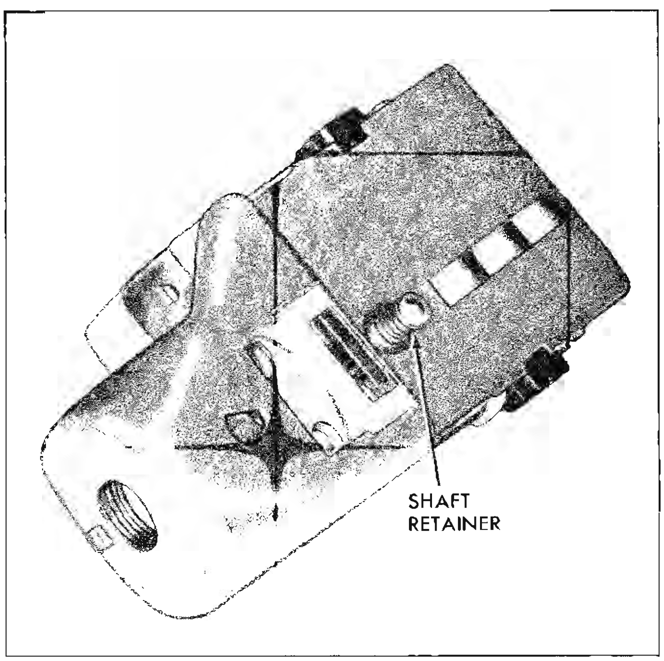


Fig. 11—Lighting Switch Shaft Retainer

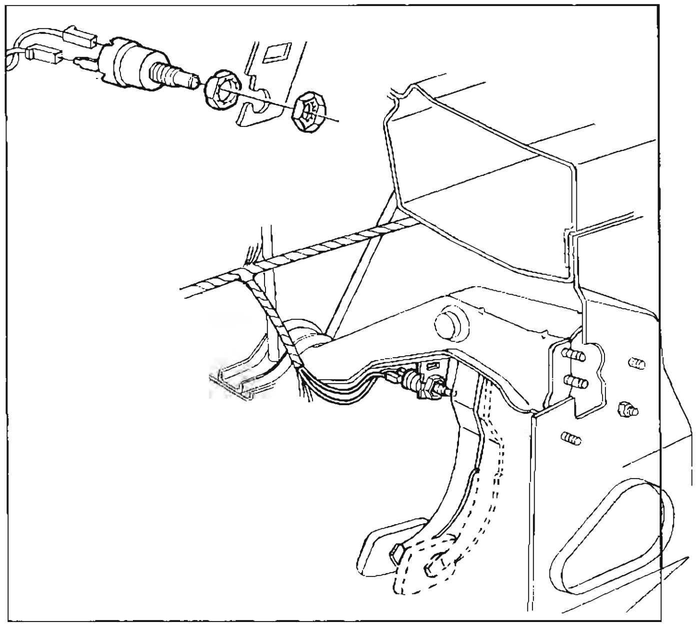


Fig. 12—Stoplight Switch (Chevrolet and Chevy II)

2. Remove the locknut from plunger end of switch and remove switch.
3. Transfer positioning nut to new switch.
4. Locate new switch in same approximate position on mounting bracket as switch previously removed. Install connectors to the switch.
5. Adjust and check switch position for proper operation. Electrical contact should be made when brake pedal is depressed 3/8" to 1/2" from fully released position.
6. After proper adjustment, install locknut on plunger side of switch.

Chevelle (Fig. 13)

1. Disengage retaining fingers, disconnect wiring harness connector from switch and unscrew switch from mounting clip.
2. Depress brake pedal and push new switch into clip until shoulder bottoms out against clip.

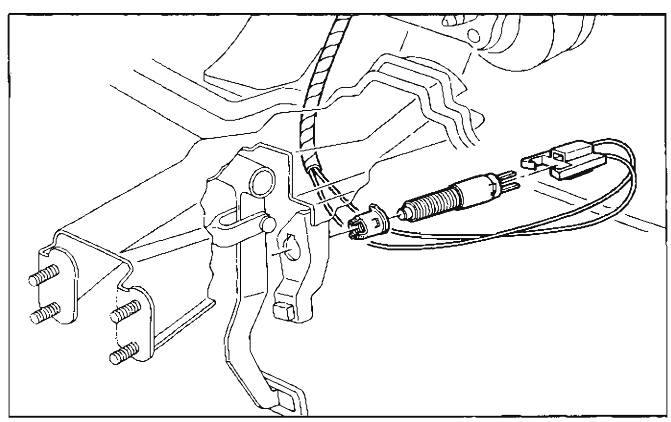


Fig. 13—Stoplight Switch Assembly (Chevelle)

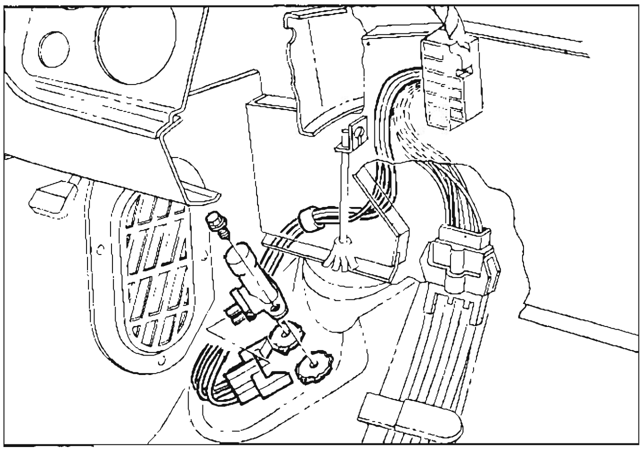


Fig. 14—Dimmer Switch Assembly (Chevelle)

3. Check switch position for proper operation. Electrical contact should be made when the brake pedal is depressed 3/8" to 5/8" from fully released position.

DIMMER SWITCH REPLACEMENT (Fig. 14)

1. Fold back upper left corner of front floor mat, disengage connector lock fingers, and disconnect multi-plug connector from dimmer switch.
2. Remove two screws retaining dimmer switch to toe pan.
3. Connect multi-plug connector to new switch and check operation. Install new switch to toe pan with two screws. Replace floor mat.

BACK-UP LAMP SWITCH REPLACEMENT

3-Speed Transmission (Fig. 15)

1. Disconnect wiring connector at switch terminals.
2. Remove switch attaching screws and switch from mast jacket.
3. Position new switch to mast jacket, install the retaining screws and connect wire connector to switch.

NOTE: Position gear shift in neutral before assembling switch to mast jacket.

4. Check operation of switch.

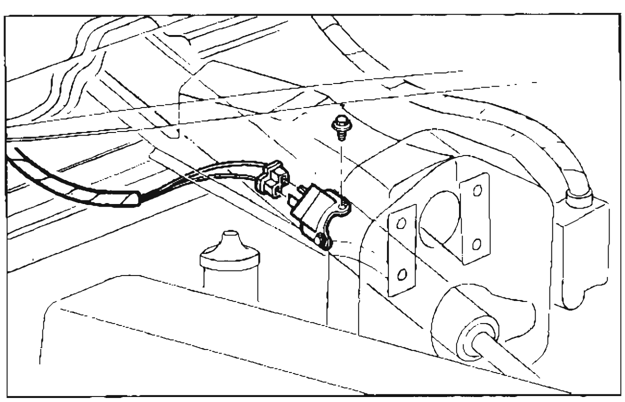


Fig. 15—Back-up Lamp Switch 3-Spd. Trans. (Chevelle)

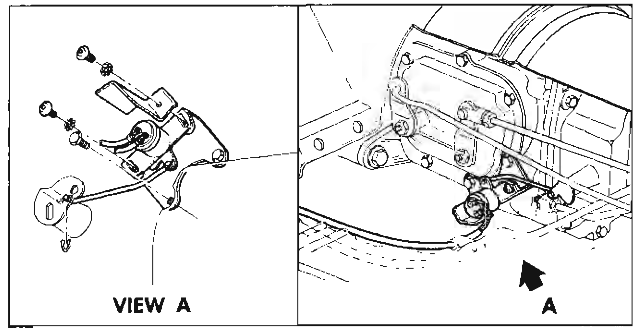


Fig. 16—Back-up Lamp Switch (4-Spd. Trans.)

4-Speed Transmission (Fig. 16)

1. Raise and support vehicle.
2. Disconnect switch wiring from harness wiring at in-line connector.
3. Remove wire clip retaining reverse lever rod to switch.
4. Remove screws retaining switch and shield assembly to transmission, remove switch.

NOTE: Do not remove transmission-to-bracket retaining bolts.

5. To install, reverse removal procedure and check switch for operation in transmission reverse range.

NEUTRAL SAFETY SWITCH REPLACEMENT

Column Shift Fig. 17

1. Disconnect wiring harness connectors at switch terminals.
2. Remove switch retaining screws and switch from mast jacket.
3. To install, position shift lever in drive and clamp lever tang against transmission selector plate.
4. Align slot in contact support with hole in switch and insert pin to hold support in place.
5. Place contact support drive slot over shifter tube drive tang and tighten screws. Remove clamp and pin.
6. Connect wiring harness to switch terminals.

Floor Shift Fig. 17

1. Remove bezel dial indicator and seal from seat separator console.
2. Disconnect switch wiring from wiring harness at in-line connector.
3. Remove switch retaining nuts and switch.
4. To install new switch, clamp pawl rod against contact point "B" of detent and align slot in contact support with drive hole in switch and insert pin to hold in place.
5. Position switch to lever and bracket assembly with lever engaged in contact support and install retaining nuts.
6. Remove clamp and pin and check operation of switch.
7. Install bezel, dial indicator and seal.

WINDSHIELD WIPER SWITCH REPLACEMENT (FIG. 18)

1. Disconnect battery ground cable.

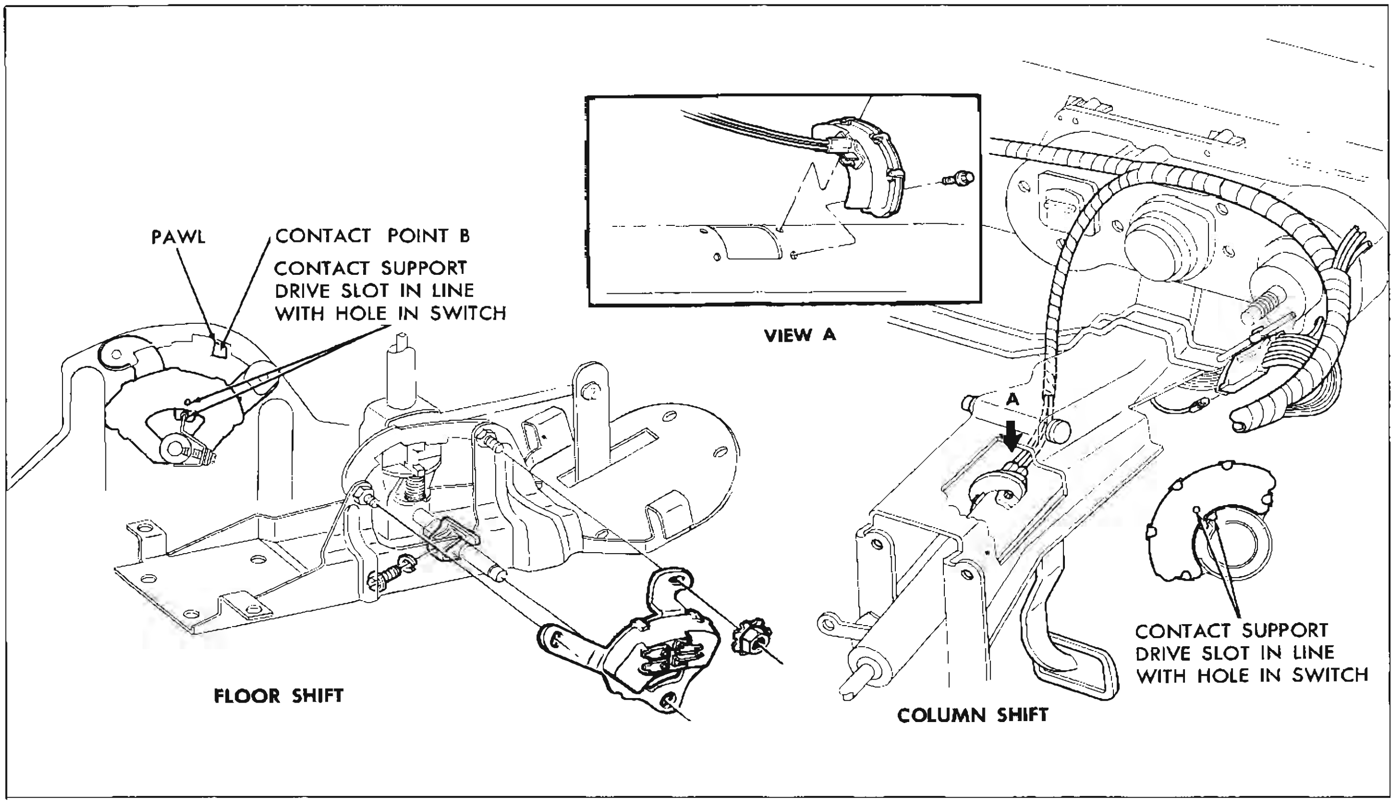


Fig. 17—Neutral Safety Switches - (Chevelle Shown)

2. Remove the connector(s) from the rear of the switch. A single connector is used on units without windshield washers. Two connectors are used on units with windshield washers.

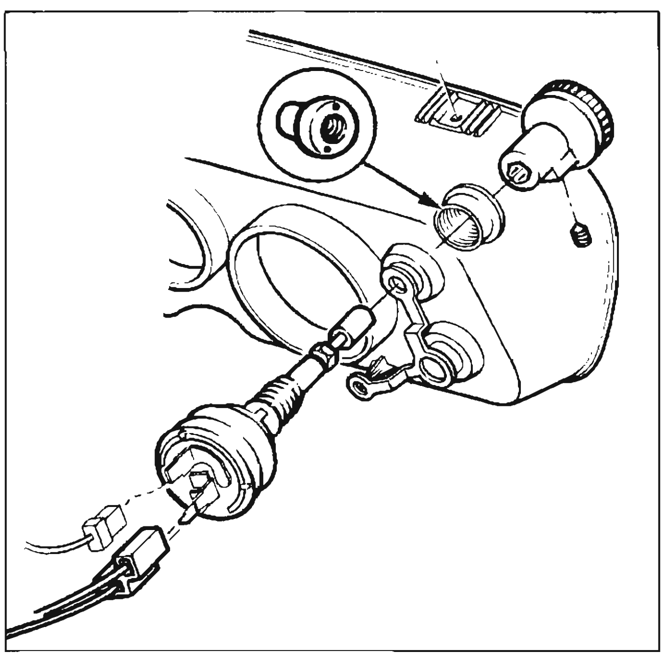


Fig. 18—Windshield Wiper Switch (Chevelle Shown)

3. Remove small set screw from bottom of wiper knob and remove knob.
4. Remove retaining nut using special Tool J-4880 (Chevelle, Chevy II) or J-21932 (Chevrolet) and withdraw wiper switch from under dash panel.
5. To install, reverse removal procedure and check operation of wipers.

PARKING BRAKE ALARM SWITCH REPLACEMENT (FIG. 19)

1. Disconnect wiring connector at switch terminals.

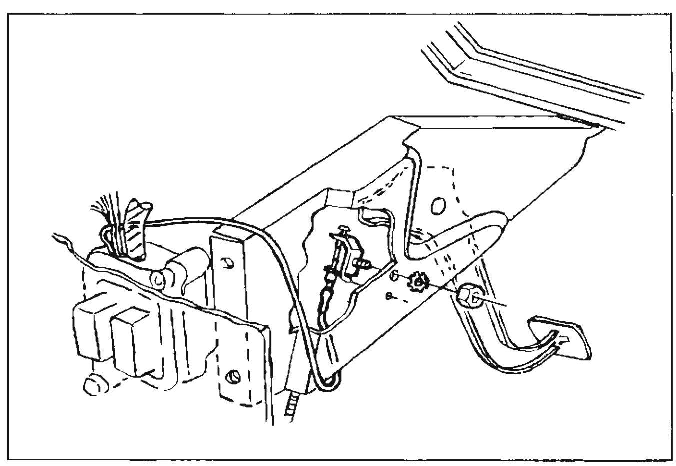


Fig. 19—Parking Brake Alarm Switch

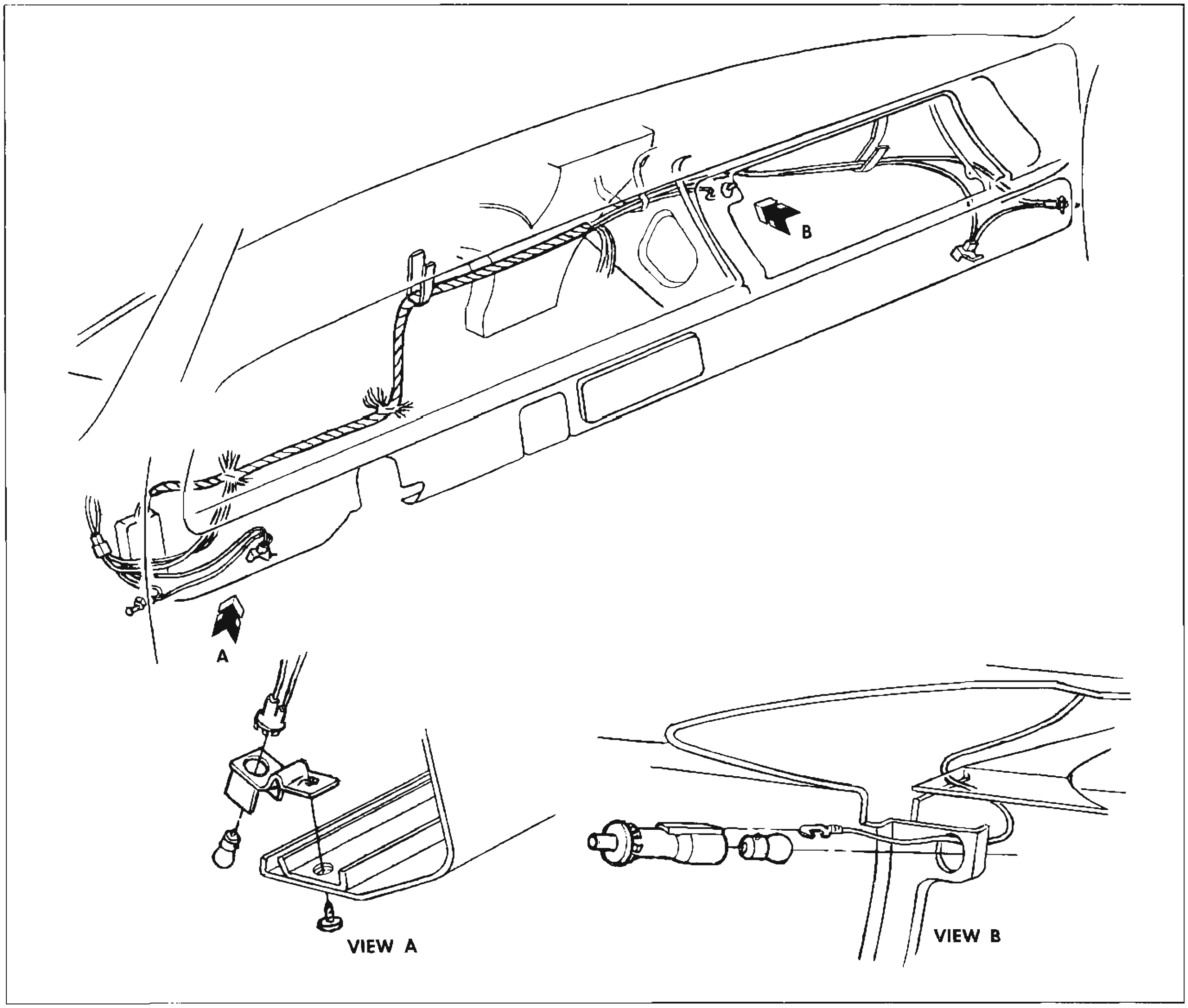


Fig. 20—Instrument Panel Compartment Switch and Courtesy Lamp Assemblies

2. Remove nut and lock washer from retaining bolt and disengage switch from dash brace.
3. To install, reverse removal procedure.

INSTRUMENT PANEL COMPARTMENT LAMP/SWITCH REPLACEMENT (FIG. 20)

1. Disconnect battery ground cable.
2. Reach into glove box, depress bulb in end of switch and turn counter-clockwise to remove bulb.
3. Remove switch from socket. Carefully detach wire and terminal from switch.

   NOTE: On some model switches the wire and terminal cannot be detached from the switch making it necessary to cut and splice the switch wire.

4. Insert wire and terminal into new switch.
5. Push switch into place and install bulb by setting it in place, depressing and turning it clockwise.

CIGARETTE LIGHTER REPLACEMENT (FIG. 21)

1. Disconnect battery ground cable.
2. Disconnect wire connector at rear of lighter unit under dash.

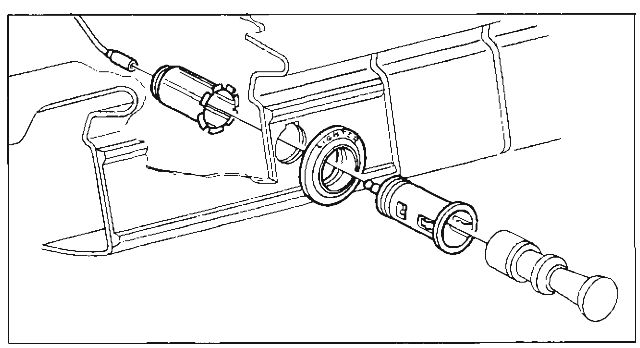


Fig. 21—Cigarette Lighter Assembly (Chevrolet Shown)

3. Remove retainer from rear of housing assembly and disengage lighter unit from panel.
4. To install, reverse removal procedure.

PARKING LAMP SERVICE

BULB REPLACEMENT (ALL)

1. Remove two lens retaining screws and disengage lens from housing.
2. Replace bulb, check operation of new bulb, reinstall lens and retaining screws.

LAMP HOUSING REPLACEMENT

(Chevrolet—Fig. 9)

1. Remove front bumper.
2. Remove battery.
3. Remove front fender moldings.
4. Remove grille, hood lock, header panel, headlamp assembly and parking lamps as an assembly.
5. Remove rivets retaining parking lamp assembly to panel.
6. Install new parking lamp assembly to panel.
7. Install front sheet metal, grille and bumper assemblies. Align all parts as required.
8. Install battery.

(Chevelle and Chevy II—Fig. 22)

1. Disconnect lamp wire assembly connector from wiring harness (located on bumper filler panel).
2. Remove two bolts retaining housing assembly in bumper and remove housing from bumper.
3. Remove lens retaining screws, lens and bulb from housing assembly and transfer to new housing unit.
4. Connect lamp wiring assembly to harness assembly, housing and check operation of lamp.

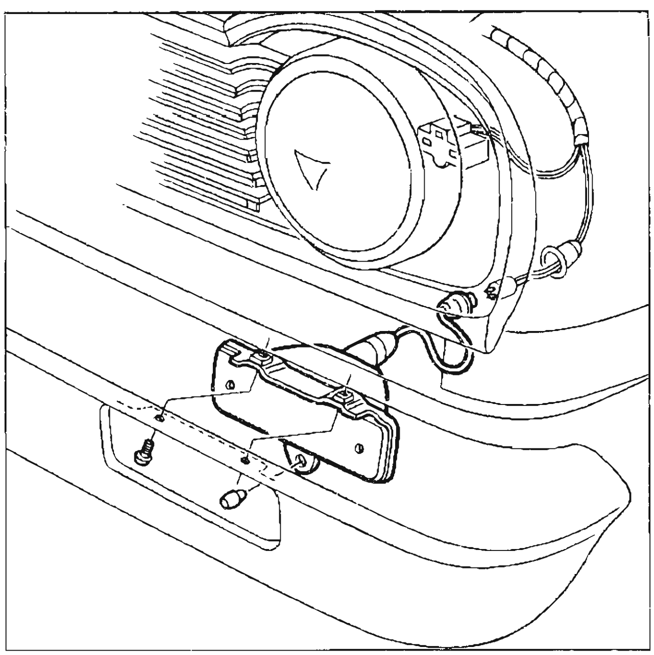


Fig. 22—Parking Lamp Assembly—Chevy II Shown

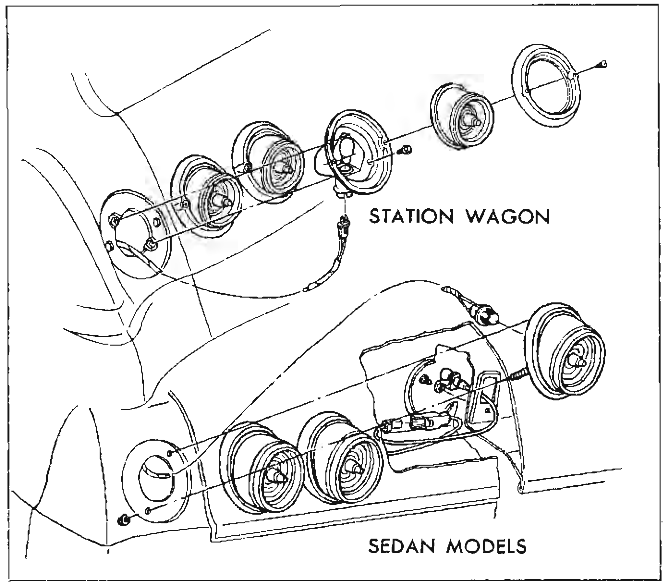


Fig. 23—Rear Lighting (Chevrolet)

5. Position lamp assembly in bumper and install retaining bolts.

TAIL, STOP AND DIRECTIONAL SIGNAL LAMP SERVICE

Refer to Figures 23 and 24.

LAMP HOUSING REPLACEMENT

1. Disconnect bulb socket from rear of lamp unit.

   NOTE: On station wagons and Chevy II Models remove lens to gain access to lamp or screws securing lamp housing to body.

2. Remove nuts at rear of housing retaining lamp housing to vehicle body, remove housing from vehicle.
3. Remove lens retaining screws or nuts, remove lens and transfer to new housing unit.
4. To install reverse removal procedure and check operation of lamp unit.

   NOTE: Gasket must be carefully installed to prevent body leaks.

BULB REPLACEMENT

1. Disconnect bulb socket from rear of lamp unit.

   NOTE: Bulb removal on station wagon models requires removal of the lens to gain access to the bulb.

2. Replace bulb and plug socket back into lamp housing.

LICENSE PLATE REPLACEMENT (FIG. 25 & 26)

LAMP HOUSING REPLACEMENT

1. Remove two housing retaining screws and remove housing from bumper or reinforcement.
2. Disconnect lamp wiring from body connector at frame rail.
3. To install, reverse removal procedure.

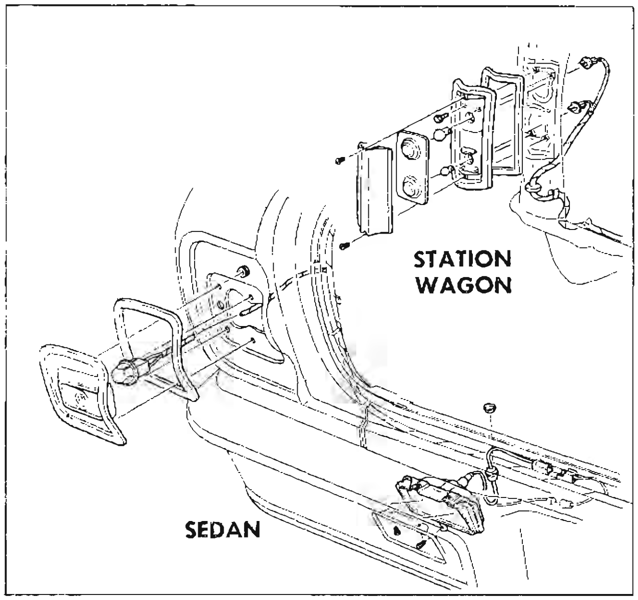


Fig. 24—Rear Lighting (Chevelle)

BULB REPLACEMENT (ALL MODELS)

1. Remove two retaining screws and disassemble lens and lens cover from unit.
2. Replace bulb and reverse removal procedure to reinstall unit.

AUTOMATIC TRANSMISSION QUADRANT LAMP SERVICE

Chevrolet (Fig. 27)

1. Remove two screws retaining lower mast jacket cover to upper cover.
2. Remove two upper indicator cover bolts and two mast jacket support attaching nuts.
3. Remove bulb and replace.

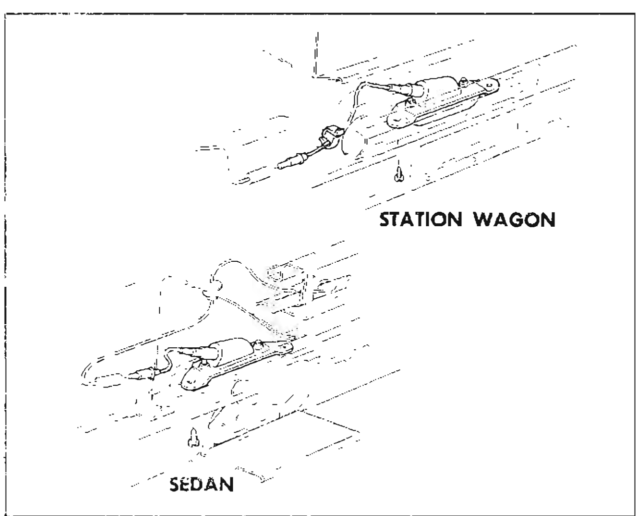


Fig. 25—License Plate Lamp Assembly (Chevrolet)

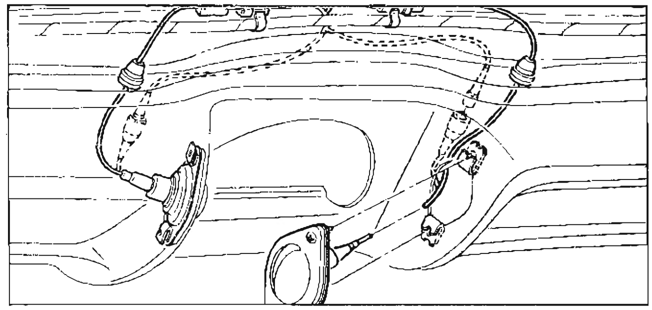


Fig. 26—License Plate Lamp Assembly (Chevelle)

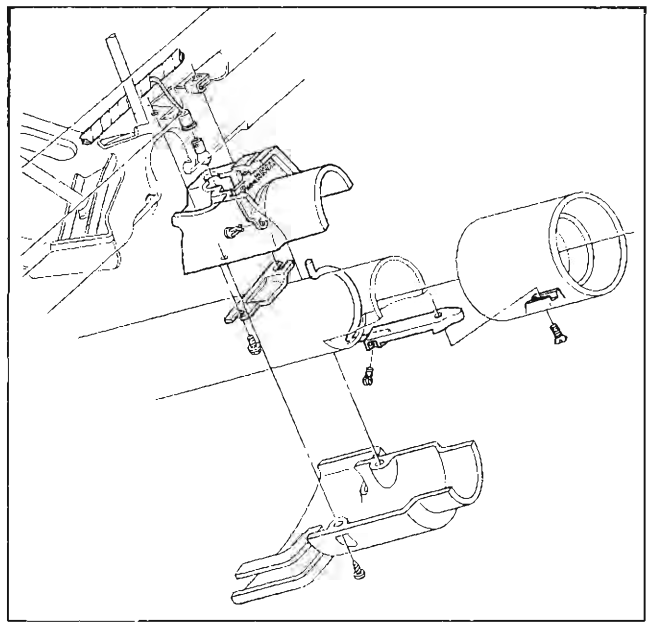


Fig. 27—Dial Quadrant Assembly (Chevrolet)

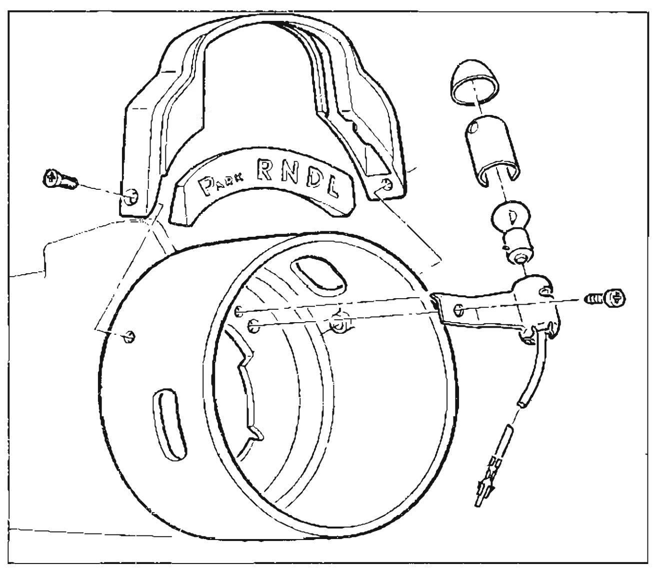


Fig. 28—Dial Quadrant Lamp Assembly

NOTE: Light shield may be retained in place with sealing compound.

4. Position steering column and install two mast jacket support attaching nuts.
5. Position upper indicator cover bolts and install two cover bolts.
6. Position lower cover and install retaining screws.

Chevelle and Chevy II (Fig. 28)

1. Remove two screws attaching dial retainer to directional signal housing; remove retainer and dial face.
2. Remove filter, cap and bulb.
3. To install new bulb, reverse removal procedure.

LAMP SOCKET REPLACEMENT

1. Remove steering wheel as outlined in Section 9, Steering.
2. Disconnect directional signal and dial lamp wiring harness assembly at multi-plug quick disconnect under instrument panel. Remove dial lamp wire lead from multi-plug connector.
3. Remove wiring harness cover retainer and cover from steering column.
4. Remove directional signal lever and three screws attaching signal control to signal housing.
5. Turn signal control housing to left and pull control unit and housing from steering shaft until control unit can be disengaged from signal housing.
6. Remove socket attaching screw, lamp socket and wire assembly from housing.
7. To install, reverse removal procedure.

SEAT SEPARATOR CONSOLE LAMPS AND WIRING SERVICE

Compartment Lamp (Fig. 29)

1. Remove two screws and lens at rear of console. On Chevrolet models gently squeeze or pry lens from console.
2. Remove and replace bulb.
3. Install lens and retaining screws.

Dial Quadrant Indicator Lamp

1. Remove bezel/trim plates, indicator dial and seal.
2. Remove and replace bulb.
3. Install bezel/trim plate, indicator dial and seal.

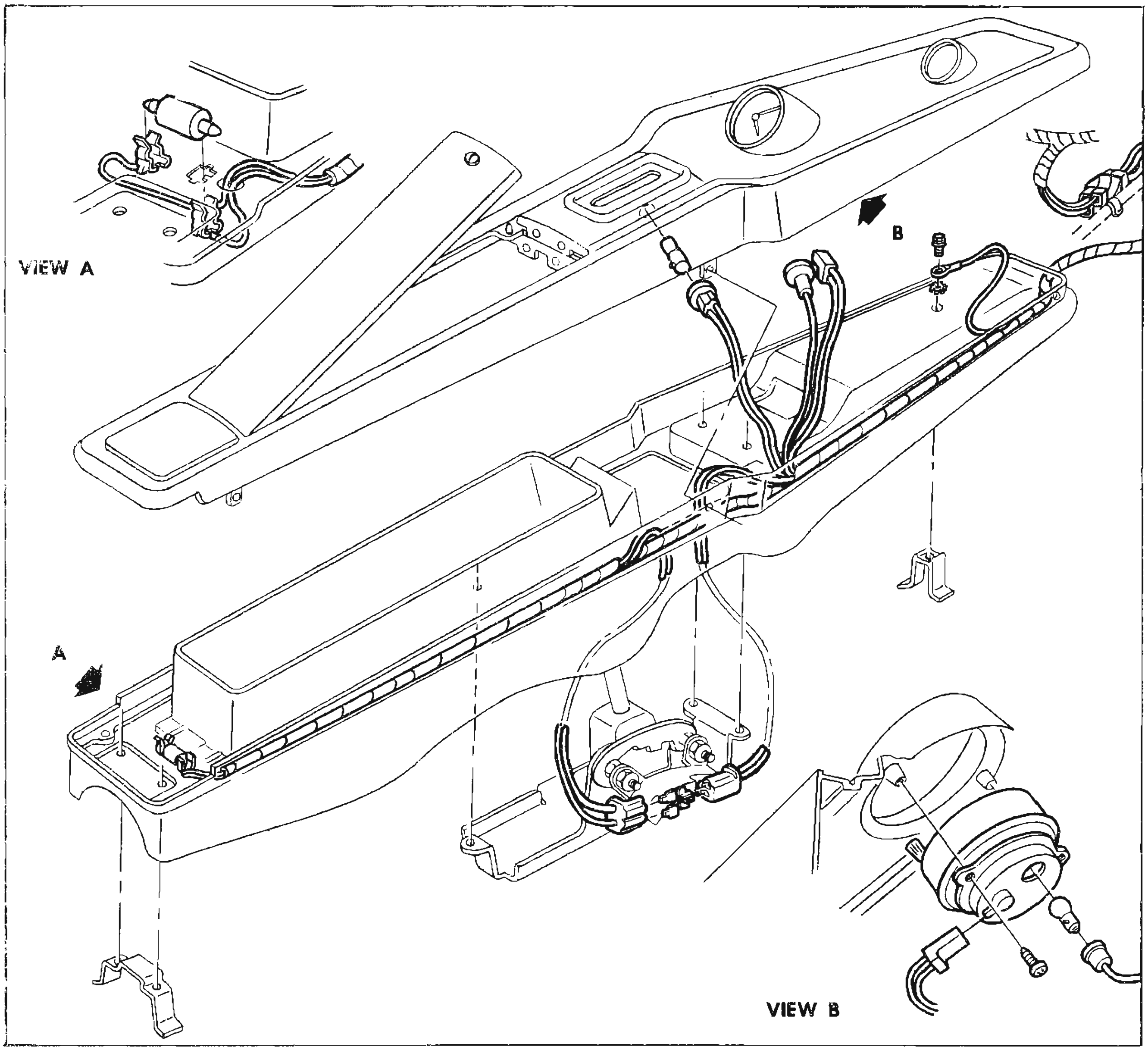


Fig. 29—Seat Separator Lamps and Wiring (Chevrolet)

CHEVROLET INSTRUMENTS AND GAUGES

INDEX

GENERAL DESCRIPTION

The standard instrument cluster consists of a speedometer, fuel gauge, generator, temperature and oil pressure indicator lamps. A clock is included on deluxe models. All of the instruments and gauges of this cluster (except speedometer) may be serviced without removing the instrument cluster from the vehicle.

On super sport models ammeter, temperature, and oil pressure gauges replace the generator, temperature and oil pressure indicator lights. The instrument cluster console must be removed to service these gauges and also the vacuum and fuel gauges on this model.

All indicator and cluster illuminating lamps may be replaced without removing the cluster from the vehicle. The lamp sockets are clip retained and may be quickly snapped in or out of position. Refer to Figure 30 for cluster wiring connections.

Regular maintenance is not required on the instrument cluster or its components other than maintaining clean, tight electrical connections, replacing defective parts and keeping the speedometer cable properly lubricated.

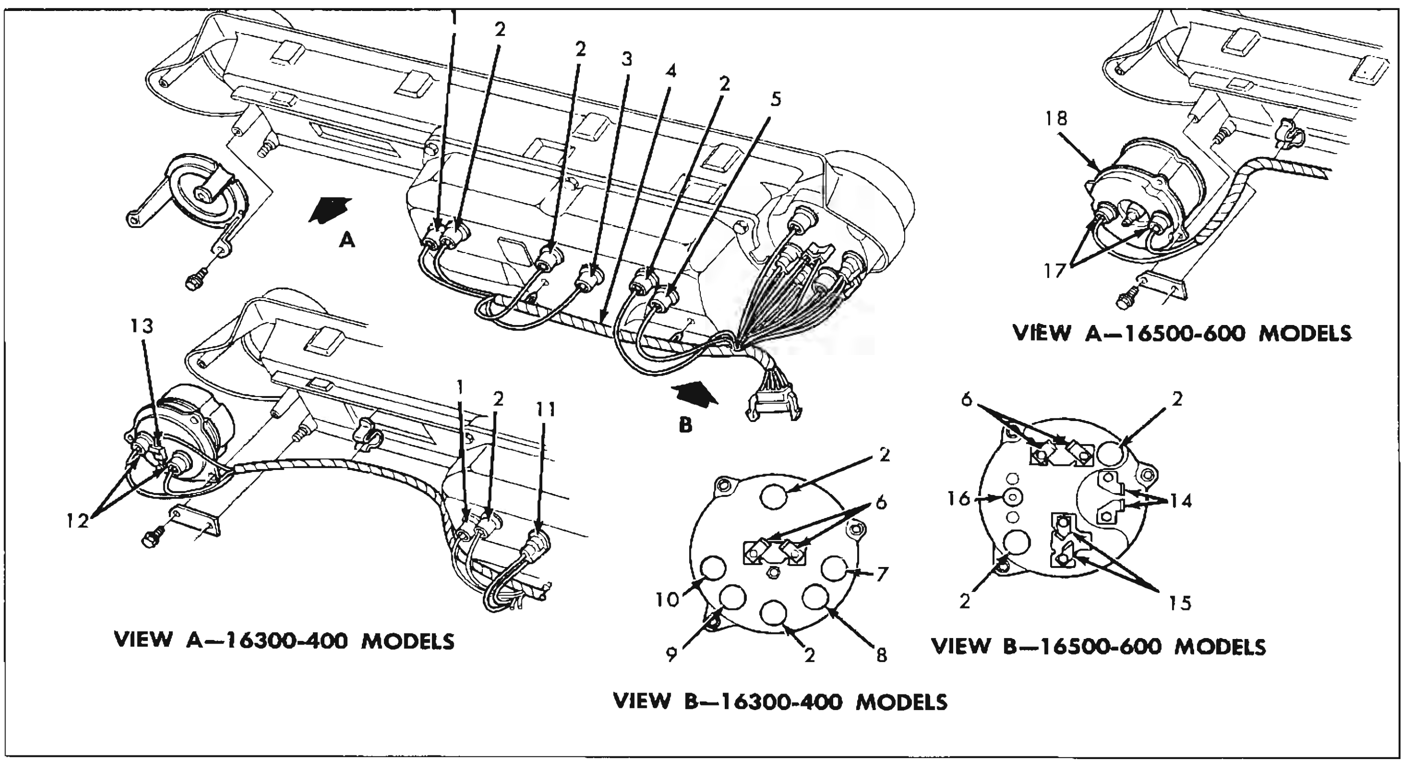


Fig. 30—Instrument Cluster Wiring

1. RH Direction Indicator
2. Instrument Cluster Lamp
3. "Bright" Indicator
4. Harness Assembly
5. LH Direction Indicator
6. To Fuel Gauge Terminal
7. "Hot" Indicator
8. "Cold" Indicator
9. "Gen" Indicator
10. "Oil" Indicator
11. "Brake" Indicator
12. Clock Lamps
13. Clock Assembly
14. To "Gen" Gauge
15. To "Temp" Gauge
16. Oil Gauge Nipple
17. Vacuum Gauge Lamps
18. Vacuum Gauge

SERVICE OPERATIONS

INSTRUMENT CLUSTER (FIG. 31)

REMOVAL

NOTE: On Air Conditioned vehicles it is necessary to remove the entire instrument panel console and cluster unit as an assembly.

1. Disconnect battery ground cable.
2. Remove steering wheel assembly as outlined in Section 9, Steering.
3. Disconnect speedometer cable from rear of speedometer housing.
4. Disconnect cluster wiring harness from panel wiring harness at multiple disconnect.
5. Remove left ash tray and retainer.
6. Remove radio assembly.
7. Remove screws attaching upper lip of cluster to console.
8. Remove four nuts from rear of cluster retaining cluster to panel.

   NOTE: As cluster is removed from panel opening observe position of mounting clips for the 4 lower studs.

9. Slide cluster to right side of vehicle pulling it gently forward out of the console. Tip cluster forward slightly to clear console edge.

   NOTE: Cluster must be pulled forward sufficiently so speedometer neck will clear console reinforcing stud.

10. With instrument cluster removed from vehicle all gauges and instruments may be quickly removed for service.

INSTALLATION

1. Position instrument cluster to console, sliding the assembly left to right along console opening.

   NOTE: When installing cluster be sure J-nuts are in position. Pull down gently on upper lip of cluster to prevent dislodging of these clips.

2. Position mounting clips and loosely attach retaining nuts to lower studs.
3. Install upper lip retaining screws and tighten lower nuts.
4. Install radio assembly.

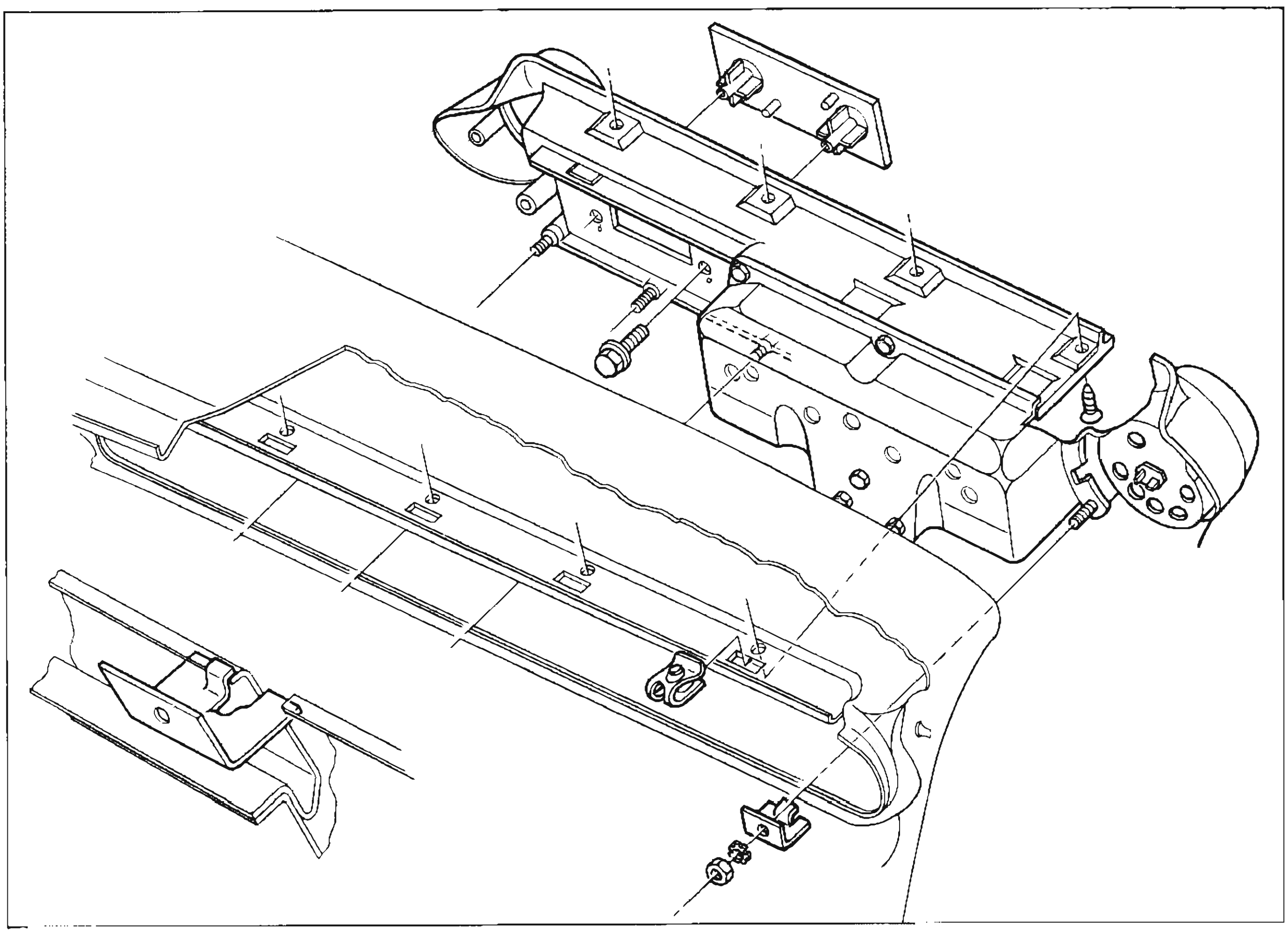


Fig. 31—Instrument Cluster Assembly

5. Install ash tray and retainer assembly.
6. Connect speedometer cable.
7. Connect cluster wiring harness to panel wiring harness at multiple connector.
8. Connect battery ground cable and check operation of unit.

INSTRUMENT PANEL CONSOLE (FIG. 32)

REMOVAL AND INSTALLATION

1. Disconnect battery ground cable.
2. Remove instrument panel compartment door and compartment.
3. Disconnect speedometer cable at speedometer housing and disconnect wiring harness at quick disconnects (fig. 33).
4. Remove steering wheel assembly and protect mast jacket.
5. Disconnect all radio connections.
6. Remove all console retaining screws and disengage console from panel.
7. To install reverse removal procedure.

INSTRUMENTS AND GAUGES

FUEL GAUGE REPLACEMENT

1. Disconnect battery ground cable.
2. Disconnect multiple lamp connections from rear of housing.
3. Remove three screws retaining fuel gauge assembly to instrument cluster housing. With fuel gauge removed from the instrument cluster assembly, remove three nuts securing gauge to template.

   NOTE: Observe carefully the stack up of gaskets and other internal parts of the fuel gauge assembly and indicator lamp cluster.

4. To install, reverse removal procedure.

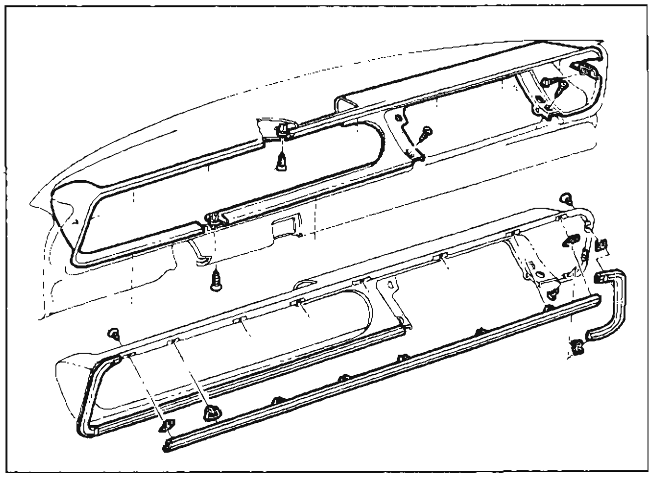


Fig. 32—Instrument Panel Console

SPEEDOMETER

Removal and Installation

1. With instrument cluster removed from vehicle, remove 5 screws securing speedometer cover to instrument panel cluster housing and remove speedometer assembly from rear of instrument cluster.
2. Uncrimp edges holding small cover to face of speedometer housing and remove small cover from housing.
3. Remove three screws from rear of speedometer housing cover securing the speedometer mechanism to the cover. Detach speedometer mechanism and dial face from the cover.
4. To install reverse removal procedure.

   NOTE: When reinstalling speedometer assembly be sure to include reflector plate.

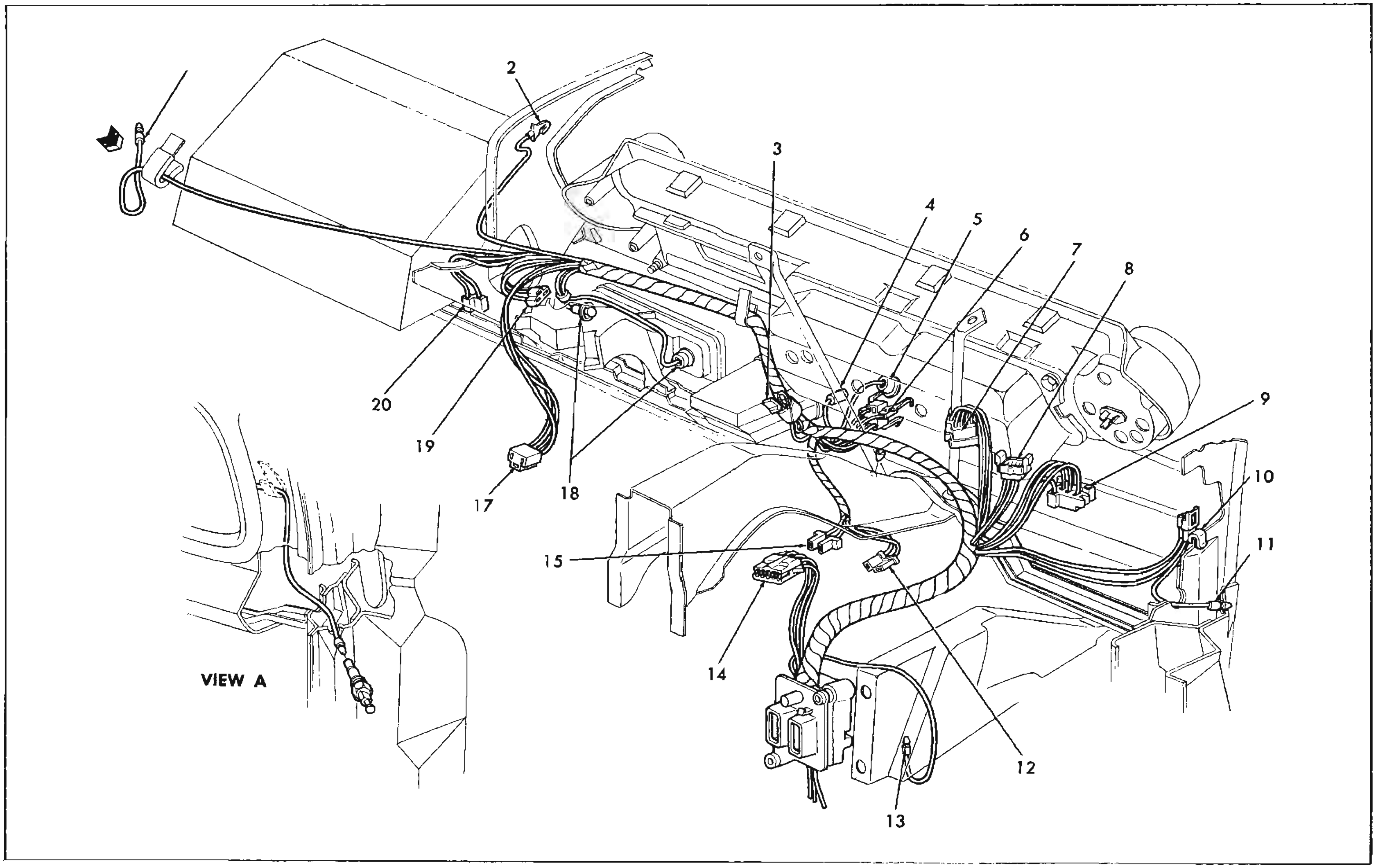


Fig. 33—Instrument Panel Wiring

1. To RH Door Jamb Switch
2. Instrument Panel Compartment Light
3. Radio Lead
4. To Cigarette Lighter
5. Ignition Switch Bulb
6. To Ignition Switch
7. To Direction Signal Switch
8. To Instrument Cluster Harness
9. To Light Switch
10. To Dome Lamp Connector
11. To LH Door Jamp Switch
12. To Back-up Lamp Switch
13. To Parking Brake Alarm
14. To Body Harness
15. To Stop Lamp Switch
16. Flasher Unit
17. To Heater Resistor
18. Heater Control Lamp
19. To Heater Switch
20. To Directional Signal Flasher

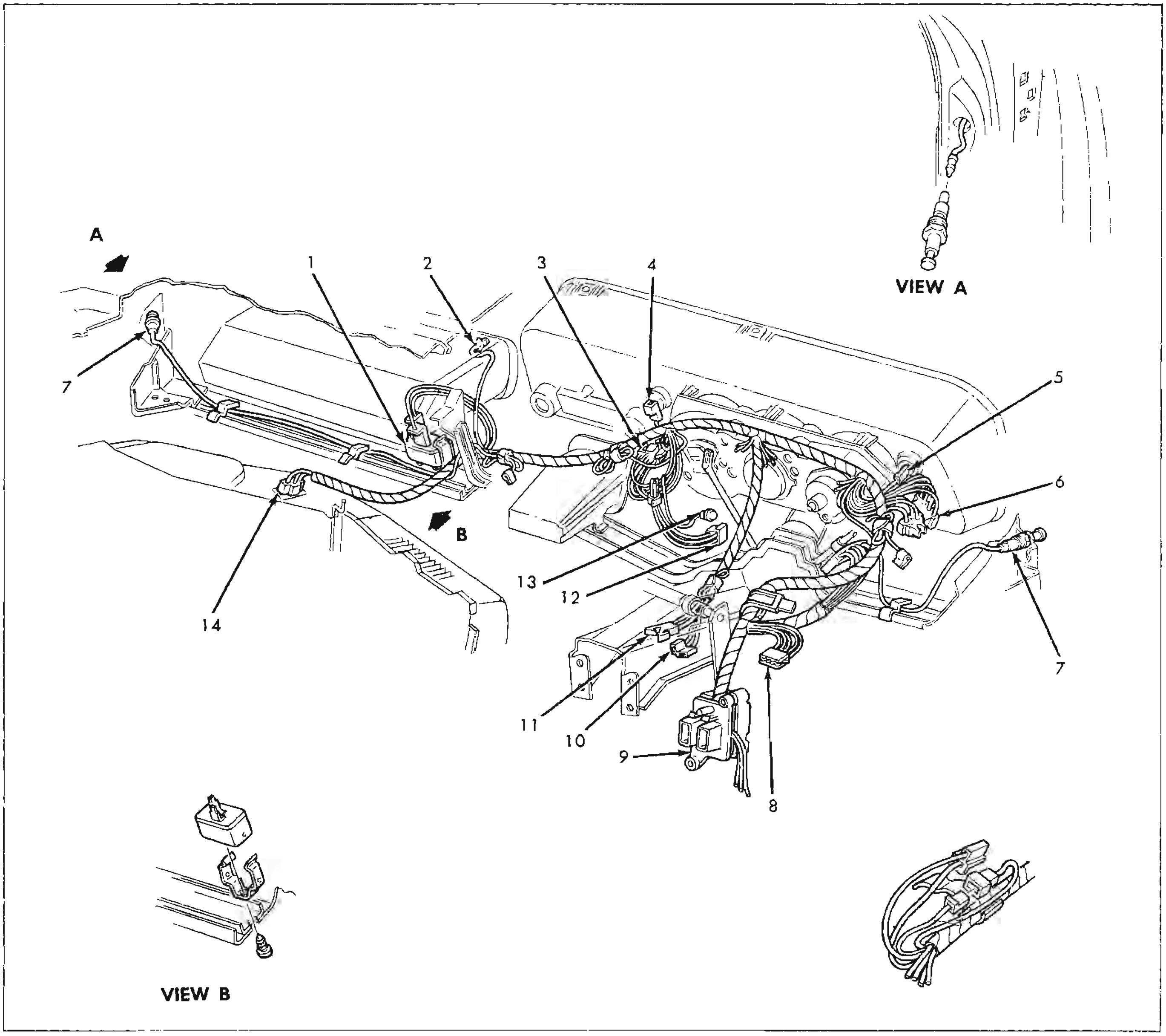


Fig. 34—Instrument Cluster Wiring

1. Directional Flasher Assembly
2. Instrument Panel Compartment Light
3. To Ignition Switch
4. To Cigarette Lighter
5. To Windshield Wiper Switch
6. To Light Switch
7. Door Jamb Switches
8. To Fisher Body Conn.
9. Fuse Panel Assembly
10. To Back-Up Lamp Switch
11. To Stoplight Switch
12. To Heater Control
13. Heater Control Lamp
14. Heater Resistor

CHEVELLE INSTRUMENTS AND GAUGES

INDEX

GENERAL DESCRIPTION

The standard instrument cluster consists of a speedometer, fuel gauge, generator, temperature and oil pressure indicator lamps and includes a clock on deluxe models. All of the instruments and gauges of this cluster may be serviced without removing the instrument console and cluster assembly from the vehicle.

On super sports models, ammeter, temperature and oil pressure gauges replace the generator, temperature and oil pressure indicator lights. The instrument console and cluster assembly must be loosened to service these gauges and also the fuel gauge in the vehicle.

All indicator and cluster illuminating lamp bulbs may be replaced without removing the cluster from the vehicle. The lamp sockets are clip retained and may be quickly snapped in or out of position. Refer to Figure 34 for cluster wiring connections.

SERVICE OPERATIONS

Regular maintenance is not required on the instrument cluster or its components other than maintaining clean, tight electrical connections, replacing defective parts and keeping the speedometer cable properly lubricated.

INSTRUMENT CONSOLE AND CLUSTER

REMOVAL AND INSTALLATION (FIG. 35)

1. Disconnect battery ground cable.
2. Remove the upper mast jacket clamp bolt and bend clamp away from steering column.

   NOTE: Protect mast jacket with suitable material.

3. Unscrew retaining collar securing speedometer cable to speedometer head. Disconnect oil pressure line at gauge on super sports model.
4. Remove nine screws attaching console to instrument panel and lean console forward onto mast jacket.

   NOTE: On models equipped with a radio remove the control knobs before attempting to remove console from panel.

5. Disconnect all cluster indicator and illumination lamps, other instrument cluster harness assembly wiring connections and two harness retaining clips from back of cluster panel (fig. 34).
6. Lift console forward and upward to remove from the vehicle completely and place on a protected bench.
7. Remove cluster housing attaching screws and cluster from console (fig. 36).
8. To install, reverse removal procedure.

   NOTE: Be sure to reinstall the ground straps held on by cluster to console attaching screws otherwise cluster function will be impaired.

INSTRUMENTS AND GAUGES

It is not necessary to remove the instrument console from the vehicle to service the instruments and gauges in the regular model instrument cluster. These units may be removed with the instrument cluster and console in the vehicle. On super sports models, however, the instrument console and cluster assembly must be loosened to service the fuel, ammeter, temperature and oil pressure gauges. With the console loosened, these units may then be easily removed from the rear of the cluster housing for servicing.

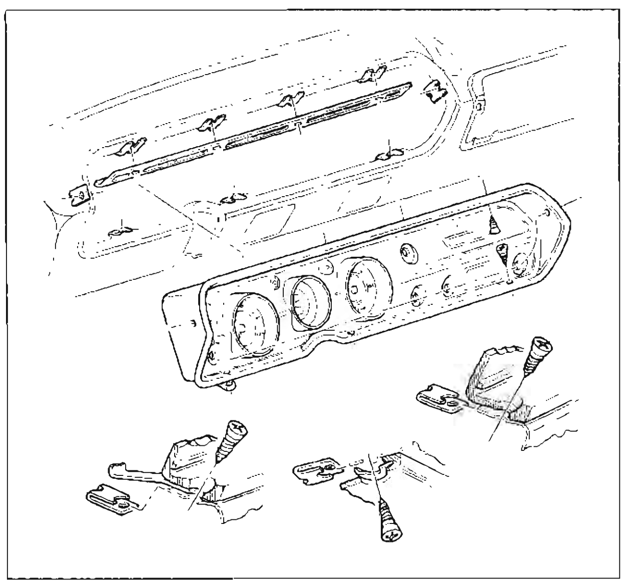


Fig. 35—Instrument Panel Console Assembly

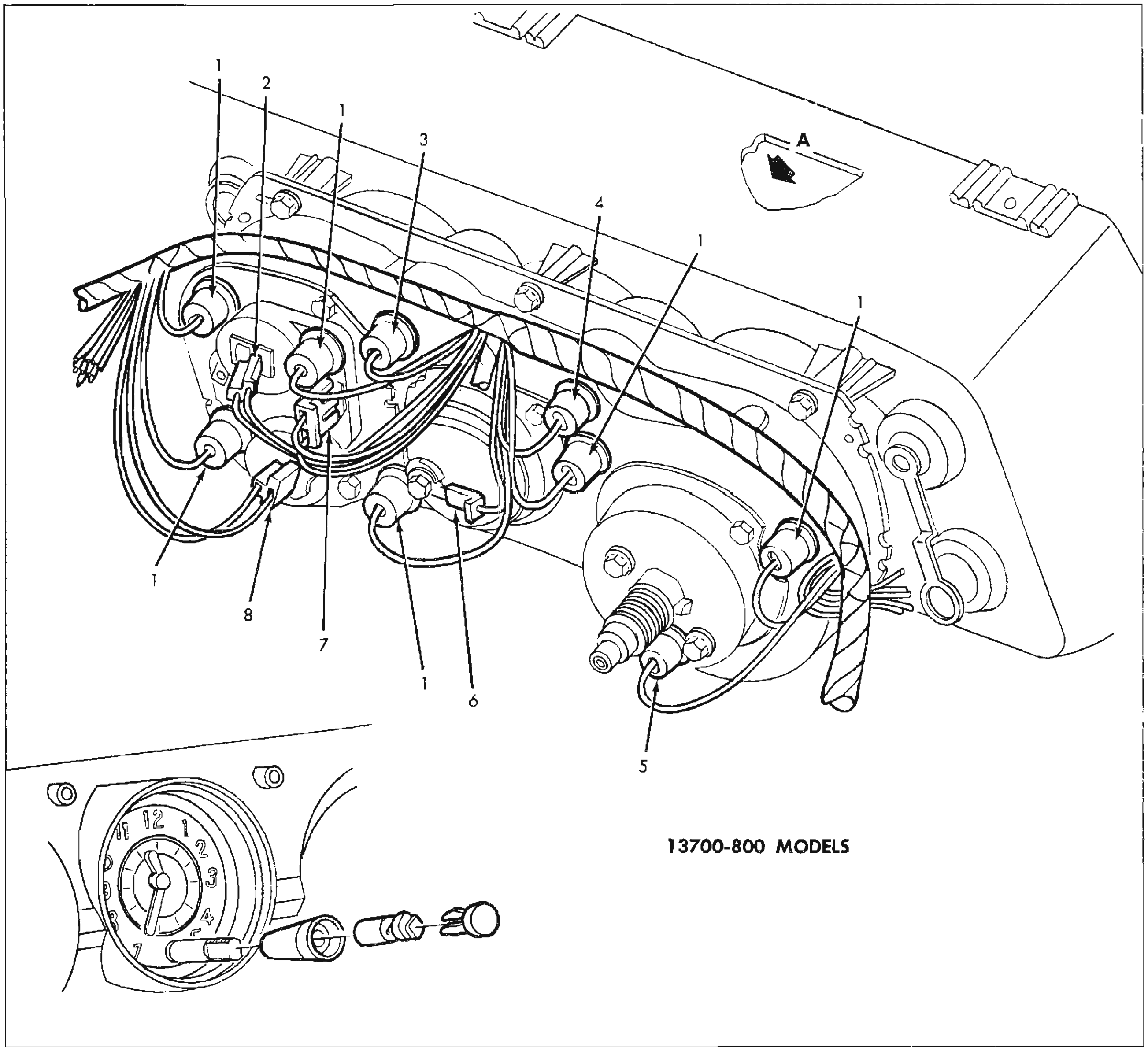


Fig. 36—Instrument Cluster Assembly

1. Instrument Cluster Lamp
2. Fuel Gauge Conn.
3. R.H. Direction Indicator
4. L.H. Direction Indicator
5. Hi-Beam Indicator
6. Clock Feed Conn.
7. "Amp" Gauge Conn.
8. "Temp" Gauge Conn.

FUEL GAUGE REPLACEMENT

1. Disconnect battery ground cable.
2. Remove lower bolt from instrument panel support and pivot brace away from rear of fuel gauge.
3. Disconnect multiple connector from gauge terminals.
4. Remove two screws attaching gauge to housing and remove gauge.
5. To install, reverse removal procedure and check operation of new unit.

CLOCK REPLACEMENT

1. Disconnect battery ground cable.
2. Remove clock set shaft knob retaining nut and knob (fig. 36).
3. Disconnect wiring harness connector from clock terminal.
4. Remove two screws attaching clock to rear of cluster housing and remove clock.
5. To install, reverse removal procedure, and check operation of new unit.

SPEEDOMETER REPLACEMENT

1. Disconnect battery ground cable.
2. Disconnect speedometer cable from the speedometer head.
3. Remove two screws attaching speedometer to cluster housing and carefully remove speedometer head.

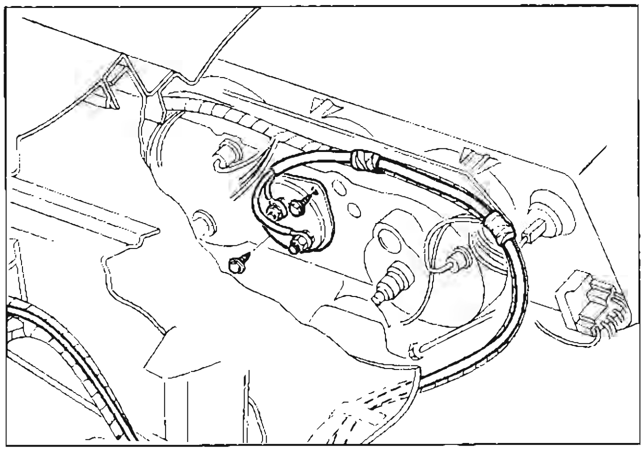


Fig. 37—Tachometer Assembly

NOTE: Servicing of the speedometer head should be performed by an authorized AC speedometer service station.

4. To install, reverse removal procedure.

TACHOMETER

The tachometer is a self-contained, all transistor unit requiring no external relays or batteries and very little service other than keeping the terminal nuts clean and tight. The unit is not serviceable and must be replaced if defective.

Removal and Installation (Fig. 37)

1. Disconnect battery ground cable.
2. Disconnect wiring harness connector from tachometer terminals.
3. Remove screws attaching gauge to cluster housing and remove instrument.
4. To install, reverse removal procedure and check operation of new unit.

CHEVY II INSTRUMENTS AND GAUGES

INDEX

GENERAL DESCRIPTION

All instruments and gauges of the 1965 Chevy II are installed in the instrument cluster. The entire cluster may be removed from the vehicle for servicing of the instruments and gauges. The temperature, oil pressure and generator indicator bulbs may be replaced without removing the cluster from the vehicle. Indicator and cluster illuminating bulb locations are identified by wiring color codes stamped near corresponding socket location or tanged holes, respectively.

Regular maintenance is not required on the instrument cluster or its components other than maintaining clean, tight electrical connections, replacing defective parts and keeping the speedometer cable properly lubricated.

SERVICE OPERATIONS

INSTRUMENT CLUSTER

REMOVAL AND INSTALLATION

1. Loosen and lower mast jacket from dash panel (see Steering, Section 9, for complete procedure for lowering jacket).

   CAUTION: Do not attempt to pry mast jacket downward without following proper procedure.

   NOTE: Apply protective tape to upper mast jacket to prevent damage to painted surfaces. Do not apply tape to instrument cluster.

2. Unscrew retaining collar securing speedometer cable to speedometer head.

3. Remove four screws attaching cluster to dash panel (fig. 39). Cluster may now be pulled clear of dash.

   CAUTION: Do not pull cluster outward further than slack in wiring harness will allow, otherwise harness retaining clips may be damaged.

4. Carefully remove the two harness retaining clips from rear of cluster.

   NOTE: Cluster may now be positioned face down on mast jacket for removal of fuel gauge.

   CAUTION: Care must be used to avoid marring cluster face on shifter housing.

5. Disconnect all indicator and illuminating bulb sockets, carefully noting their location for proper reinstallation. Remove cluster from vehicle.
6. To install cluster in dash panel, reverse above procedure.

FUEL GAUGE

A "balanced needle" is used in the gasoline gauge for greater accuracy. When the ignition switch is turned off, the gauge needle will not necessarily return to the L.H. position on the gauge. It will "float" on the gauge face or go off scale on either end. The gauge will resume normal operation when the ignition switch is turned on.

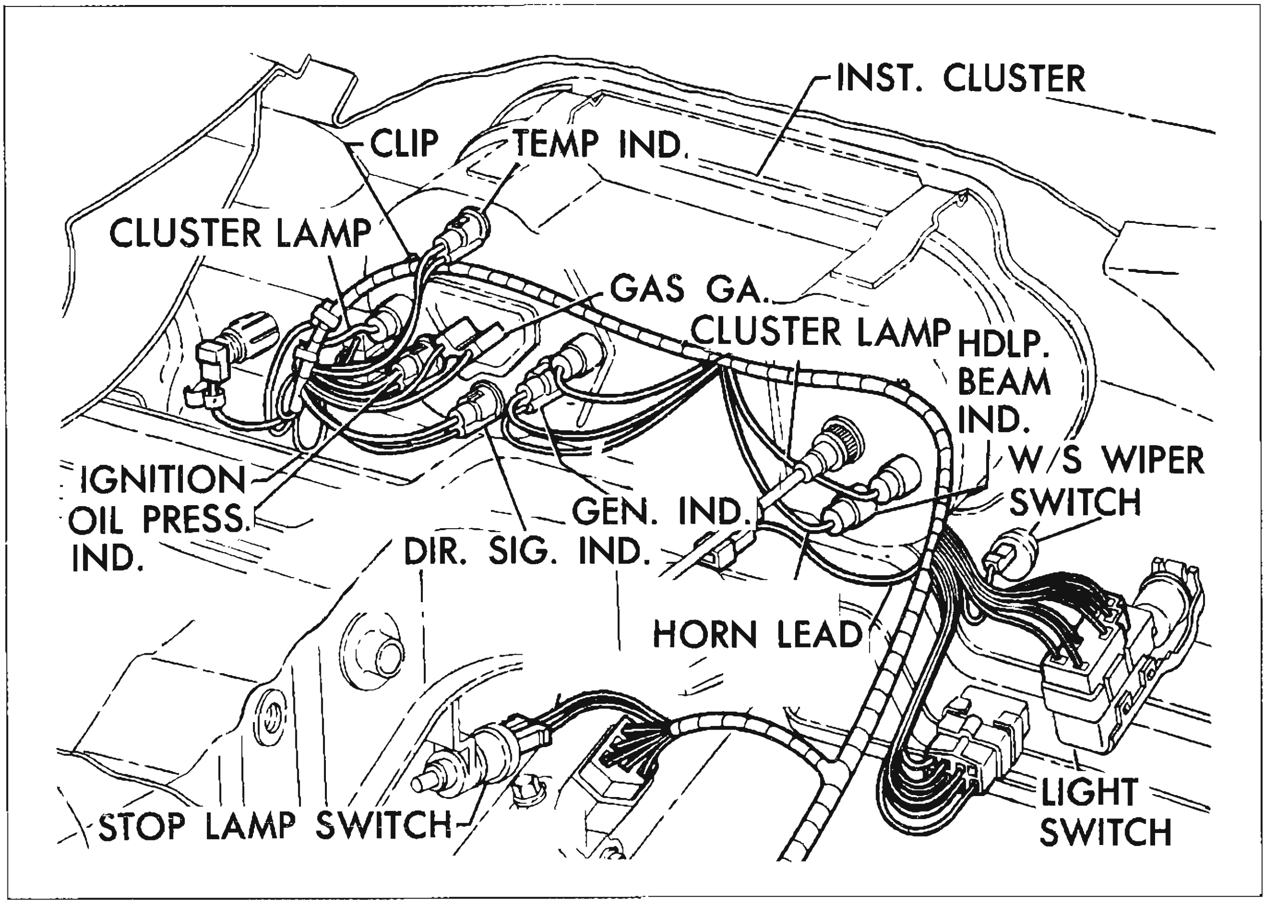


Fig. 38—Instrument Cluster Assembly

Removal and Installation

To remove the fuel gauge, refer to Steps one thru four under cluster removal procedure. In addition, remove two screws securing gauge to cluster and disconnect electrical connector. Carefully remove gauge from cluster opening.

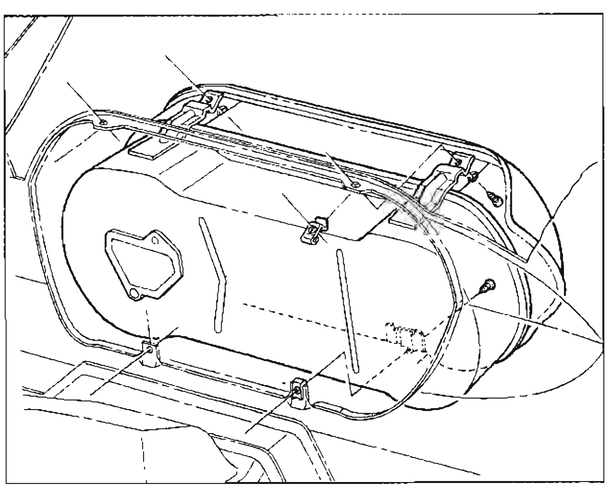


Fig. 39—Instrument Cluster Installation

CLOCK REPLACEMENT

1. Remove clock set knob attaching screw and knob from set shaft.
2. Disconnect the electrical connector.
3. Remove three screws attaching clock to rear of cluster housing.
4. To install reverse removal procedures.

SPEEDOMETER REPLACEMENT

Cluster must be removed from vehicle to service speedometer head assembly (see Cluster Removal procedure). With cluster removed from vehicle:

1. Remove four screws securing cluster back panel to bezel assembly; separate the parts carefully.

   CAUTION: Care must be used to avoid marring instrument cluster face.

   NOTE: Assemble the two parts with alignment dowels properly positioned.

2. Remove two screws securing speedometer head to cluster back panel; carefully remove speedometer head.

   NOTE: Servicing of speedometer head should be performed by an authorized AC speedometer service station.

3. Reverse above procedure to install speedometer.

INDICATOR SERVICE (ALL)

BULB REPLACEMENT

1. Replacing indicator light bulbs consists of merely unsnapping proper socket from rear of instrument cluster and replacing bulb.

OIL PRESSURE INDICATOR

If the light does not come on when ignition switch is turned on, or if light comes on and stays on after engine is started, either the oil pressure is low or the wiring or a unit in this circuit is defective. Refer to Trouble Diagnosis chart at the end of this section for servicing procedures.

Engine Sender Unit Replacement

1. Disconnect wiring harness connector from sender unit terminal. (Located in block above starter on L-6 engines and at left front of distributor on V-8 engines).
2. Remove sender unit, replace with new unit, and check operation.

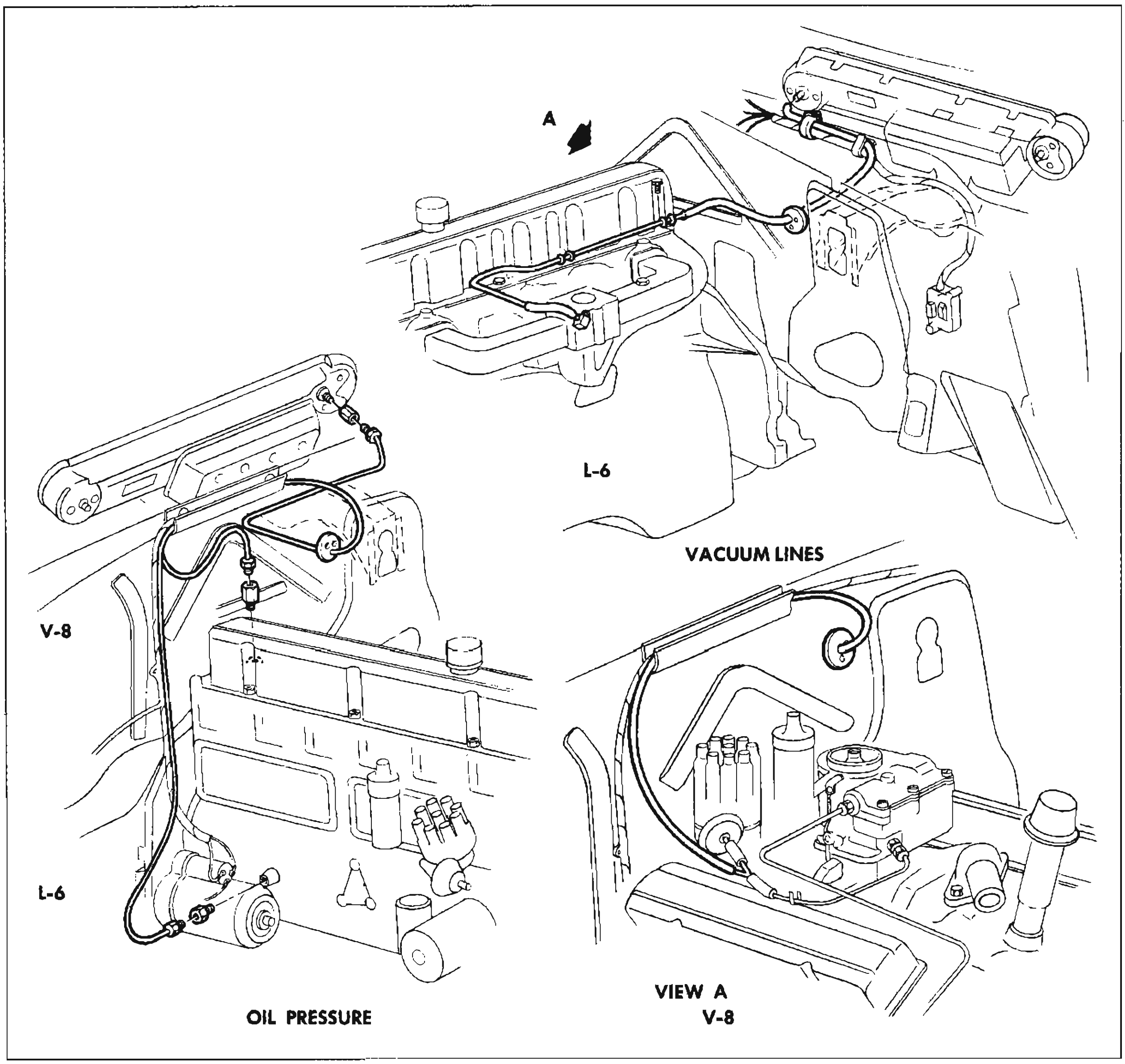


Fig. 40—Temperature, Oil Pressure and Vacuum Gauge Connections (Chevrolet)

GENERATOR INDICATOR

Ignition on, Engine not Running and Telltale Light Off

1. Indicator bulb burned out, replace bulb.
2. Open circuit or loose connection in the telltale light circuit.

Telltale Light Stays on after Engine is Started

1. If indicator light does not go out at engine idle speed, refer to Charging Systems under Engine Electrical, Section 6Y.

TEMPERATURE INDICATOR

The temperature indicator circuit consists of two remotely located units, indicator gauge and engine sender unit. The indicator gauge on all models uses a single red light to indicate an overheated engine condition. In addition on Chevrolet models a green light appears when the engine is cold and remains on until the engine begins to approach normal operating temperature.

Engine Sender Unit Replacement

1. Drain engine cooling system to a level below unit.
2. Remove sender unit, (located in the inlet manifold near water pump housing) replace with new unit.
3. Refill cooling system and check operation of unit.

SPEEDOMETER CABLE

Cable Replacement or Lubrication

1. Disconnect the speedometer cable from the speedometer head. Remove the old cable by pulling it out from speedometer end of conduit.

   NOTE: If old cable is broken it may be necessary to remove lower piece from transmission end of conduit.

2. Lubricate the lower 3/4 of cable with speedometer cable lubricant and push the cable into the conduit. Connect the upper end to the speedometer head and road test vehicle for proper speedometer operation.

DIRECTIONAL SIGNAL

REMOVAL AND INSTALLATION

Chevrolet (Fig. 41)

1. Remove steering wheel (refer to Section 9, Steering).
2. Remove lever arm attaching screw and lever from cancelling mechanism.
3. Remove shift control lever retaining pin and lever (column shift only).
4. Disconnect directional signal wiring assembly at harness quick disconnect.
5. Remove lower trim cover plate and mast jacket upper clamp. (If Powerglide, remove dial indicator retaining screws.)
6. Remove three screws attaching directional signal control to signal housing.
7. Remove wiring assembly retaining clamps (slide components upward on steering to expose upper clamp).

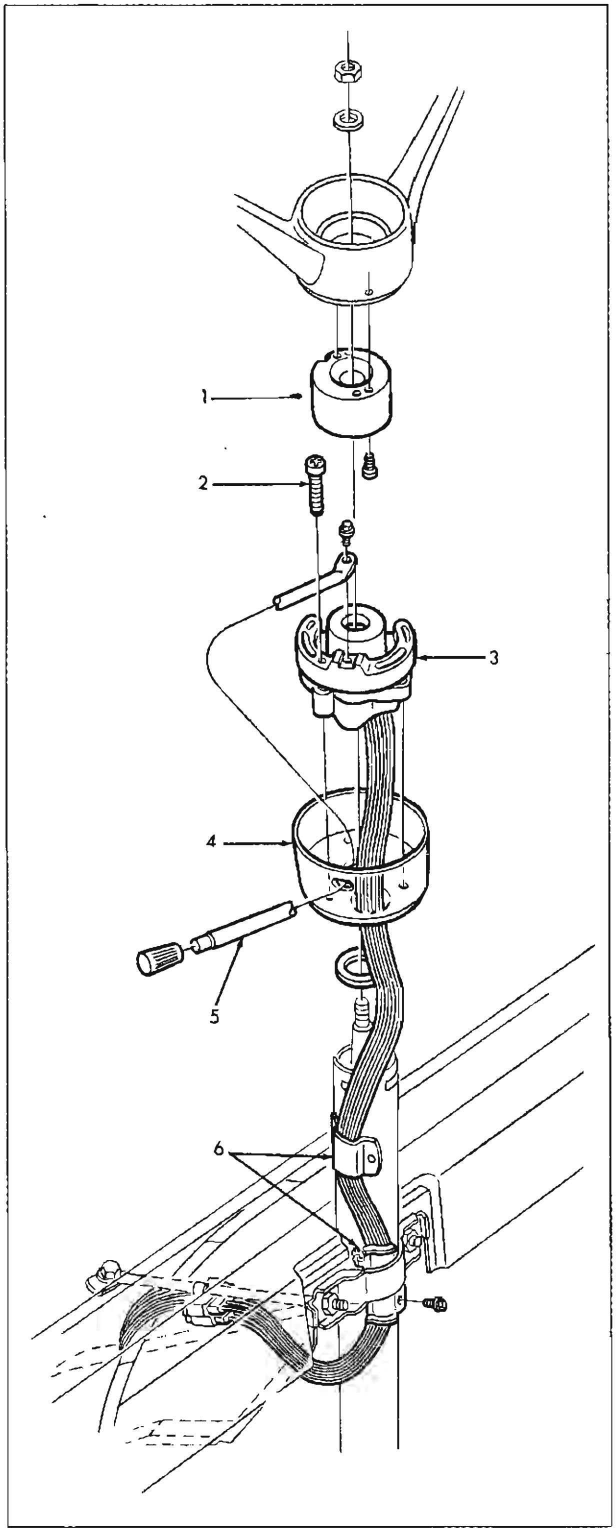


Fig. 41—Directional Signal Assembly (Chevrolet)

1. Canceling Cam
2. Control Attaching Screw
3. Control Unit
4. Control Housing
5. Lever
6. Harness Clamps

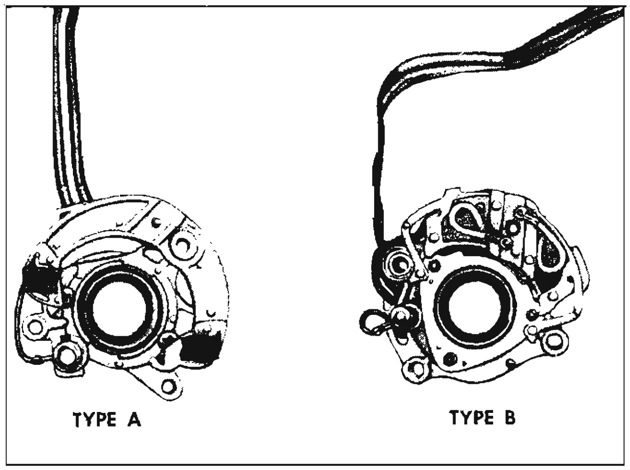


Fig. 42—Directional Signal Switches

8. Remove directional signal assembly and housing, shift lever housing and mast jacket cover extension from steering column.
9. Remove turn signal assembly from signal and shift lever housings and mast jacket.

CAUTION: Direction signal control assembly must be in neutral position when assembling steering wheel to prevent damage to cancelling cam and control assembly.

Chevelle (Fig. 43)

Two different design directional signal assemblies are used on this vehicle (fig. 42). Both assemblies incorporate a control mechanism having the cancelling mechanism and the electrical switching in one plastic assembly. These assemblies are not interchangeable since each unit uses a stamped bowl type signal housing particular to that unit only. Service operations relative to replacement are basically the same for the two assemblies.

1. Remove steering wheel (Refer to Steering, Section 9).
2. Remove cancelling cam, spring directional signal lever attaching screw and lever.
3. Remove shift lever pin and lever from shift bowl.
4. Disconnect directional signal wiring harness assembly from instrument panel harness at multiple connector.
5. Disconnect mast jacket upper clamp and bend away from column. Remove wiring harness cover retainer and cover.
6. Remove three screws attaching switch assembly to switch housing and remove switch assembly, switch housing and shift bowl from steering column. Disengage switch assembly and wiring harness from other units.

NOTE: On automatic transmission models using type "B" directional signal assemblies, the dial quadrant lamp and socket must be detached from the signal housing first.

7. To install, reverse removal procedure.

CAUTION: Direction signal control assembly must be in neutral position when assembling steering wheel to prevent damage to cancelling cam and control assembly.

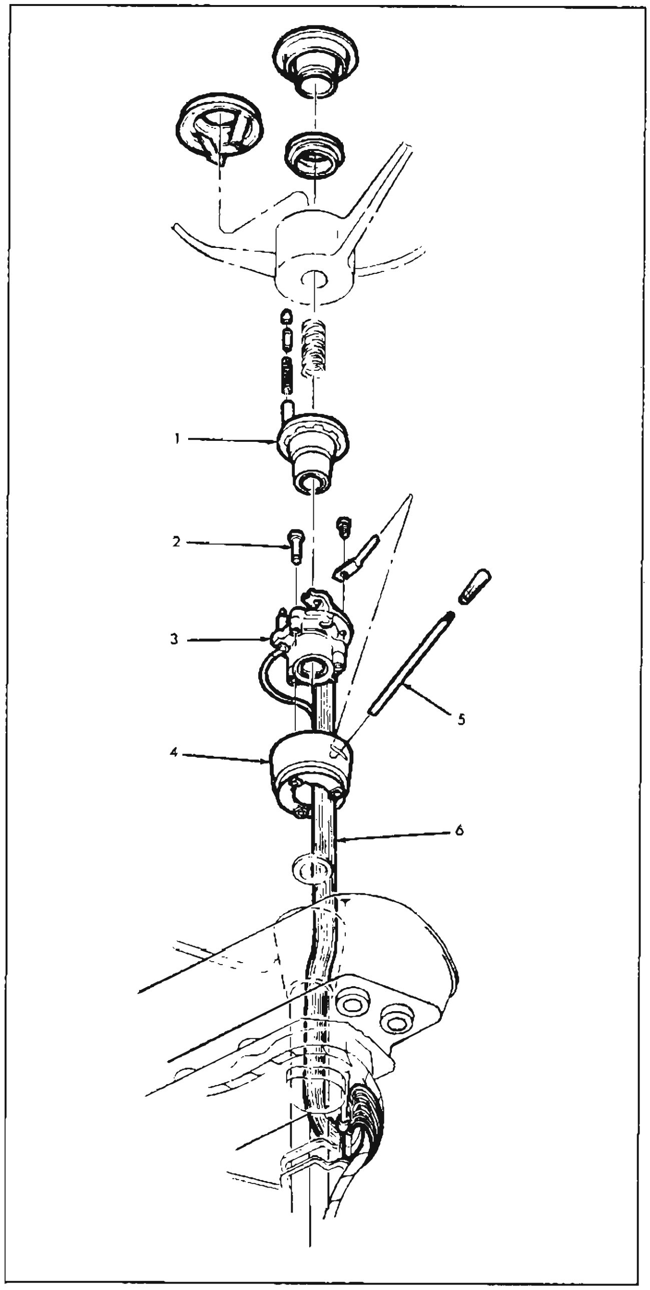


Fig. 43—Directional Signal Assembly (Chevelle)

1. Canceling Cam
2. Attaching Screw
3. Switch Assembly
4. Switch Housing
5. Lever
6. Harness Wiring

Chevy II (Fig. 44)

1. Remove steering wheel (refer to Section 9, Steering).
2. Remove lever arm attaching screw and lever from cancelling mechanism.
3. Remove shift control lever retaining pin and lever (column shift only).

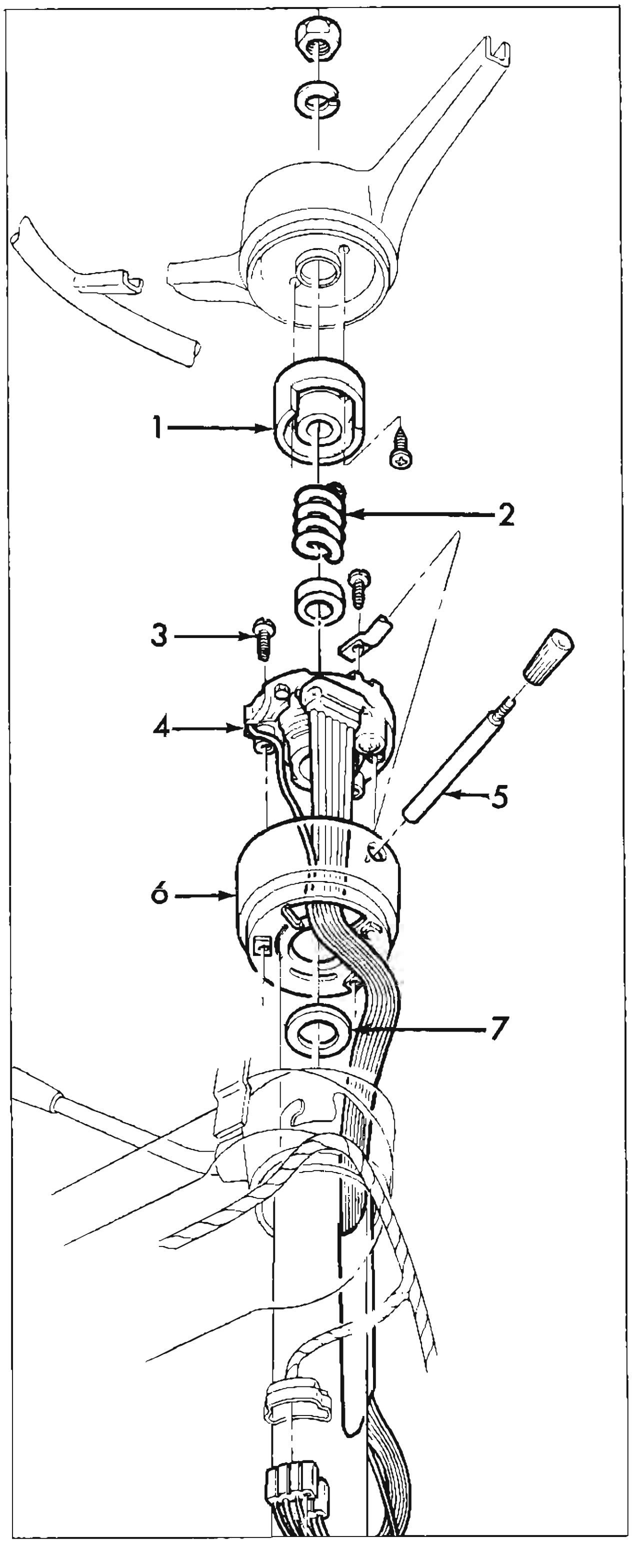


Fig. 44—Directional Signal Assembly (Chevy II)

1. Canceling Cam
2. Spring and Seal
3. Control Attaching Screw
4. Switch and Control Assembly
5. Lever
6. Signal Housing
7. Switch Wiring

4. Remove mast jacket upper support clamp.
5. Disconnect directional signal, horn and shift indicator light (automatic only) wiring assembly at chassis harness quick disconnect and disconnect plastic harness cover attaching wiring harness to mast jacket.
6. Remove three screws attaching directional signal control assembly to signal housing.
7. Remove directional signal assembly, signal housing and shift bowl from steering column.
8. Disconnect shift indicator light (automatic only) and horn wires from multiple connector. Disengage turn signal assembly from signal and shift lever housings.
9. Remove upper shaft bearing and horn assembly from directional signal control assembly.
10. To install reverse removal procedure.

CAUTION: Directional signal control assembly must be in neutral position when assembling steering wheel to prevent damage to cancelling cam and control assembly.

WINDSHIELD WIPERS AND WASHERS

INDEX

WIPER TRANSMISSION ASSEMBLY (CHEVROLET)

REMOVAL AND INSTALLATION (FIG. 45)

1. Make certain motor is in park position, remove wiper rod and blade assemblies from transmission shaft.
2. Remove plenum chamber ventilator grille.
3. Loosen nuts retaining drive rod to crank arm and detach drive rod from crank arm.
4. Remove transmission retaining screws and lower transmission and drive rod assemblies into plenum chamber.
5. Remove transmission and linkage from plenum chamber through cowl opening.
6. To install reverse removal procedure.

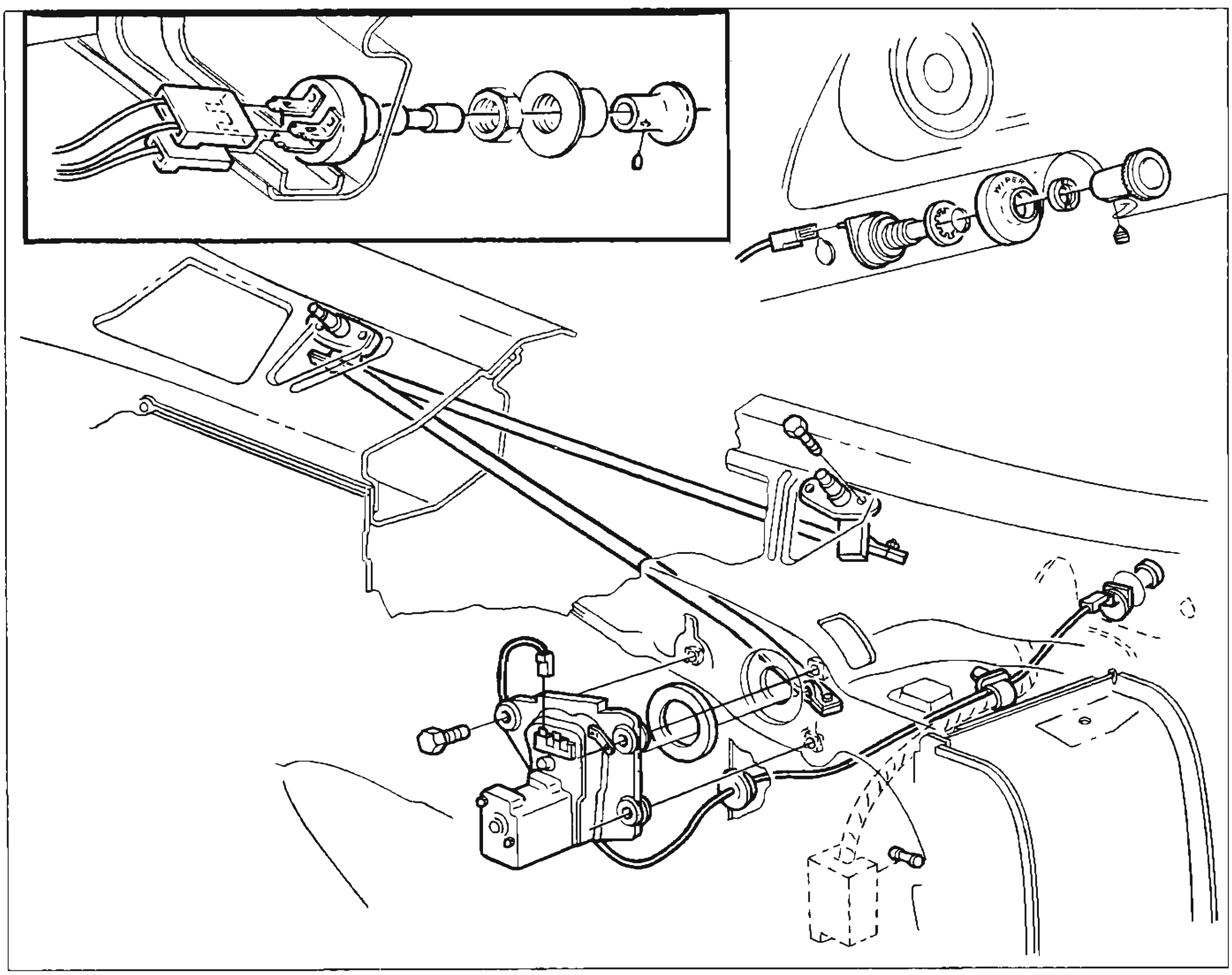


Fig. 45—Windshield Wiper Motor and Linkage Assy. (Chevrolet)

WIPER MOTOR ASSEMBLY (CHEVROLET)

REMOVAL AND INSTALLATION (FIG. 45)

1. Make certain motor is in park position, remove wiper rod and blade assemblies from transmission shaft.
2. Remove plenum chamber side cover.
3. Loosen nuts retaining drive rod to crank arm.
4. Disconnect battery ground cable, then remove washer hoses, if present, and all electrical connectors.
5. Remove three motor retaining bolts, remove motor from vehicle.
6. To install, check sealing gaskets at motor and retaining bolts; replace as necessary.
7. Attach motor crank arm to transmission rod, position motor to cowl and install retaining bolts.

   CAUTION: Motor assembly must be in the park position prior to installation to cowl. Do not install motor which has dropped or hung from the drive link.

8. Connect wiring to wiper and washer, connect battery and check operation of unit.
9. Install plenum grille side cover.
10. Install wiper arm and blade assemblies.

WIPER TRANSMISSION ASSEMBLY (CHEVELLE)

REMOVAL AND INSTALLATION (FIG. 46)

1. Make certain motor is in park position, remove wiper arm and blade assemblies from transmission shaft.
2. Remove plenum chamber grille.
3. Remove clip retaining transmission drive rod to motor crank arm and detach drive rod from crank arm.

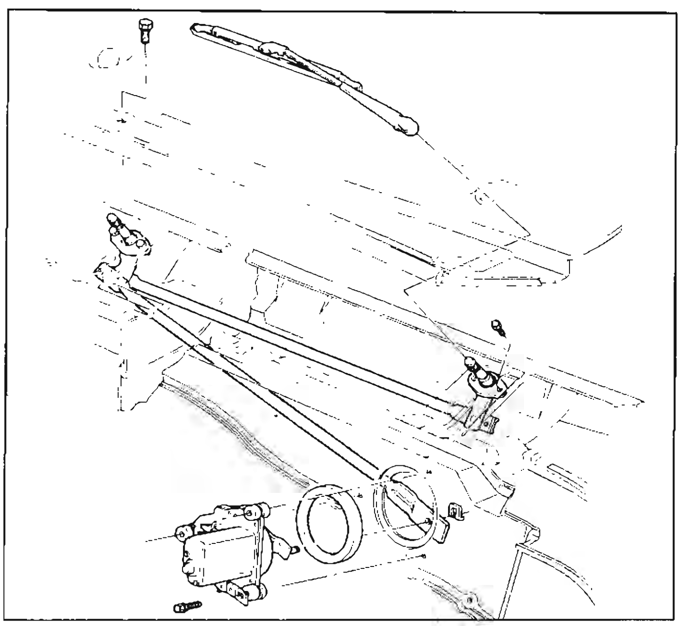


Fig. 46—Windshield Wiper Motor and Transmission Assembly (Chevelle)

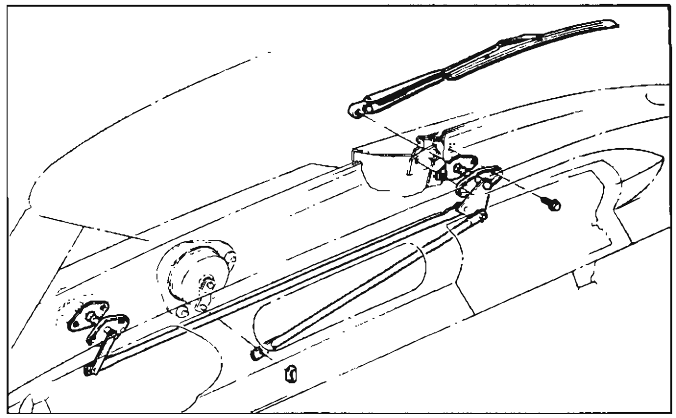


Fig. 47—Wiper Transmission Removal

4. Remove transmission retaining screws, lower assembly into plenum chamber, and remove unit from chamber.
5. To install, reverse removal procedure.

WIPER MOTOR ASSEMBLY (CHEVELLE)

REMOVAL AND INSTALLATION (FIG. 46)

1. Make certain motor is in park position.
2. Remove washer hoses, if present, and all electrical connectors.
3. Remove three motor retaining bolts, carefully remove motor from firewall and detach clip retaining wiper transmission drive arm to motor crank arm.
4. To install, check sealing gaskets at motor and retaining bolts; replace as necessary.
5. Attach motor crank arm to transmission rod and install clip. Position motor to cowl and install retaining bolts.

   CAUTION: Motor assembly must be in the park position prior to installation to cowl. Do not install motor which has dropped or hung from the drive link.

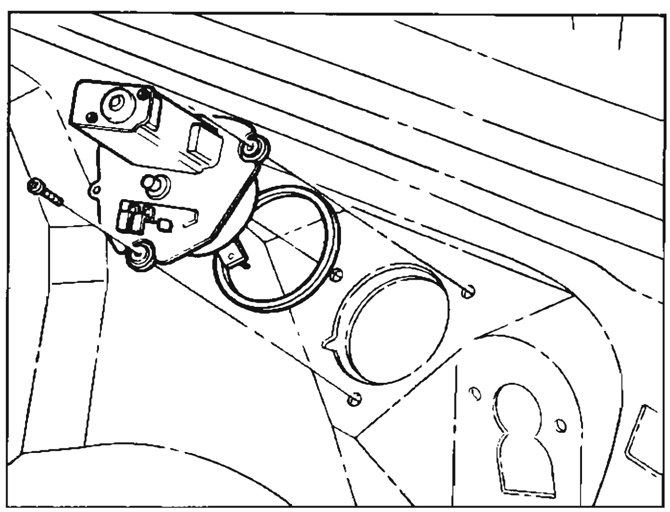


Fig. 48—Wiper Motor Removal

6. Install washer hoses and electrical connections.

WIPER TRANSMISSION ASSEMBLY (CHEVY II)

REMOVAL AND INSTALLATION (FIG. 47)

1. Make certain wiper motor is in park position, remove wiper arm and blade assembly from transmission shaft.
2. Remove special retainer clip securing transmission linkage to wiper crank arm, remove linkage from crank. Remove retainer clip securing left transmission link to right transmission, remove link from right transmission.
3. Remove two retaining screws securing transmission to cowl (one side), remove transmission from under dash.
4. To install new transmission reverse above procedure.

NOTE: Check and replace gasket if necessary. Use waterproof cement to seal screw holes.

WIPER MOTOR ASSEMBLY (CHEVY II)

REMOVAL AND INSTALLATION (FIG. 48)

1. Make certain wiper motor is in park position.
2. Remove special retainer clip securing transmission linkage to motor crank arm, remove linkage, electrical connectors and washer hoses if present.

NOTE: Mark washer hoses for correct reinstallation.

NON-DEPRESSED PARK WIPER

The Type "E" single-speed and optional two-speed electric windshield wiper assembly (fig. 49) incorporates a non-depressed type (blades park approximately 2" above windshield molding) motor and gear train. The rectangular, 12 volt, shunt wound motor is coupled to a train consisting of a helical drive gear at the end of the motor armature shaft, an intermediate gear and pinion assembly, and an output gear and shaft assembly. The crank arm is attached to the output gear shaft.

Two switches, connected in parallel, control the starting, stopping and parking of the Type "E" wiper motor. The manually operated start, stop switch is located on the instrument panel, while the cam operated park switch is located in the wiper gear box.

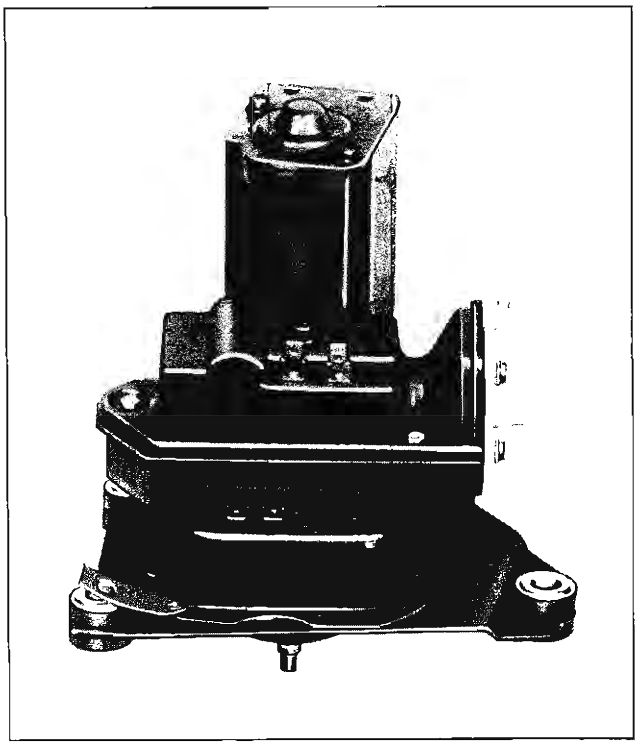


Fig. 49—Non-Depressed Park Wiper

WIPER MOTOR ASSEMBLY

DISASSEMBLY

Gear Box

Refer to Figure 50.

1. For wipers equipped with a washer pump, remove the two washer pump mounting screws (fig. 51) and lift pump off washer.
2. Remove washer pump drive cam as required (fig. 52). The cam is pressed on the shaft but can be wedged off by using two screw drivers between cam and plate.
3. Clamp crank arm in a vise and remove crank arm retaining nut.

CAUTION: Failure to clamp crank arm may result in stripping of wiper gears!

4. Remove crank arm, seal cap, Tru-Arc retaining ring, and end-play washers.

NOTE: Seal cap should be cleaned and repacked with a water-proof type grease before reassembly.

5. Drill out gear box cover retaining rivets, remove cover from gear train.

NOTE: Screws, nuts and lock washers for reassembling cover to wiper are contained in a service repair package.

6. Remove output gear and shaft assembly, then slide intermediate gear and pinion assembly off shaft.
7. If necessary, remove terminal board and park switch assembly as follows:
   a. Unsolder motor leads from terminals. Coding of motor leads is not necessary on single-speed wipers.
   b. Drill out rivets securing terminal board and park switch ground strap to mounting plate.

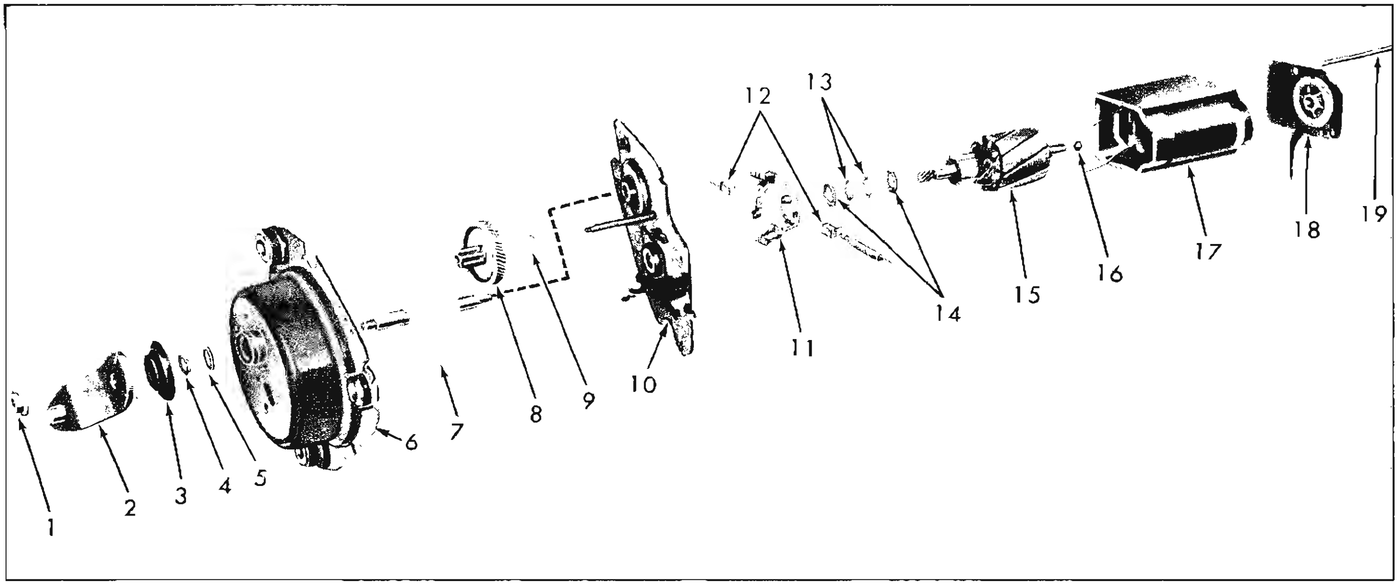


Fig. 50—Wiper Motor and Gear Box Assembly

1. Nut
2. Crank Arm
3. Seal Cap
4. Retaining Ring
5. Washer
6. Gear Box Cover
7. Output Gear and Shaft Assembly
8. Intermediate Gear
9. Wave Washer
10. Gear Box Housing
11. Brush Plate Assembly and Mounting Brackets
12. Brushes
13. Wave Washers
14. Flat Washers
15. Armature
16. Thrust Plug
17. Frame and Field
18. End Plate
19. Tie Bolts (Two Required)

NOTE: Screws, nuts and washers for attaching a replacement terminal board-park switch assembly are included with the replacement assembly.

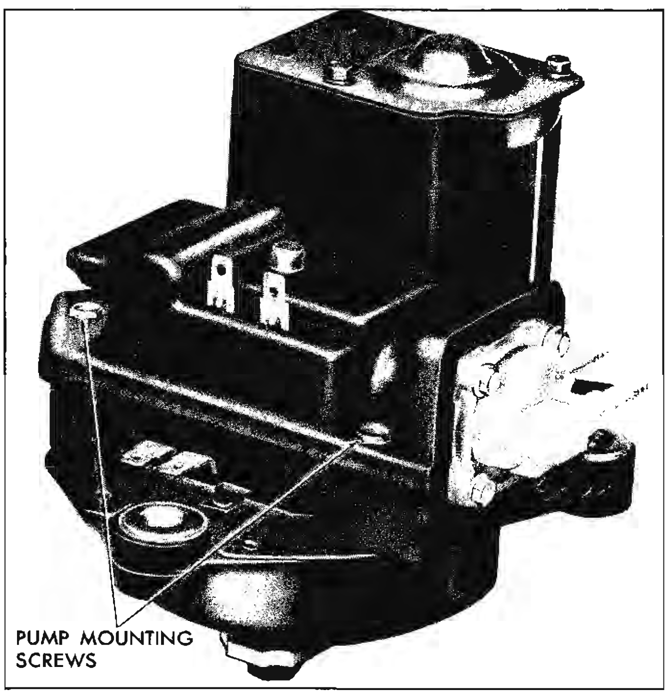


Fig. 51—Washer Pump Attaching Screws

Motor (fig. 50)

1. Follow Steps 1 through 7b under gear box disassembly.
2. Remove motor through bolts, tap motor frame lightly, and remove motor from mounting plate.
3. Remove brush spring tension (fig. 53), slide armature and end plate from motor frame. Pull end plate from armature.

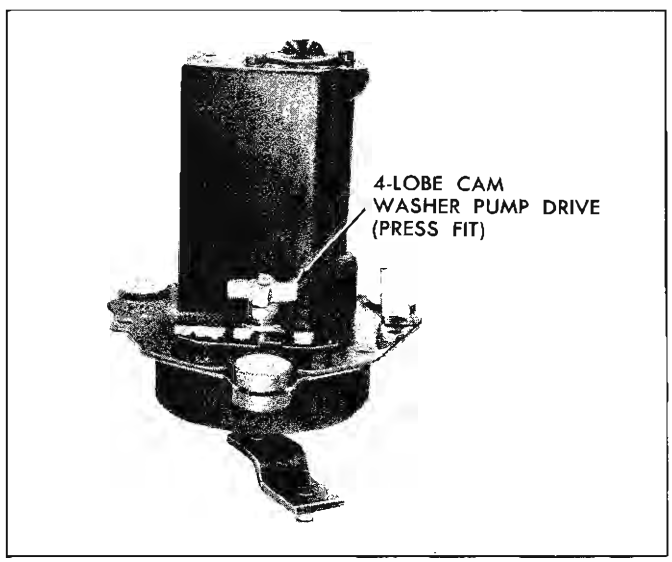


Fig. 52—Washer Pump Drive Cam

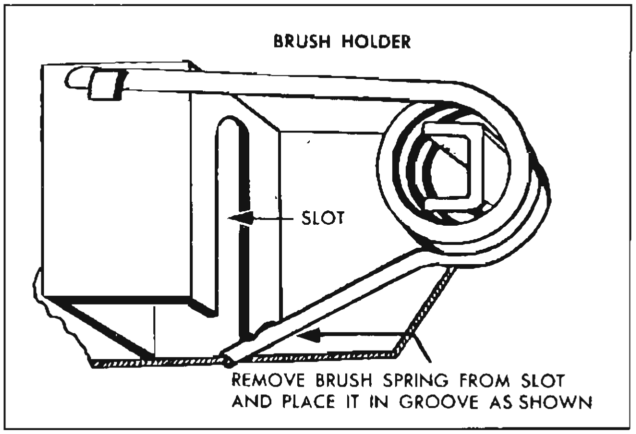


Fig. 53—Releasing Brush Spring Tension

NOTE: Thrust plug located between armature shaft and end plate.

4. Remove end play adjusting washers from armature, noting arrangement for proper reinstallation.

INSPECTION

Check and inspect all parts for serviceability, replace as necessary. All parts can be replaced individually except motor frame and field, which is serviced as an assembly. Service kits also provide screws, nuts and washers to replace gear cover and terminal board rivets.

ASSEMBLY

Refer to Figure 50 for exploded view of motor and gear train.

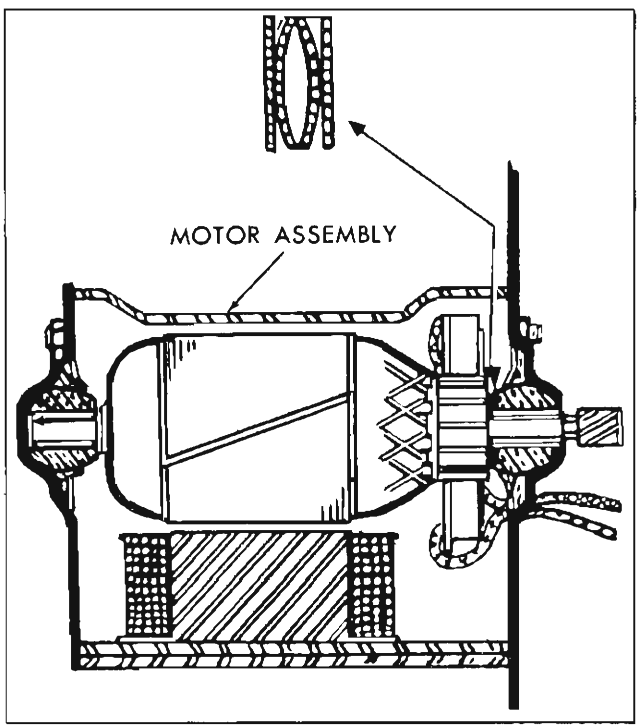


Fig. 54—End Play Wave Washer Installation

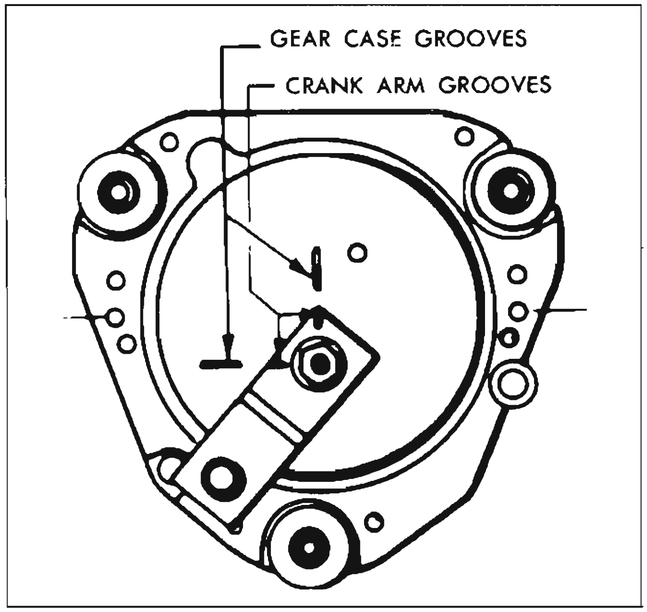


Fig. 55—Wiper Crank Arm in Park Position (Chevrolet)

Motor

Reassemble motor using reverse of disassembly procedures.

NOTE: Armature end play is controlled by end play washers. See Figure 54 for proper assembly of end play washers. Lubricate armature shaft bushings with light machine oil.

Gear Box

1. Assemble gear box using reverse of disassembly procedure.

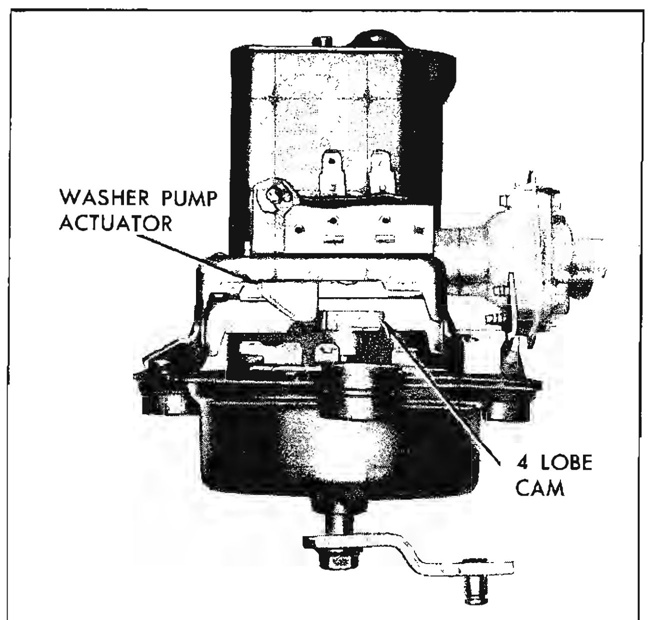


Fig. 56—Washer Pump Drive Cam—Chevelle & Chevy II Shown

NOTE: Lubricate gear teeth with Delco Cam and Ball Bearing lubricant or equivalent. Be sure cover is properly located over dowel pins and be sure to reinstall ground strap.

2. Place wiper in park position and install crank arm on output shaft, rotate crank so alignment marks line up with those on cover (fig. 55).
3. Replace retaining nut, place crank arm in vise, tighten retaining nut.

WINDSHIELD WASHER PUMP

The windshield washer pump used on the single or 2-speed Type "E" wiper motor assembly is a positive displacement type pump employing a small bellows, bellows spring and valve arrangement. The pumping mechanism is actuated by a four lobe cam and driven directly by the wiper motor (fig. 56). Thus, when the wiper is operated, this rotor is always turning with the gear. Programming is accomplished electrically and mechanically by a relay assembly and ratchet wheel arrangement.

REMOVAL AND INSTALLATION

Removal of the washer pump from the wiper motor consists of:

1. Disconnect wiring harness and washer hoses from washer.
2. Remove the two pump-to-wiper retaining screws, remove washer from wiper (fig. 51).
3. Reverse removal procedure to install assembly.

DISASSEMBLY—ASSEMBLY

Refer to Figure 57.

1. Remove washer pump cover

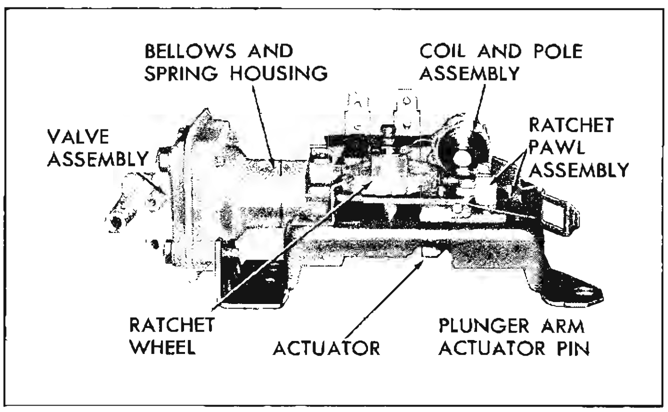


Fig. 57—Washer Pump Mechanism

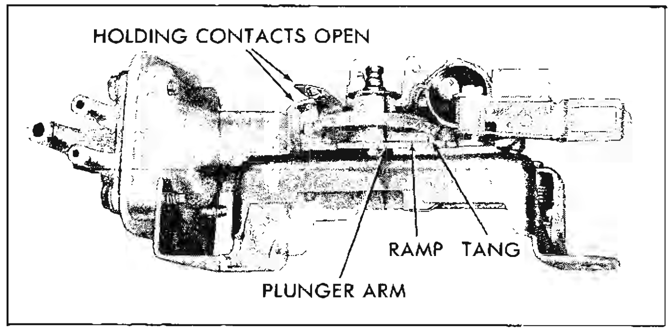


Fig. 58—Releasing Pump from Lockout Position

2. Relay
   a. To remove relay unsolder coil leads from terminals.

NOTE: No coil polarity is necessary when resoldering coil leads.

   b. Remove coil retainer clip and slip coil assembly out of mounting bracket.
3. Ratchet Pawl
   a. To remove ratchet pawl disengage spring from ratchet pawl and slide ratchet pawl from shaft.

CAUTION: Be sure spring is properly assembled before replacing washer pump cover.

4. Terminal Board
   a. Remove terminal board attaching screws, ratchet dog and board from washer base.
5. Ratchet Wheel
   a. Remove lock ring from shaft.
   b. Slide ratchet wheel from shaft.
6. Valve Assembly
   a. To remove valve assembly remove screws that secure valve assembly to bellows housing.

CAUTION: It may be necessary to carefully pry bellows lip out of the valve body groove.

7. Bellows
   a. To remove bellows first remove valve assembly.
   b. Manually operate pump clockwise to release pump from "lock-out" position (fig. 58).
   c. Hold bellows plunger arm from moving, then push in against bottom of bellows with thumb and twist bellows spring from housing.
8. Actuator Pin
   a. Remove actuator pin retaining spring and slide pin from washer base.
9. Reverse disassembly procedure to assemble washer.

DEPRESSED PARK 2-SPEED WIPER

CHEVROLET AND CHEVELLE MODELS

The optionally available Type "C" two speed electric wiper assembly (fig. 59) incorporates a depressed park type (blades park against windshield lower molding when the motor is turned off) motor and gear train. The wiper has a compound wound 12 volt motor and a gear box section containing the gear mechanism and relay control. The motor armature is fitted with a worm gear which drives the main gear assembly and crank arm.

The relay control, consisting of a relay coil, relay armature and switch assembly, is located in the gear box section and controls the starting and stopping of the wiper through a latching mechanism (fig. 60).

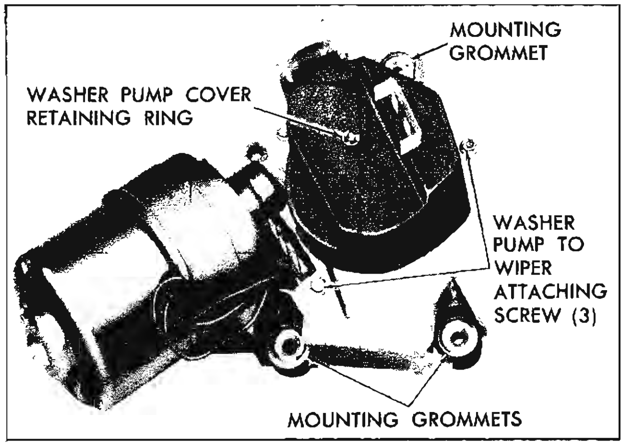


Fig. 59—Depressed Park 2-Speed Wiper

An electric washer pump is mounted on the gear box section of the wiper and is driven by the wiper unit gear assembly (fig. 60).

MAJOR SERVICE OPERATIONS

The overhaul procedures for the wiper are broken down into three major areas: The motor section, gear

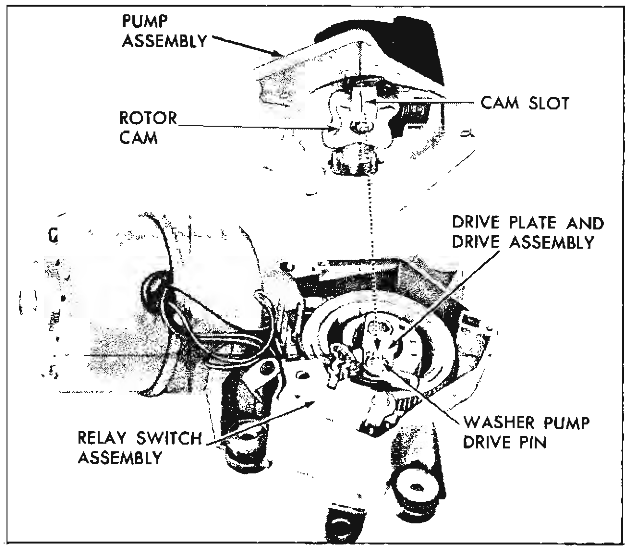


Fig. 60—Wiper and Washer Pump Mechanism

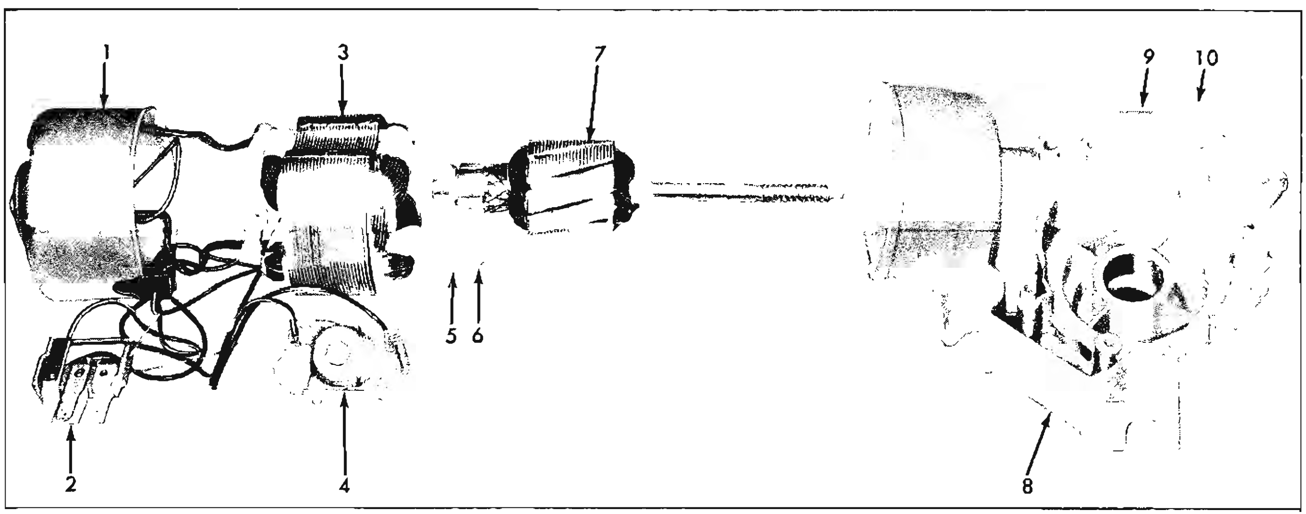


Fig. 61—Wiper Motor Exploded View

1. Motor Case
2. Terminal Board
3. Motor Field
4. Relay Switch Assembly
5. Felt Washer
6. Thrust Ball
7. Armature
8. Wiper Housing
9. End Play Adjusting Screw
10. Adjusting Screw Locknut

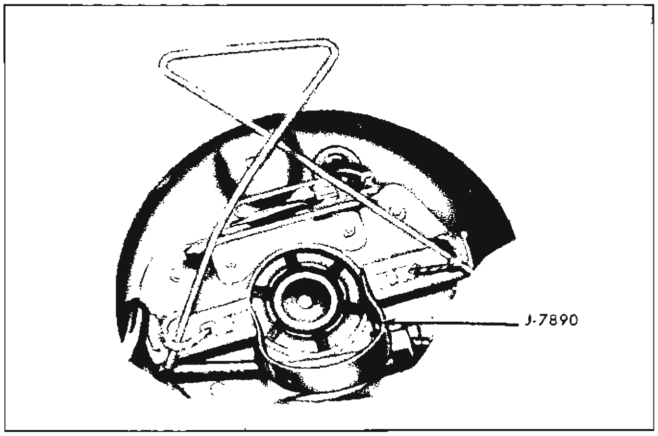


Fig. 62—Retaining Armature Brushes

box section and washer pump section. Each section may be serviced independently of the other.

MOTOR SECTION

Disassembly (fig. 61)

1. Remove the two motor tie bolts.
2. Remove the armature end-play adjusting screw.
3. Strike the steel case lightly with a mallet to partially loosen it from the die case housing and motor field.
4. Insert a tool through the armature adjusting screw opening and push against the end of the armature shaft to back off the case. This will retain the armature commutator in position between the brushes until ready to separate the armature from the case.
5. To separage armature from case while still retaining the brush springs and brushes in place fashion a spring similar to that shown in Figure 62 and insert behind the brush leads as shown.

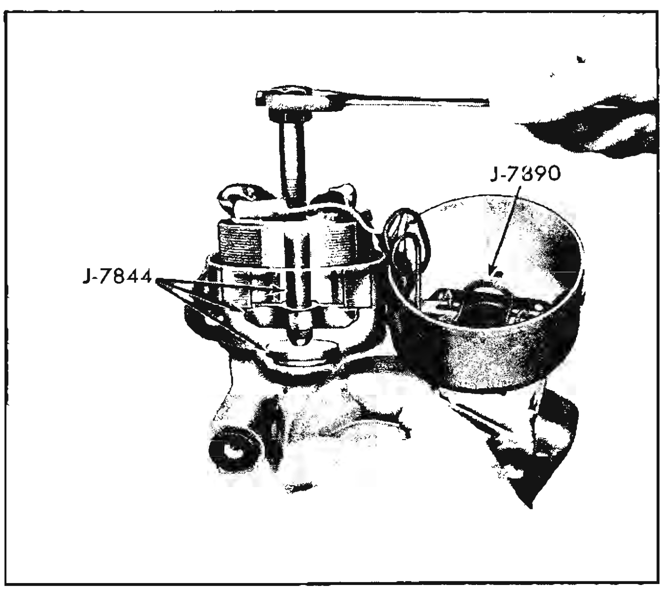


Fig. 63—Removing Field Coil with J-7844

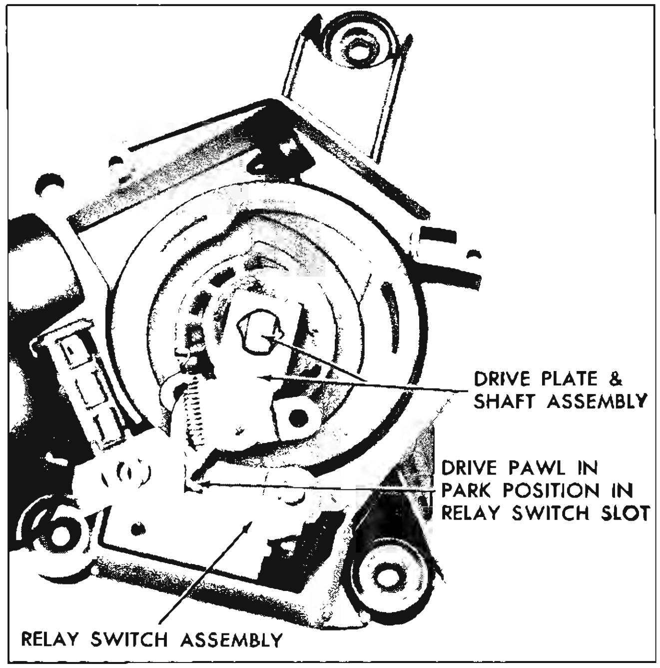


Fig. 64—Drive Pawl in Full Park Position

6. Pull the armature out of the case and install brush retainer spring, Tool J-7890, as shown in Figure 63.
7. Remove the felt washer, thrust plate, and rubber thrust disc from the case assembly bearing as required.
8. The field assembly is pressed in the housing under light pressure and should be carefully checked prior to removal. If necessary to remove field assembly proceed as follows:

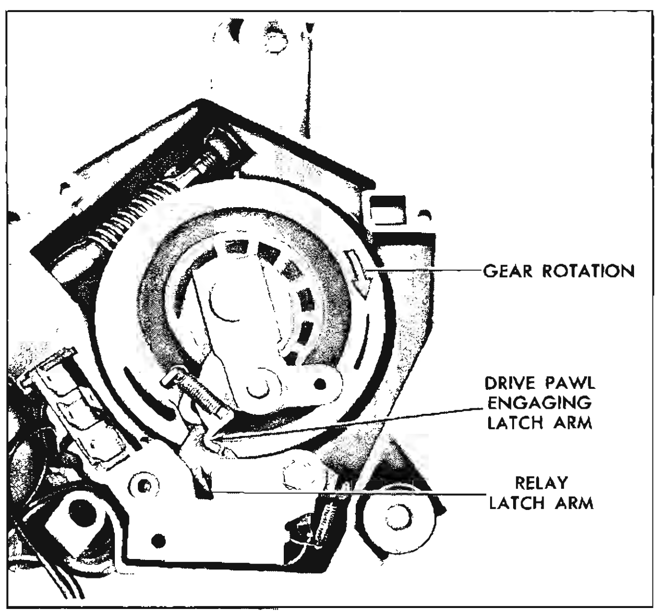


Fig. 65—Relay Assembly

a. Cut the plain black and the black with pink stripe leads that extend through the case assembly rubber grommet in a location convenient for splicing.
b. Cut the internal field leads enclosed in black plastic tubing approximately two inches from the brush holder to which they are attached.
c. Scribe reference line along side of the housing and field for reassembly purposes.
d. Install Tool J-7844 in motor housing as shown in Figure 63. Make certain puller screw base plate is installed flat side up and puller flanges straddle sides of coil.
e. Remove coil by turning puller screw clockwise.

9. Clean and inspect all parts.

Inspect both the field and armature for damage due to overheating such as unsoldered electrical connections. Check that brush leads are firmly attached both to the brushes and their connections at the brush holders. Check brushes for wear. If brushes are worn to within 3/16" of brush lead, or pigtail, they should be replaced. Check contacts of circuit breaker shown at top of Figure 62. Clean as required or file lightly to remove irregularities.

Inspect all leads from the brush and circuit breaker plate for worn insulation or breaks.

If it was determined by inspection that brush replacement was required, proceed as follows:

a. Remove retainer installed during disassembly and remove brush springs.
b. Place a hot soldering iron against brush lead connection on brush holders, remove old brushes, and install new brushes.
c. To reinstall brushes in holders, compress spring within holder and hold fully compressed with a thin instrument inserted through slot in brush holder, hold brush tightly, and remove instrument retaining spring. Hold brushes installed with retaining Tool J-7890 as shown in Figure 62.

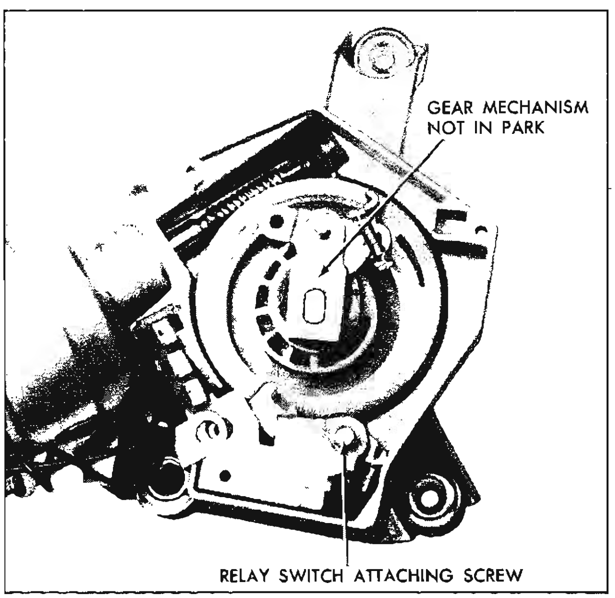


Fig. 66—Drive Gear Not in Park Position

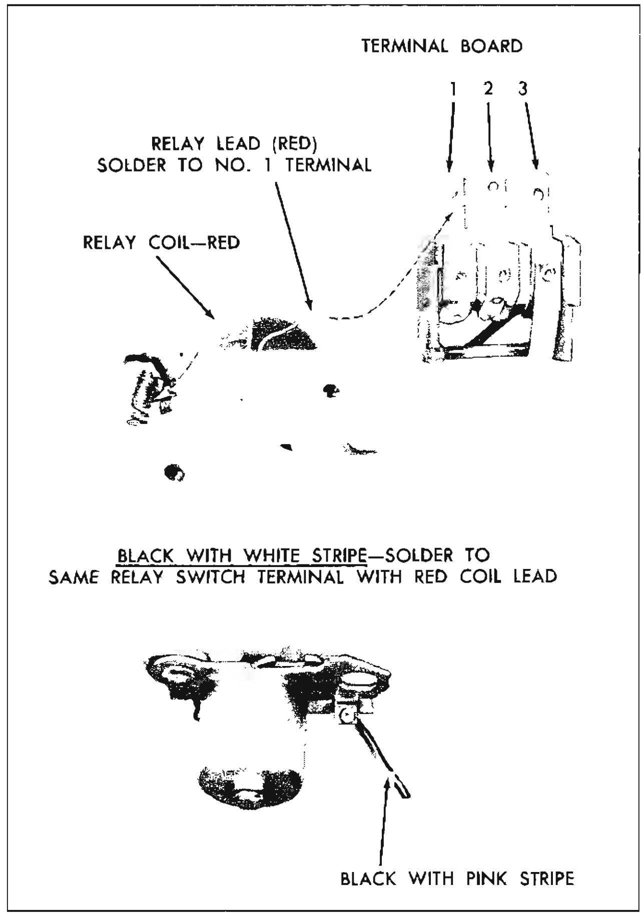


Fig. 67—Relay Assembly Wiring

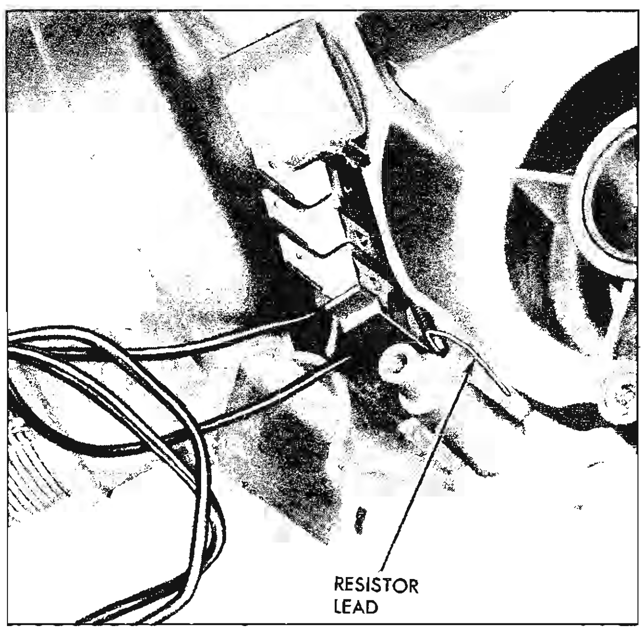


Fig. 68—Terminal Board Resistor

Assembly

1. Assemble rubber thrust disc, steel thrust plate and felt washer in order indicated (fig. 61) into case.
2. Install field as follows:
   a. Scribe a reference line on the replacement field in the approximate location as the one scribed on the original field.
   b. Align the field and housing according to the reference lines and start the field in the housing. The two internal grooves in field should line up with housing tie bolts.
   c. Push the field in the housing until it bottoms against the machined ridge.
   d. Shorten as required and splice the replacement field leads to those leads cut in Steps 8a and 8b under motor disassembly.
3. Be sure steel thrust ball is located in commutator end of armature shaft, lubricate armature shafts and thrust ball with a high melting point grease and install armature shaft in case assembly bearing.
4. Remove the brush retainer spring.
5. Maintaining the armature in its assembled position in the case, start the armature worm shaft through the field and housing bearing until it starts to mesh with the worm gear.

NOTE: It may be necessary at this point to rotate the armature slightly before the worm will engage with the worm gear.

6. Rotate the case as required to align the holes in the case with those in the housing.
7. Being very careful not to pinch any of the motor leads between the case and edge of the field push the case onto the field until it butts against the housing.
8. Secure case to housing with two tie bolts.
9. Install end-play adjusting screw and locknut as follows:
   a. Tighten adjusting screw until end of screw barely touches end of armature shaft.
   b. Back off 1/4 turn and tighten locknut.

GEAR BOX SECTION

The gear box section is subdivided into two areas, (A) the relay control and latching mechanism and (B) the drive gear mechanism.

A—Relay Switch and Latch Assembly—Terminal Board Removal

1. Remove screws retaining washer pump assembly to wiper unit.
2. If wiper pawl is in full park position (drive pawl located in magnetic switch assembly slot, fig. 64), it becomes necessary to remove gear assembly first (see Gear Assembly Removal).

   If wiper gear mechanism is not in park position (drive pawl away from latch arm (fig. 66), proceed to Step 3.
3. Remove relay-switch attaching screw (fig. 65) and carefully lift the relay-switch assembly out of the gear box. Unsolder leads from switch terminals as required. Refer to Figure 67 when resoldering leads.
4. To remove terminal board assembly simply slide it out of housing and unsolder leads as required.

Reassembly of Relay Switch-Latch and Terminal Board

1. Resolder leads to wiper terminal board as required (fig. 67).
2. Slide terminal board into wiper housing being careful to position the terminal board resistor lead as shown in Figure 68.

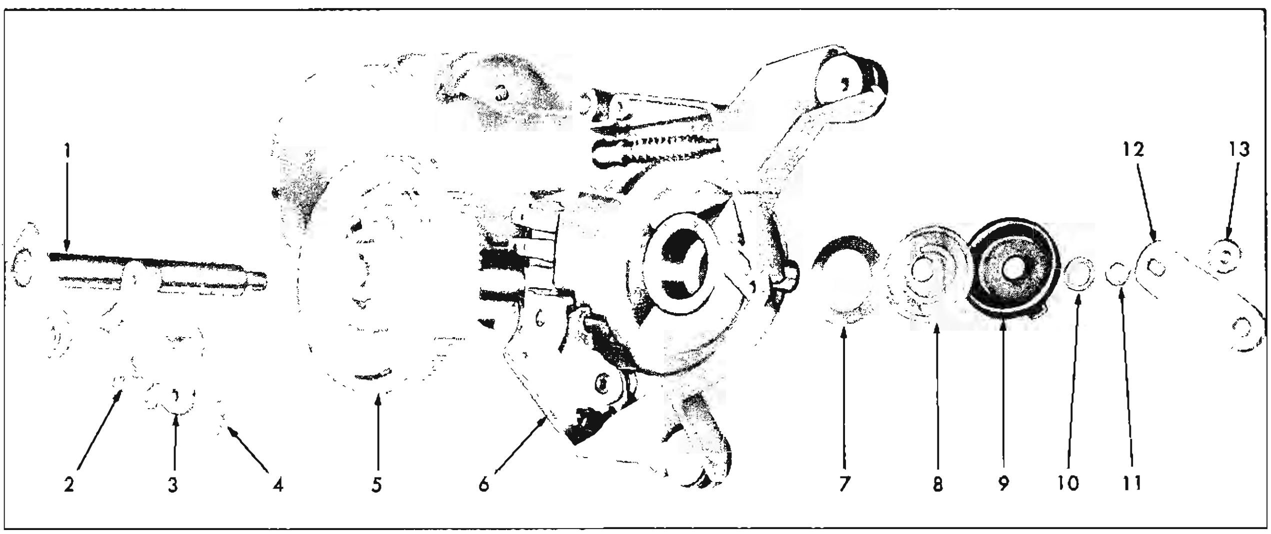


Fig. 69—Drive Gear Mechanism Assembly

1. Drive Gear Shaft
2. Drive Pawl
3. Lock Pawl
4. Coil Spring
5. Drive Gear
6. Relay Assembly
7. Spacer
8. Shield
9. Seal
10. Washer
11. Snap Ring
12. Crank Arm
13. Nut

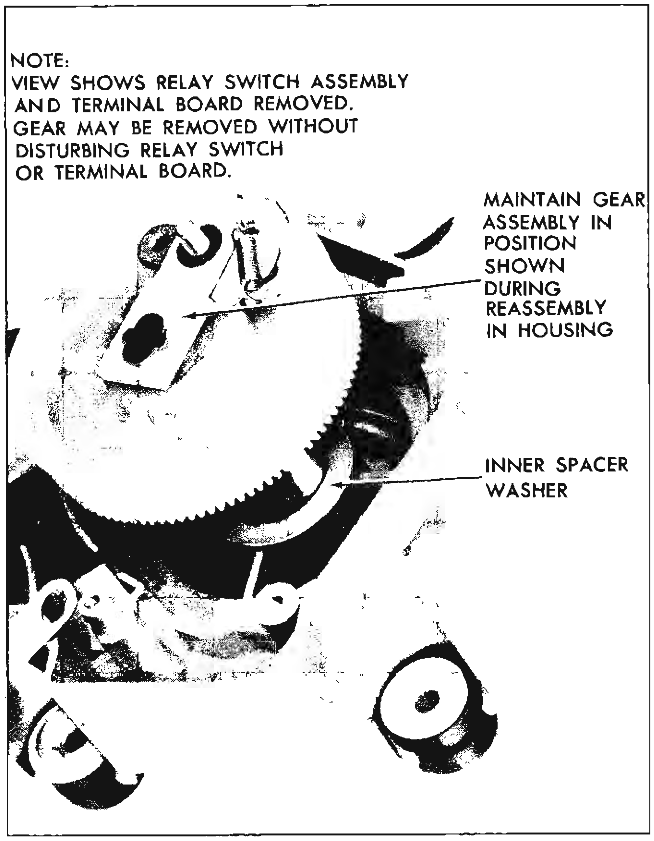


Fig. 70—Removing Gear Assembly

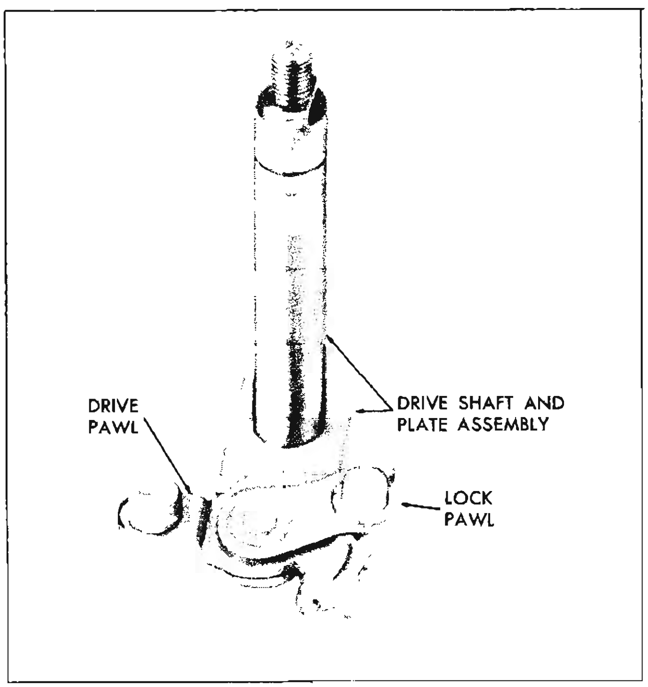


Fig. 71—Lock and Drive Pawl Assembly

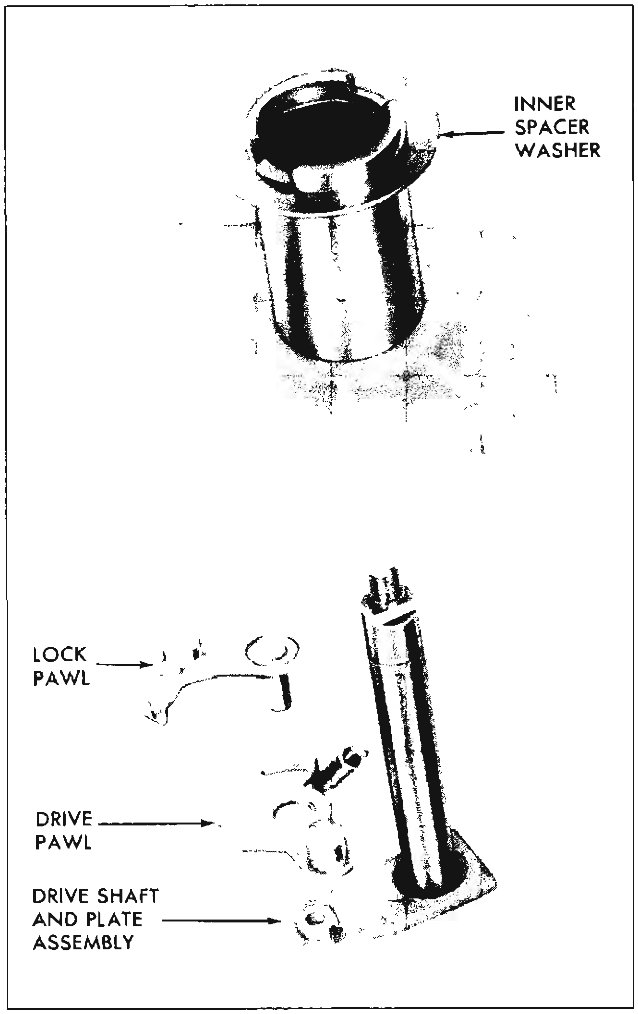


Fig. 72—Drive Gear and Shaft Assembly

3. Resolder leads to relay switch assembly as required (fig. 67).
4. Position relay-switch assembly in housing.

   CAUTION: Be very careful to route leads in such a manner as to avoid having them pinched between relay and wiper housing.

5. Install relay-switch mounting screw.
6. Assemble gear box cover and washer pump assembly to wiper being careful that the ground strap is properly connected. Refer to Figure 60 for assembly of washer pump to gear housing.

B—Drive Gear Disassembly (fig. 69)

1. Remove washer pump assembly.
2. Remove crank arm retaining nut, crank arm, rubber seal cap, retaining ring, shim washers, shield and spacer washer in the order indicated.
3. Slide gear assembly out of housing (fig. 70).
4. Slide drive plate and shaft out of gear and remove the drive pawl, lock pawl and coil spring as required.

Drive Gear Re-Assembly

1. Position drive pawl on drive plate as shown in Figure 71.
2. Assemble lock pawl over drive pawl as shown in Figure 71.
3. Slide gear and tube over the drive shaft (fig. 72). (Move drive and lock pawls as required to allow their respective pins to fit in the gear guide channel (fig. 73).
4. Holding the gear, manually rotate the drive plate until the drive and lock pawl guide pins snap into their respective pockets in the gear (fig. 73).
5. Reinstall coil spring between lock and drive pawls (fig. 73).

IMPORTANT: Be very careful to maintain lock and drive pawl guide pins in their respective pockets during Step 6.

6. Assemble inner spacer washer over gear shaft and assemble gear mechanism in housing so that it is positioned with respect to the housing in the approximate location shown in Figure 70.

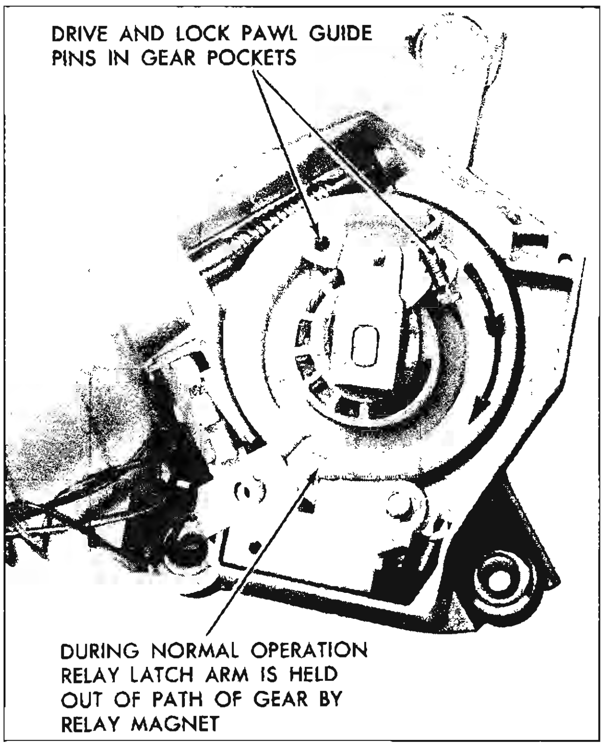


Fig. 73—Drive and Lock Pawl Guide Pins in Pockets

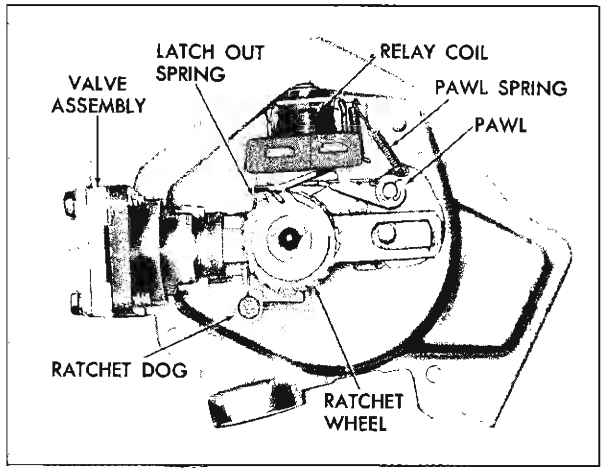


Fig. 74—Washer Pump Assembly

7. Reassemble the outer spacer washer, shield, shim washers as required to obtain .005" max. end play, snap ring and rubber seal cap in the order indicated. Refer to Figure 69.
8. Operate wiper to "park" or "off" position (refer to Figure 55) and install crank arm.
9. Reassemble washer pump to wiper (fig. 60).

WASHER PUMP UNIT

The washer pump and/or valve assembly may be removed from the wiper assembly as a unit; therefore, it is not necessary to remove the wiper assembly from the vehicle if only the washer pump and/or valve assembly required service.

When the pump is removed from the wiper assembly, all working parts are readily accessible and may easily be serviced as necessary (fig. 74). An exploded view of the washer pump is shown in Figure 75.

Removal and Installation (Refer to Figure 75)

1. Raise vehicle hood.
2. Disconnect washer hoses and electrical connections from assembly.
3. Remove 3 screws securing washer pump and cover to wiper assembly. Remove pump from wiper gear box.
4. Install new washer pump and cover assembly so that slot in the washer pump cam fits over the pin on the wiper unit drive plate (fig. 60).
5. Install the 3 retaining screws.
6. Connect washer hoses to valve assembly and wiring leads to pump and wiper terminals.
7. Check operation of unit.

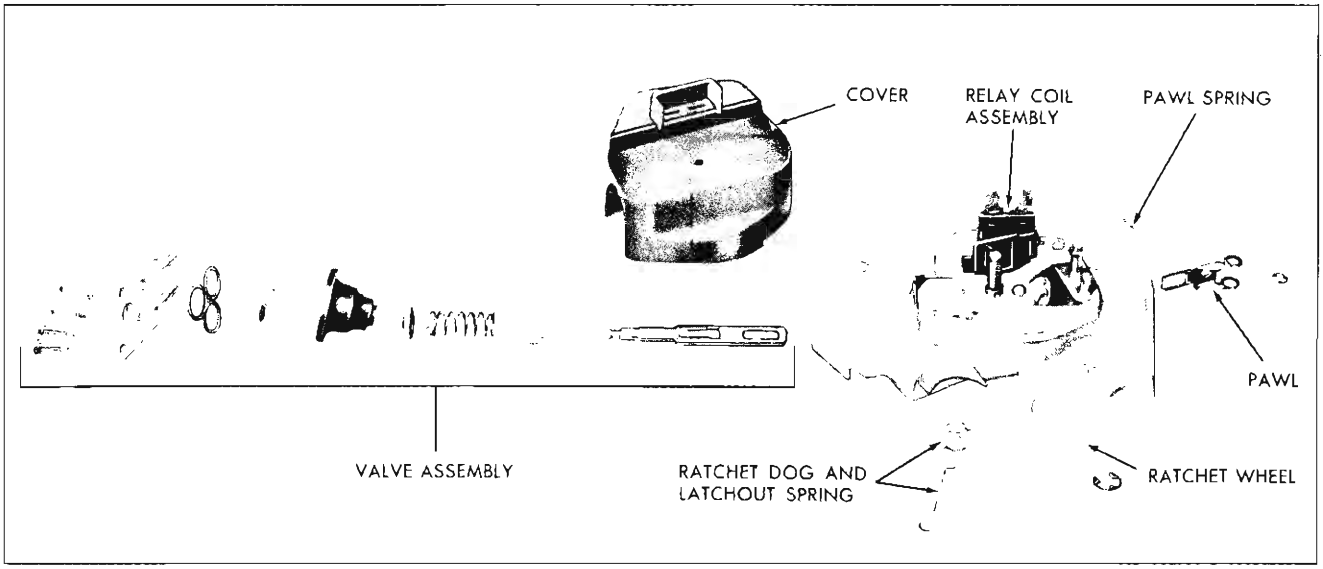


Fig. 75—Exploded View of Pump

WIRING

The wiring harnesses incorporate the standardized color code common to all Chevrolet vehicles. Under the color code, the color of the wire designates a particular circuit. The harness name title will indicate a type of harness, single or multiple wire, and also describe the location of the harness. In addition to the color coding, the body harness is a flat, solid wire assembly and is routed through the vehicle near the center of the body. A wire color code chart and composite wiring diagrams (figs. 76 thru 91) are included at the end of this section.

WIRING CIRCUIT COLOR CODE

Diagram Key	Wire Color	Diagram Key	Wire Color
B	Black	P	Pink
B/LG	Black with Light Green Stripe	PPL	Purple
B/LBL	Black with Light Blue Stripe	PPL/W	Purple with White Stripe
B/OR	Black with Orange Stripe	OR	Orange
B/P	Black with Pink Stripe	R	Red
B/W	Black with White Stripe	T	Tan
B/Y	Black with Yellow Stripe	T/W	Tan with White Stripe
BRN	Brown	W	White
BRN/W	Brown with White Stripe	W/OR/PPL	White with Orange and Purple Stripes (Resistance Wire)
DBL	Dark Blue		
DG	Dark Green	W/R&B	White with Red and Black Stripes (Resistance Wire)
GY	Gray		
LBL	Light Blue	Y	Yellow

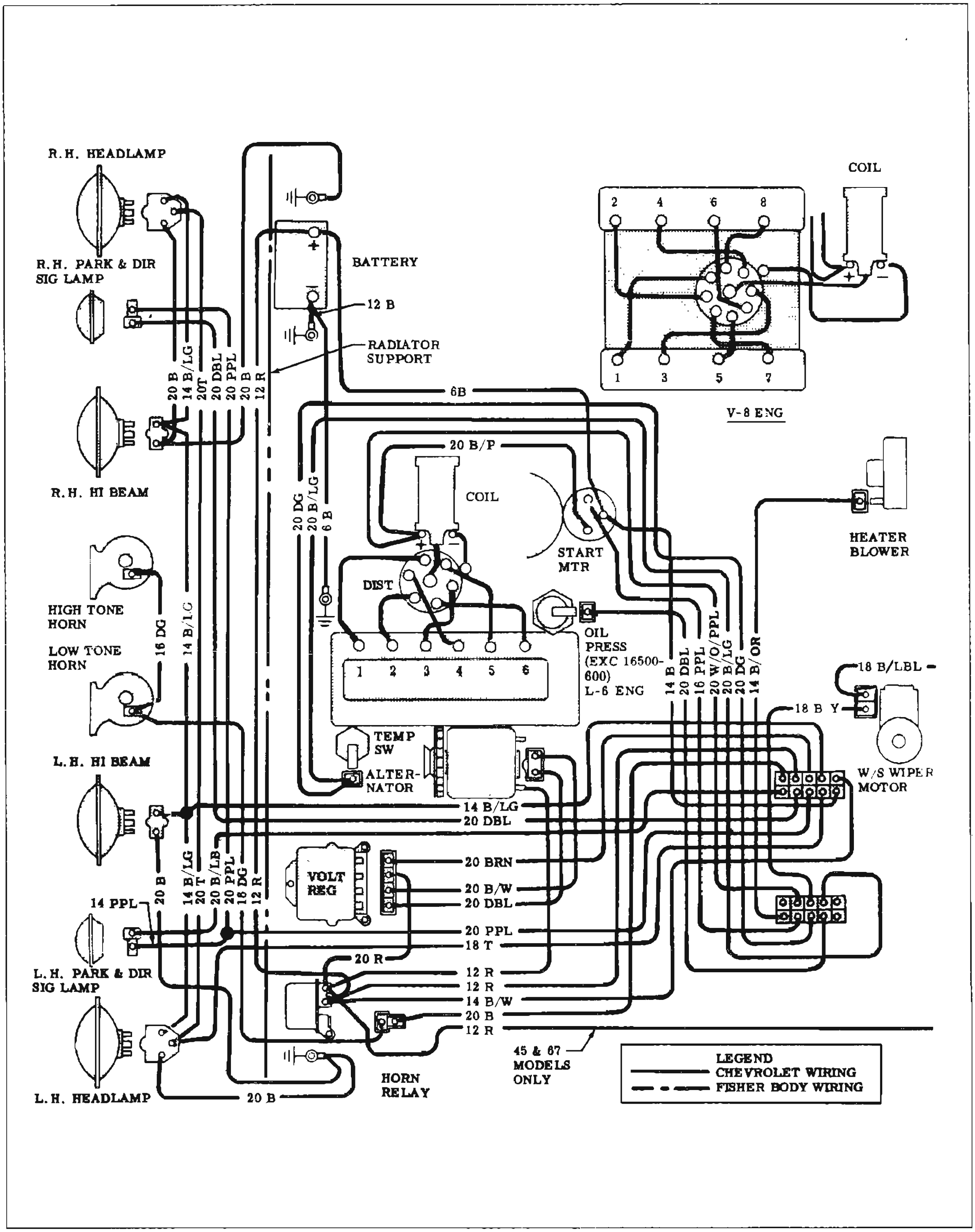


Fig. 76—Engine Compartme...

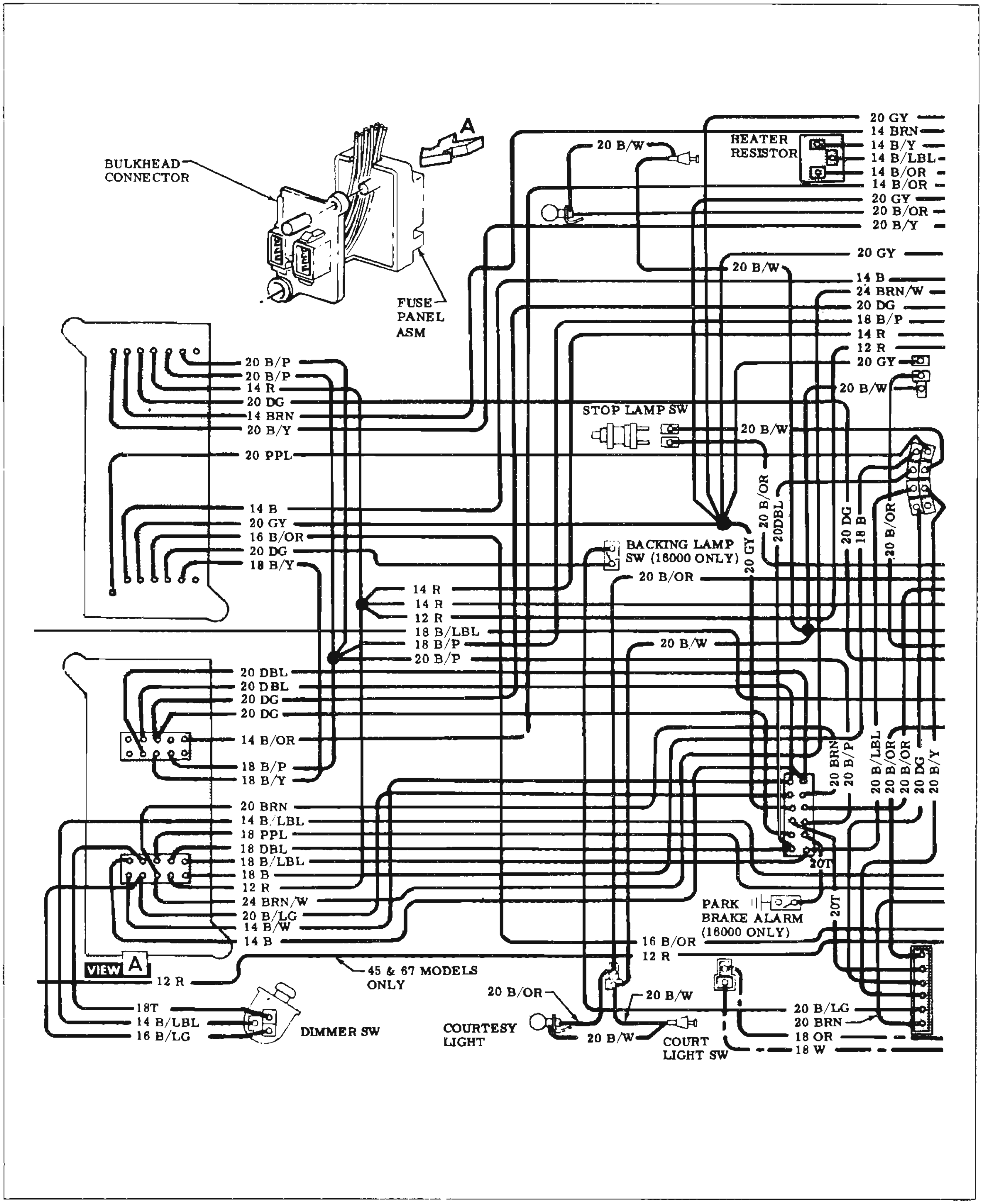


Fig. 77—Fuse Panel

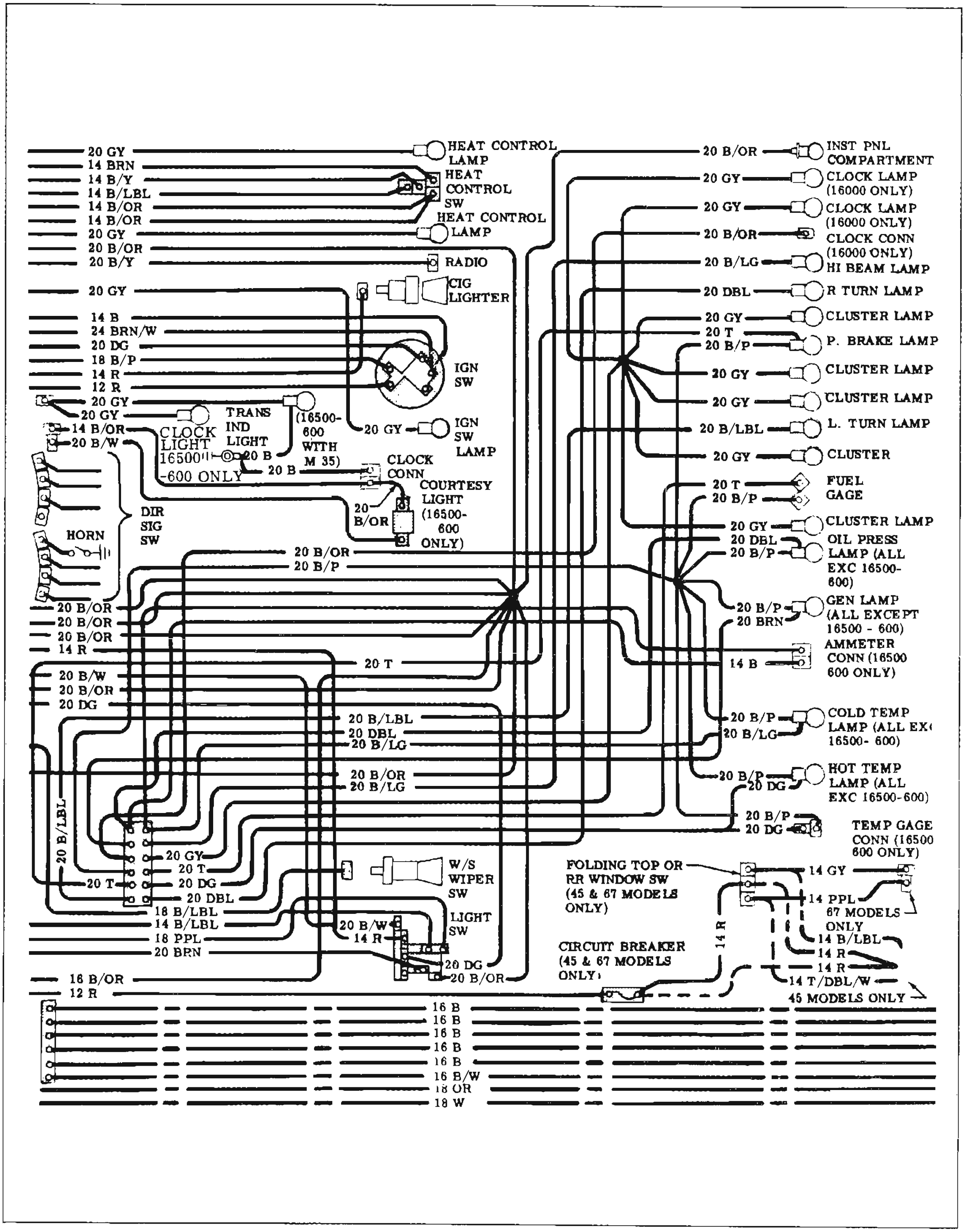


Fig. 78—Instrument Panel Cluster

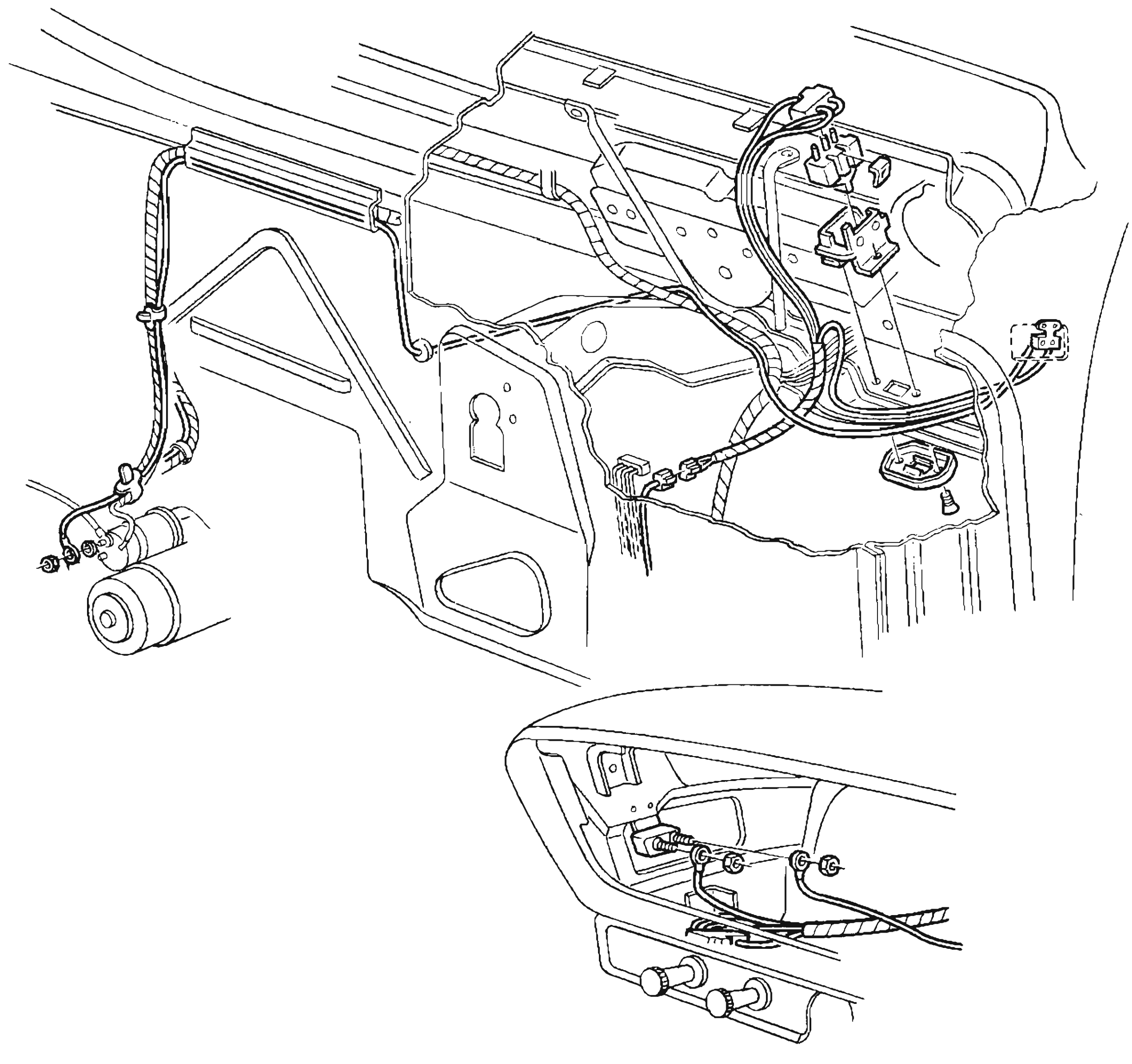


Fig. 79—Power Feed Wiring

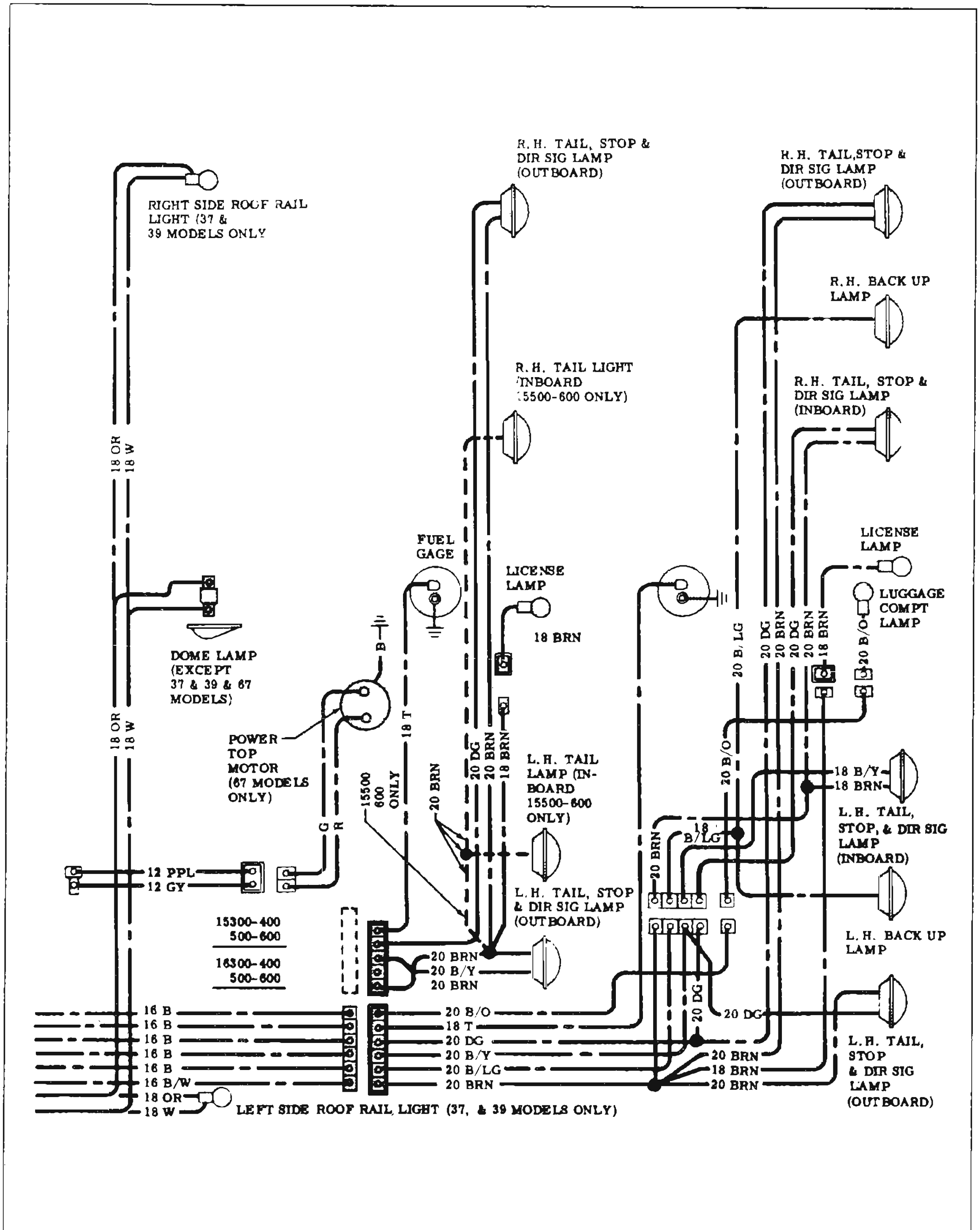


Fig. 80—Body and Rear End Lighting (Except 35 and 45 Models)

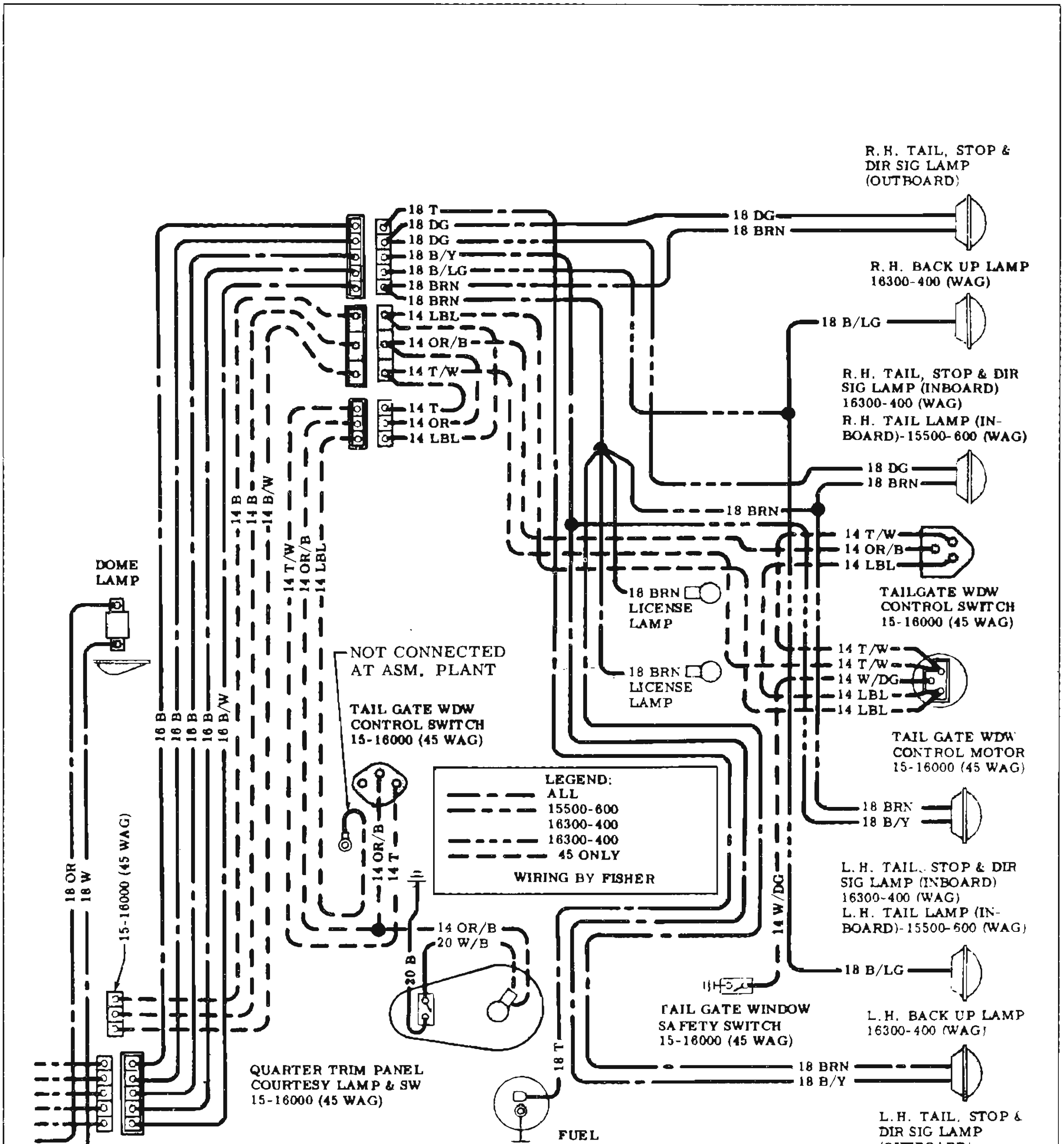


Fig. 81—Body and Rear End Lighting (35 and 45 Models)

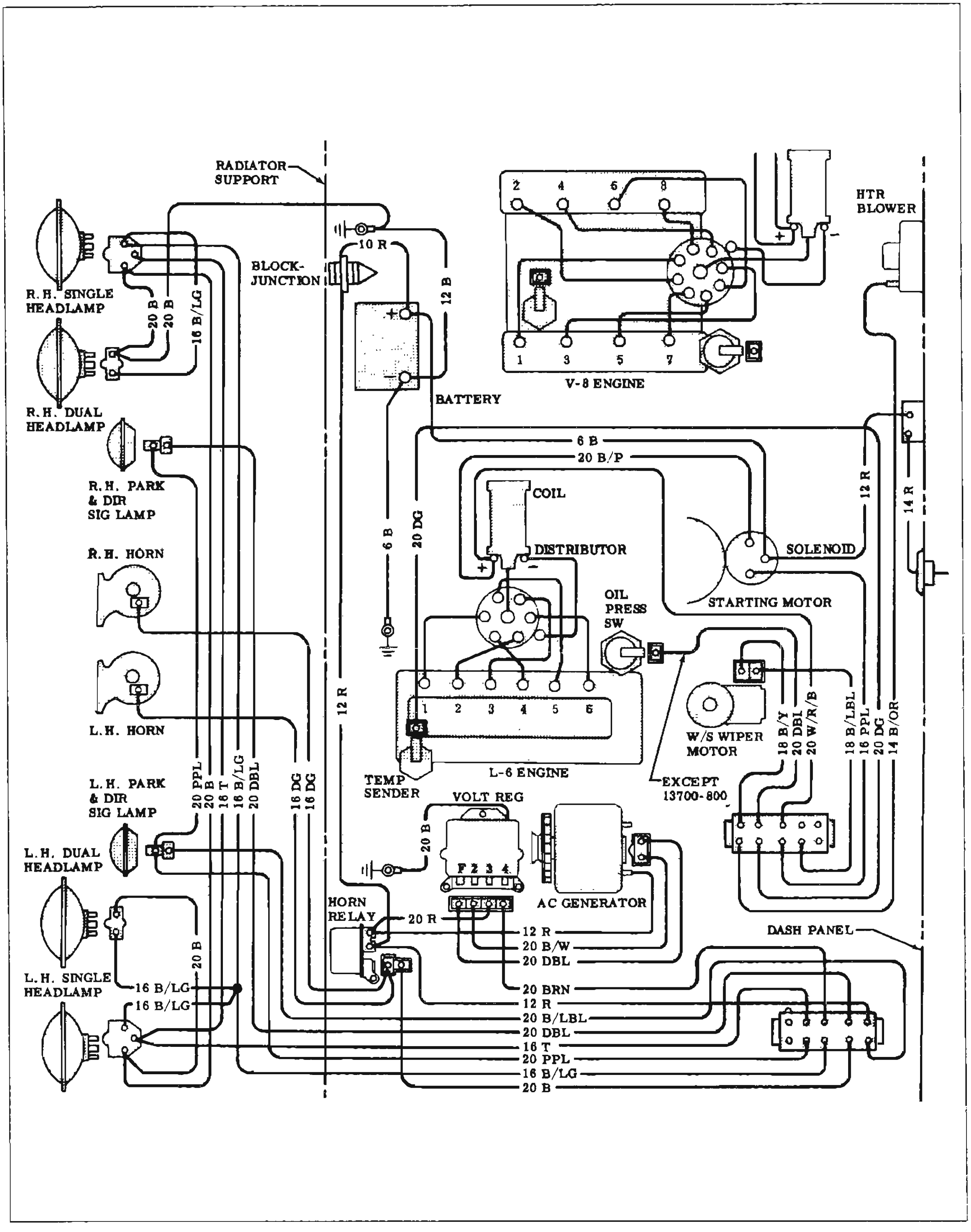


Fig. 82—Front Lighting and Engine Compartment

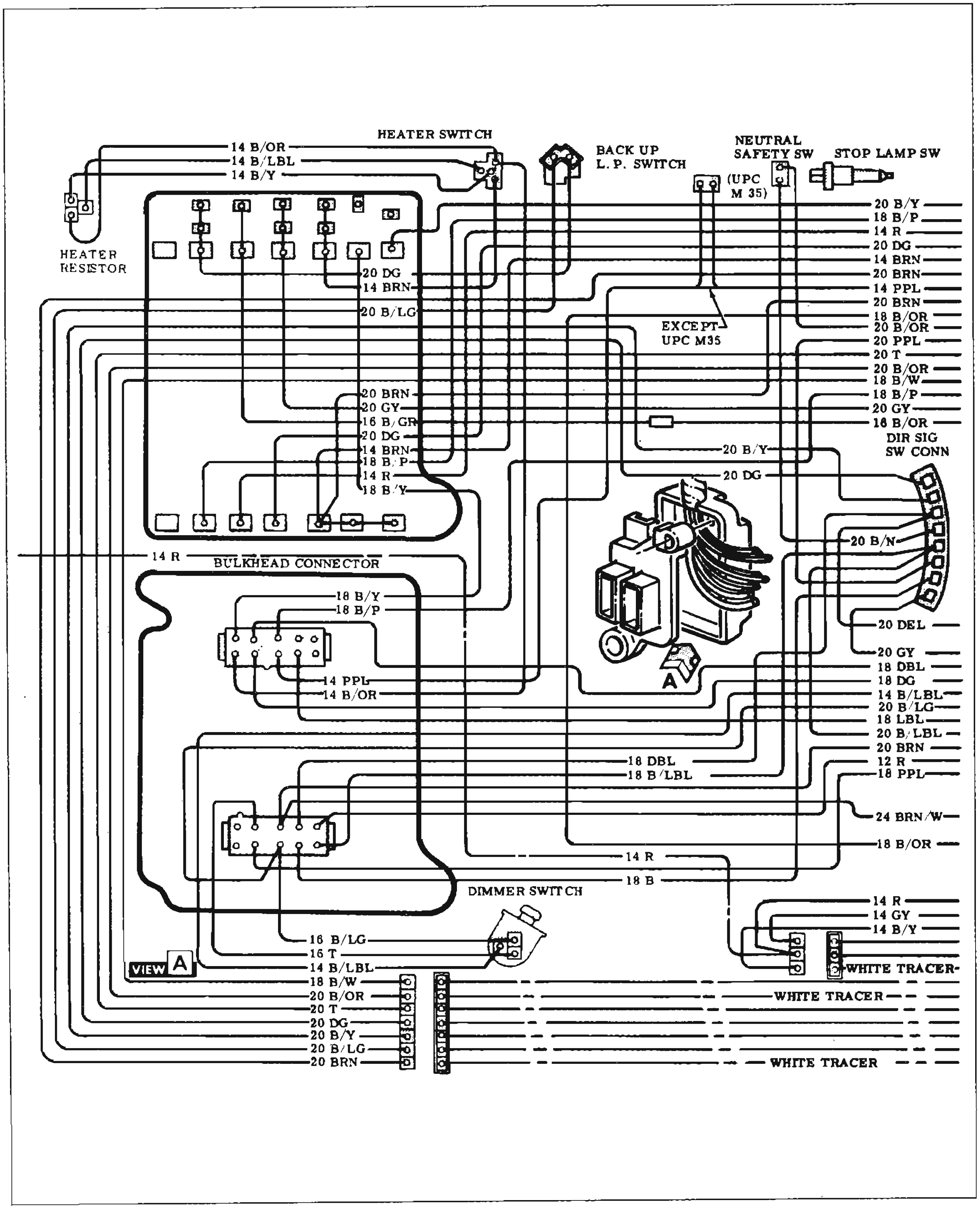


Fig. 83—Fuse Panel

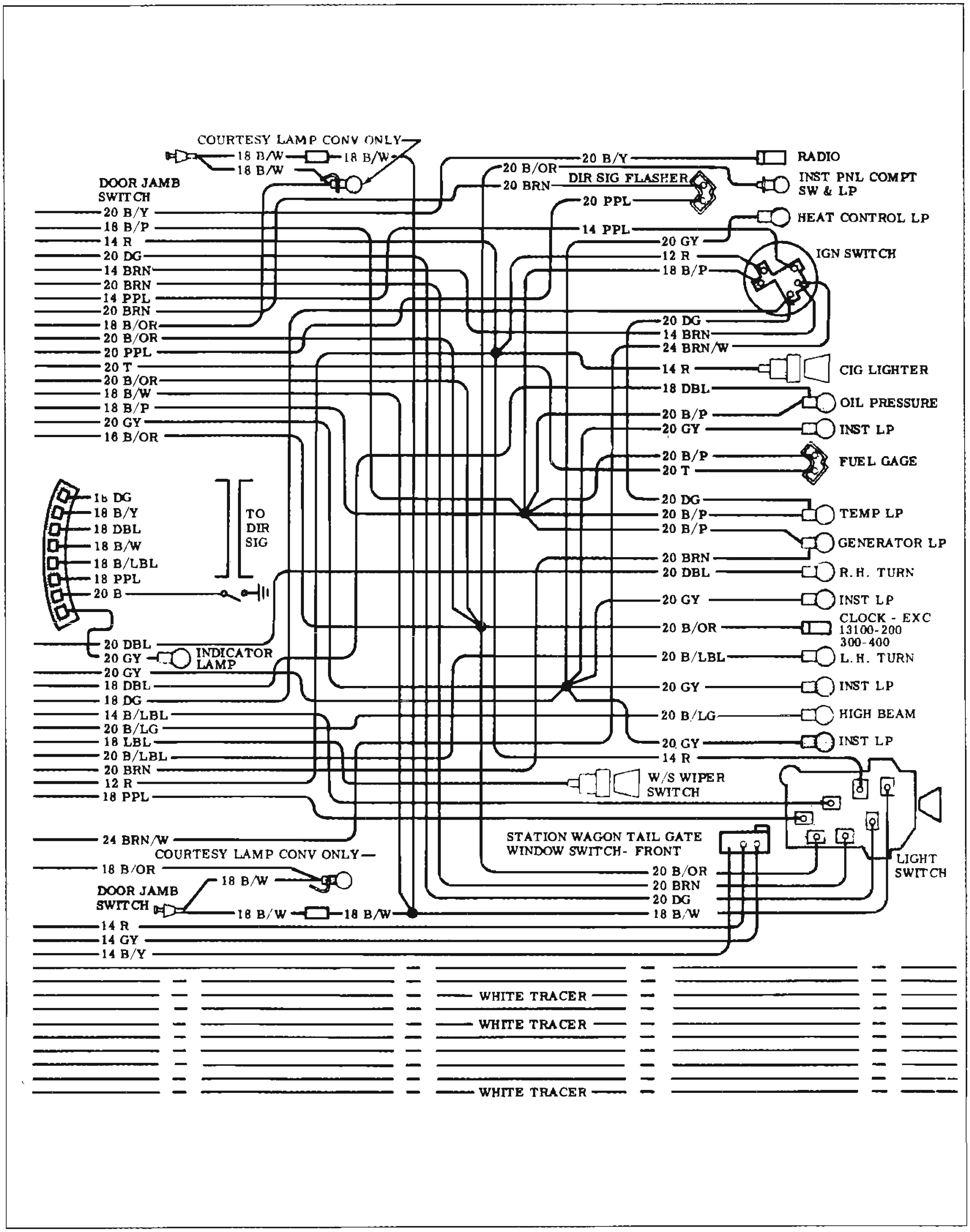


Fig. 84—Instrument Panel and Cluster (Except 13700 and 13800)

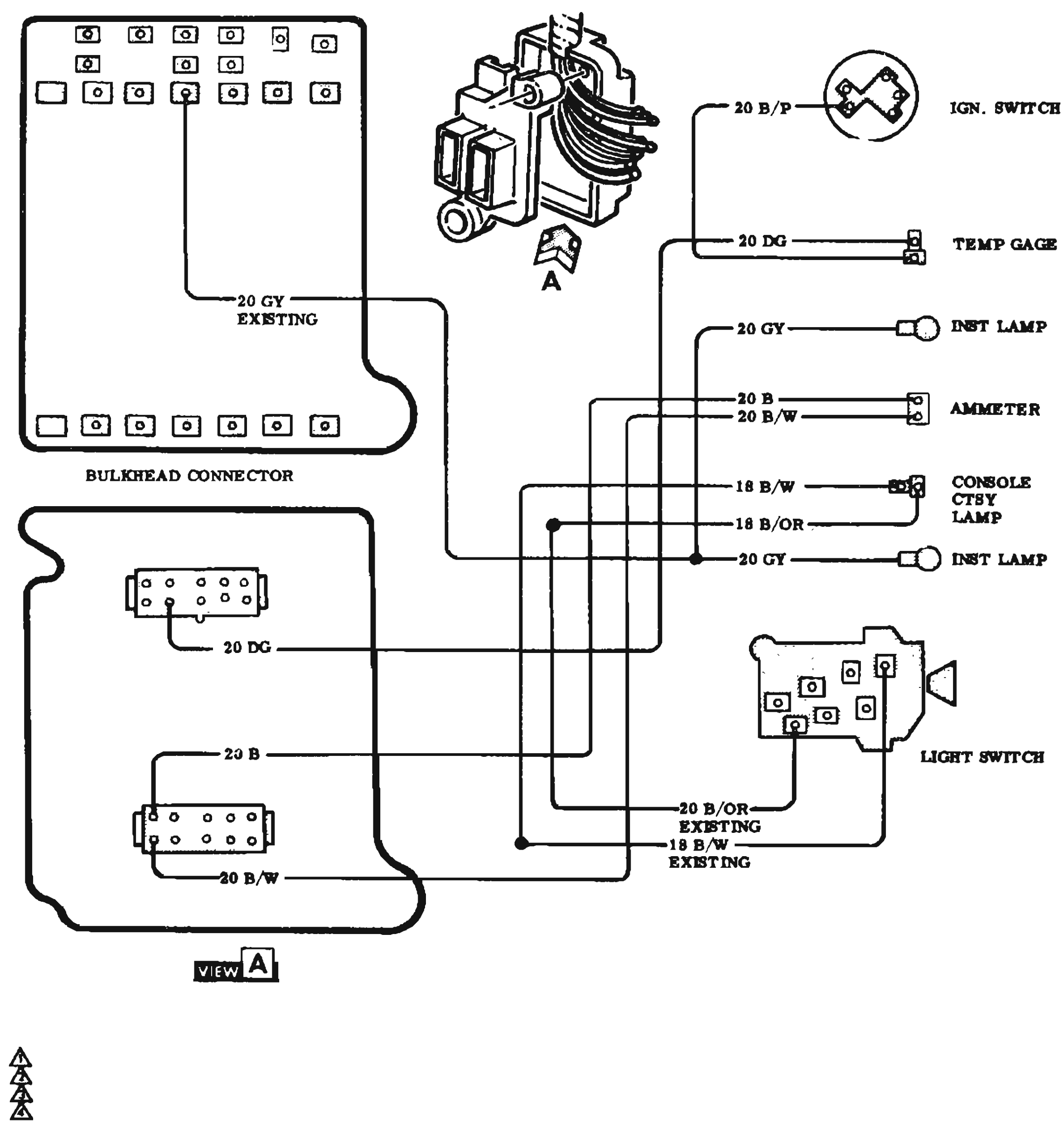


Fig. 85—Instrument Panel and Cluster 13700-800 Models

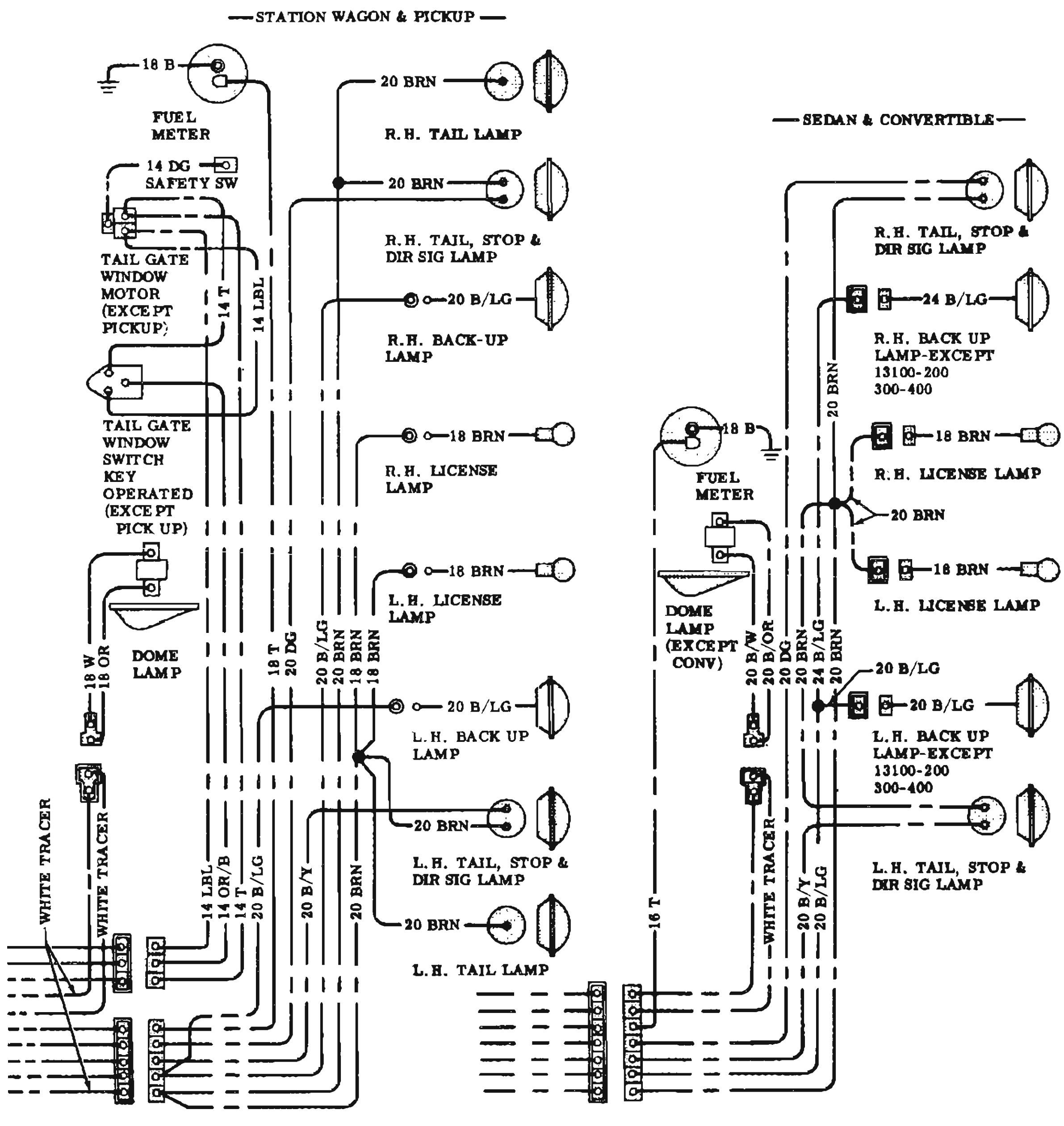


Fig. 86—Body and Rear End Lighting

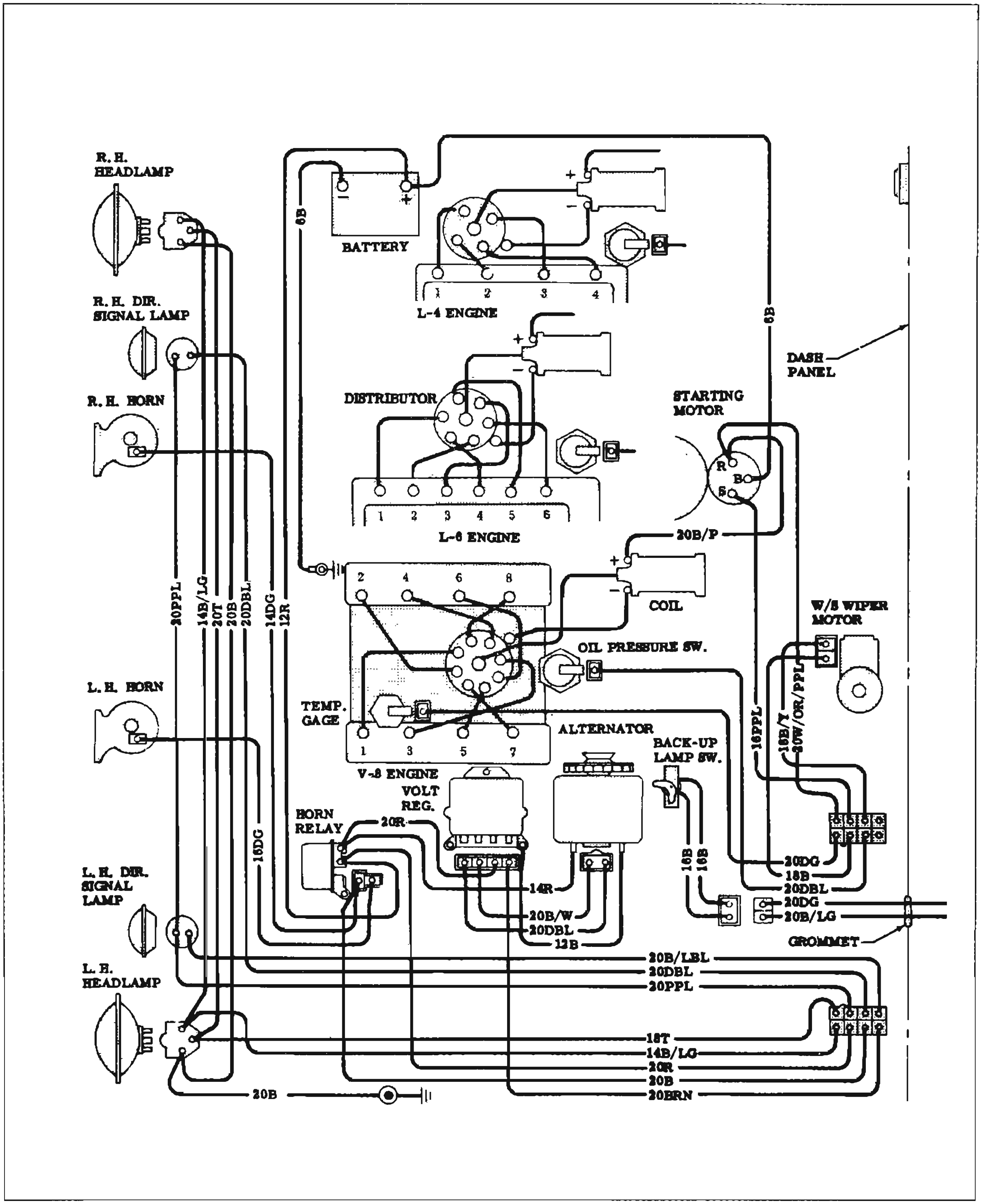


Fig. 87—Engine Compartment

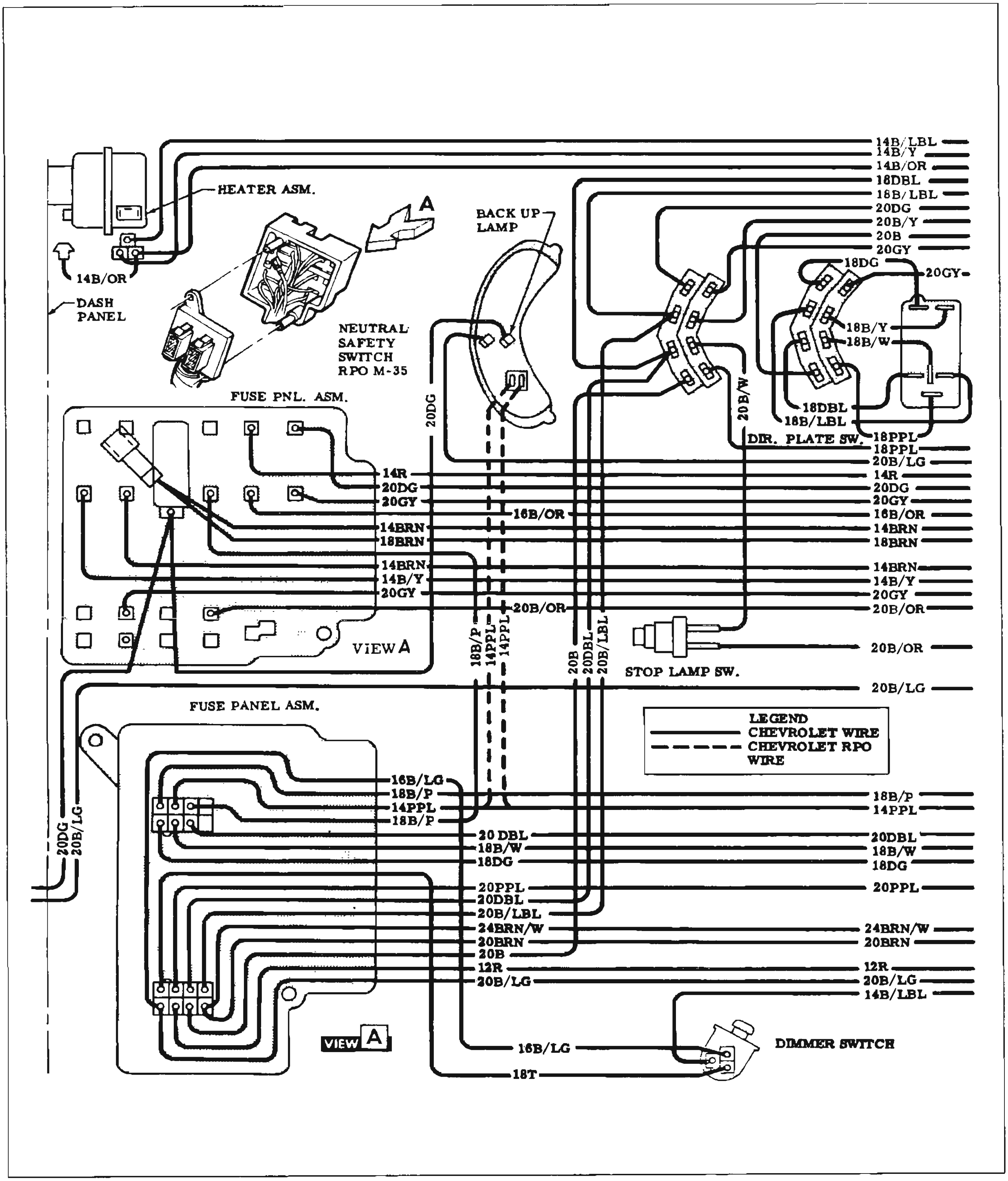


Fig. 88—Fuse Panel

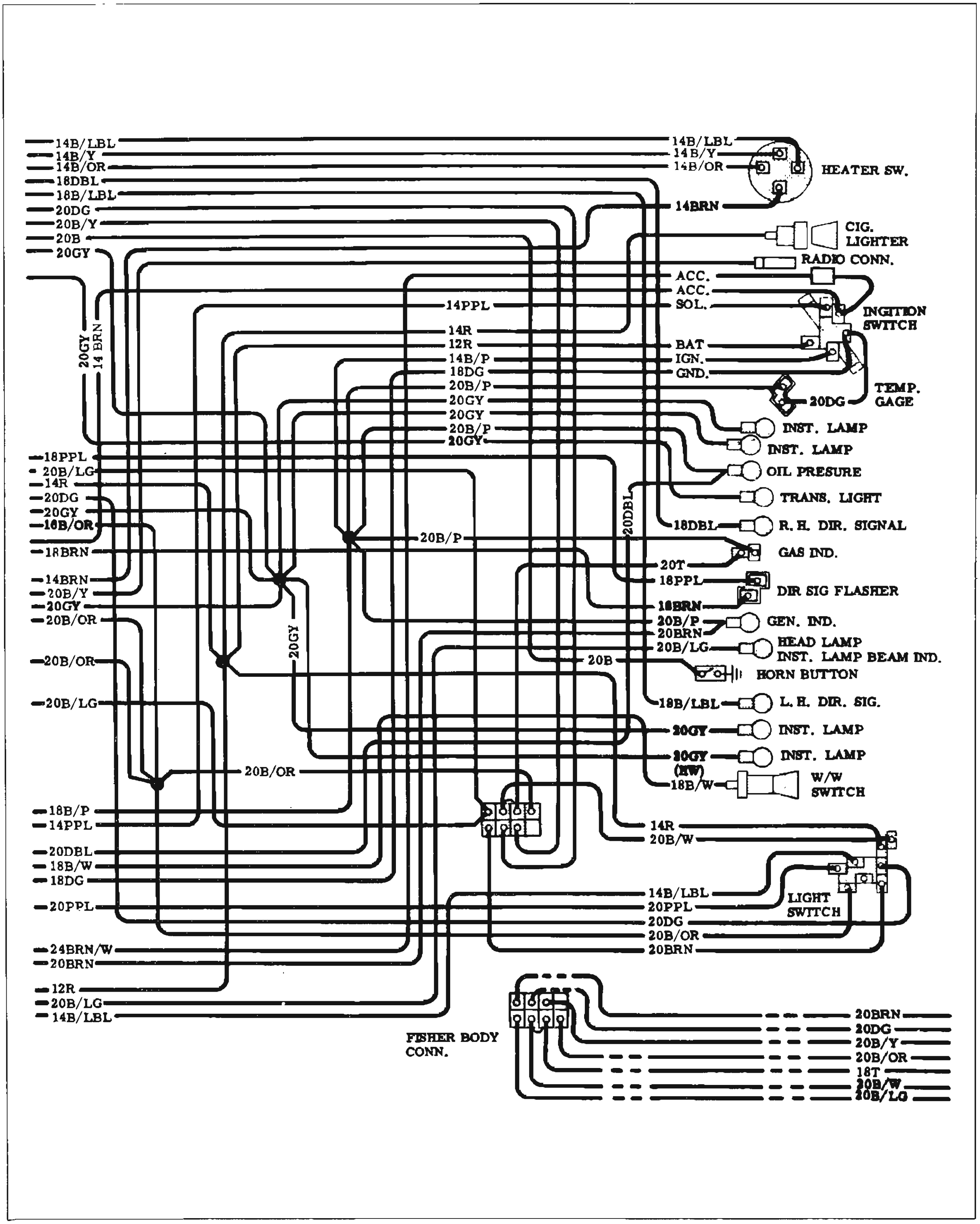


Fig. 89—Instrument Panel (Except 11700 and 800 Models)

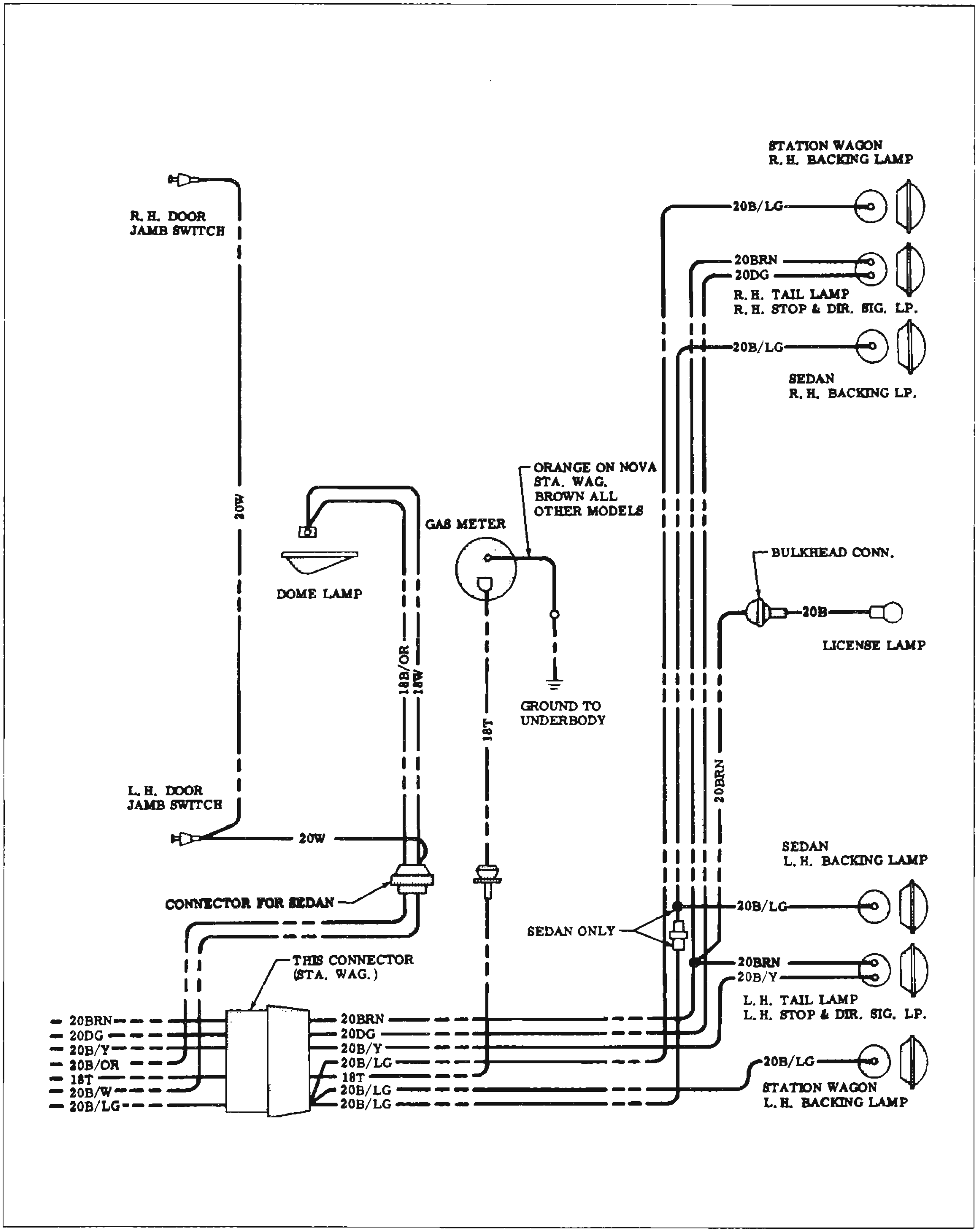


Fig. 90—Body and Tail Lamps

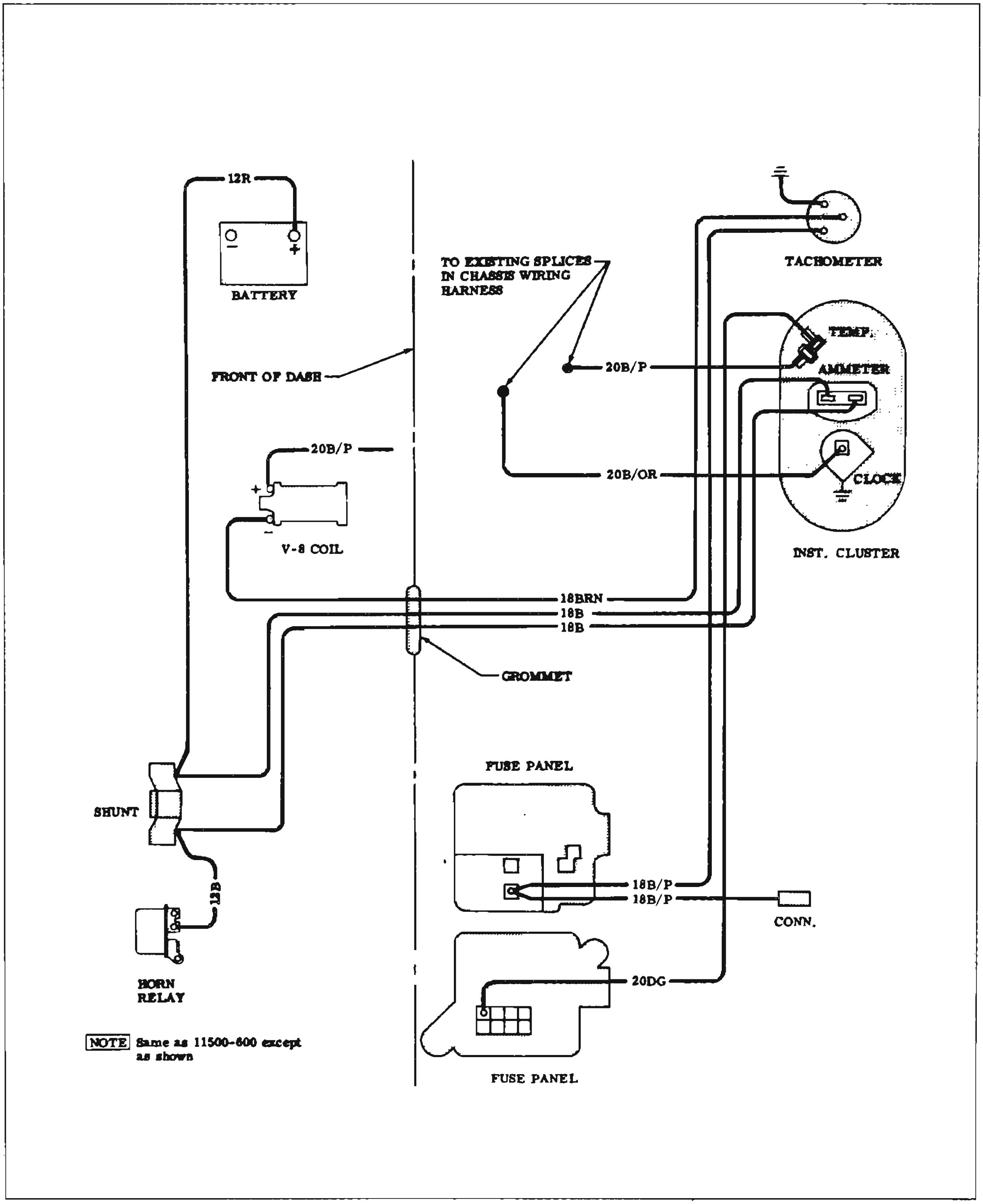


Fig. 91—Engine Compartment Panel & Cluster (11700-800)

SPECIAL TOOLS

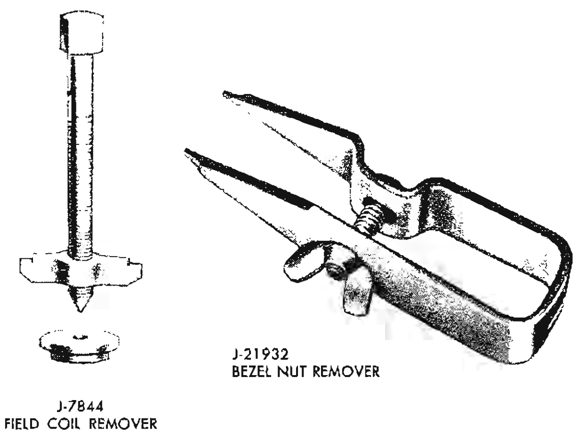


Fig. 92—Special Tools

SECTION 13
RADIATOR AND GRILLE

INDEX

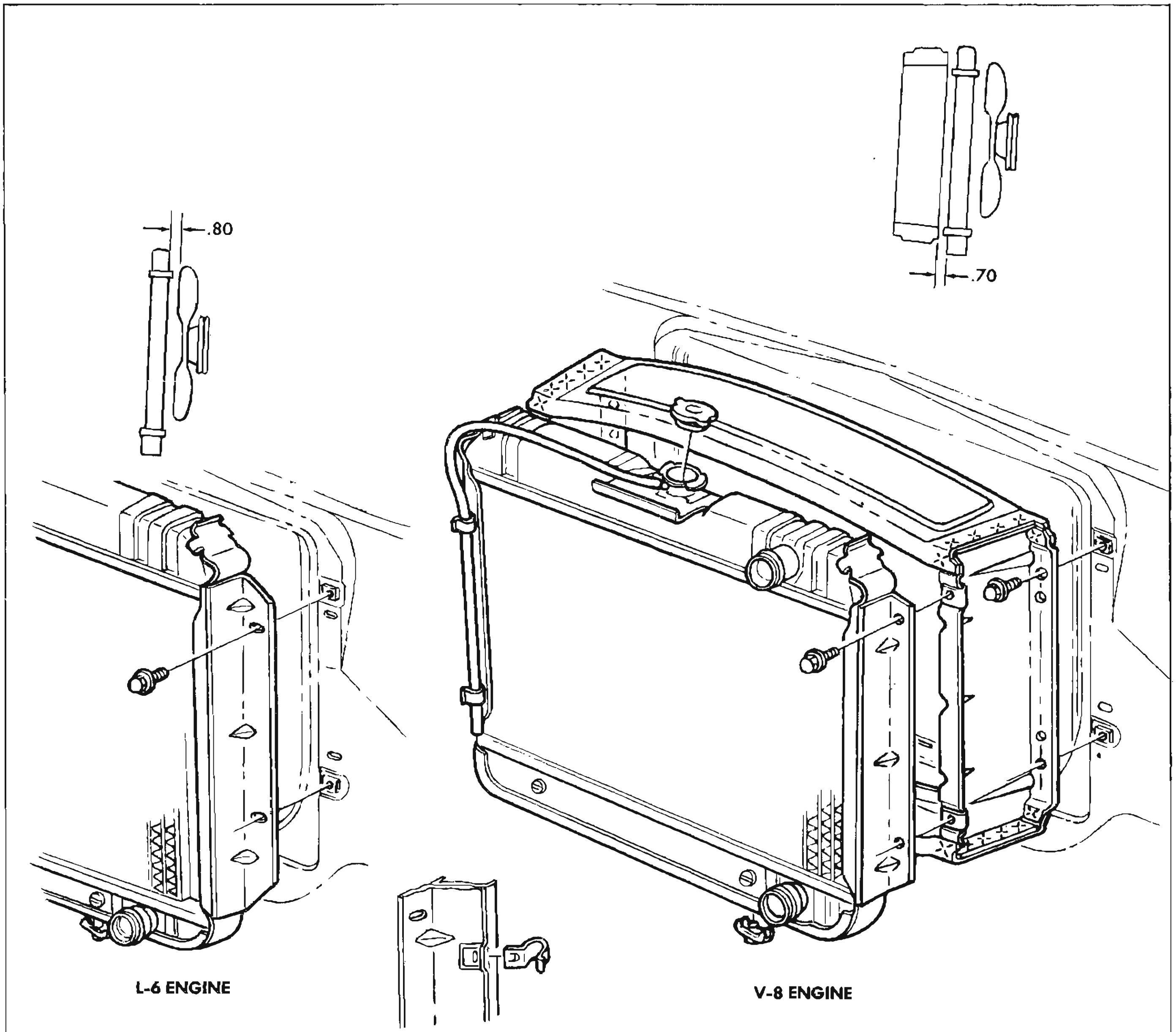


Fig. 1—Radiator and Fan and Shroud—Chevrolet

GENERAL DESCRIPTION

Radiator assemblies are attached by four cap screws either to the radiator support or to the radiator shroud, depending on the engine installation of each vehicle. The removal and installation procedures for the radiator are basically the same for each vehicle.

NOTE: Refer to Body Service Manual for Body, Section 11 for Sheet Metal, and Section 14 for Bumpers.

RADIATOR REPLACEMENT—All Vehicles

Removal

1. Drain radiator.
2. Disconnect inlet and outlet radiator hoses and Powerglide cooler lines if vehicle is so equipped.
3. Remove four radiator attaching screws and lift radiator out of vehicle (also remove fan shroud on Chevrolet V-8).

Installation

NOTE: Refer to Figures 1, 2, and 3 for radiator fan, and shroud assembled position for each vehicle.

Reverse removal procedures; fill cooling system and check for leaks.

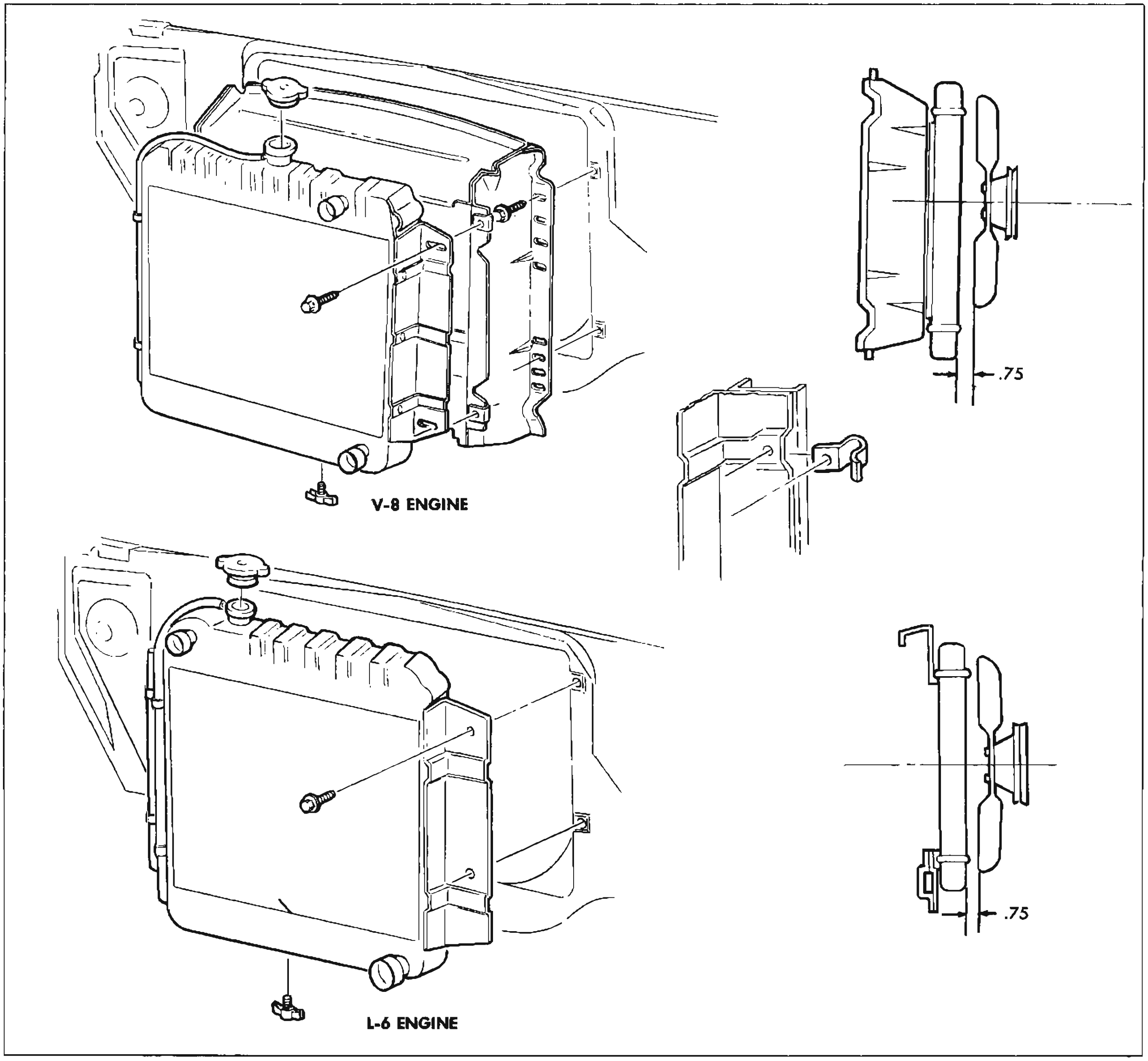


Fig. 2—Radiator and Radiator Shroud—Chevelle

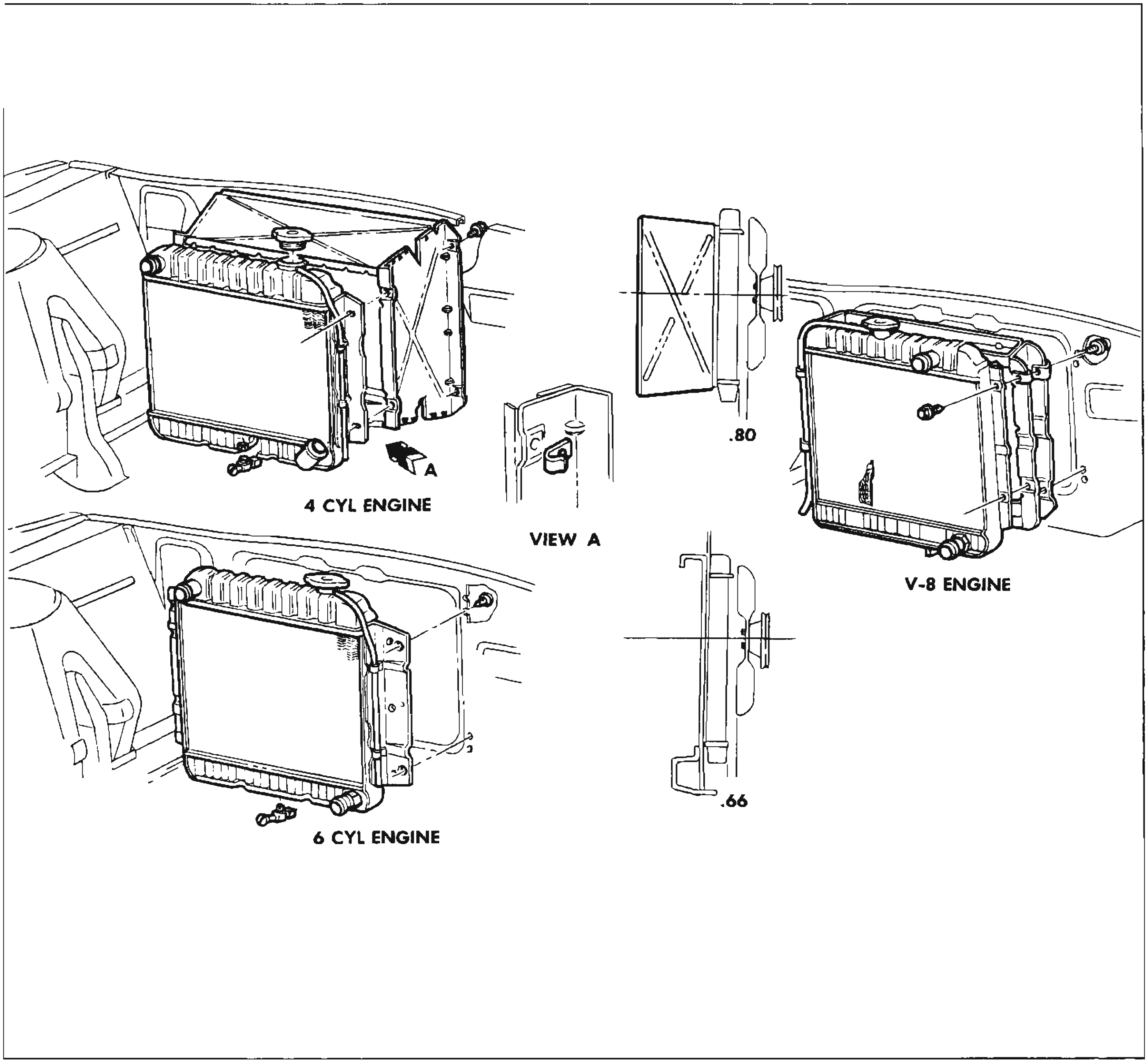


Fig. 3—Radiator and Radiator Shroud—Chevy II

GRILLE ASSEMBLY—CHEVROLET (See Fig. 4)

Removal

1. Remove bumper assembly (see Section 14).
2. Remove headlamp moldings and bezels.
3. Remove screws from grille header assembly, outer reinforcements, and center support.
4. Disconnect parking lamp and headlamp wiring.
5. Remove screws attaching grille skirt extension to fender skirt.
6. Remove screws attaching the headlamp assembly along fender front edge and at grille between headlamps.
7. Remove grille with header assembly, outer reinforcements, center support headlamp, and parking lamp assemblies attached from vehicle.

Repairs

If grille header assembly, hood latch, hood latch support, grille outer reinforcement, and grille skirt extension are undamaged, they may be transferred to new grille by drilling out rivets (22) retaining them to old grille. Attachment to new grille may be made by using either rivets, screws and nuts, or patent clips.

Also, if undamaged, transfer headlamp and parking lamp assemblies to new grille.

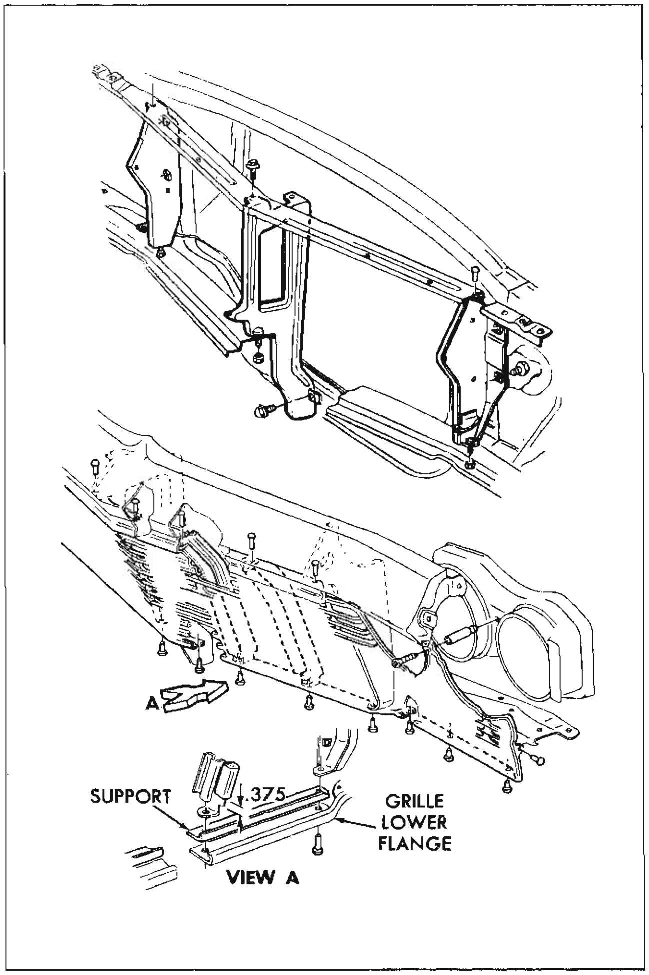


Fig 4—Grille Assembly—Chevrolet

Installation

1. Position grille on vehicle aligning all screw holes. Be sure retaining screws are started before any final tightening is done.
2. Install bumper assembly.
3. Connect headlamp and parking lamp wiring.
4. Check headlamp aiming (see Section 12).
5. Install headlamp bezels and moldings.

GRILLE ASSEMBLY—CHEVELLE (See Fig. 5)

Removal

1. Remove front fender moldings.
2. Remove headlamp bezels (Fig. 6).
3. Disconnect headlamp wiring.
4. Remove screws (including Hood Bumper nut and screw) attaching tie bar to radiator support.
5. Remove screws attaching outer grille brackets and center support to radiator support assembly; also, remove nuts attaching these parts at the bumper filler panel.
6. Remove screws attaching the headlamp assemblies at fender front edge and below at headlamp assembly mounting bracket and filler panel.
7. Remove grille, with headlamp assemblies attached, from vehicle.

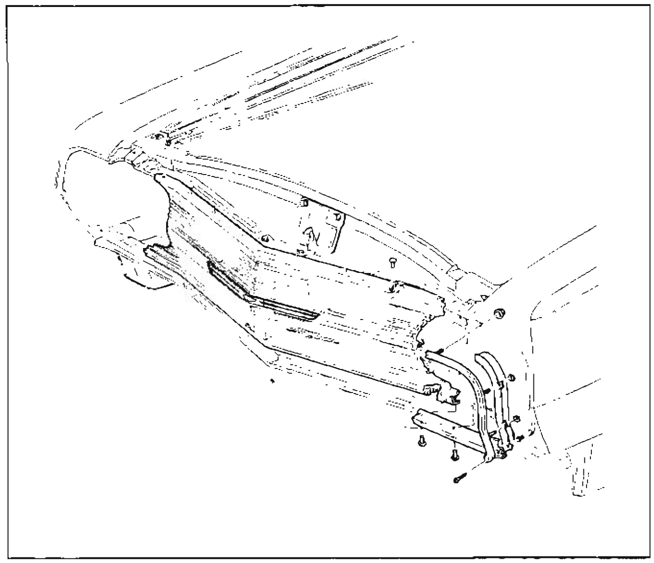


Fig. 5—Grille Assembly—Chevelle

Repair

If tie bar, lower molding, hood latch, hood latch support or grille brackets are undamaged, they may be transferred to new grille by drilling out rivets retaining them to old grille. Attachment to new grille may be made by using either rivets, screws and nuts, or patent clips.

Also, if undamaged, transfer headlamp assemblies to new grille.

Installation

1. Position grille on vehicle, aligning all screw holes. Be sure all retaining nuts and screws are started before any final tightening is done.
2. Connect headlamp wiring.
3. Check headlamp aiming (see Section 12).

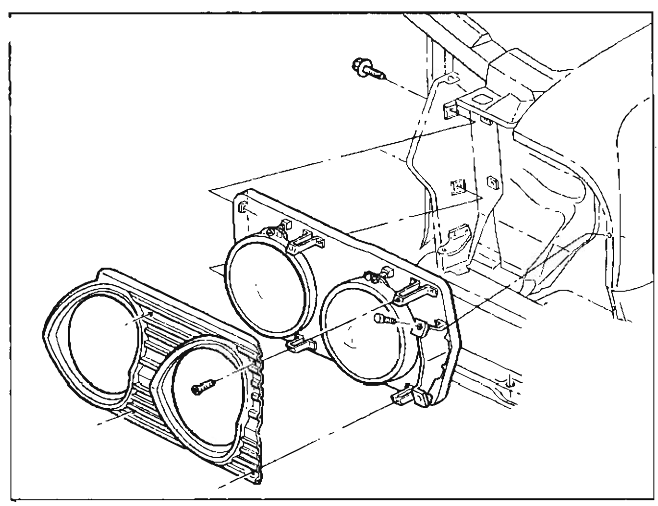


Fig. 6—Headlamp Attachment—Chevelle

4. Install headlamp bezels and fender moldings.
5. Check hood bumper height adjustment (see Section 11).

GRILLE ASSEMBLY—CHEVY II (See. Figs. 7 and 8)

Removal

1. Remove headlamp door as outlined in Section 12.
2. Remove cap screws retaining hood lock support to hood lock and grille center bracket.
3. Remove cap screws retaining grille outer brackets to radiator support and bumper filler panel.
4. Remove grille from vehicle.

Repairs

If hood lock support and outer bracket assemblies are undamaged, they may be transferred to new grille by drilling out and removing the rivets retaining them to the old grille. Attachment to new grille may be made by using either rivets, screws and nuts or patent clips.

Installation

1. Position in vehicle, aligning all mounting holes. Be sure all retaining screws are started before any final tightening is done.
2. Install headlamp assemblies as outlined in Section 12.

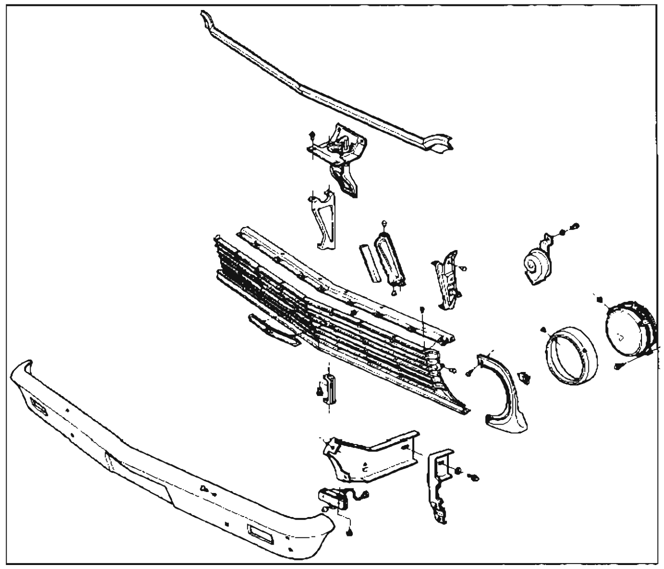


Fig. 7—Grille Assembly—Chevy II

3. Check headlamp aiming as outlined in Section 12.

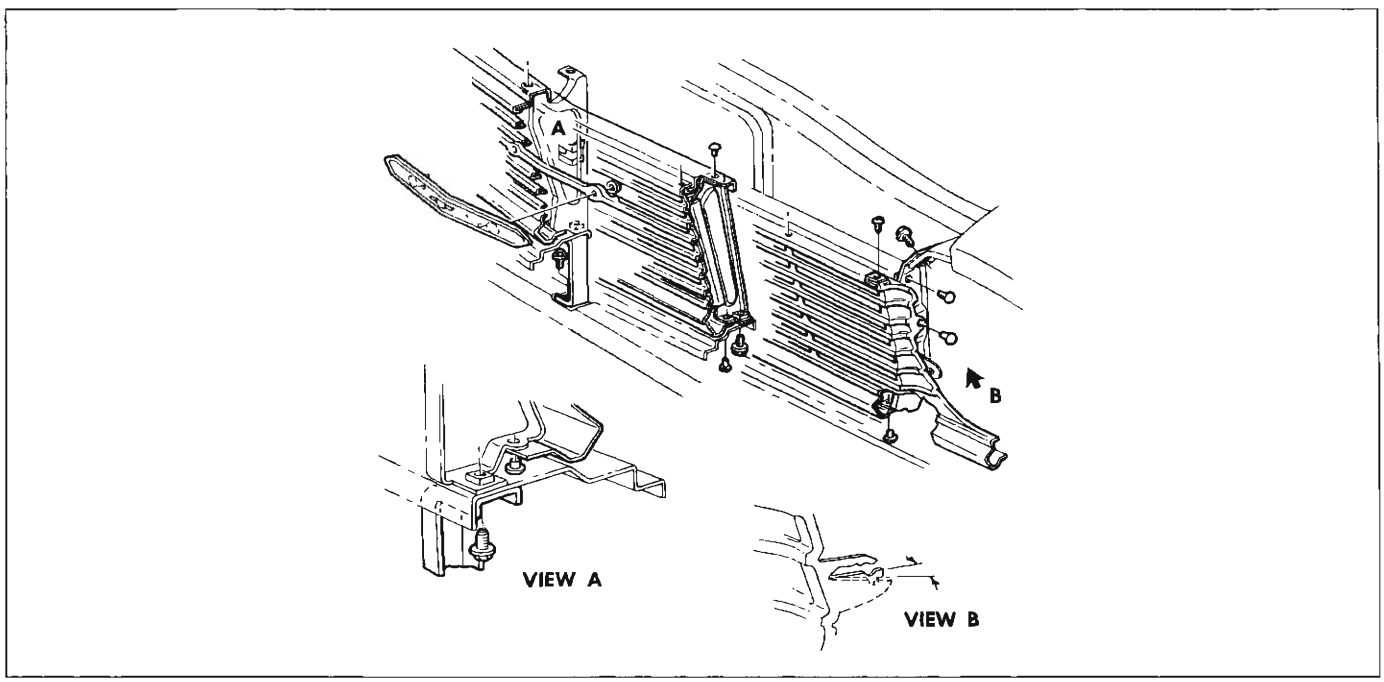


Fig. 8—Grille Attaching Parts—Chevy II

SECTION 14
BUMPERS

INDEX

GENERAL DESCRIPTION—CHEVROLET

The new front bumper is of a new six-piece design that includes a slim center face bar with attached right and left outer face bars. An anodized and painted valance panel is vertically attached at each end to the outer face bars and horizontally to each frame bracket. The vertical bumper guards attach to the lower edge of the center face bar and valance panel mounting bracket.

The rear bumper assembly is of a three-piece design with provisions in the center face bar for gas tank rear fill on sedan models. The spring loaded license lamp door conceals the filler neck and gas cap.

SERVICE OPERATIONS

FRONT BUMPER ASSEMBLY (See Fig. 1)

Removal

1. Raise front end of vehicle.
2. Remove bolts from brackets at frame horn (behind bumper guards).
3. Remove bolts attaching bumper braces to frame horn.
4. Remove bumper from vehicle.

Disassembly

1. Remove bolts attaching bumper to bumper braces.
2. Remove bolts attaching bumper guard and bumper guard bracket to center face bar and valance panel.
3. Separate valance panel from face bar by removing two bolts at each end of outer face bar.
4. Separate face bar sections by removing three bolts at each joint.

Assembly

Assemble the front bumper following the disassembly procedure in reverse order. Install all bolts loosely (do not tighten any bolts until all bolts are installed).

Installation

1. Position assembled bumper on frame horns aligning holes in bumper brackets and braces with those in frame.
2. Install bolts, lock washers, and nuts; do not tighten. NOTE that eight sided washer is placed in tab of each bumper bracket. Dial the washer (fig. 1) in the tab as required to position the bumper at the desired mounted height.
3. Tighten all bolts securely and lower vehicle.

REAR BUMPER ASSEMBLY (See Fig. 2)

Removal

1. Raise rear end of vehicle.
2. Disconnect rear license plate lamp wire.
3. Remove center face bar to frame bolts (two) behind license plate door.
4. Remove six bolts (three per side) retaining bumper brackets and braces to frame horns.
5. Remove bumper from vehicle.

Disassembly

1. Remove license plate lamp.
2. Remove two bolts retaining each bumper brace to the bumper.
3. Remove three bolts retaining each bumper bracket to bumper and separate sections of face bar at joints.
4. The center face bar reinforcement and license plate door (sedan models) may be removed for service by removing the attaching parts (fig 2).

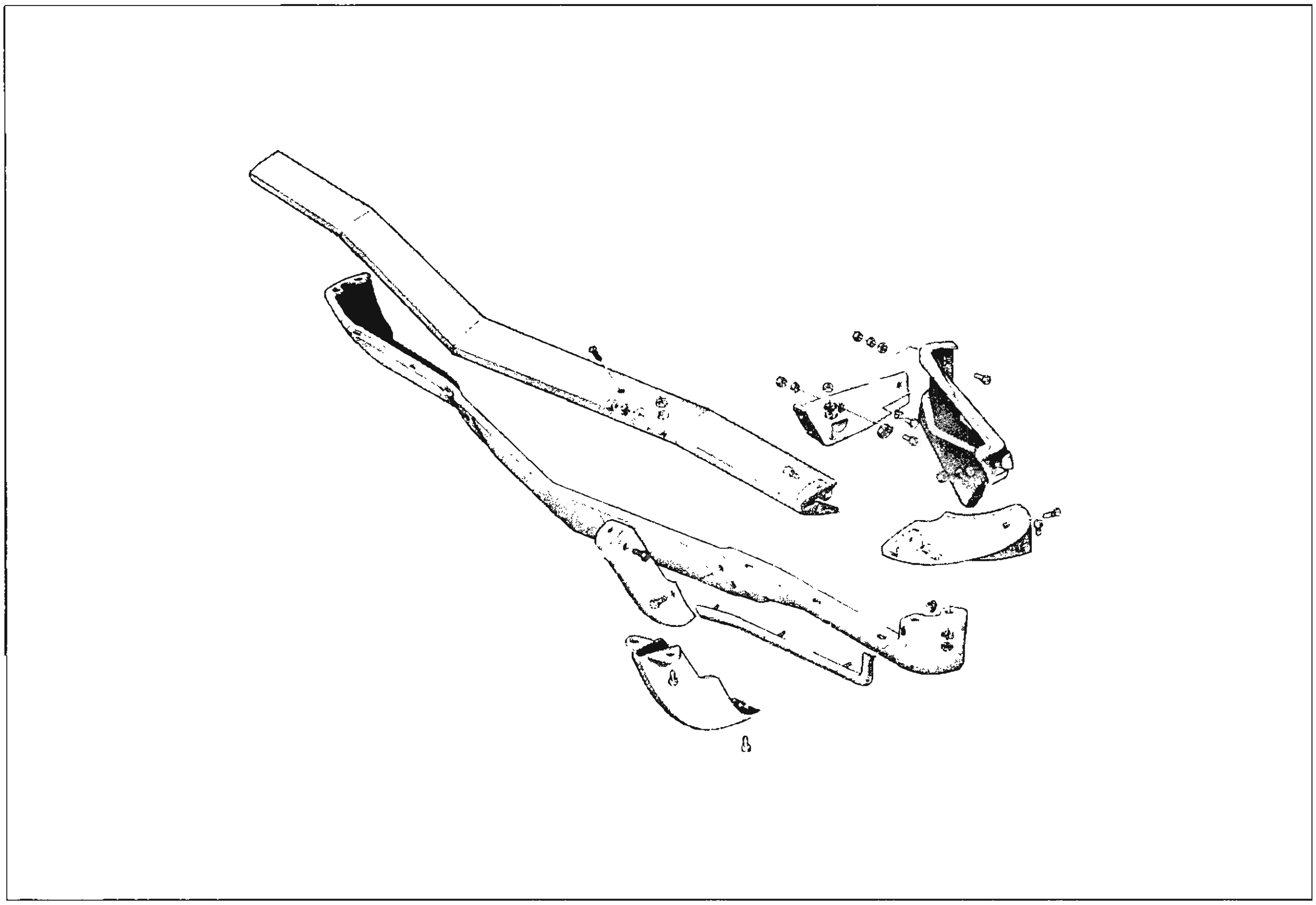


Fig. 1—Front Bumper and Valance Assembly—Chevrolet

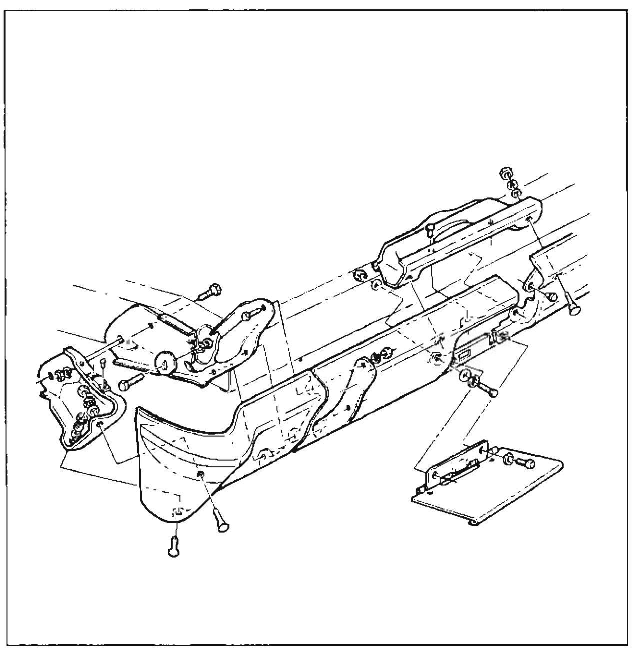


Fig. 2—Rear Bumper Assembly—Chevrolet

Fig. 3—Rear Bumper Assembly—Station Wagon

Assembly

Assemble the rear bumper following the disassembly procedure in reverse order. Install all bolts loosely (do not tighten any bolts until all bolts are installed).

Installation

1. Position bumper assembly on vehicle; aligning holes in brace and mounting bracket with those in frame.
2. Install bolts, lock washers, and nuts including two center face bar to frame bolts behind license plate door; do not tighten.
   NOTE that eight sided washer is placed in the tab of each bumper mounting bracket. Dial the washer in the tab as required to position bumper at desired height.
3. With bumper adjusted to the desired height, tighten all mounting bolts securely and lower vehicle.

GENERAL DESCRIPTION—CHEVELLE

The new front bumper is of a one piece design with the parking and turn signal lamp assemblies attached to each outboard end of the bumper.

The rear bumper is also of a one piece design with provisions for rear gas fill. Pierced holes are provided in the bumper for back-up lamp installation.

SERVICE OPERATIONS

FRONT BUMPER ASSEMBLY (See Fig. 4)

Removal

1. Raise front of vehicle.
2. Disconnect parking lamp wiring.
3. Remove four bolts retaining the bumper brackets and braces to the frame horn.
4. Remove bumper assembly from vehicle.

Disassembly

1. Remove bolts attaching braces and brackets to bumper.
2. Remove the license plate mounting bracket.
3. Remove parking lamp assemblies. (Refer to Section 12)

Assembly

Assemble the front bumper parts by following the disassembly procedure in reverse order. Install all bolts loosely (do not tighten any bolts until all bolts are installed).

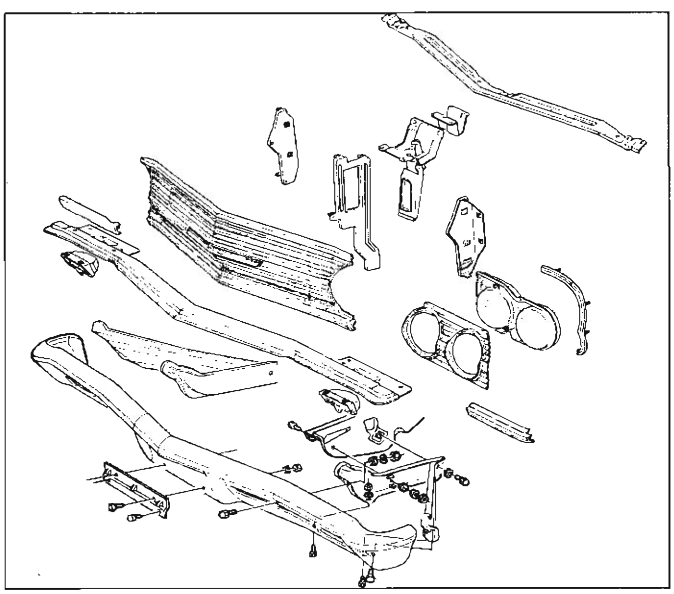


Fig. 4—Front Bumper Assembly—Chevelle

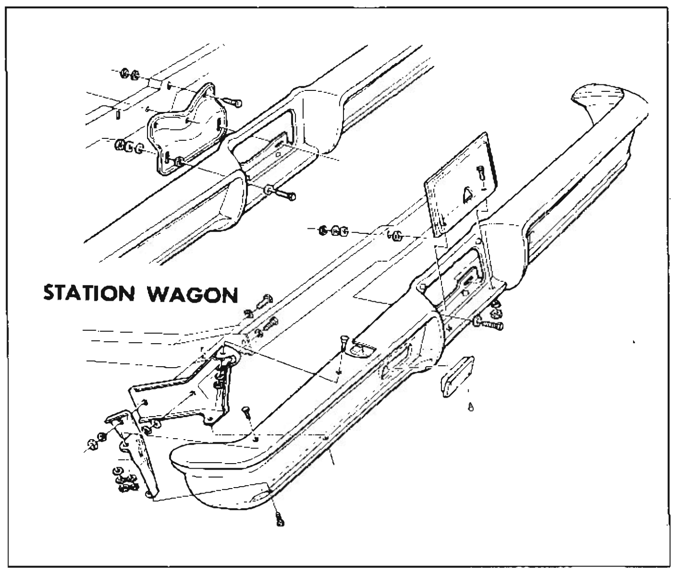


Fig. 5—Rear Bumper Assembly—Chevelle

Installation

1. Position the front bumper on the frame horns, aligning holes in frame with those in the bracket and brace.
2. Install bolts, lock washers, and nuts; do not tighten.
   NOTE that eight sided washer is placed in the tab of each mounting bracket. Dial the washer in the tab as required to position bumper at desired height.
3. With bumper adjusted to the desired height, tighten all mounting bolts securely and connect parking lamp wiring.
4. Lower front end of vehicle.

REAR BUMPER ASSEMBLY (See Fig. 5)

Removal

1. Raise rear end of vehicle.
2. Disconnect rear license plate lamp and back-up lamps (if so equipped) wiring.
3. Remove two bolts behind license plate door attaching bumper to frame crossmember.

4. Remove four bolts retaining bumper brackets and braces to frame.
5. Remove bumper from vehicle.

Disassembly

1. Remove license plate and back-up lamps (see Section 12).
2. Remove brackets and brace at each end of bumper.
3. Remove license plate door.
4. On station wagons and pickup delivery, remove bracket at center of bumper.

Assembly

Assemble the bumper parts by following the disassembly procedure in the reverse order. Install all bolts loosely (do not tighten any bolts until all bolts have been installed).

Installation

1. Position bumper bracket and brace on the frame aligning holes in frame with those in bracket and brace.
2. Install bolts, lock washers, and nuts; do not tighten. NOTE that eight sided washer is placed at end inside surface of rear frame channel. Dial washer as required to position bumper at desired height.
3. With bumper adjusted to desired height, tighten all mounting bolts securely and connect back-up lamp wiring.

GENERAL DESCRIPTION—CHEVY II

The front and rear bumpers are of a one piece design with the parking and turn signal assemblies attached to each outboard end of the front bumper.

SERVICE OPERATIONS

FRONT BUMPER ASSEMBLY (See Fig. 6)

Removal

1. Raise front end of vehicle.
2. Disconnect parking lamp wiring.
3. Remove bolts retaining bumper brackets and braces to frame (two at each side).
4. Remove bumper assembly from vehicle.

Disassembly

1. Remove parking lamp assemblies (See Section 12).
2. Remove bolts attaching brace and bumper bracket to bumper face bar (four each side).

Assembly

Referring to Figure 6, assemble brackets and braces and install parking lamps to face bar. Install all bolts loosely--do not tighten any bolts until all bolts have been installed.

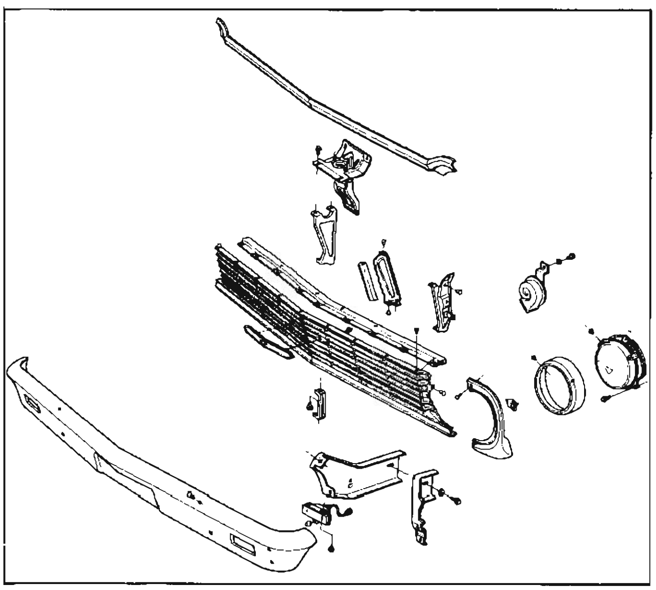


Fig. 6—Front Bumper Assembly—Chevy II

Installation

1. Position assembled bumper on frame extensions, aligning holes in extension with holes in bracket and brace.
2. Install bolts, lock washers, and nuts; tighten securely.
3. Connect parking lamp wiring.

REAR BUMPER ASSEMBLY (Fig. 7)

Removal

1. Disconnect license plate lamp wire at connector.
2. Raise vehicle from floor. From forward side and underside of rear crossmember, remove the six mounting bolts retaining the bumper brackets to the vehicle.
3. Remove bumper assembly from vehicle.

Disassembly

1. Remove license plate lamp.

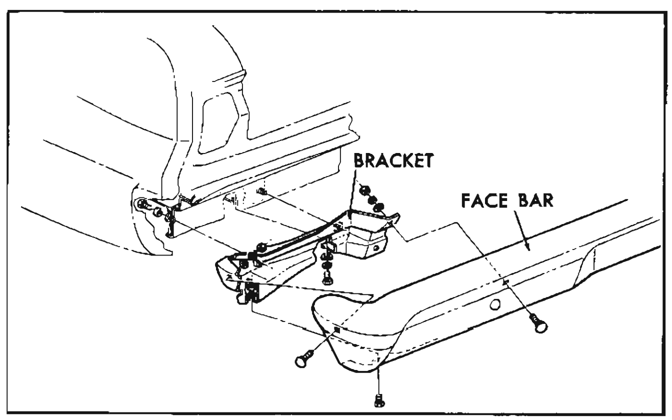


Fig. 7—Rear Bumper Assembly—Chevy II

2. Remove 4 bolts holding each bracket to bumper. Check condition of seal; replace if necessary.

Assembly

1. Position brackets on face bar as shown in Figure 7 and install mounting bolts; tighten nuts securely.
2. Install license plate lamp.

Installation

1. Position bumper assembly on vehicle, aligning tapped holes in bracket with slotted holes in rearward face of rear crossmember and install bolts loosely.
2. Align slotted hole in bracket with tapped hole in lower flange of rear crossmember and install bolt loosely.
3. Adjust entire bumper assembly so that the distance from rear fender side panel to the end flange of the bumper is approximately 3/4" on Passenger Cars and 7/8" on station wagons; tighten all bolts.

If enclosed weld nuts are stripped or damaged, they may be repaired by the following methods:

1. Install spiral-type thread insert, following directions furnished by manufacturer.
2. Drill out nut and tap to next larger size.
3. Hole saw through rear crossmember in area of nut. Cut old nut from frame member and weld or braze new one in place.

SECTION 15

HEATER AND ACCESSORIES

CONTENTS OF THIS SECTION

HEATER

GENERAL DESCRIPTION

CHEVROLET AND CHEVELLE

Components of the Chevrolet and Chevelle heaters are attached to the firewall on the right side of the vehicle. The blower and air inlet assembly and water hoses are located on the engine side of the firewall while the heater core and distributor duct are on the passenger side.

The heater operates on outside air only with the blower receiving its airflow from the cowl vent plenum chamber.

Since the unit has no water valve, water circulation keeps the core hot at all times. Air passing through the core receives maximum heat from the core.

In operation, three knobs control all heater operations. The FAN-AIR knob (Chevelle) or AIR knob (Chevrolet) is a combination control; moving the knob half-way opens the AIR door (by means of a bowden cable) to supply outside air to the three speed blower. Further movement of the knob operates the blower. The other knobs depend on bowden cables to operate the diverter doors located in the distributor duct to control heater output and operation.

At the heart of the heater operation is the temperature door. Air from the blower follows parallel paths through the distributor duct, with one path passing through the heater core and the other path bypassing the core. The temperature door, operated by the TEMP or TEMPERATURE control knob, is placed in the duct so that when it closes off the path from the heater core, it allows ambient airflow through the unheated path. In the opposite position only heated airflow is allowed. Final heater output temperature is dependent upon the proportion of heated and unheated air blended together according to the setting of this temperature door. To insure positive closing of this door when the heat lever is in the off

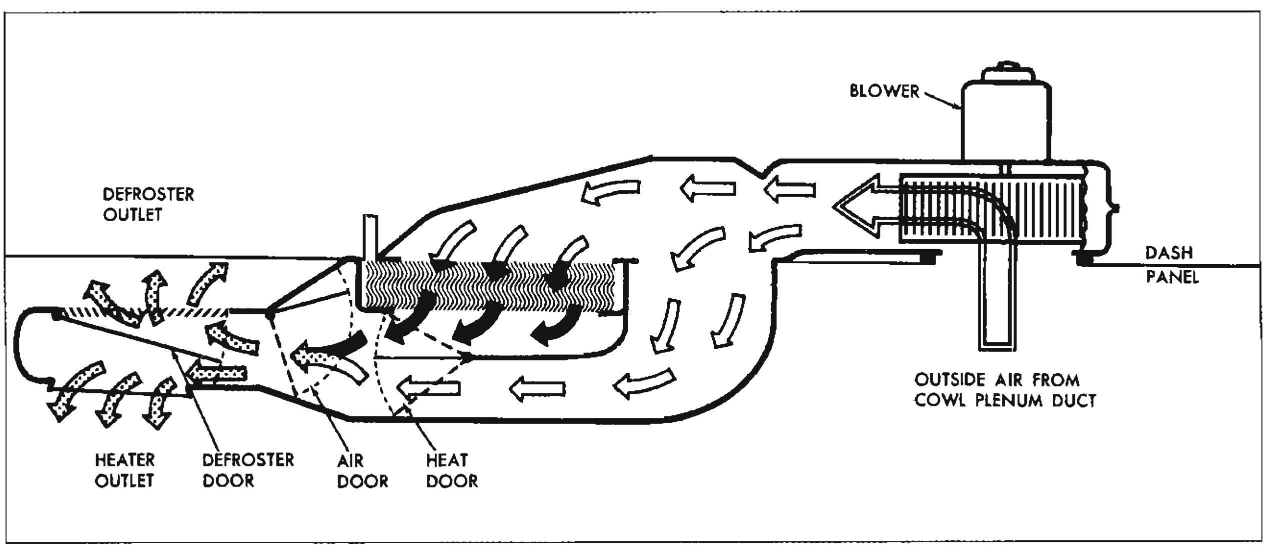


Fig. 1—Heater Air Flow (Chevrolet and Chevelle)

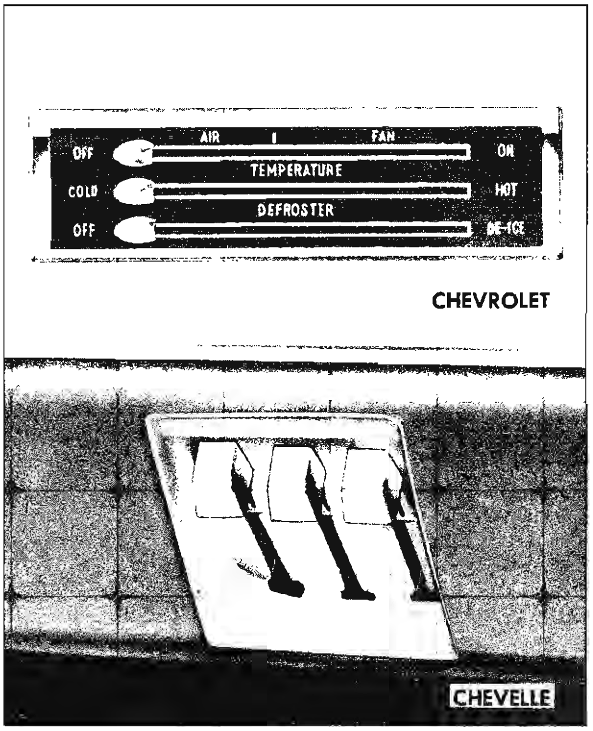


Fig. 2—Control Panels (Chevrolet and Chevelle)

position, a cam lock device is utilized in the control linkage of the Chevelle heater only.

Just beyond the temperature damper door is the Air door, operated by the AIR or FAN-AIR control knob, which is the air on-or-off control. This door must be open whenever the heater blower is in operation.

The defroster door, operated by the DEF or DEFROSTER knob, acts to divert the heated air flow up through the defroster ducts for de-fogging, defrosting or de-icing operations.

Figure 1 illustrates airflow through the heater.

CONTROLS

Control Assembly

The control assembly is attached to the dash reinforcement as shown in Figure 7.

Fan-Air or Air Knob

Since the heater makes use of outside air only, this knob serves as an "air on or off" control by actuating a damper in the distributor assembly downstream from the heater core. With the knob in the half-way position, this damper will be open to allow airflow into the vehicle. Moving the lever further will actuate the three-speed (LOW-MED-HIGH) fan lever which controls the blower motor and determines the volume and force of the air flowing through the heater core into the car.

Temperature Knob

Through its bowden cable, this knob controls the positioning of the temperature door in the distributor duct. This door allows airflow through either the heater core (full DOWN) or the bypass duct around the heater core (full UP). Because the water temperature is constant, this knob acts as an air mixture control, controlling temperature by varying the proportions of hot and cold air blended in the heater distributor duct.

The cam lock device at the damper door operating lever (Chevelle only) may be adjusted as follows: Loosen the two attaching screws. Place the cam in the closed position and insert a pin through holes provided, locking the cam in this position. Rotate the entire assembly toward the closed position. Hold closed with some force and tighten attaching screws. Remove the locking pin.

Defrost Knob

The defrost knob controls the position of the damper (or deflector) door located in the heater and defroster assembly. In the "up" (Chevelle) or "off" (Chevrolet) position full airflow will go to the floor duct for car heating purposes. In the "down" (Chevelle) or "de-ice" (Chevrolet) position the diverter door will drop down and divert almost all the airflow to the defroster duct. (This position will seldom be needed except for extreme de-icing requirements.) A "detent" position is built into the linkage of this knob which will provide partial airflow only to the defroster duct and which should be used for all normal defogging operations.

CHEVY II

Heater components are located under the instrument panel in the passenger compartment. Hot water hoses from the engine are routed to the fire wall to the heater core pipes. The blower motor receives outside air from the cowl vent plenum chamber through the adapter assembly. The air enters the heater core chamber where it either bypasses or passes through the core depending on the position of the temperature door, controlled by the TEMP knob on the instrument panel. Temperature control is achieved by adjusting the position of this door to vary the proportion of heated and unheated air introduced to the car interior. As the air flow is drawn out of the heater core chamber (in the desired proportion of hot and cold), it enters the blower where it is thoroughly mixed, assuring a uniform temperature. The distributor guides the air flow through either the floor outlet or the defroster outlets depending on the setting of the DEF knob on the instrument panel. The AIR knob is the air OFF knob as well as, when rotated, the three-speed blower control and should be pulled out before operation of the heater or fan is attempted.

Controls

See Figure 3 for a Schematic which will aid in understanding control knob operation.

Air-Pull Knob

Since this heater makes use of outside air only, this lever serves as an "air-on-or-off" control by actuating a damper door located between the air source and the blower. This door will be closed when the control knob is in the "IN" position and open when the knob is pulled fully "out."

Temp Knob

The temperature of the water entering the heater core remains constant (engine temperature) at all times since it is not controlled by a water valve type of device. Instead, the air is allowed to bypass the heater core (and

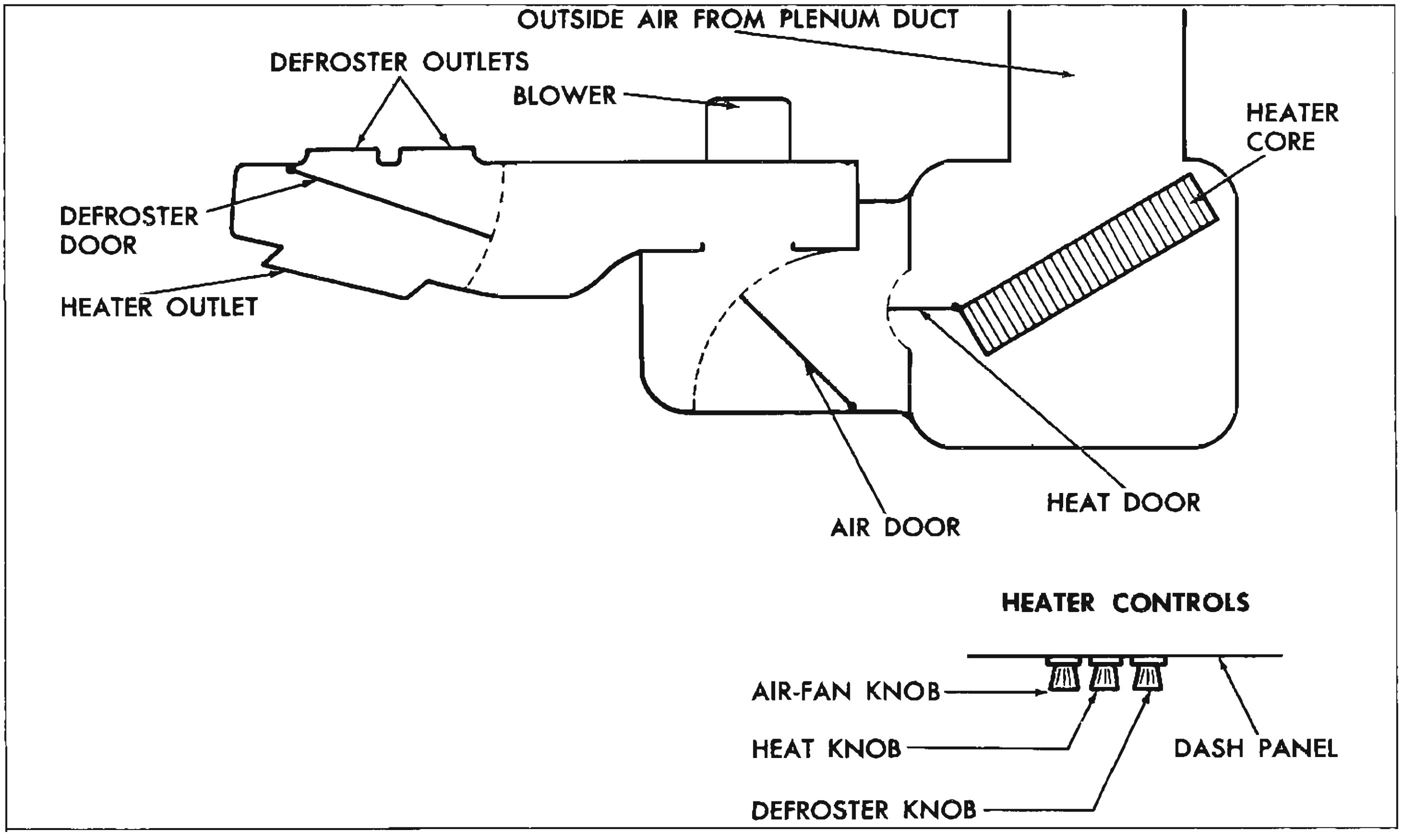


Fig. 3—Heater Schematic—Chevy II

remain cool) or pass through the core to be heated. The "temp" knob actuates a damper door which may be positioned to adjust the proportion of cool or heated air which enters the vehicle.

With the knob fully "in" the damper is positioned to shut off all warm air flow into the vehicle interior. As the knob is pulled out, the damper door begins to move, allowing greater and greater proportions of heated air to enter the vehicle. Maximum heat is attained with the knob pulled fully "out."

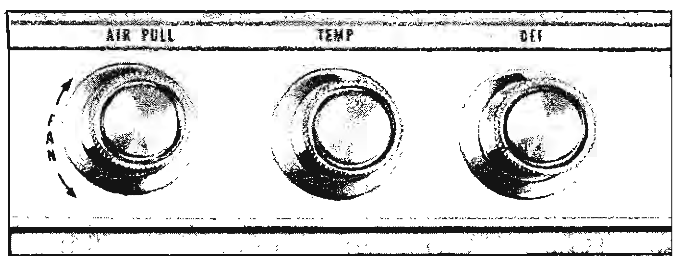


Fig. 4—Control Panel—Chevy II

Def Knob

Pull this knob out to actuate a damper door which will divert heated air flow from the floor distributor outlet to the defroster outlets.

Fan Control

Rotate the "Air-Pull" knob to control the three-speed blower motor only when AIR knob is pulled out.

COMPONENT REPLACEMENT AND REPAIR

CHEVROLET AND CHEVELLE

Blower Assembly

Blower Motor Replacement

1. Disconnect battery ground cable.
2. Unclip heater hoses from fender skirt.
3. Disconnect the blower motor electrical feed wire at the motor.
4. Move the vehicle front wheels to the extreme right turn position.
5. Remove all bolts retaining the right fender skirt. Allow the skirt to drop and rest on top of the tire.

   To gain maximum clearance for access to the blower motor attaching bolts, a block of wood may be wedged between the fender lower flange and the top of the fender skirt. Position the wood block so that the rear portion of the skirt will be forced down and inboard.

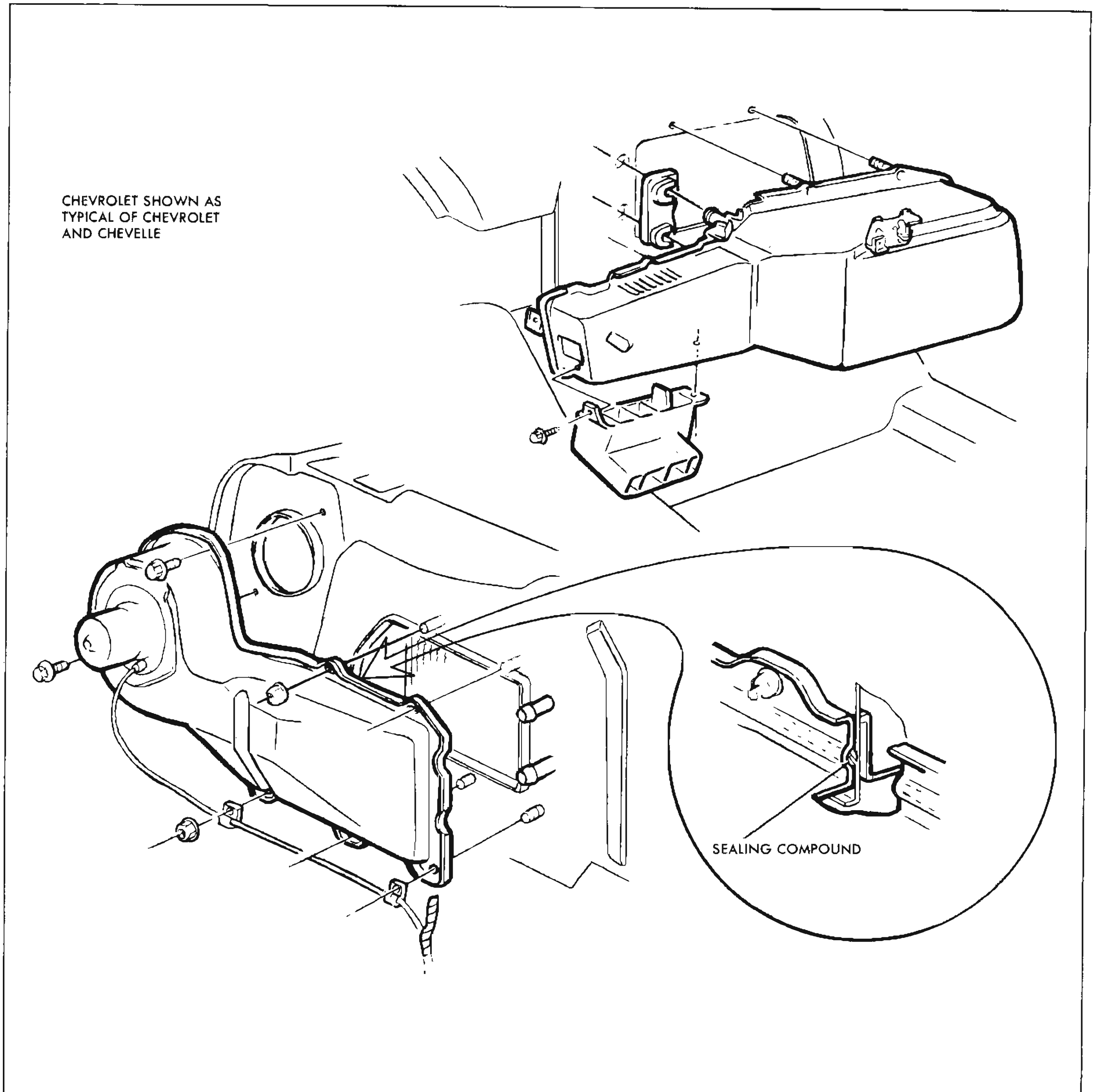


Fig. 5—Heater Blower and Air Inlet Assembly and Floor Distributor

6. Remove the screws attaching the blower motor mounting plate to the air inlet housing. Slide the blower assembly and mounting plate from the air inlet housing.
7. Remove the two screws attaching the motor to its mounting plate.
8. Remove the clip attaching the blower cage to the motor shaft.
9. Reinstall the blower motor assembly by performing the above steps in reverse order.

Core

Replacement

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

   NOTE: The hose from the water pump must go to the top heater core pipe; the other hose runs from the thermostat housing to the lower core pipe.

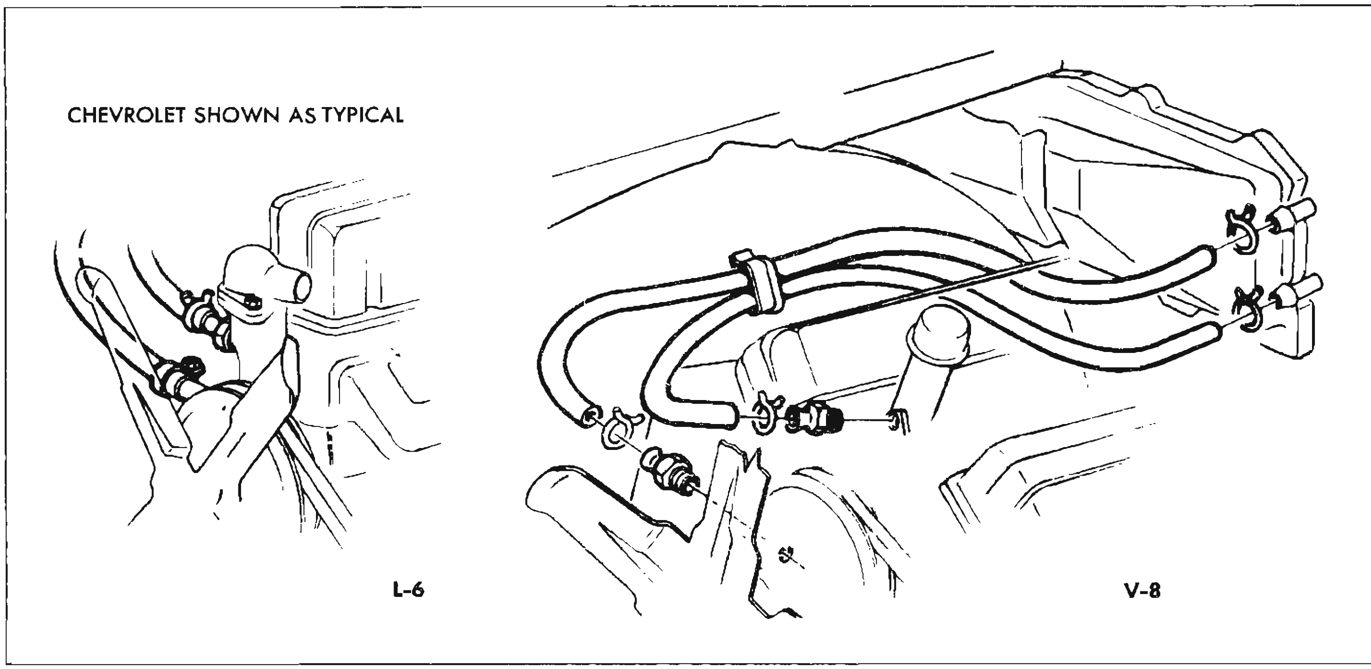


Fig. 6—Heater Hose Routing

3. Remove the bowden cables (except the Chevrolet defroster cable) and all electrical connectors from the heater and defroster assembly.
4. On the engine side of the dash, remove the two screws and five nuts attaching the air inlet assembly to the dash panel.
5. Inside the vehicle, pull the entire heater and defroster assembly from the firewall (remove the Chevrolet defroster cable at this time) then remove the assembly from the vehicle and set on a bench.
6. Remove the core assembly retaining springs and remove the core.
7. Install the replacement core.

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

8. Replace the core and core retaining springs.
9. Within the vechicle (after attaching the Chevrolet defroster cable) insert the five studs on the heater and defroster assembly through the holes in the cowl and blower and air inlet assembly. Replace the five stud nuts and the two blower housing retaining screws.
10. Replace the remaining bowden cables and electrical connectors.
11. Replace heater hoses, being careful to reinstall them in their proper location.
12. Refill radiator.

Bowden Cables

Bowden cable adjustment should be made in the following manner:

1. With the cables attached to the control levers and the control knobs in the "up" (Chevelle) or full "left" (Chevrolet) position, pull on the cable sheaths (5 lbs. approximately) and attach the sheath clips to the proper brackets on the heater and defroster assembly.
2. Attach the cable wires to the heater and defroster assembly crank arms.

Control Panel

Control panel installation is shown in Figure 7.

Fan Switch

Replacement

1. Remove control assembly-to-instrument panel reinforcement attaching screws and push the control assembly toward the front of the vehicle and down.
2. Remove the two switch attaching screws and the electrical connector.
3. Replace switch, screws, and electrical connector.
4. Place control assembly into instrument panel and replace attaching screws.

Resistor

The resistor assembly is attached to the heater distributor assembly. It should be replaced if low or medium blower speed is inoperative.

Temperature Door Cam Lock (Chevelle only)

The temperature cam lock device may be adjusted as follows:

Loosen the two attaching screws. Place the cam in the closed position and insert a pin in the holes provided to lock it in this position. Turn the entire assembly toward the closed position and hold firmly while tightening the two attaching screws. Remove the locking pin. (See Figure 8).

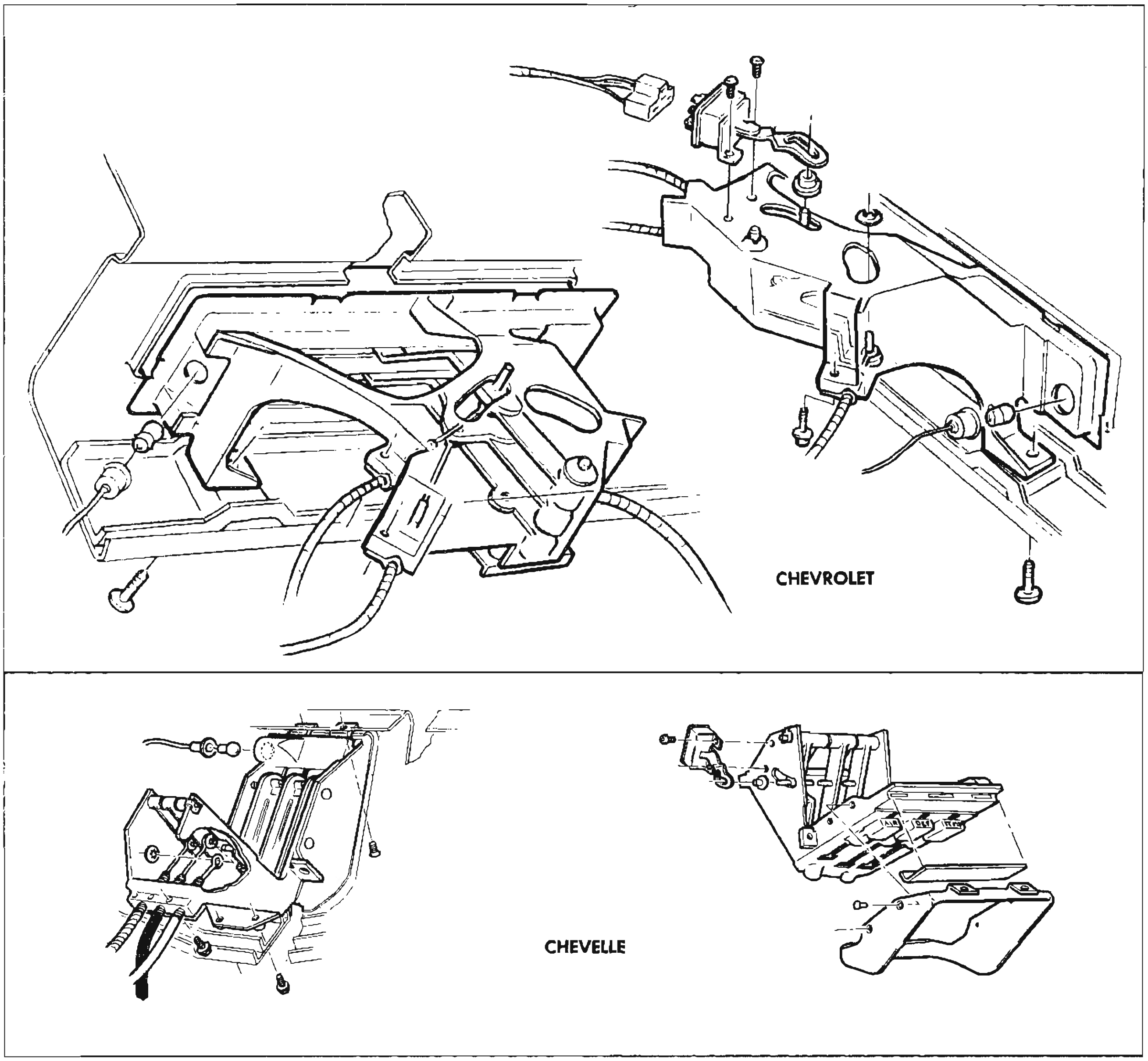


Fig. 7—Control Assembly Installation

CHEVY II

Heater Assembly

Removal (Fig. 9)

1. Drain radiator.
2. From within engine compartment;
   a. Remove heater hoses from heater inlet and outlet connections.
   b. Remove three nuts around blower motor attaching heater assembly to dash panel.
3. From within vehicle:
   a. Remove glove box and glove box door.
   b. Remove screw attaching distributor bracket to dash.
   c. Remove the screw attaching case bracket to the adapter assembly bracket.
   d. Carefully detach heater assembly from dash panel and adapter assembly and lower it toward floor of vehicle.
   e. Disconnect all bowden cable connections, the wiring connector and the defroster hoses.
4. Remove the heater assembly from the vehicle.

Core Replacement

1. With the heater assembly removed from the vehicle, remove the screws attaching the core cover to the heater assembly.
2. Remove the core mounting screws and remove the core from the assembly.
3. Replace with a new core and replace the core cover.

Installation

1. Be sure the adapter seal and blower motor seal are in place and set into place beneath the instrument panel.
2. Attach all bowden cables, defroster hoses and the wiring connector.
3. Set heater assembly into place and install all attaching nuts and screws.
4. Attach inlet and outlet hoses.
5. Replace glove box and glove box door.
6. Refill cooling system.

Blower Motor

Replacement

1. Remove the five screws attaching the motor and blower to the heater assembly.
2. Remove the retainer attaching blower to the motor shaft.
3. Replace blower on new motor assembly, balance and reinstall into heater assembly.

Fan Control

Replacement

1. Remove glove box and glove box door.
2. Disconnect the air control bowden cable at the heater.
3. Remove the cable handle, nut and bezel and disconnect the switch wires.
4. Pull the cable and switch forward through the dash panel.

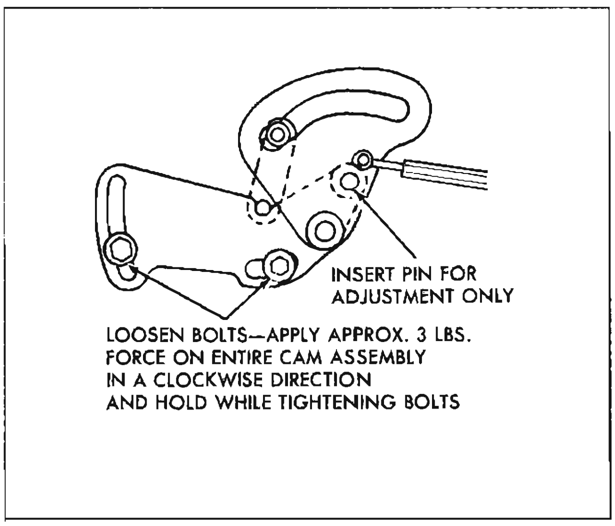


Fig. 8—Temp Door Cam Adjustment (Chevelle)

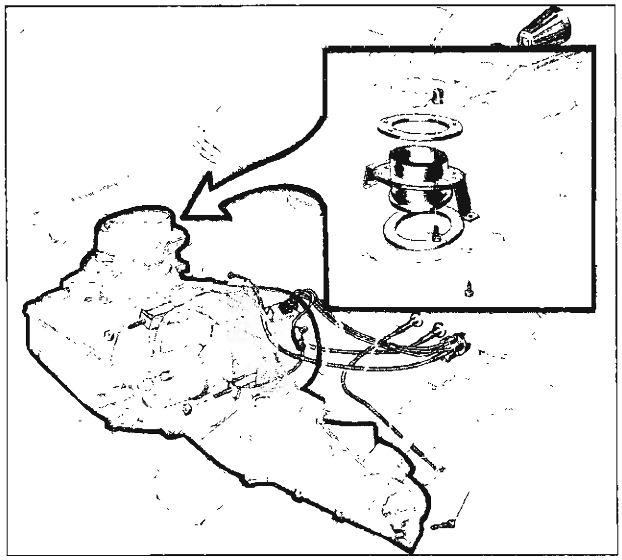


Fig. 9—Heater Components Removal

5. Replace with a new cable and switch assembly and reassemble.

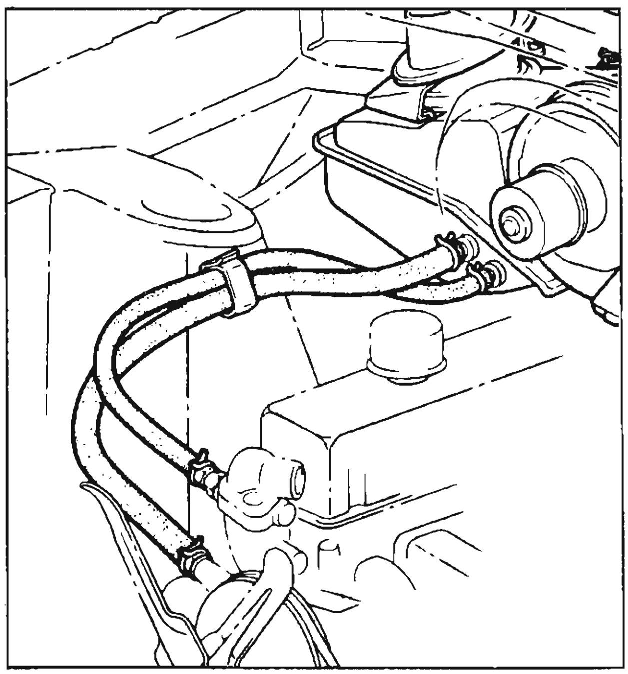


Fig. 10—Heater Hose Routing—Chevy II

AIR CONDITIONING

INDEX

GENERAL DESCRIPTION

Three air conditioning systems are covered in this section. They are:

1. The Four-Season Air Conditioning System (Chevrolet and Chevelle).
2. The Custom Air Conditioning System (Chevrolet, Chevelle and Chevy II).
3. The All-Weather Air Conditioning System (Chevy II).

Underhood components (that is, the compressor, condenser and receiver-dehydrator) are much the same in type, location and method of attachment on all of the above systems. The six-cylinder reciprocating compressor is bracket-mounted to the engine and belt driven from the crankshaft pulley. The condenser is mounted ahead of the engine cooling radiator and the receiver-dehydrator is mounted in the refrigerant line downstream of the condenser. All cooling system components are connected by means of flexible refrigerant lines.

Evaporator size and location differ from system to system as do methods of temperature control and air supply and distribution.

FOUR-SEASON SYSTEM

The Four-Season system is used in the Chevrolet and Chevelle vehicles and may be identified by the fact that it uses a suction throttling valve as a control.

Both the heating and cooling functions are performed by this system. Air entering the vehicle must pass through the cooling unit (evaporator) and through (or around) the heating unit, in that order, and the system is thus referred to as a "reheat" system.

The evaporator provides maximum cooling of the air passing through the core when the air conditioning system is calling for cooling. The suction throttling valve acts in the system only to control the evaporator pressure so that minimum possible temperature is achieved without core freeze-up. The Suction Throttling Valve is preset and has no manual control. A manually operated (by means of the Temperature control lever) vacuum control raises the valve setting to provide a higher evaporator pressure to prevent evaporator core freeze-up at higher altitudes.

The heater core will be hot at all times since no water valve is present in the system. A cam-lock device assures positive closing of the Temperature door when heating is not required.

System operation is as follows (See Figures 12 and 13): Air, either outside air, recirculated air or a mixture enters the system and is forced through the system by the blower. As the air passes through the evaporator core, it receives maximum cooling if the air conditioning controls are calling for cooling. After leaving the evaporator, the air enters the Heater and Air Conditioner Selector Duct Assembly where, by means of manually operated diverter doors, it is caused to pass through or to bypass the heater core in the proportions necessary to provide the desired outlet temperature. Conditioned airflow then enters the vehicle through either the floor distributor duct or the dash outlets. Remember that the

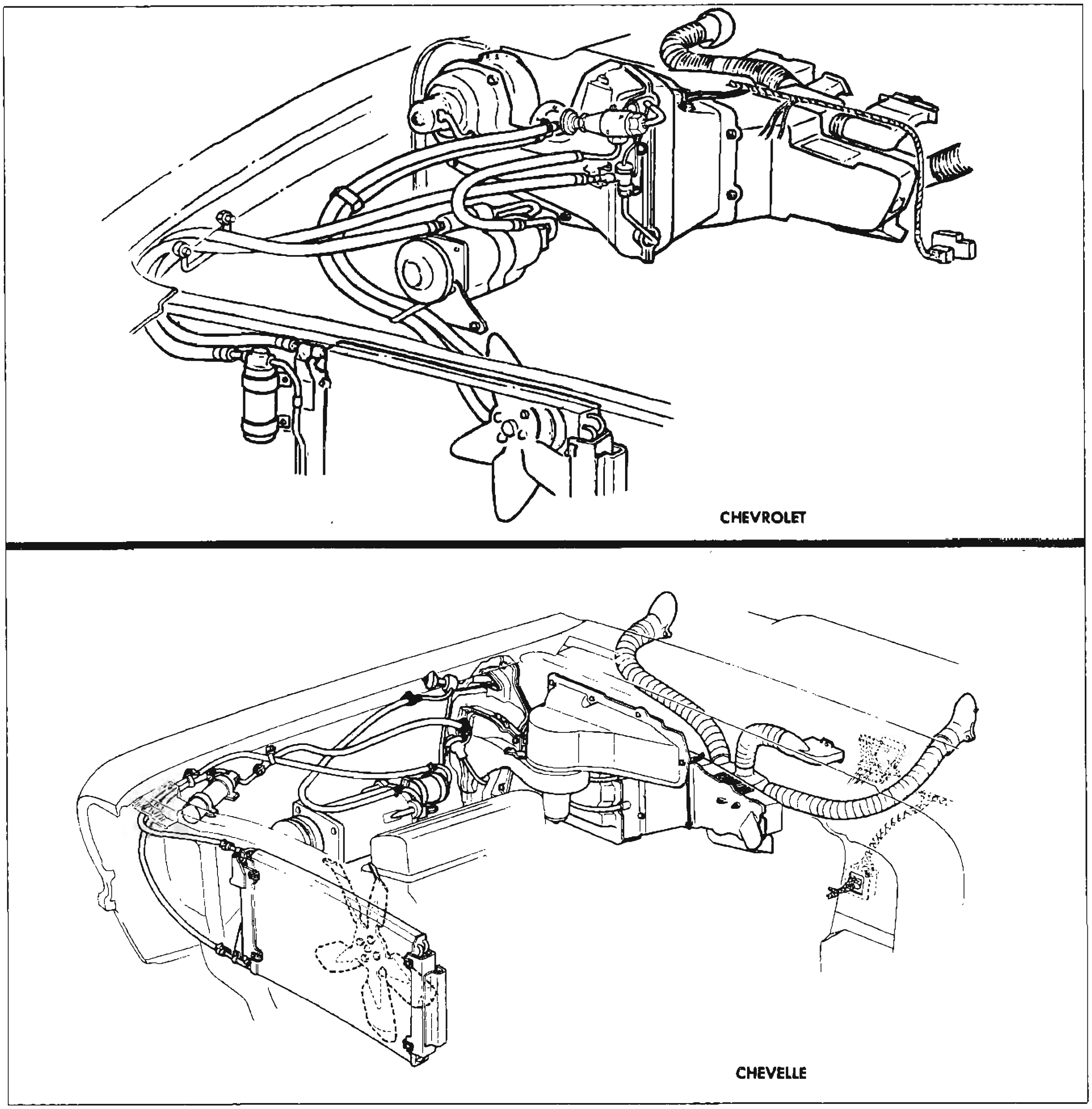


Fig. 11—Four-Season System Components

heater core will be hot at all times. When, during cooling operations, the air is cooled by the evaporator to below comfort level, it is then warmed by the heater to the desired temperature; during "heating only" operations the evaporator will not be in operation and ambient air will be warmed to the desired level in the same manner. Linkage is so designed that when the system controls are calling for heat, air will enter the vehicle through the floor distributor duct, and when the system controls call for cooling, air will enter through the three dash outlets. The side dash outlets may be rotated to provide either soft, diffused, airflow or spot cooling. Rotate half way to shut off airflow. The barrel type outlet in the center of the dash will direct air in any direction or, if desired, shut it off.

CONTROLS

Four-Season System (Chevrolet)

Full control of the Four-Season System is obtained through the use of a single control panel (fig. 14). The control knobs make use of bowden cables to activate the

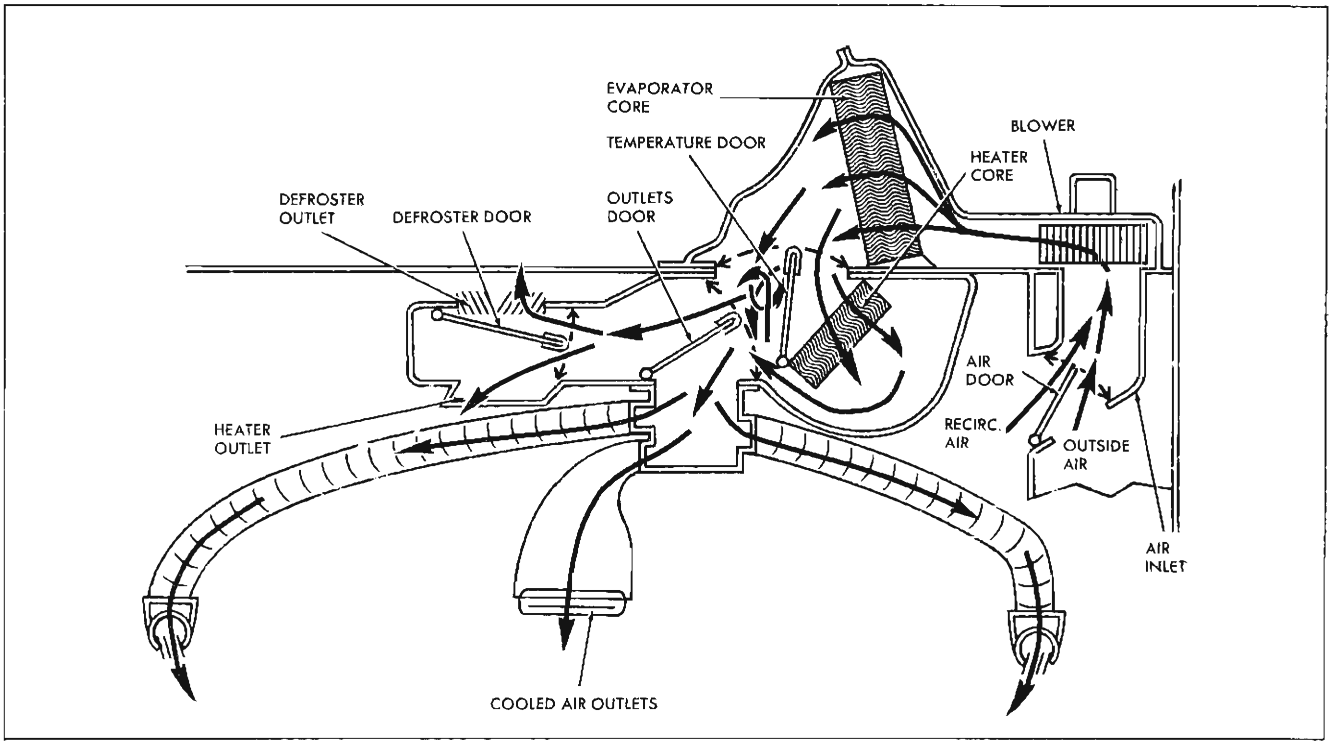


Fig. 12—Airflow Schematic—Chevrolet Four-Season System

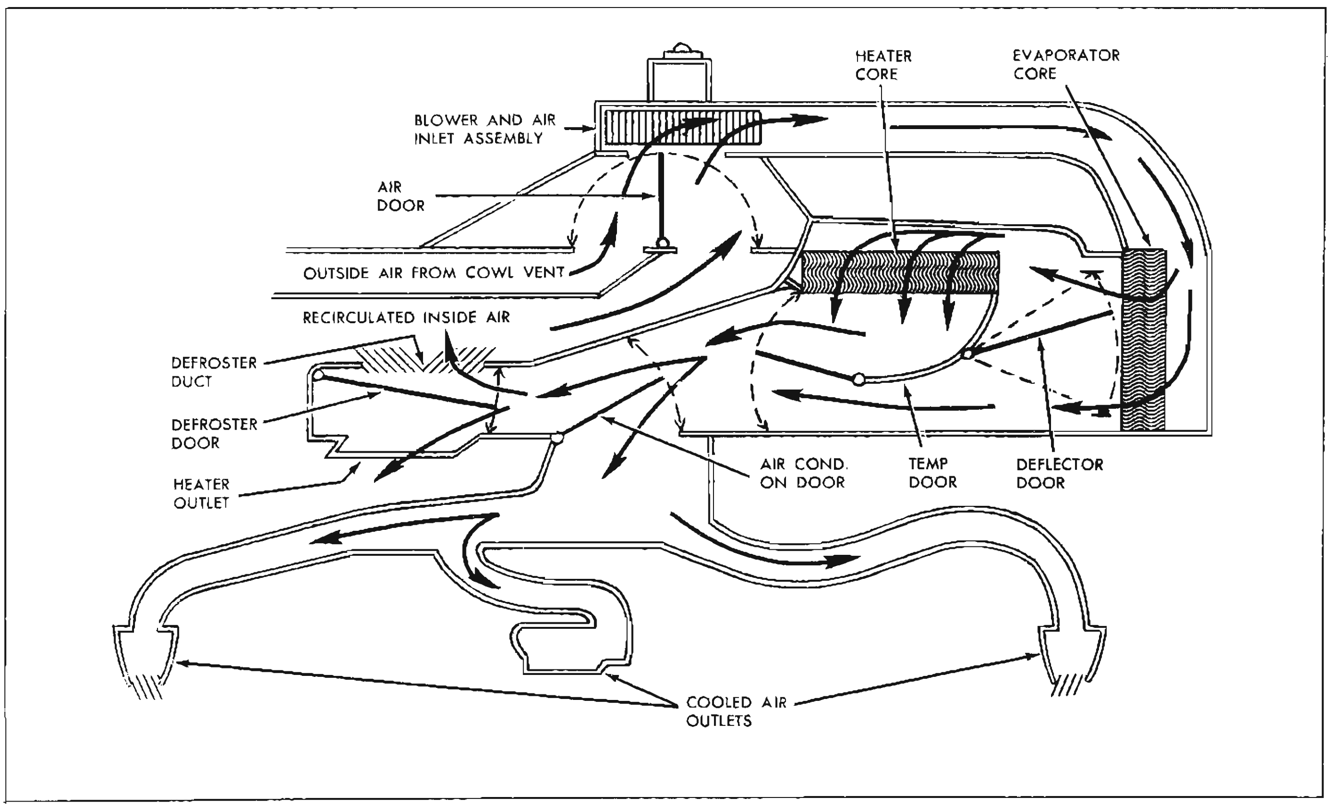


Fig. 13—Airflow Schematic—Chevelle Four-Season System

various doors and switches necessary for system operation. Therefore, control adjustment is a matter of properly setting these bowden cables. The following paragraphs explain each control.

"Outlet" Knob

This knob actuates an air diverter door within the duct assembly which routes airflow when fully right (HEATER) to the floor distributor ducts (for heater operation) or when fully left (A/C) to the dash outlets (for cooling operation).

Setting this knob at or to the left of the horizontal mark beside the word OUTLET, will activate the compressor clutch switch and set the cooling portion of the system in operation providing the FAN switch is turned on.

When the knob is moved fully toward the right (heating position) the AIR control knob will automatically move to the outside air position.

Temperature Knob

The "TEMPERATURE" knob, through its bowden cable, actuates the door which controls outlet temperature. Since the heater core in this system is hot at all times, this door is necessary to shut off the heat when not wanted as well as to permit mixing of hot and cool air to provide the desired conditioned air outlet temperature, whether during heating or cooling operations. A cam lock device assures positive closing of this door. As the door opens, more and more heated air is mixed with the air which is bypassing the heater core. This bypass air may be either ambient air (if the system controls are calling for heating only), or air which received maximum cooling as it passed through the evaporator (if the system controls are set so that the compressor is operating). In either case the air will be tempered as desired through the movement of the Temperature knob.

A cam, which moves as the Temperature diverter door is moved, acts to open and close a vacuum valve which supplies vacuum to the STV vacuum head. In operation, the first movement of Temperature knob will close the vacuum valve. Cutting off the vacuum to the STV in this manner will result in a 3 lb. rise in evaporator pressure, lowering its cooling capacity at a time when, as evidenced by the heat being introduced into the airflow, full capacity is not needed. This is designed to prevent evaporator freeze-up when operating the system at elevations of 4000 feet and higher.

> **NOTE:** Owners should be instructed that, when operating at such altitudes, the Temperature knob should be moved from its closed position even though maximum cooling is desired.

Air Control Knob

When the control is properly adjusted, full left position ("INSIDE") will supply 100% recirculated inside air, and moving the knob to the word "OUTSIDE" will supply 100% outside air to the system. A vertical mark between "outside" and "inside" positions indicates the setting which will provide a mixture of outside and inside air. Knob movement controls a vacuum switch which in turn actuates a vacuum switch at the AIR door to control door positioning. The switch and its vacuum lines are illustrated in Figure 65.

Defroster

As the Air control knob is moved to the right from the "OUTSIDE" position toward the word DEFROSTER the diverter door within the distributor duct moves to send a portion of the airflow to the defroster ducts. Full "right" position of the AIR knob, as indicated on the panel, is the DE-ICE position which sends the total airflow to the defroster ducts.

Fan Switch

The fan switch controls the operation of the three speed blower motor.

Four-Season System (Chevelle)

Full control of the Four-Season System is obtained through the use of a single control panel, (Fig. 15). The control knobs, with the exception of the fan knob, make use of bowden cables to activate the various doors and switches necessary for system operation. Therefore,

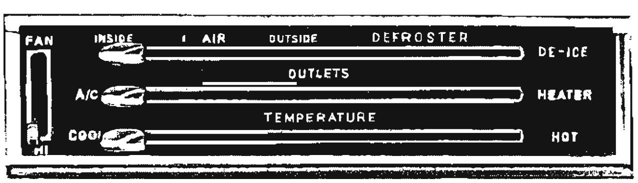


Fig. 14—Chevrolet Four-Season System Controls

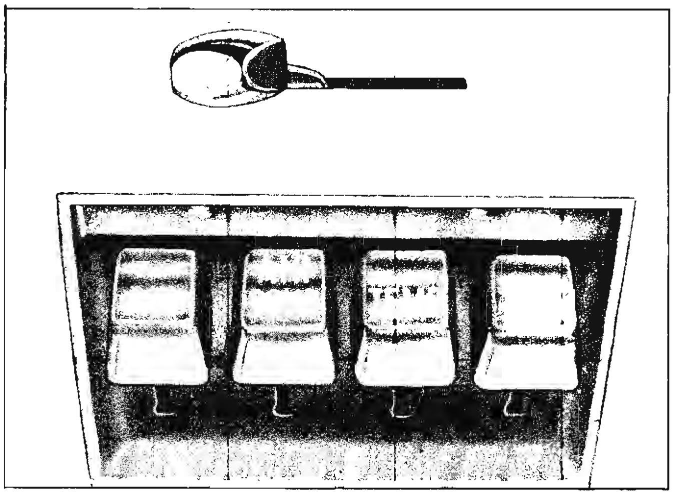


Fig. 15—Four-Season System Controls—Chevelle

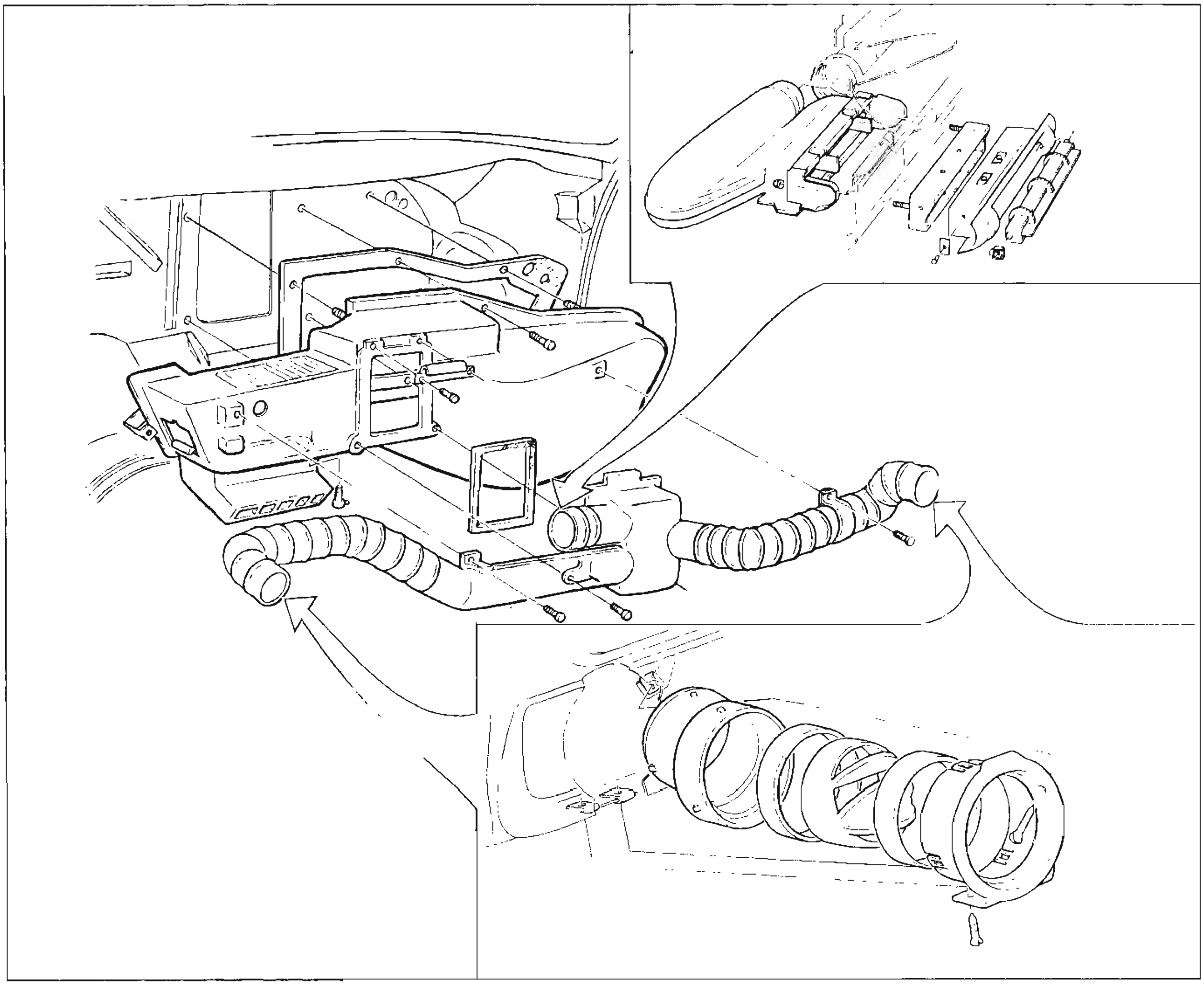


Fig. 16—Chevrolet Four-Season System Duct Linkage

control adjustment is a matter of properly setting these bowden cables. The following paragraphs explain each control.

"Air Cond" Knob

This knob actuates an air diverter door within the duct assembly which routes airflow when fully "up" to the floor distributor ducts (for heater operation) or when fully "down" to the dash outlets (for cooling operation).

The initial movement of this knob activates, through the diverter door crank lever, the compressor clutch switch which sets the air conditioning system in operation.

This knob also operates a second door called a deflector door by means of a link assembly. When the knob is fully "up" the deflector door is positioned to divert the major portion of the airflow through the heater core, bypassing just enough ambient air with which to temper the heater airflow as desired. As the knob is moved "down" this door is moved, with a snap action, so as to allow most of the airflow to bypass the heater core allowing just enough heated airflow to raise the temperature of the cooled airflow as desired.

"Temp" Knob

The TEMP control knob, through its bowden cable, actuates the door which controls heater output. Since the heater core in this system is hot at all times, this door is necessary to shut off the heat when not wanted as well as to permit mixing of hot and cool air to provide the desired heated air output. A cam lock device assures positive closing of this door. As the door opens, more and more heated air is mixed with the air which is bypassing the heater core. This bypass air may be either ambient air (if the AIR COND lever is fully "up"), or air which received maximum cooling as it passed through the evaporator (if the AIR COND lever is fully "down"). In either case the air will be tempered as desired through the movement of the TEMP lever.

A cam, which moves as the TEMP diverter door is

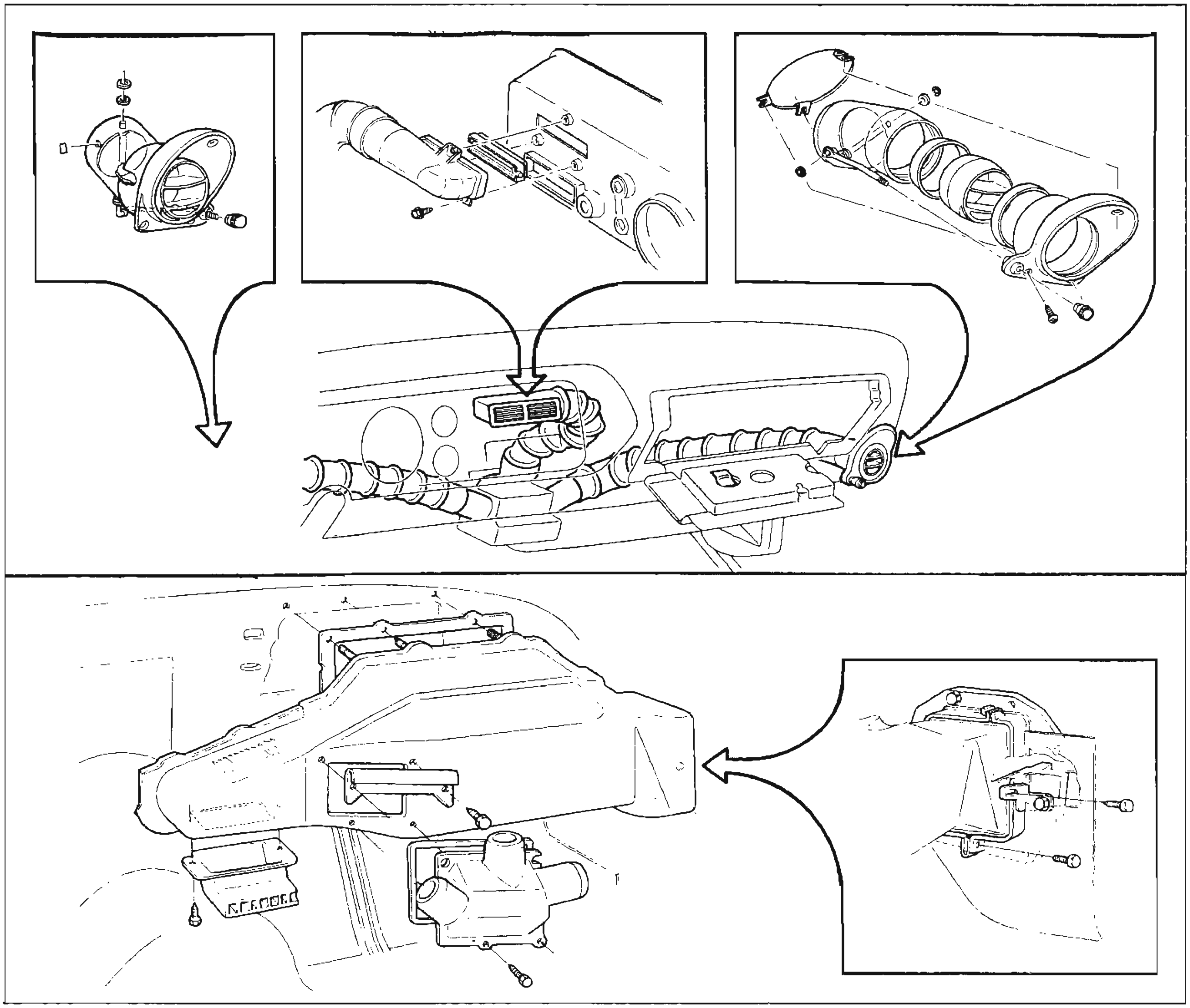


Fig. 17—Chevelle Four-Season System Duct

moved, acts to open and close a vacuum valve which supplies vacuum to the STV vacuum head. In operation, the first 5/16" of TEMP lever travel will close the vacuum valve. Cutting off the vacuum to the STV in this manner will result in a 3 lb. rise in evaporator pressure, lowering its cooling capacity at a time when, as evidenced by the heat being introduced into the airflow, full capacity is not needed. This is designed to prevent evaporator freeze-up when operating the system at elevations of 4000 feet and higher.

NOTE: Owners should be instructed that, when operating at such altitudes, the TEMP knob should be cracked open at least 1/2" even though maximum cooling is desired.

Air-Control Knob

The AIR control knob actuates the door within the blower assembly which chooses between recirculated air or outside air. When the lever is properly adjusted, full UP position will supply 100% recirculated inside air (for cooling operations during city driving) and full DOWN position will supply 100% outside air (for heating operations). A "detent" position built into the linkage supplies a mixture of inside and outside air (for use during most air conditioning operations).

CAUTION: When setting the control to the detent position it is necessary to start from the off (or up) position of the lever.

CUSTOM SYSTEM

A self-contained unit, the dealer installed Custom System operates on recirculated air only and entirely independent of the vehicle heater. This system is available on Chevrolet, Chevelle and Chevy II vehicles. Recirculated inside air is drawn into the unit, passed through the evaporator core and into the car through the adjustable outlets in the evaporator case. The entire unit mounts compactly beneath the dash. Temperature control is by means of a thermostatic switch.

The 10.8 cu. in. compressor used with the Custom System is internally identical to that used for the Four-Season system except for displacement. Underhood components are similar in placement to the Four-Season system.

Controls

Custom system controls are the three speed blower motor switch and the cooling knob which controls the setting of the thermostatic switch. Switch adjustment is covered elsewhere in this section. When operating this system the Heater must be fully off.

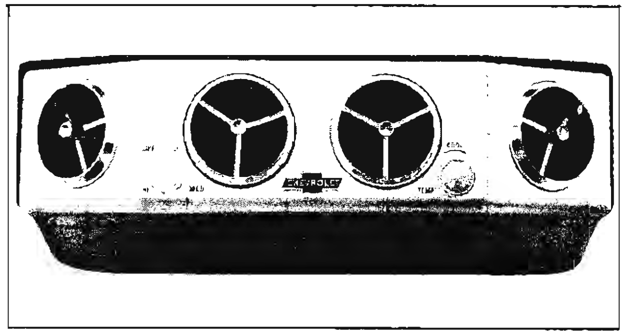


Fig. 18—Custom System Controls

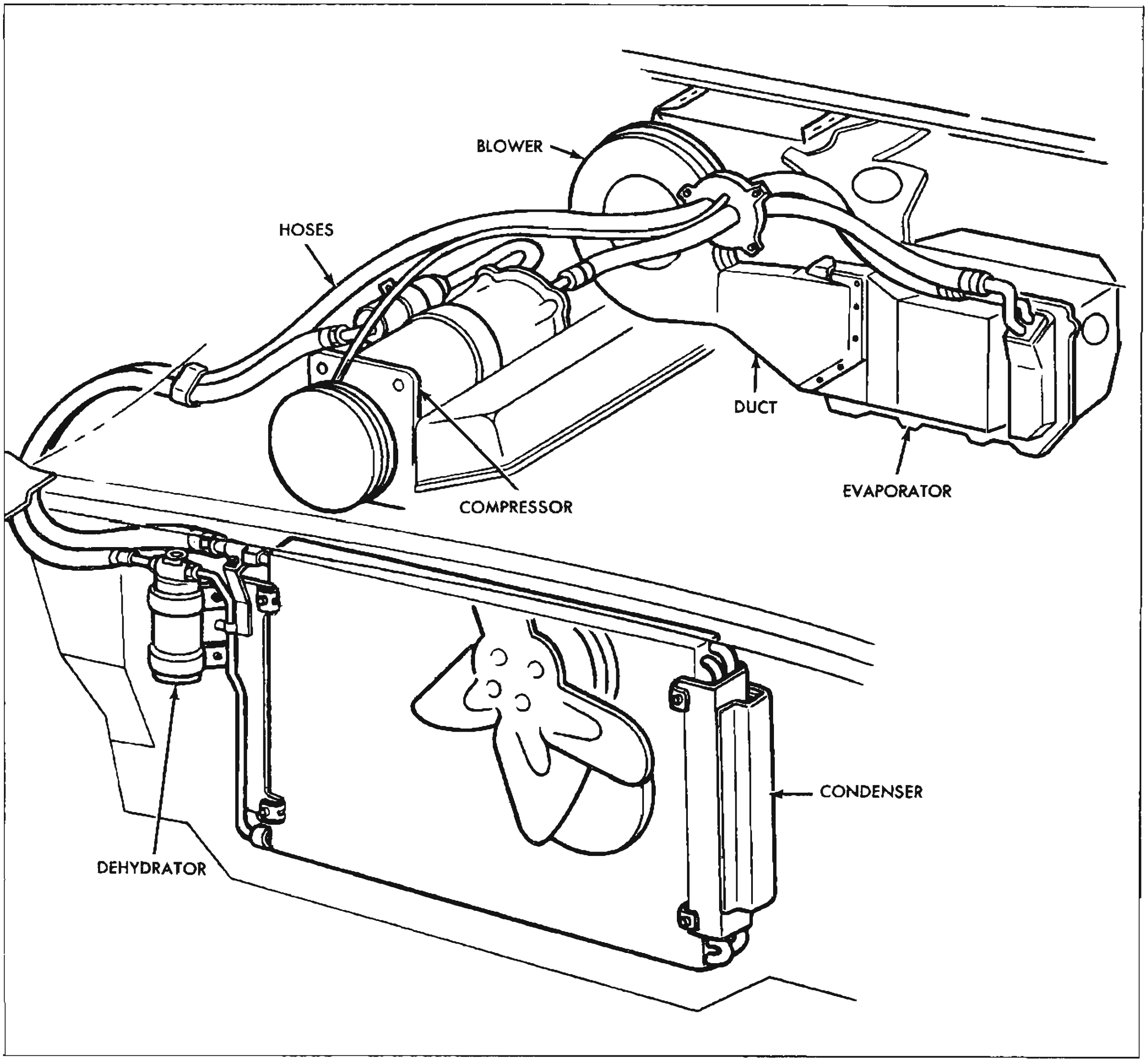


Fig. 19—Custom System Components (Chevrolet)

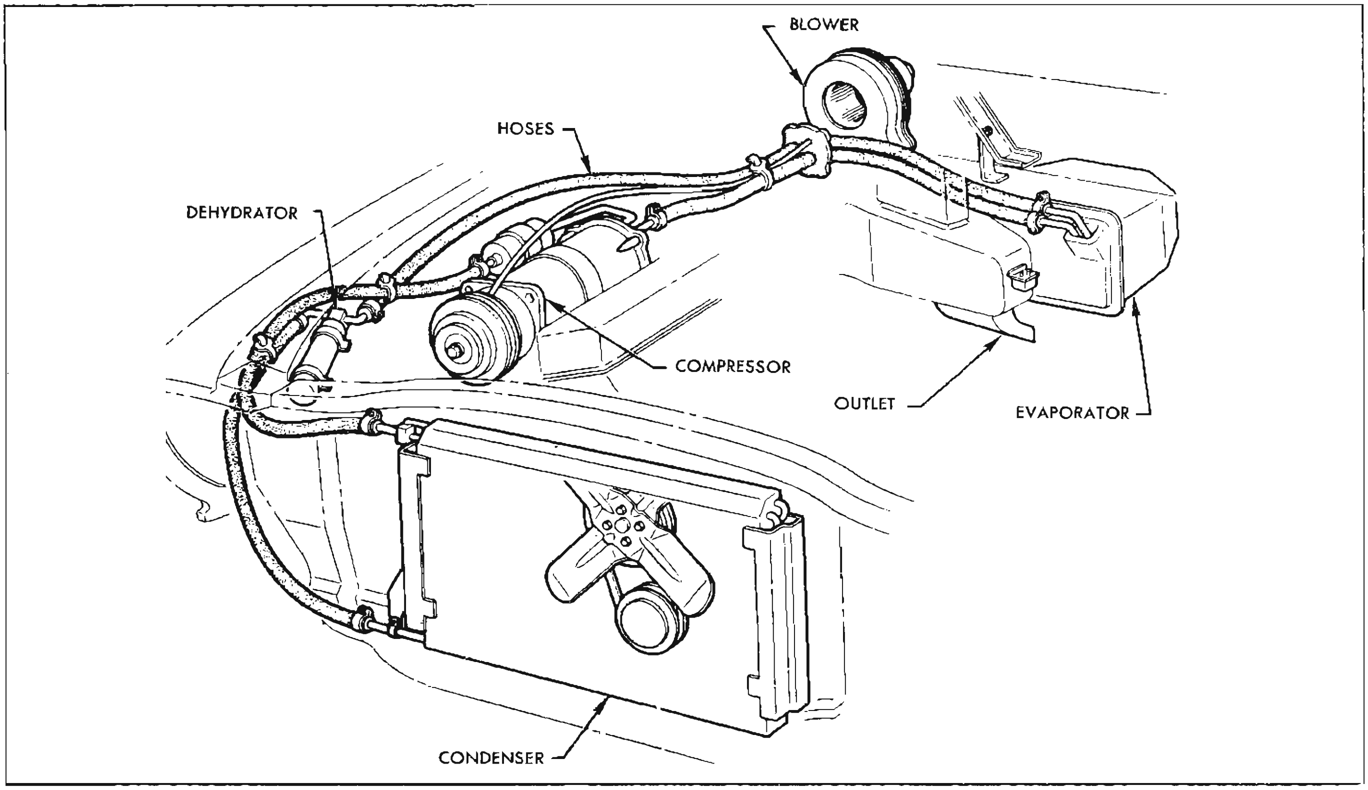


Fig. 20—Custom System Components (Chevelle)

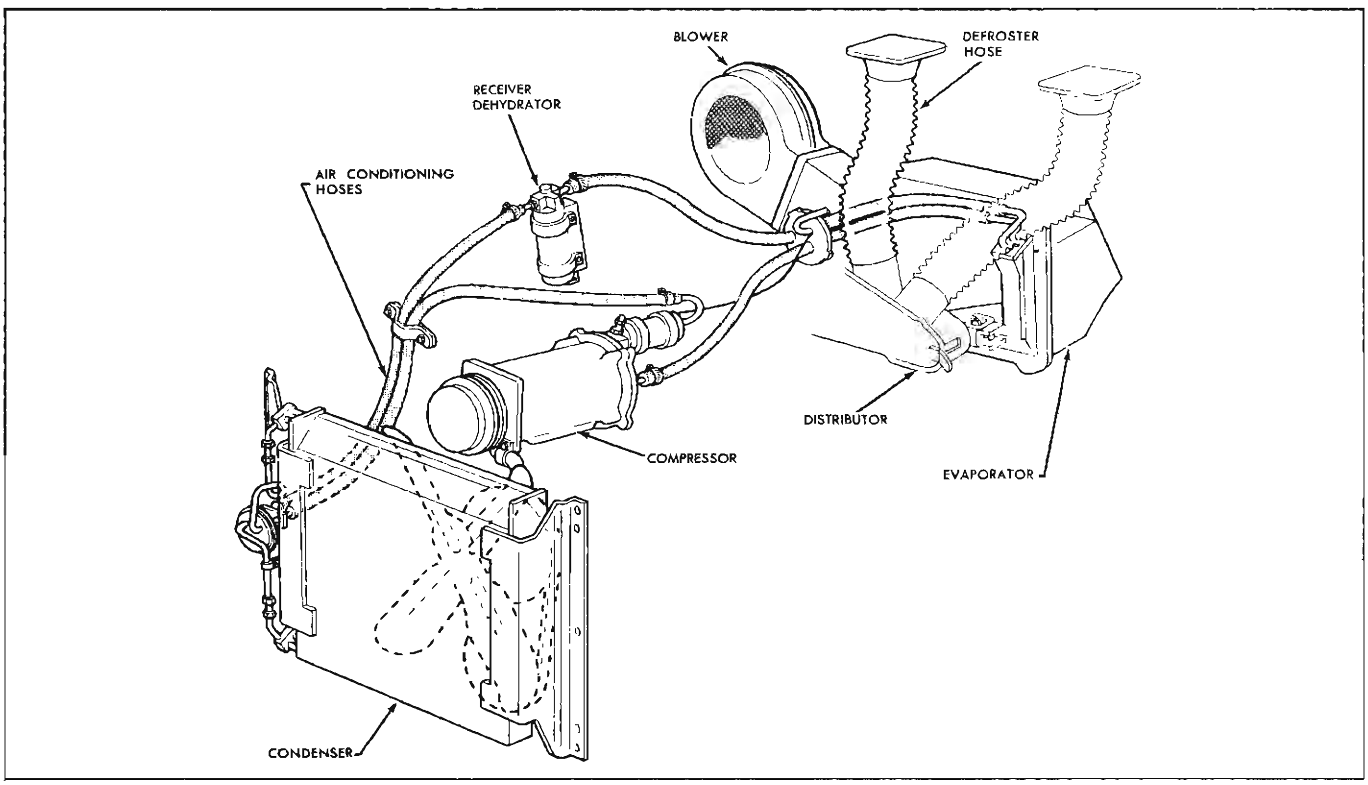


Fig. 21—Custom System Components (Chevy II)

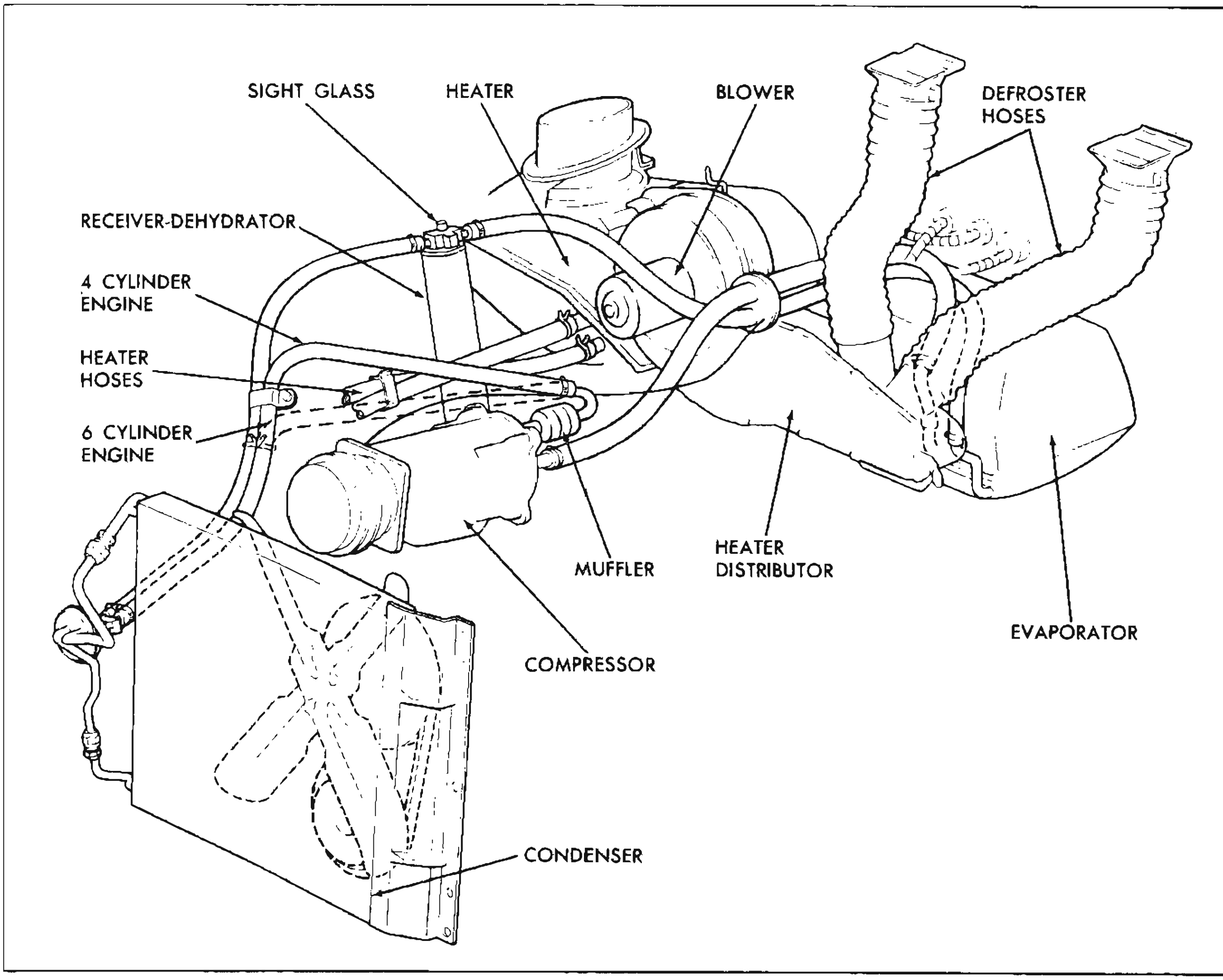


Fig. 22—All-Weather Chevy II Air Conditioning System

CHEVY II ALL-WEATHER SYSTEM

The Chevy II All-Weather Air Conditioning System, Figure 22, operates in conjunction with the heater to provide a complete air condition system operating on either outside air, recirculated air or a combination of both. The cooling unit attaches to the heater distributor and utilizes the heater blower. Several controls allow full use of either the heating or cooling features of the system. During marginal weather, it is possible to provide heated air at floor level and cooled air at breath level.

A schematic view of the air conditioning underdash components is provided in Figure 23 to aid in understanding airflow and control operation.

The evaporator assembly, located in the passenger compartment attached directly to the heater distributor, contains the evaporator core, expansion valve, thermostatic switch and the air conditioning "ON" knob. The thermostatic switch, utilized as the cooling control, feels the temperature of the cooled air leaving the evaporator core and turns the compressor on and off in accordance with cooling needs. Refrigerant lines connect the evaporator assembly to the other system components located in the engine compartment.

The six cylinder air conditioning compressor, completely field serviceable, is bracket-mounted to the engine and is belt driven from the crankshaft pulley. A muffler assembly, designed to eliminate compressor pulsations is an integral part of the compressor connector block. The condenser is mounted on the radiator support just ahead of the engine radiator. The receiver-dehydrator, with its sight glass, is located on the right fender skirt.

Controls

Control of the air conditioning system is achieved through the use of heater control knobs on the instrument panel as well as the two knobs located on the air conditioning unit itself (fig. 24).

Air Conditioning "ON" Knob

Labeled "Pull for AIR Cond.", this knob diverts airflow from the floor distributor and through the air conditioning unit. Initial movement of this knob also actuates a

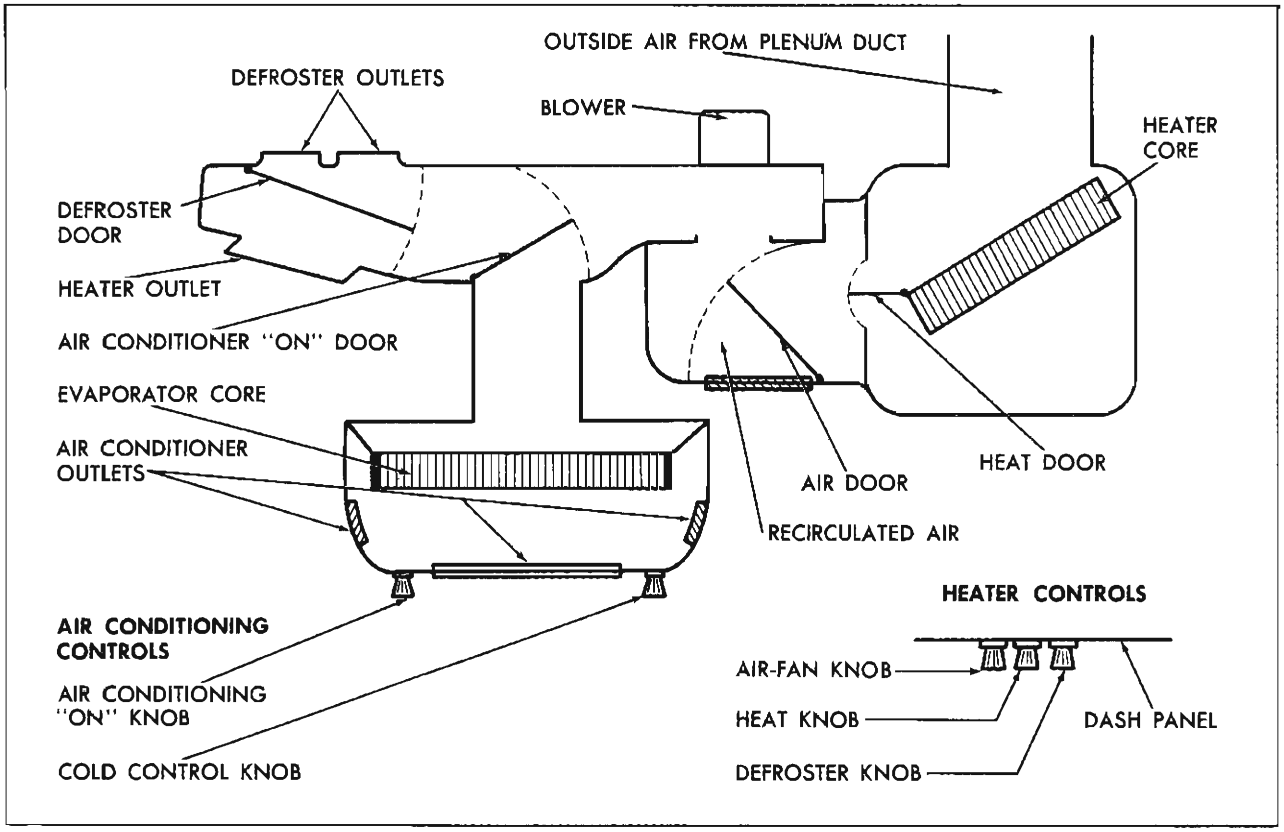


Fig. 23—Schematic of Underdash Components—Chevy II All-Weather System

switch, located at the damper door, which energizes the compressor clutch thus putting the system into operation and under the control of the thermostatic switch.

Temp-Cool Knob

This knob controls the thermostatic switch. Turn the knob clockwise for more cooling, counter-clockwise for less cooling.

Air-Pull Knob

This knob actuates the damper within the assembly which chooses between recirculated air or outside air. When the knob and bowden cable are fully adjusted, full "out" position will supply 100% outside air (for heater operation) to the system while full "in" position will provide 100% inside (recirculated) air for cooling operation during city driving to shut out dust and fumes. Recommended setting of this knob for most air conditioning operations is pulled about 1/4" "out". This will provide a mixture of recirculated air and outside air.

Fan Control Knob

The "air-pull" knob also rotates to operate the three-speed fan control.

Temp Knob

This knob operates the damper door which controls heater outlet temperature in the same manner as described in the heater section.

"Two-Level" Temperature Control

By pulling out the "Temp" knob to provide the desired temperature on the floor, pulling the "Pull for Air Cond." knob out halfway and the "Air-Pull" knob out fully and setting the "Temp-Cool" knob for the desired breath level temperature, "two-level" temperature control can be maintained. This is especially desirable during "marginal" weather conditions.

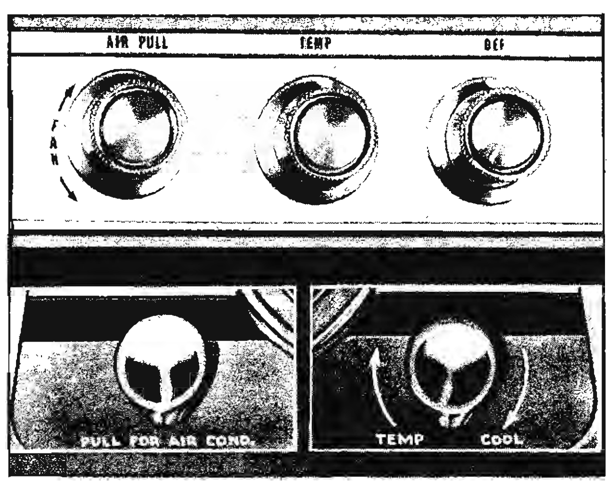


Fig. 24—Air Conditioning Controls—Chevy II All Weather

GENERAL INFORMATION

In any vocation or trade, there are established procedures and practices that have been developed after many years of experience. In addition, occupational hazards may be present that require the observation of certain precautions or use of special tools and equipment. Observing the procedures, practices and precautions of servicing refrigeration equipment will greatly reduce the possibilities of damage to the customers' equipment as well as virtually eliminate the element of hazard to the serviceman.

PRECAUTIONS IN HANDLING REFRIGERANT-12

Refrigerant-12 is transparent and colorless in both the gaseous and liquid state. It has a boiling point of 21.7°F below zero and, therefore, at all normal temperatures and pressures it will be a vapor. The vapor is heavier than air and is noninflammable, nonexplosive, nonpoisonous (except when in contact with an open flame) and noncorrosive (except when in contact with water). The following precautions in handling R-12 should be observed at all times.

- All refrigerant drums are shipped with a heavy metal screw cap. The purpose of the cap is to protect the valve and safety plug from damage. It is good practice to replace the cap after each use of the drum.
- If it is ever necessary to transport or carry a drum or can of refrigerant in a car, keep it in the luggage compartment. Refrigerant should not be exposed to the radiant heat from the sun for the resulting increase in pressure may cause the safety plug to release or the drum or can to burst.
- Drums or disposable cans should never be subjected to high temperature when adding refrigerant to the system. In most instances, heating the drum or can is required to raise the pressure in the container higher than the pressure in the system during the operation. It would be unwise to place the drum on a gas stove, radiator or use a blow torch while preparing for the charging operation, for a serious accident can result. Don't depend on the safety plug - many drums have burst when the safety plug failed. Remember, pressure can be a powerful force. A bucket of warm water, not over. 125°F, or warm wet rags around the container is all the heat that is required.
- Do not weld or steam clean on or near the system. Welding or steam cleaning can result in a dangerous pressure buildup in the system.
- When filling a small drum from a large one, never fill the drum completely. Space should always be allowed above the liquid for expansion. If the drum were completely full and the temperature was increased, hydraulic pressure with its tremendous force would result.
- Discharging large quantities of R-12 into a room can usually be done safely as the vapor would produce no ill effects, however, in the event of an accidental rapid discharge of the system it is recommended that inhalation of large quantities of R-12 be avoided. This caution is especially important if the area contains a flame producing device such as a gas heater. While R-12 normally is nonpoisonous, heavy concentrations of it in contact with a live flame will produce a toxic gas. The same gas will also attack all bright metal surfaces.
- Protection of the eyes is of vital importance! When working around a refrigerating system, an accident may cause liquid refrigerant to hit the face. <u>If the eyes are protected with goggles or glasses, no serious damage can result. Just remember, any R-12 liquid that you can touch or that touches you is at least 21.7°F. below zero.</u> The eyeballs can't take much of this temperature. If R-12 liquid should strike the eyeballs, here is what to do:

1. Keep calm.
2. Do not rub the eyes! Splash the affected area with quantities of cold water to gradually get the temperature above the freezing point. The use of mineral, cod liver or an antiseptic oil is important in providing a protective film to reduce the possibility of infection.
3. As soon as possible, call or consult an eye specialist for immediate and future treatment.

REMEMBER - "An ounce of prevention is worth a pound of cure."

PRECAUTIONS IN HANDLING REFRIGERANT LINES

- All metal tubing lines should be free of kinks, because of the restriction that kinks will offer to the flow of refrigerant. The refrigeration capacity of the entire system can be greatly reduced by a single kink.
- The flexible hose lines should never be bent to a radius of less than 10 times the diameter of the hose.
- The flexible hose lines should never be allowed to come within a distance of 2-1/2" of the exhaust manifold.

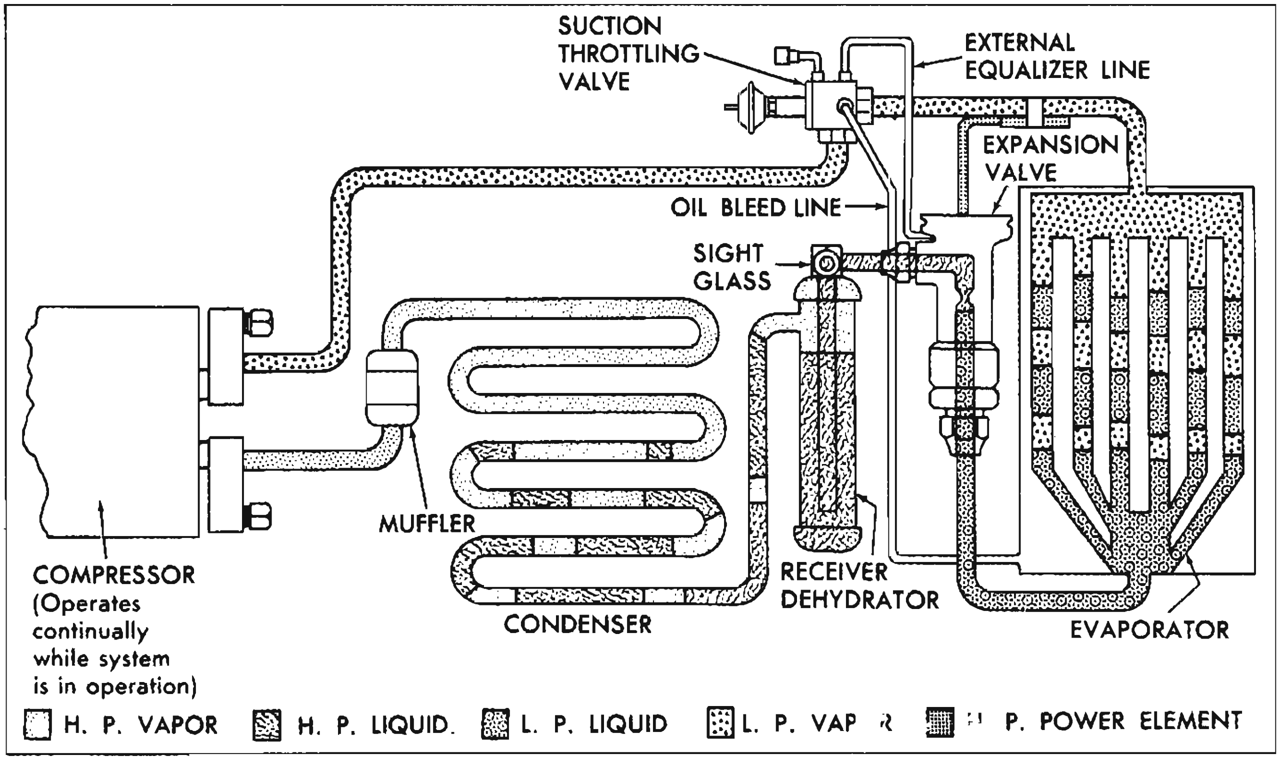


Fig. 25—Cycle of Operation—Four-Season System

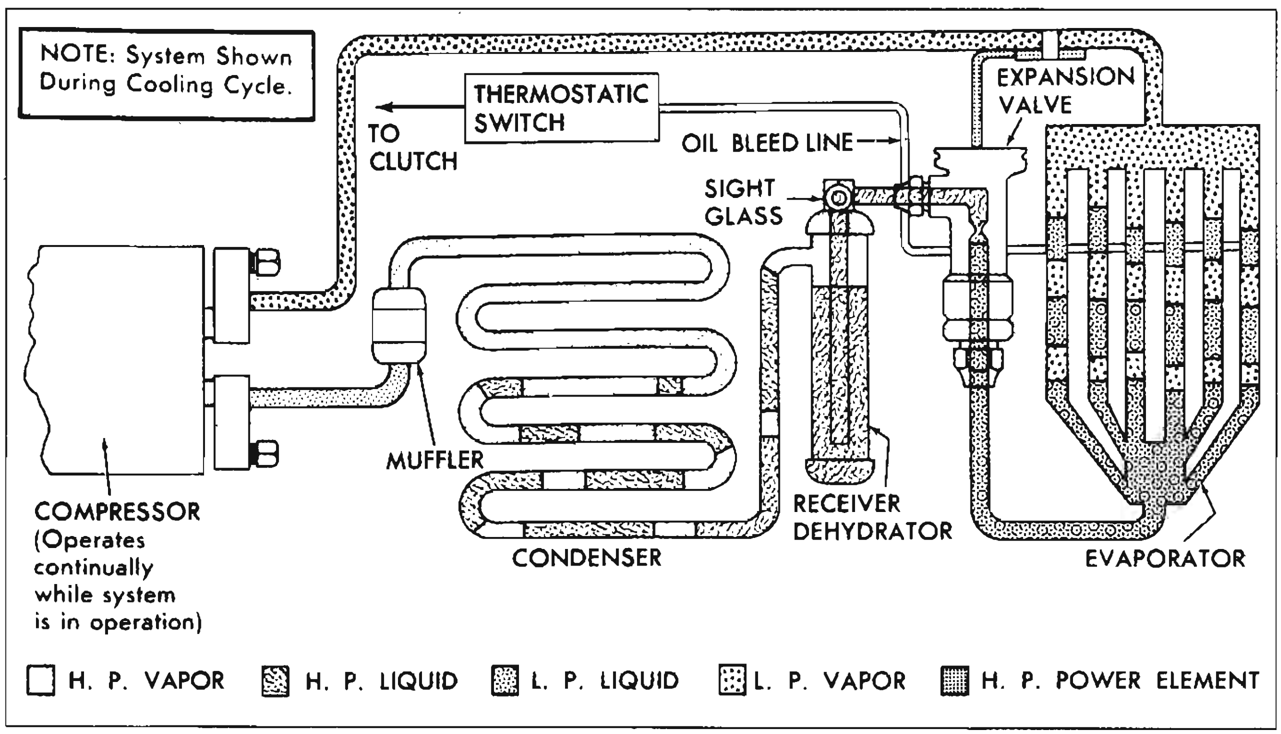


Fig. 26—Cycle of Operation—Custom and Chevy II All-Weather System

- Flexible hose lines should be inspected at least once a year for leaks or brittleness. If found brittle or leaking they should be replaced with new lines.
- Use only sealed lines from parts stock.
- When disconnecting any fitting in the refrigeration system, the system must first be discharged of all refrigerant. However, proceed very cautiously regardless of gauge readings. Open very slowly, keeping face and hands away so that no injury can occur if there happens to be liquid refrigerant in the line. If pressure is noticed when fitting is loosened, allow it to bleed off very slowly.

  CAUTION: Always wear safety goggles when opening refrigerant lines.

- In the event any line is opened to atmosphere, it should be immediately capped to prevent entrance of moisture and dirt.
- The use of the proper wrenches when making connections on "O" ring fittings is important. The use of improper wrenches may damage the connection. The opposing fitting should always be backed up with a wrench to prevent distortion of connecting lines or components. When connecting the flexible hose connections it is important that the swagged fitting and the flare nut, as well as the coupling to which it is attached, be held at the same time using three different wrenches to prevent turning the fitting and damaging the ground seat.
- "O" rings and seats must be in perfect condition. The slightest burr or piece of dirt may cause a leak.
- Sealing beads on hose clamp connections must be free of nicks and scratches to assure a perfect seal.

MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM

The metal internal parts of the Chevrolet refrigeration system and the refrigerant and oil contained in the system are designed to remain in a state of chemical stability as long as pure R-12 plus refrigeration oil is used in the system.

However, when abnormal amounts of foreign materials, such as dirt, air or moisture are allowed to enter the system, the chemical stability may be upset. When accelerated by heat, these contaminates may form acids and sludge and eventually cause the breakdown of components within the system. In addition, contaminates may affect the temperature-pressure relationship of R-12, resulting in improper operating temperature and pressures and decreased efficiency of the system.

Fig. 27—System Contaminants

The following general practices should be observed to insure chemical stability in the system.

- Whenever it becomes necessary to disconnect a refrigerant or gauge line, it should be immediately capped. Capping the tubing will also prevent dirt and foreign matter from entering.
- Tools should be kept clean and dry. This also includes the gauge set and replacement parts.
- When adding oil, the container should be exceptionally clean and dry due to the fact that the refrigeration oil in the container is as moisture-free as it is possible to make it. Therefore, it will quickly absorb any moisture with which it comes in contact. For this same reason the oil container should not be opened until ready for use and then it should be capped immediately after use.
- When it is necessary to open a system, have everything you will need ready and handy so that as little time as possible will be required to perform the operation. Don't leave the system open any longer than is necessary.
- Finally, after the operation has been completed and the system sealed again, air and moisture should be evacuated from the system before recharging.

GAUGE SET

The gauge set (fig. 28) is used when purging, evacuating, charging or diagnosing trouble in the system. The gauge at the left is known as the low pressure gauge. The face is graduated into pounds of pressure and, in the opposite direction, in inches of vacuum. This is the gauge that should always be used in checking pressures on the low pressure side of the system. When all parts of the system are functioning properly the refrigerant pressure on the low pressure side never falls below 0 pounds pressure. However, several abnormal conditions can occur that will cause the low pressure to fall into a partial vacuum. Therefore, a low pressure gauge is required.

The high pressure gauge is used for checking pressures on the high pressure side of the system.

The connection at the left is for attaching the low pressure gauge line and the one at the right the high pressure gauge line. The center connector is common to both and is for the purpose of attaching a line for adding refrigerant, discharging refrigerant, evacuating the system and other uses. When not required, this line or connection should be capped.

> **NOTE:** Gauge fitting connections should be installed hand tight only and the connections leak tested before proceeding.

The hand shutoff valves on the gauge manifold do not control the opening or closing off of pressure to the gauges. They merely close each opening to the center connector and to each other. During most diagnosing and service operation, the valves must be closed. The only occasion for opening both at the same time would be to bypass refrigerant vapor from the high pressure to the low pressure side of the system, or in evacuating both sides of the system.

J-8393 CHARGING STATION

The J-8393 Charging Station is a portable assembly of a vacuum pump, refrigerant supply, gauges, valves, and most important, a five (5) pound metering refrigerant charging cylinder. The use of a charging cylinder eliminates the need for scales, hot water pails, etc.

The chief advantage of this unit is savings. A very definite savings in refrigerant and time can be obtained by using this unit. Since the refrigerant is metered into the system by volume, the correct amount may be added to the system and charged to the customer. This, coupled with the fact that the unit remains ''plumbed'' at all times and thus eliminates loss of refrigerant in purging of lines and hooking-up, combines to enable the operator to get full use of all refrigerant purchased by the dealership.

All evacuation and charging equipment is hooked together in a compact portable unit (fig. 29) which nearly anyone can use to do an adequate job of servicing a car air conditioner. It brings air conditioning service down to the basic problem of hooking on two hoses, and manipulating clearly labeled valves.

This will tend to insure that the job will be done without skipping operations. As a result, you can expect to save time and get higher quality work, less chance of an over or undercharge, or comeback.

The pump mount is such that the dealer may use his own vacuum pump. The gauges and manifold are in common use. Thus a current air conditioning dealer can use the equipment on hand and avoid duplication.

LEAK TESTING THE SYSTEM

Whenever a refrigerant leak is suspected in the system or a service operation performed which results in disturbing lines or connections, it is advisable to test for leaks. Common sense should be the governing factor in performing any leak test, since the necessity and extent of any such test will, in general, depend upon the nature of the complaint and the type of service performed on the system. It is better to test and be sure, if in doubt, than to risk the possibility of having to do the job over again.

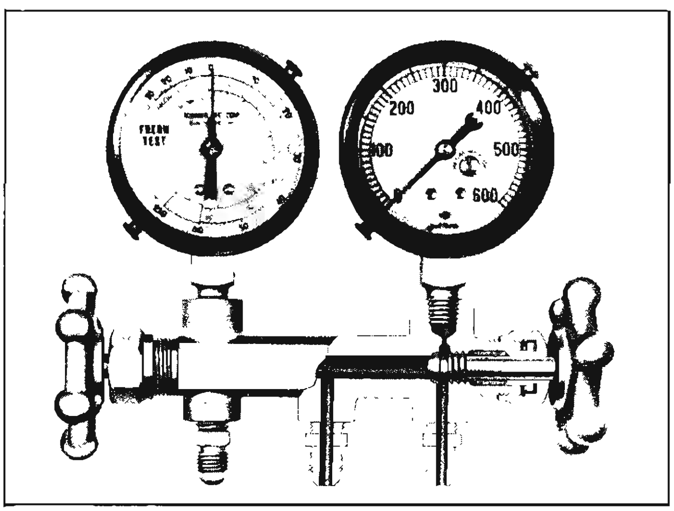


Fig. 28—Gauge Set

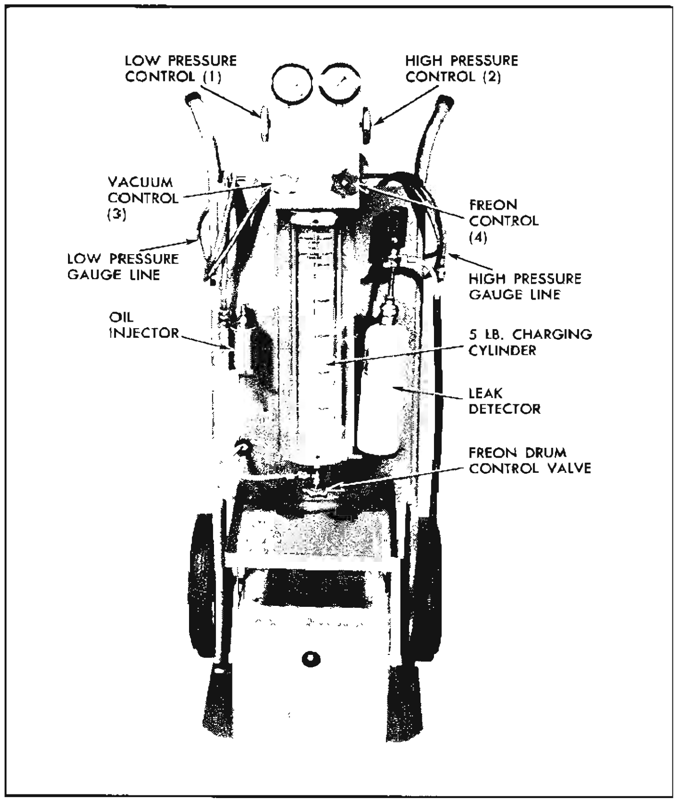


Fig. 29—J-8393 Charging Station

Leak Detector

Tool J-6084 (fig. 30) is a propane gas-burning torch which is used to locate a leak in any part of the system. Refrigerant gas drawn into the sampling tube attached to the torch will cause the torch flame to change color in proportion to the size of the leak. Propane gas fuel cylinders used with the torch are readily available commercially throughout the country.

CAUTION: Do not use lighted detector in any place where combustible or explosive gases, dusts or vapors may be present.

Operating Detector

1. Open control valve only until a low hiss of gas is heard, then light gas at opening in chimney.
2. Adjust flame until desired volume is obtained. This is most satisfactory when blue flame is approximately 3/8" above reactor plate. The reaction plate will quickly heat to a cherry red.
3. Explore for leaks by moving the end of the sampling hose around possible leak points in system. Do not pinch or kink hose.

NOTE: Since R-12 is heavier than air, it is good practice to place open end of sampling tube immediately below point being tested, particularly in cases of small leaks.

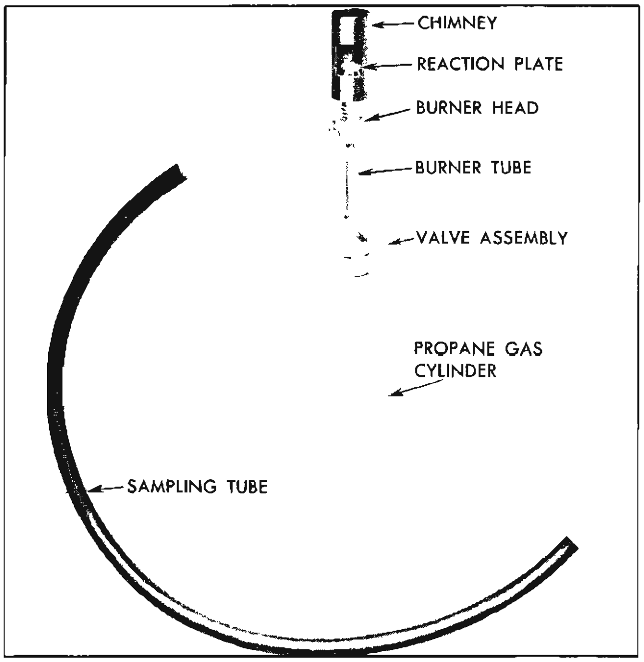


Fig. 30—Leak Detector

CAUTION: Do not breathe the fumes that are produced by the burning of R-12 gas in the detector flame, since such fumes can be toxic in large concentrations of R-12.

4. Watch for color changes. The color of the flame which passes through the reaction plate will change to yellow when sampling hose draws in very small leaks of R-12. Large leaks will be indicated by a change in color to a vivid purplish-blue. When the sampling hose passes the leak, the flame will clear to an almost colorless pale-blue again. If the flame remains yellow when unit is removed from leak, insufficient air is being drawn in or the reaction plate is dirty.

   NOTE: A refrigerant leak in the high pressure side of the system may be more easily detected when, if possible, the system is in operation. A leak on the low pressure side may be most easily detected after the engine has been shut off for several minutes to allow system pressures to equalize. This particularly applies to the front seal.

VACUUM PUMP

A vacuum pump should be used for evacuating air and moisture from the air conditioning system.

Vacuum pump, Tool J-5428, (fig. 31) is available for this purpose. It is used as a component part of the Charging Station J-8393, described previously. The following precautions should be observed relative to the operation and maintenance of this pump.

- Make sure dust cap on discharge outlet of vacuum pump is removed before operating.
- Keep all openings capped when not in use to avoid moisture being drawn into the system.

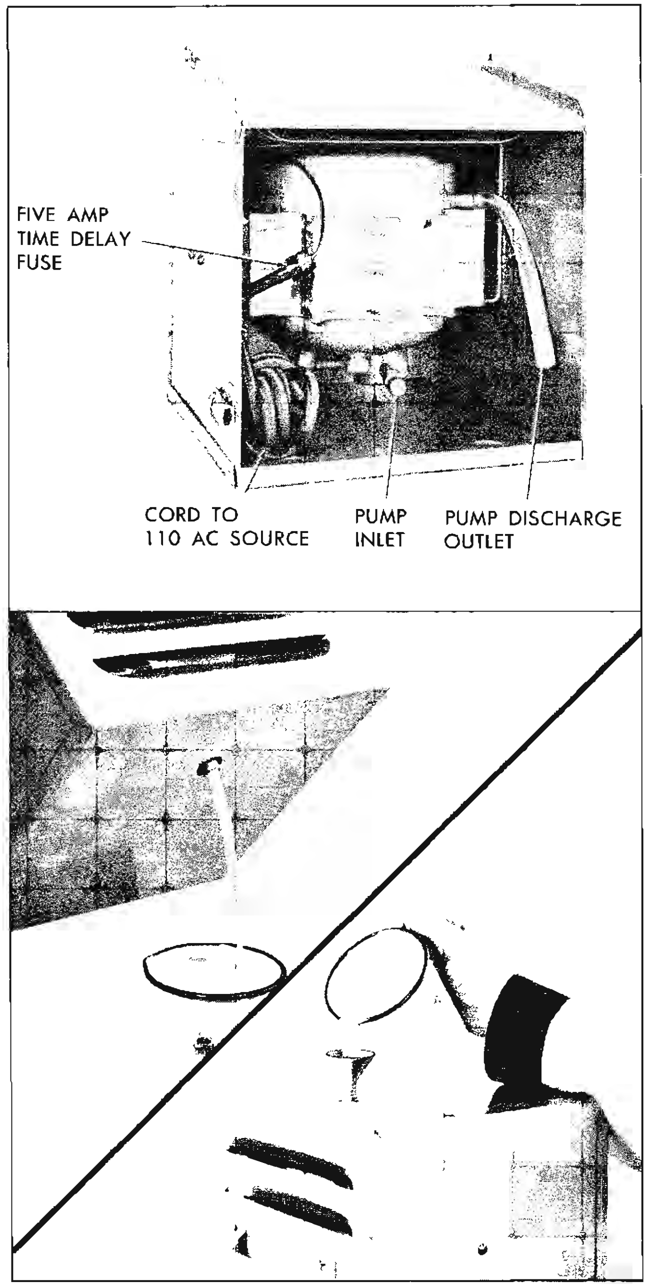


Fig. 31—Vacuum Pump

- Oil should be changed after every 250 hours of normal operation.

  To change oil, simply unscrew hex nut located on back side of pump, tilt backward and drain out oil (fig. 31). Recharge with 8 ounces of vacuum pump oil Frigidaire 150 or equivalent (fig. 31). If you desire to flush out the pump, use this same type clean oil. Do not use solvent.

  NOTE: Improper lubrication will shorten the life of pump.

- If this pump is subjected to extreme or prolonged cold, allow it to remain indoors until oil has reached approximate room temperature. Failure to warm oil will result in a blown fuse.

- A five ampere time delay cartridge fuse has been installed in the common line to protect the windings of the compressor. The fuse will blow if an excessive load is placed on the pump. In the event the fuse is blown, replace with a five ampere time delay fuse - do not use a substitute fuse as it will result in damage to the starting windings.
- If the pump is being utilized to evacuate a burnt-out system, a filter must be connected to the intake fitting to prevent any sludge from contaminating the working parts, which will result in malfunction of the pump.
- Do not use the vacuum pump as an air compressor.

AVAILABILITY OF REFRIGERANT-12

Refrigerant-12 is available through Parts Stock in 25 lb. drums and in 15 oz. disposable cans. Valves are available for the disposable cans, which may be used as individual cans or as a group of up to four cans (fig. 32).

Tool J-6272 is used with one through four cans. The use of the four-can fixture makes it possible to charge the system with a known quantity of refrigerant without the use of weighing equipment necessary with the larger drum. The single can Valve J-6271 can be used for completing the charge and for miscellaneous operations such as flushing. The valves are installed by piercing the top seal of the cans.

Evacuating and charging procedures later in this section will make use of the J-8393 Charging Station which uses the 25 lb. drum of refrigerant.

COMPRESSOR OIL

Special refrigeration lubricant should be used in the system. It is available in 1 quart graduated bottles through Parts Stock. This oil is as free from moisture and contaminants as it is possible to attain by human processes. This condition should be preserved by immediately capping the bottle when not in use.

See "Air Conditioning System Capacities" for the total system oil capacity.

Due to the porosity of the refrigerant hoses and connections, the system refrigerant level will show a definite drop after a period of time. Since the compressor oil is carried throughout the entire system mixed with the refrigerant a low refrigerant level will cause a dangerous lack of lubrication. Therefore the refrigerant charge in the system has a definite tie-in with the amount of oil found in the compressor and an insufficient charge may eventually lead to an oil build-up in the evaporator.

COMPRESSOR SERIAL NUMBER

The compressor serial number is located on the serial number plate on top of the compressor. The serial number consists of a series of numbers and letters. This serial number should be referenced on all forms and correspondence related to the servicing of this part.

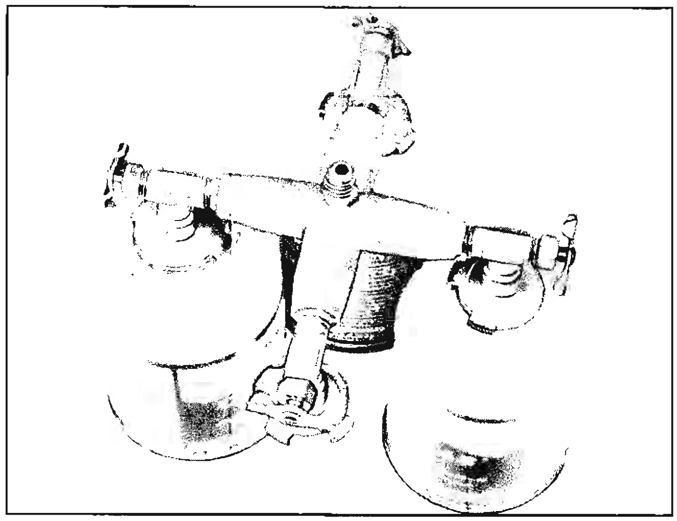


Fig. 32—Refrigerant-12 Disposable Cans and Valves

INSPECTION AND PERIODIC SERVICE

PRE-DELIVERY INSPECTION

1. Check the belt for proper tension.
2. With controls positioned for operation of the system, operate the unit for ten minutes at approximately 2000 rpm. Observe the clutch pulley bolt to see that the compressor is operating at the same speed as the clutch pulley. Any speed variation indicates clutch slippage.
3. Check the sight glass to see that the unit has a sufficient Refrigerant charge. The glass should be clear, although during milder weather it may show traces of bubbles. Foam in the flow indicates a low charge. No liquid visible indicates no charge.
4. Check hose clamp connections (see "Hose Clamps" under "System Service Operations") and leak test the complete system.
5. If there is evidence of an oil leak, check the compressor to see that the oil charge is satisfactory.
6. Check the system controls for proper operation.

6000 MILE INSPECTION

1. Check unit for any indication of a refrigerant leak.
2. If there is an indication of an oil leak, check the compressor proper oil charge.
3. Check sight glass for proper charge of Refrigerant-12.
4. Tighten the compressor brace and support bolts and check the belt tension.
5. Check hose clamp connections. See "Hose Clamps" under "System Service Operations".
6. Check thermostatic switch setting (Custom and All-Weather Systems.)

PERIODIC SERVICE

- Inspect condenser regularly to be sure that it is not plugged with leaves or other foreign material.

- Check evaporator drain tubes regularly for dirt or restrictions.
- At least once a year, check the system for proper refrigerant charge and the flexible hoses for brittleness, wear or leaks.
- Every 6000 miles check sight glass for low refrigerant level.
- Check belt tension regularly.
- Every week - during winter months or other periods when the system is not being operated regularly - run the system, set for maximum cooling, for 10 or 15 minutes to insure proper lubrication of seals and moving parts.

INSTALLING GAUGE SET TO CHECK SYSTEM OPERATION

Compressor Suction and Discharge Connector

Compressor connector assemblies used on all 1965 Chevrolet, Chevelle and Chevy II vehicles are of the same basic design consisting of the inlet (suction) and outlet (discharge) connections, gauge fittings and muffler and, in general, the assemblies differ only in the location of the gauge fittings and muffler.

On Chevrolet, Chevelle and Chevy II Custom and Four-Season Systems the outlet line extends along side of and toward the front of the compressor and the muffler in the line is bracket mounted to the compressor body. In all Custom Systems the gauge fittings for both low and high pressure sides of the system are located in the connector body. On Four-Season Systems the high pressure gauge fitting is located on the muffler. There is no low pressure gauge fitting on Four-Season Systems since this pressure is checked at the fitting on the Suction Throttling Valve.

The Chevy II All-Weather System compressor connector assembly is similar to the Custom System connector assembly described above except that the muffler extends straight out from the connector and is not bracket mounted to the compressor.

Custom and Chevy II All-Weather System

1. Install the Gauge Adapter (J-5420 or J-9459) onto the high and low pressure hoses of the gauge set.
2. With the engine stopped, remove the caps from the cored valve gauge connectors on the compressor fittings block.
3. Connect the gauge lines with adapters to the threaded connectors on the compressor fittings block.

Four-Season System

Installation of the gauge set onto the Four-Season system is accomplished in the same manner as outlined above except that system performance checks must be performed with the low pressure hose line and adapter attached to the fitting on the suction throttling valve. Four-Season charging procedures should be performed with the high pressure gauge line connected to the high pressure gauge fitting located on the outlet line muffler and the low pressure gauge line attached to the STV fitting.

CAUTION: When removing gauge lines from the compressor fittings block be sure to remove the adapters from the fittings rather than the gauge lines from the adapters.

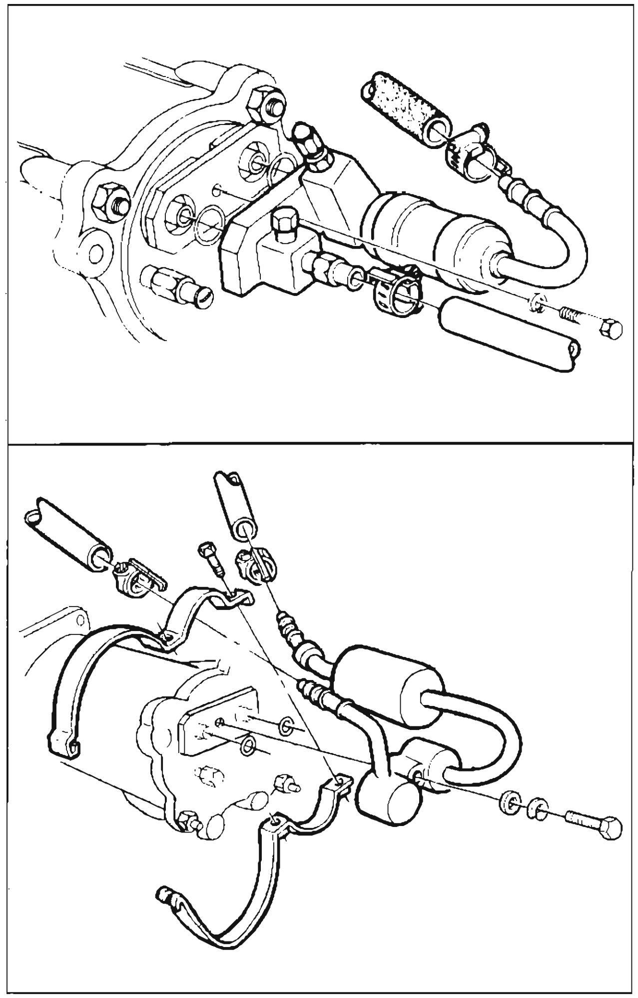


Fig. 33—Compressor Connector Block (Typical)

PERFORMANCE TEST

This test may be conducted to determine if the system is performing in a satisfactory manner and should be used as a guide by the serviceman in diagnosing trouble within the system. The following fixed conditions must be adhered to in order to make it possible to compare the performance of the system being tested with the standards below:

1. Doors and windows closed.
2. Hood up.
3. Vehicle in NEUTRAL with engine running at 2000 rpm.
4. Air Conditioning controls set for -
   - Maximum cooling.
   - High blower speed.
5. TEMP knob and AIR knob set for full recirculating air, fully up (Chevelle) or fully left (Chevrolet). On the Chevy II all heater knobs should be pushed in.
6. Gauge set installed.
7. System settled out (run-in approximately 10 minutes).
8. A thermometer placed in front of vehicle grille and another in the right hand diffuser outlet.

PERFORMANCE DATA

The following Performance Data define normal operation of the system under the above conditions. Relative humidity does not appear in the tables because after running the prescribed length of time on recirculated air and maximum cooling, the relative humidity of the air passing over the evaporator core will remain at approximately 35% to 40% regardless of the ambient temperature or humidity.

Should excessive head pressures be encountered at higher ambient temperatures, an 18" fan placed in front of the vehicle and blowing into the condenser will provide the extra circulation of air needed to bring the pressures to within the limits specified.

NOTE: Higher temperatures and pressures will occur at higher ambient temperatures. In areas of high humidity it is possible to have thermometer and gauge readings approach but not reach the figures listed in the performance tables and still have a satisfactory operating unit. However, it is important to remember that low pressure has a direct relationship to nozzle outlet temperature. If pressure is too low, ice will gradually form on the evaporator fins, restricting airflow into the passenger area and resulting in insufficient or no cooling.

Four Season System

Chevrolet

(Refrigerant Charge = 3 Lbs. - 12 Oz.)						
Temperature of Air Entering Condenser	70°	80°	90°	100°	110°	120°
Engine rpm	2000					
Compressor Head Pressure	150-160	170-180	195-205	230-240	270-280	300-310
Suction Pressure at STV	28 psi					
Discharge Air Temp. at Right Hand Outlet	35-37	36-38	37-39	39-41	41-43	44-46

Four-Season System

Chevelle

(Refrigerant Charge = 3 Lbs. - 12 Oz.)						
Temperature of Air Entering Condenser	70°	80°	90°	100°	110°	120°
Engine rpm	2000					
Compressor Head Pressure	150 160	160 170	195 205	230 240	265 275	300 310
Evaporator Pressure at STV	28 psi					
Discharge Air Temp. at Right Hand Outlet	37 39	38 40	39 41	40 42	41 43	44 46

All Weather System

Chevy II

(Refrigerant Charge = 2-1/2 Lbs.)						
Grille Air Temperature	70°	80°	90°	100°	110°	120°
Engine rpm	1500					
Compressor Head Pressure	120-140	150-160	175-185	220-230	240-250	265-275
Compressor Suction Pressure**	13	14	15	15	19	19
Discharge Air Temp. at R/H Outlet**	32-37	33-38	35-40	36-41	37-42	38-43

Custom System

Chevrolet and Chevelle

(Refrigerant Charge = 3 Lbs.)						
Temperature of Air Entering Condenser	70°	80°	90°	100°	110°	120°
Engine rpm	2000					
Compressor Head Pressure	90-100	135-145	140-150	180-190	205-215	235-245
Suction Pressure**	5	6	7	9	9	10
Discharge Air Temperature**	39-44	39-44	40-45	40-45	42-47	45-50

Custom System

Chevy II

(Refrigerant Charge = 2-1/2 Lbs.)						
Temperature of Air Entering Condenser	70°	80°	90°	100°	110°	120°
Engine rpm	2000					
Compressor Head Pressure	120-130	145-155	165-175	190-200	230-240	265-275
Suction Pressures**	10	11	13	14	16	18
Discharge Air Temperature**	36-41	37-42	37-42	38-43	39-44	40-45

**When Compressor Clutch Disengages.

MAINTENANCE AND ADJUSTMENTS

SUCTION THROTTLING VALVE (STV)

(Four-Season System)

The suction throttling valve determines the temperature of the evaporator core by limiting the minimum evaporator pressure. The valve in this manner also protects the core against freeze-up which would result in a partial or complete loss of cooling capacity. While the system is in operation, the evaporator will be held to a minimum pressure of 28 psi and will provide maximum cooling at all times. The evaporator pressure will hold at this level so long as maximum cooling is desired by the occupants of the car. Should the cold air output begin to become uncomfortable, the Temperature knob may be moved to mix heated air with the maximum cooled air and thus temper the outlet air to a desired temperature. This action, indicating that maximum cooling is no longer needed, acts through the control cable and linkage to close a vacuum valve through which 4-1/2" of vacuum has been applied to the vacuum head on the STV. Loss of this vacuum increases the internal spring pressure exerted upon the STV piston and effectively increases the minimum evaporator pressure approximately 3 pounds to 31 psi. This results in less evaporator cooling capacity. The primary reason for this feature is to guard against evaporator freeze-up when operating at higher elevations.

NOTE: When operating the system at elevations above 4000 feet the Temperature knob should be moved about 1/2" from its closed position.

Checking for Proper Suction Throttling Valve Operation

To check for proper operation of the suction throttling valve, proceed as follows:

1. Attach the low pressure gauge to the suction throttling valve gauge connection, using the proper gauge line adapter.
2. With the air conditioning system in operation, check the gauge reading, then move the Temperature knob about 1/2". The pressure reading should rise approximately 3 psi. If no change is noted, check the following items.
   a. The vacuum head assembly may be damaged and in need of replacement.

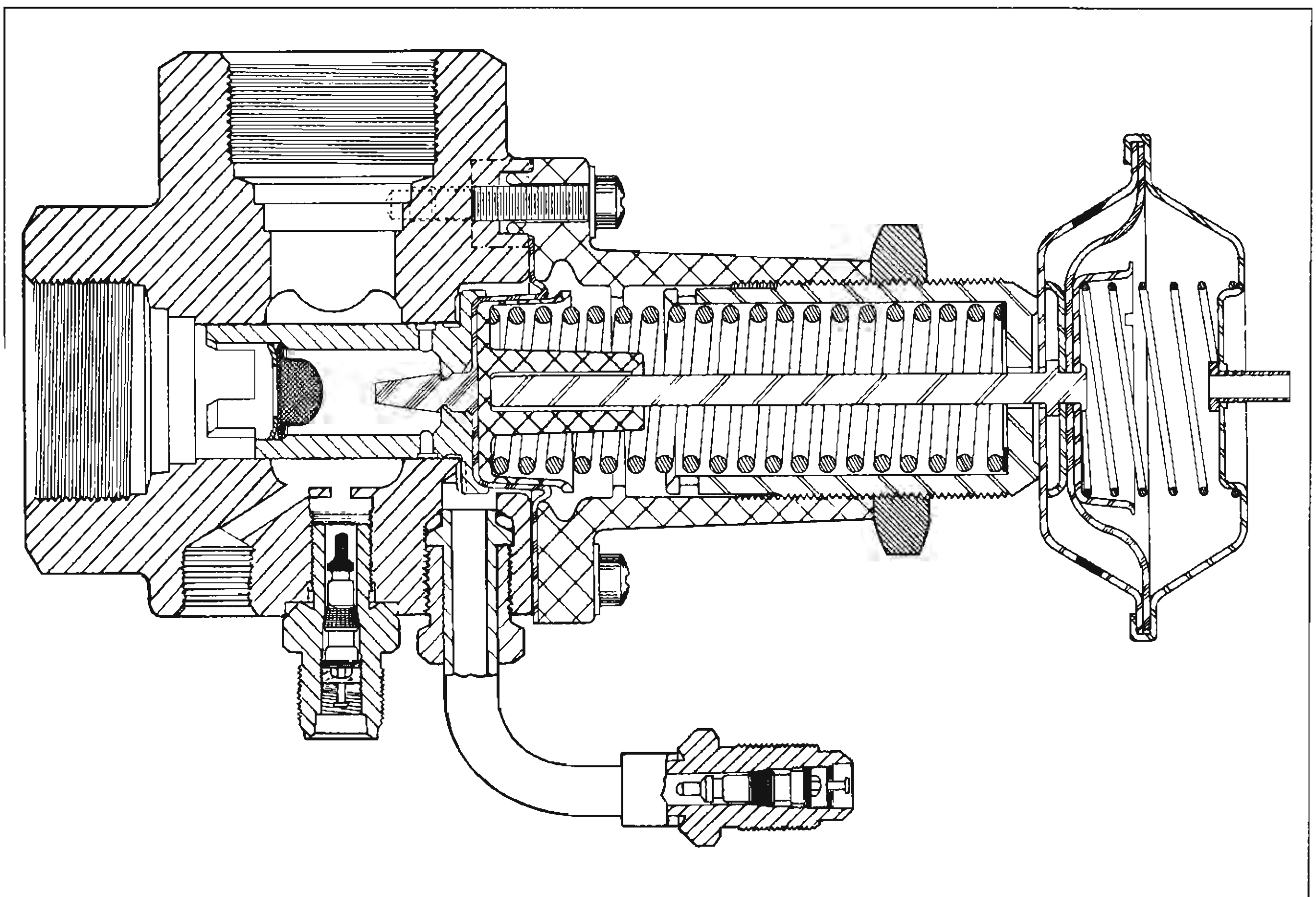


Fig. 34—Suction Throttling Valve—Sectional View

b. The vacuum hose may be pinched off, broken or unplugged.
c. The vacuum valve located on the top of the floor distributor duct within the car may be defective or its linkage poorly adjusted.

With evaporator pressure reacting properly (after any necessary repairs or adjustments as indicated in Step 2 above) and with vacuum applied to the vacuum unit (vacuum line connected and Temperature fully "up" on Chevelle; full "left" on Chevrolet), the evaporator pressure reading on the gauge should be 28 psi.

1. If adjustment is necessary, loosen the jam nut and, with the system in operation, rotate the vacuum head assembly (vacuum line in place) until the proper pressure reading is reached. Approximately three turns of the head assembly will result in a 1 psi pressure change. Turn clockwise to raise, counterclockwise to lower the pressure.

   NOTE: Be sure that the system is in operation and vacuum applied to the vacuum head assembly before attempting this adjustment.

2. Tighten the jam nut.
3. Recheck operation by moving the Temperature knob slightly or by pinching off or removing the vacuum line. Evaporator pressure should rise approximately 3 psi above the normal of 28 psi.

THERMOSTATIC SWITCH

(Custom and Chevy II All-Weather System)

Thermostatic switches used in Custom and All-Weather systems differ only in the capillary tube sensing unit.

The Chevy II All-Weather System thermostatic switch has an air sensing capillary which is coiled and attached to the front of the evaporator core with plastic plugs. This type of unit is controlled by the temperature of the air leaving the evaporator (See Figure 60).

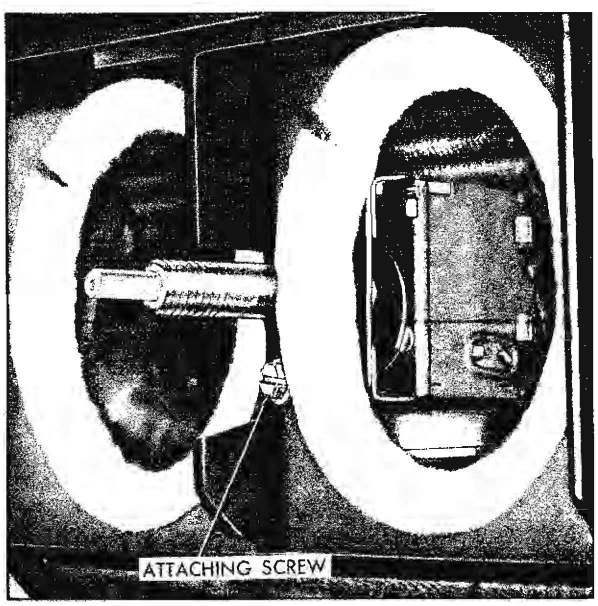


Fig. 35—Thermostatic Switch Removal

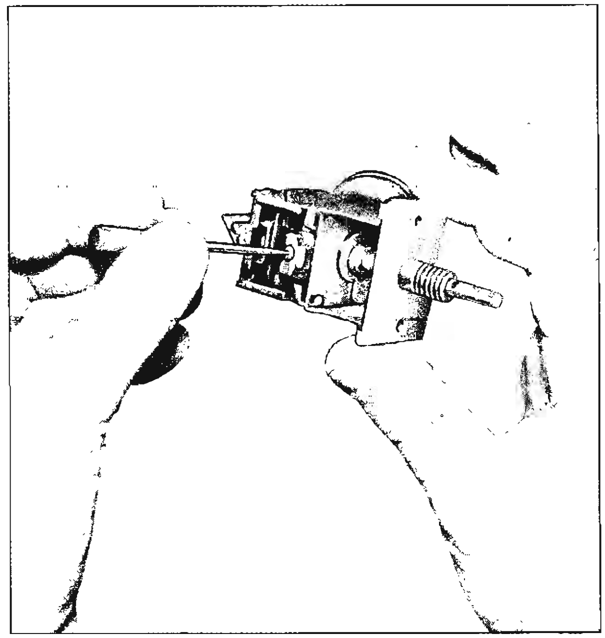


Fig. 36—Thermostatic Switch Adjustment

All Custom systems make use of a thermostatic switch with a fin sensing capillary. The end of this capillary is inserted between the fins of the evaporator core where it controls the switch by sensing the temperature of the metal fins. The capillary should be inserted into the front of the evaporator core about 2-1/8" up from the bottom and 3-5/8" over from the right side (See Figure 60).

Checking for Proper Operation

1. Install the gauge set and set up the vehicle as described under Performance Test.
2. Movement of the temperature control knob should result in a definite change in suction pressure and cycling of the compressor clutch.
   - If compressor continues to operate regardless of the knob adjustment, it indicates that the points are fused which will lead to evaporator freeze-up. Replace the switch.
   - If the compressor does not operate regardless of the position of the knob a loss of the power element charge is indicated provided that it has been established that power is supplied to the switch. This, of course, results in no cooling. Replace the switch.
   - Check the screw threads for stripped or otherwise damaged threads.

Adjusting Switch

If, after checks above, the switch seems to be operating properly, adjust for proper settling if necessary, as follows:

1. Turn the outer air deflector in the face plate so that the attaching screws may be removed. Then remove the control knobs, bezels and the thermostatic switch.
2. Vehicle must be set up as in Step 2 above.
3. The suction side of the system, read on the low pressure gauge, should pull down to the pressure

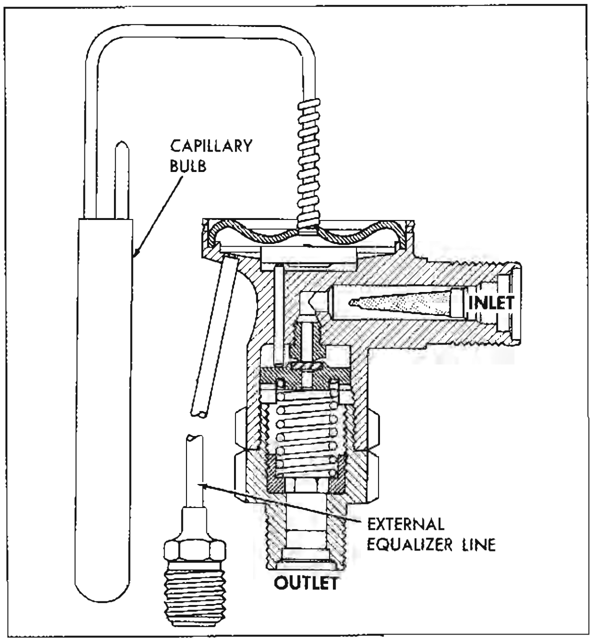


Fig. 37—Expansion Valve

shown in the chart in Performance Test under the ambient temperature at the time the switch is being set.

4. If the low side pulls down lower than the prescribed pressure at the end of each cooling cycle, turn the adjusting screw (See Figure 36) clockwise in single turn increments until the suction pressure rises to the correct pressure.
5. If the pressure is more than it should be, turn the adjusting screw counter-clockwise until the proper proper pressure is reached.
6. After adjusting the switch, observe the operation of the system for several minutes. Then if the operation is satisfactory remove the gauge set, replace the switch and reinstall the face plate onto the evaporator case.

EXPANSION VALVE

A malfunction of the expansion valve will be caused by one of the following conditions: valve stuck open, valve stuck closed, broken power element, a restricted screen or an improperly located or installed power element bulb. The first three conditions require valve replacement. The last two may be corrected by replacing the valve inlet screen and by properly installing the power element bulb.

Attachment of the expansion valve bulb to the evaporator outlet line is very critical. The bulb must be attached tightly to the line and must make good contact with the line along the entire length of the bulb. A loose bulb will result in high low side pressures and poor cooling. On bulbs located outside the evaporator case insulation must be properly installed.

The external equalizer line shown in Figure 37 is not used in the Custom and Chevy II All-Weather systems.

Indications of expansion valve trouble provided by the Performance Test are as follows:

VALVE STUCK OPEN OR BROKEN POWER ELEMENT
Noisy Compressor.
No Cooling - Freeze Up.

VALVE STUCK CLOSED OR PLUGGED SCREEN
Very Low Suction Pressure.
No Cooling.

POORLY LOCATED POWER ELEMENT BULB
Normal Pressure.
Poor Cooling.

ENGINE IDLE COMPENSATOR

This additional aid to prevent stalling during prolonged hot weather periods is included with all air conditioned vehicles. The idle compensator is a thermostatically controlled air bleed which supplies additional air to the idle mixture. On V-8 engines, with factory installed air conditioning systems, the compensator is located within the carburetor and is accessible when the engine air cleaner is removed. On all other vehicles the compensator is threaded into a manifold fitting below the carburetor. All compensators are factory set and are non-adjustable. A malfunctioning unit should be replaced.

> **NOTE:** If engine idle is erratic, hold the idle compensator valve closed with a pencil or wooden dowel while adjusting the idle mixture screw(s). Never attempt to bend the bimetal strip or attempt any valve adjustment.

TEMPERATURE DOOR CAM LOCK

(Four-Season System)

The cam lock device is adjusted in the manner described under Heater in this section.

EVACUATING AND CHARGING PROCEDURES

1965 AIR CONDITIONING SYSTEM CAPACITIES

	Refrigerant Charge	Oil Charge
Four-Season Systems (Chevrolet and Chevelle)	3 lbs., 12 oz.	11 ozs. 525 viscosity
Custom System (Chevrolet and Chevelle)	3 lbs.	11 ozs. 525 viscosity
Custom and All-Weather Systems (Chevy II)	2 lbs., 8 oz.	11 ozs. 525 viscosity

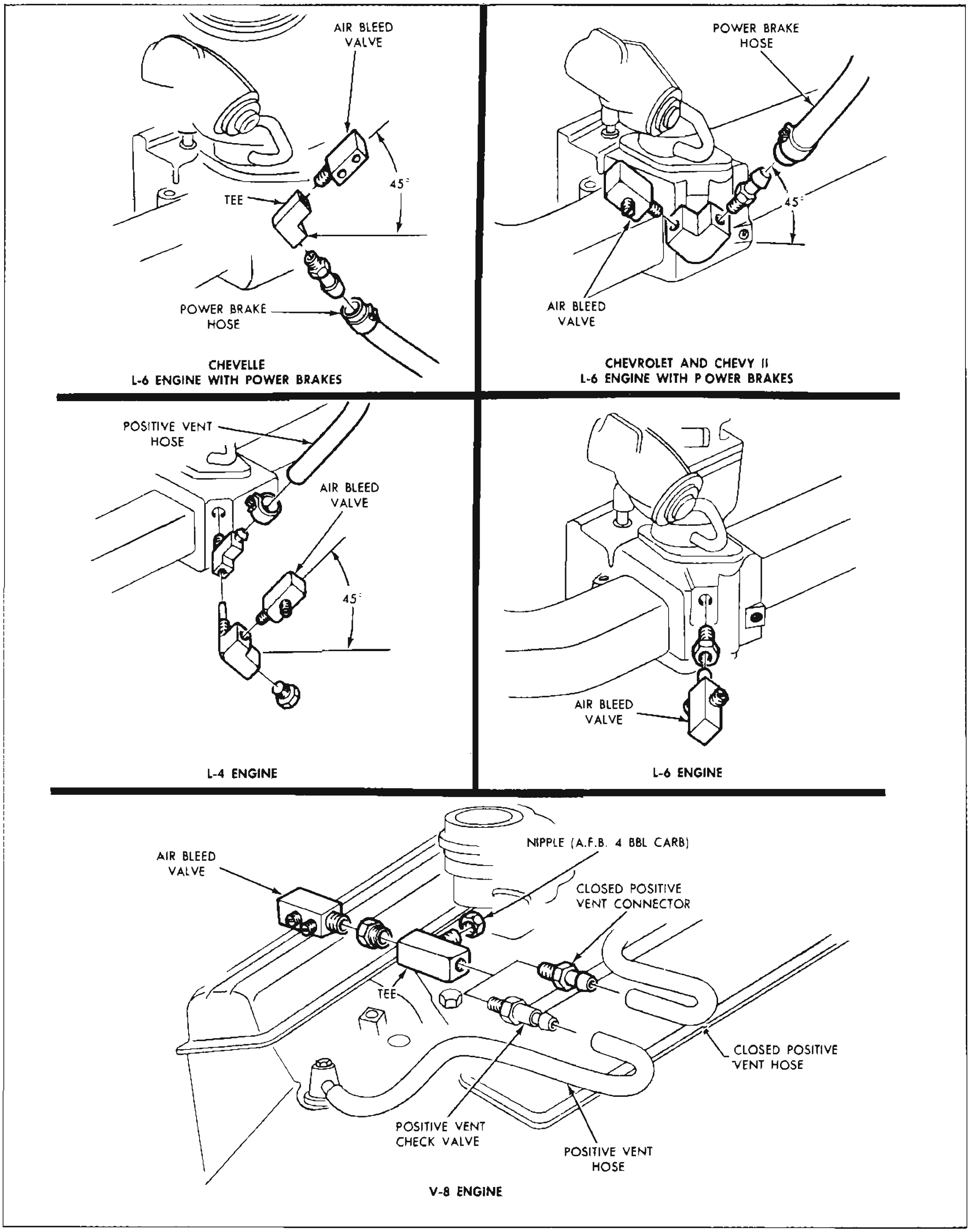


Fig. 38—Engine Idle Compensator

PURGING THE SYSTEM

In replacing any of the air conditioning components the system must be completely purged or drained of refrigerant. The purpose is to lower the pressure inside the system so that a component part can be safely removed.

1. With engine stopped install high and low pressure lines of gauge set to the proper high and low pressure gauge fittings (see "Installing Gauge Set to Check Operation").
2. With plug removed from the centerline on the gauge manifold, open high pressure gauge valve and discharge the vapor slowly through the center connection.

CAUTION: Do not open valves too much or compressor oil may be discharged with the refrigerant. A rag wrapped around the end of the center gauge line will prevent the splashing of oil in the event of accidental rapid discharge.

3. When the pressure is reduced to below 100 pounds on the high pressure gauge, open the low pressure gauge valve and continue discharging until all refrigerant has been released. Close both gauge valves.

EVACUATING AND CHARGING THE SYSTEM

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

Whenever the air conditioning system is open for any reason, it should not be put into operation again until it has been evacuated to remove air and moisture which may have entered the system.

The following procedures are based on the use of the J-8393 Charging Station.

Filling Charging Cylinder

1. Open control valve on refrigerant drum.
2. Open valve on bottom of charging cylinder allowing refrigerant to enter cylinder.
3. Bleed cylinder valve on top (behind control panel) as required to allow refrigerant to enter. When refrigerant reaches desired level (see "Air Conditioning System Capacities"), close valve at bottom of cylinder and be certain bleed valve is closed securely.

NOTE: It will be necessary to close bleed valve periodically to allow boiling to subside to check level in sight glass.

Installing Charging Station to System

1. Be certain all valves on charging station are closed.
2. Connect high pressure gauge line to high pressure gauge fitting. (See "Installing Gauge Set to Check System Operations.")
3. See Figure 39. Turn high pressure control (2) one turn counter-clockwise (open). Crack open low pressure control (1) and allow refrigerant gas to hiss from low pressure gauge line for three seconds, then connect low pressure gauge line to low pressure gauge fitting.
4. System is now ready for performance testing.

Evacuating and Charging System

1. Install charging station as previously described. Refer to Figure 39 while performing the following operation.
2. Remove Low Pressure gauge line from compressor.
3. Crack open high (2) and low (1) pressure control valves, and allow refrigerant gas to purge from system. Purge slow enough so that oil does not escape from system along with Refrigerant.
4. When refrigerant flow stops, connect Low Pressure gauge line to compressor.
5. Turn on vacuum pump and open Vacuum Control Valve (3).
6. With system purged as above, run pump until 28-29 inches of vacuum is obtained. Continue to run pump for 15 minutes after the system reaches 28-29 inches vacuum.
7. If 28-29 inches cannot be obtained, close Vacuum Control Valve (3) and shut off vacuum pump. Open Refrigerant Control Valve (4) and allow 1/2 pound of R-12 to enter system. Locate and repair all leaks.
8. After evacuating for 15 minutes, add 1/2 pound of R-12 to system as described in Step 7 above. Purge this 1/2 pound and reevacuate for 5 minutes. This second evacuation is to be certain that as much contamination is removed from the system as possible.

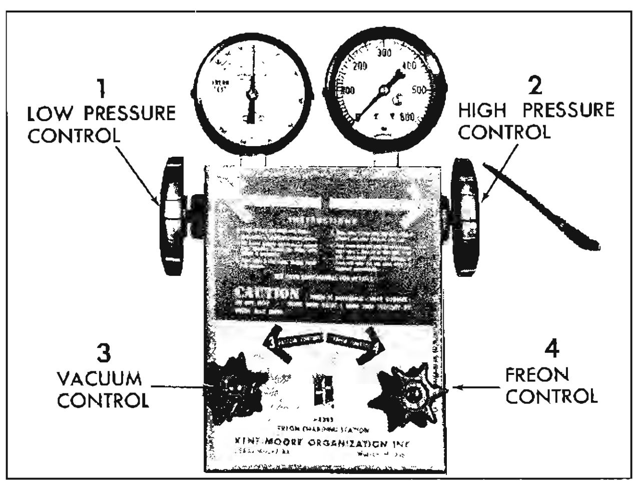


Fig. 39—Charging Station Controls

9. Only after evacuating as above, system is ready for charging. Note reading on sight glass of charging cylinder. If it does not contain a sufficient amount for a full charge, fill to the proper level.
10. Close Low-Pressure valve (1). Fully open Refrigerant Control Valve (4) and allow all liquid R-12 to enter system. When full charge of R-12 has entered system, turn off Refrigerant Control Valve (4) and close hand shut-off valves.
11. If full charge of R-12 will not enter system in Step 3 above, close high pressure control, and Refrigerant Control Valve (4). Start engine and run at slow idle with compressor operating. Crack Refrigerant Control Valve (4) and Low Pressure Control (1). Watch low side gauge and keep gauge below 50 psi by regulating Refrigerant Control Valve (4). Closing valve will lower pressure. This is to prevent liquid refrigerant from reaching the compressor while the compressor is operating. When required charge has entered system, close Refrigerant Control Valve (4) and close Low Pressure Control (1).
12. System is now charged and should be performance tested before removing gauges.

COMPONENT REPLACEMENT AND MINOR REPAIRS

REFRIGERANT LINE CONNECTIONS

"O" Rings

Always replace the "O" ring when a connection has been broken. When replacing the "O" ring, first dip it in refrigeration oil. Always use a backing wrench on "O" ring fittings to prevent the hose from twisting and damaging the "O" ring. Do not overtighten. Correct torque specifications are as follows:

Metal Tube O.D.	Thread and Fitting Size	Steel Tubing Torque*	Alum. Tubing Torque*
1/4	7/16	10-15	5-7
3/8	5/8	30-35	11-13
1/2	3/4	30-35	11-13
5/8	7/8	30-35	18-21
3/4	1-1/16	30-35	23-28

*Foot Pounds

NOTE: Where steel to aluminum connections are being made, use torque for aluminum tubing.

Hose Clamps (Fig. 40)

When hose clamp connections are encountered special procedures are necessary for both installation and removal.

NOTE: All hose clamps must be checked after the first 6000 miles of operation. Torque a new hose clamp connection to 30-38 in. lbs. When checking a connection, any torque above 10 in. lbs. is satisfactory. If torque has fallen below 10 in. lbs., retorque 20-25 in. lbs. Visual evidence of overtorquing may be noted as a "feathering" of the rubber hose cover through the notches of the clamp.

CAUTION: Do not overtorque.

Installation

1. Coat tube and hose with refrigeration oil.
2. Carefully insert hose over the three beads on the fitting and down as far as the fourth, or locating, bead. Hose must butt against this fourth bead.

   CAUTION: Use no sealer of any kind.
3. Install clamps on hose, hooking the locating arms over the cut end of the hose.
4. Tighten the hose clamp screw with a large screw driver.

Removal

1. Carefully, with a sharp knife, make an angle cut in the hose as shown in Figure 40. This should loosen the hose so that it may be worked off the fitting.
2. Cut off slit end of hose when reinstalling. Reinstall as described above.

   CAUTION: Use only approved refrigeration hose. Never use heater hose. Use extreme care not to nick or score the sealing beads when cutting off the hose. Cutting the hose lengthwise may result in this problem.

REPAIR OF REFRIGERANT LEAKS

Any refrigerant leaks found in the system should be repaired in the manner given below:

Leaks at "O" Ring Connection

1. Check the torque on the fitting and, if too loose, tighten to the proper torque. Always use a backing wrench to prevent twisting and damage to the "O" ring. Do not overtighten. Again leak test the joint.
2. If the leak is still present, discharge the refrigerant from the system as described under "Evacuating and Charging Procedures."
3. Inspect the "O" ring and the fitting and replace if damaged in any way. Coat the "O" ring before re-installed with refrigeration oil and install carefully.
4. Retorque the fitting, using a backing wrench, and then add 1/2 to 1 lb. of R-12 to the system and recheck for leaks.

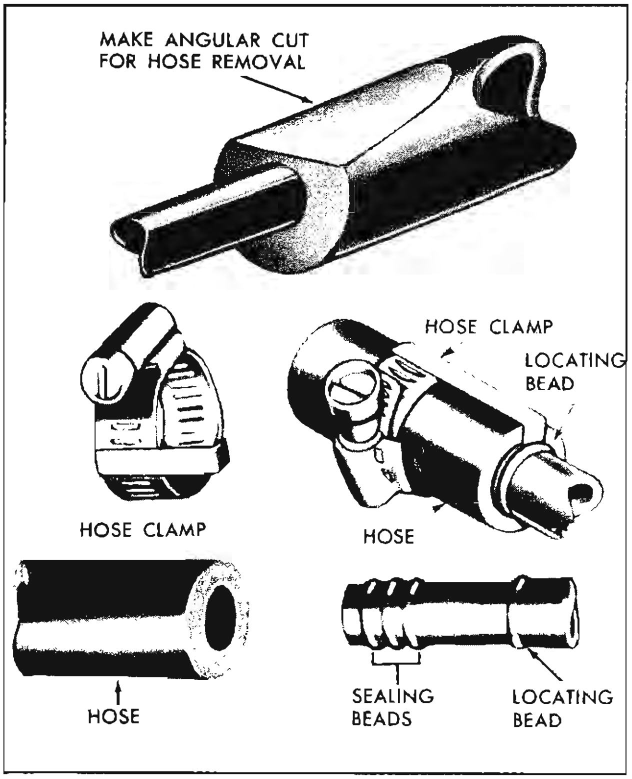


Fig. 40—Hose Clamp Connections

CAUTION: Do not operate the system with this small refrigerant charge.

5. Purge the system, thus removing the 1/2 to 1 lb. installed in Step 4 above.
6. Evacuate and charge the system.

Leaks at Hose Clamp Connection

1. Check the tighteness of the clamp itself and tighten if necessary. Recheck for leak.
2. If leak has not been corrected discharge the system and loosen clamp and remove hose from connection. Inspect condition of hose and connector. Replace scored or damaged parts.
3. Dip end of new hose in refrigerant oil and carefully reinstall over connector. Never push end of hose beyond the locating bead. Properly torque the clamp.
4. Recheck the system for leaks by installing 1/2 to 1 lb. of R-12 into the system. Do not run compressor.
5. Purge the system, thus removing the 1/2 to 1 lb. installed in Step 4 above.
6. Evacuate and charge the system.

Compressor Leaks

If leaks are located around the compressor shaft seal or shell, replacement of necessary seals should be made as outlined under "Compressor."

REFRIGERANT HOSE FAILURE

After a leak or rupture has occurred in a refrigerant hose, or if a fitting has loosened and caused a considerable loss of refrigerant and oil, the entire system should be flushed and recharged after repairs have been made. If the system has been open to atmosphere for any prolonged period of time the receiver-dehydrator should be replaced.

CONDITIONING SYSTEM FOR REPLACEMENT OF COMPONENT PARTS

Air conditioning, like many other things, is fairly simple to service once it is understood. However, there are certain procedures, practices and precautions that should be followed to prevent costly repairs, personal injury or damage to equipment. For this reason it is strongly recommended that the preceding information in this section be studied thoroughly before attempting to service the system.

Great emphasis must be placed upon keeping the system clean. Use plugs or caps to close system components and hoses when they are opened to the atmosphere. Keep your work area clean.

In removing and replacing any part in the refrigeration system, the following operations, which are described in this section must be performed in the sequence shown.

1. Purge the system by releasing the refrigerant to the atmosphere.
2. Remove and replace the defective part.
3. Evacuate and charge the system with R-12.

CAUTION: Always wear protective goggles when working on refrigeration systems. Goggles J-5453 are included in the set of air conditioning special tools. Also, beware of the danger of carbon monoxide fumes by avoiding running the engine in closed or improperly ventilated garages.

CONDENSER

Chevrolet

Replacement

1. Remove the hood lock catch support and catch and both horns.
2. Chisel off rivet "A" and drill out rivet "B" (fig. 41). Then remove bolts "C" and remove the grille support.
3. With the system purged of refrigerant, disconnect the inlet hose clamp connection at "D," Figure 41; the receiver-dehydrator "O" ring outlet connection at "A" and the four condenser to radiator support attaching screws.
4. Remove the condenser and receiver-dehydrator assembly from the vehicle.

NOTE: If it is to be reused, cap or tape the receiver-dehydrator inlet and outlet connections at once.

5. Remove the receiver-dehydrator from the condenser by disconnecting the inlet "O" ring connection at "B" and removing the two receiver to condenser attaching screws "C."

6. Install receiver-dehydrator on new condenser, position the assembly and install the four radiator support to condenser attaching screws and replace all line connections.
7. Replace the Radiator Grille Support and its attaching bolts. Replace the rivets removed in Step 2 with suitable size nuts, bolts and lock washers.
8. Replace the hood lock catch support and catch and the horns.
9. Evacuate, charge and check the system.

Chevelle

Replacement

1. Remove the hood lock catch support and catch and both horns.
2. With the system purged of refrigerant, disconnect the inlet and outlet hose clamp connections and the four condenser to radiator support attaching screws.
3. Remove the condenser from the vehicle.

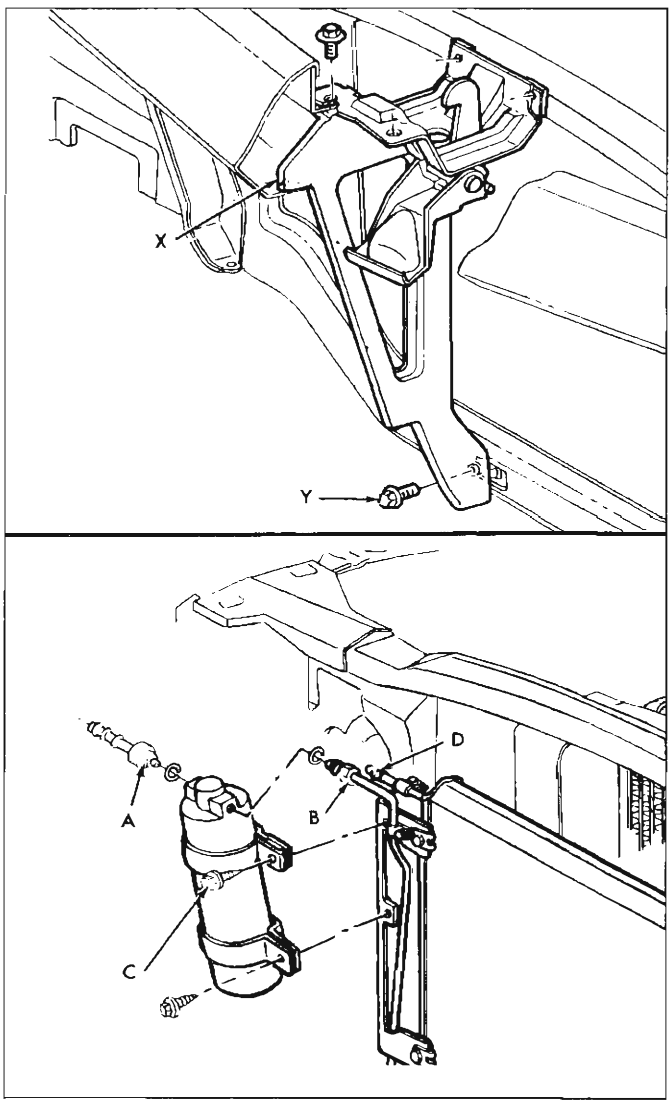


Fig. 41—Condenser Replacement—Chevrolet

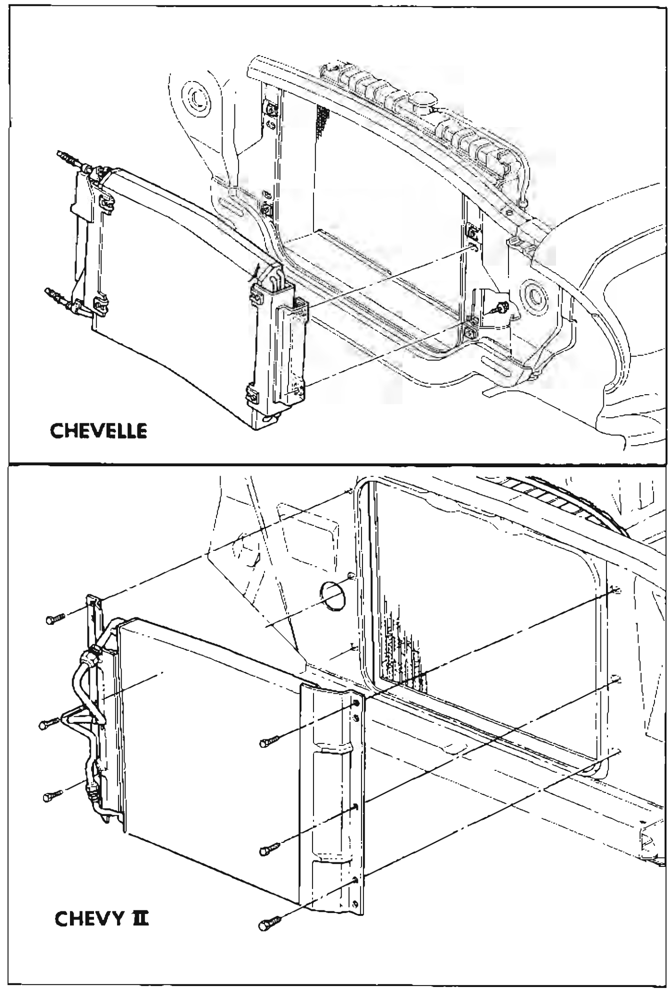


Fig. 42—Condenser Removal—Chevelle and Chevy II

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

4. Install new condenser, position the assembly and install the four radiator support to condenser attaching screws and replace all line connections.
5. Evacuate, charge and check the system.

Chevy II

Replacement

1. Purge the refrigerant from the system.
2. Remove the bumper, bumper filler panel, grille, grille support, hood lock catch support and catch.
3. Disconnect connectors at condenser inlet and outlet tubes and remove screws attaching refrigerant line holding clips to the condenser baffle.
4. Remove six bolts attaching condenser to radiator support and slide condenser to the left and out of vehicle.
5. Reverse these steps to reinstall new condenser.
6. Evacuate and charge the system.

RECEIVER-DEHYDRATOR

The receiver-dehydrator should be replaced if it has

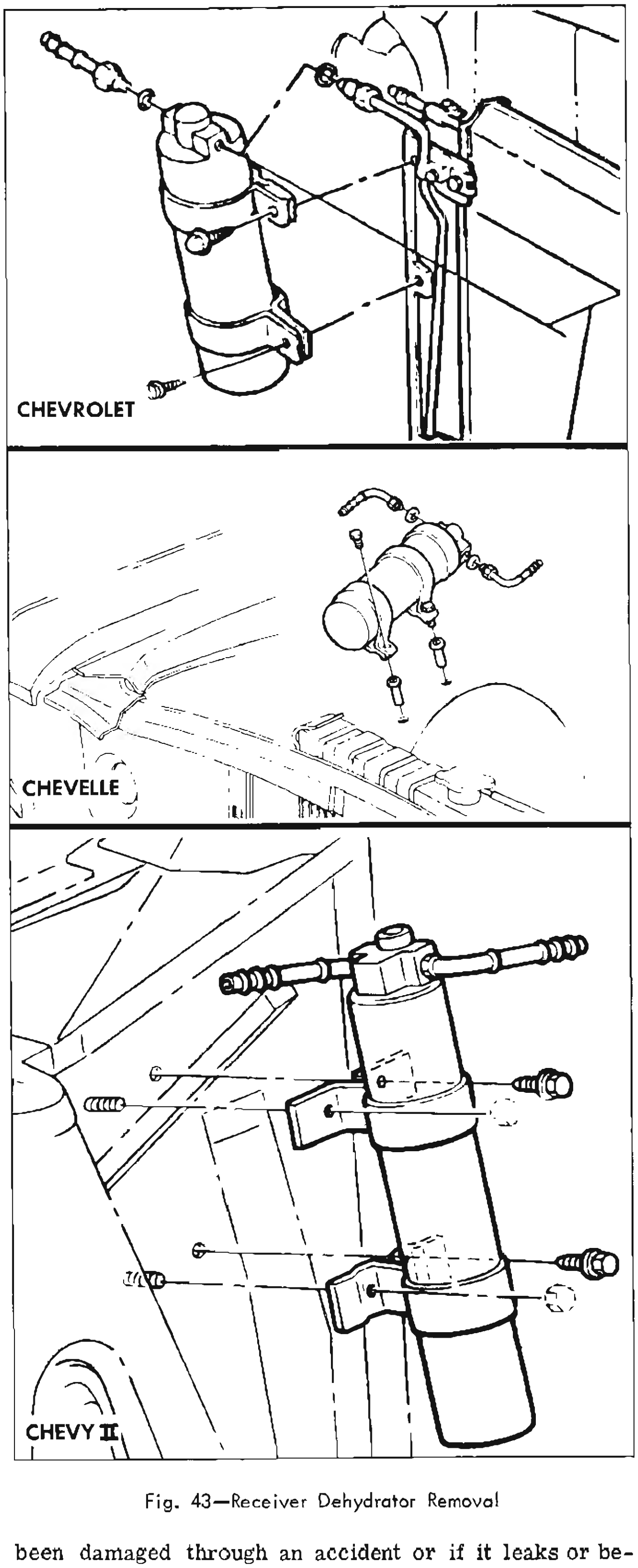


Fig. 43—Receiver Dehydrator Removal

been damaged through an accident or if it leaks or becomes restricted or clogged. Do not attempt to repair the receiver-dehydrator.

The receiver-dehydrator is merely a moisture collecting device and a refrigerant storage area and is the least likely component of the system to cause a malfunction.

If at any time when examining the compressor oil, moisture is found or there is an indication of moisture at the expansion valve needle, the receiver-dehydrator should be replaced as follows (fig. 43):

NOTE: If the receiver-dehydrator is to be re-used, cap the inlet and outlet connections immediately. When installing a receiver-dehydrator, do not uncap the connections until the last possible moment.

Chevrolet

The receiver-dehydrator may be removed by itself without the necessity of removing grille, grille components or condenser from the vehicle.

Replacement

1. Remove the receiver inlet and outlet connections ("A" and "B", fig. 43) and the two receiver to condenser attaching screws "C".
2. Carefully remove the receiver-dehydrator from the vehicle.
3. Replace the new receiver-dehydrator assembly in the vehicle and install all attaching screws and refrigerant lines.

Chevelle

Replacement

1. Remove the receiver inlet and outlet connections and the two receiver to fender skirt attaching screws.
2. Carefully remove the receiver-dehydrator from the vehicle.
3. Replace the new receiver-dehydrator assembly in the vehicle and install all attaching screws and refrigerant lines.

Chevy II

Replacement

1. Purge the system of refrigerant.
2. Remove the hose clamp connections from the inlet and outlet tubes.
3. Remove the two screws and the two nuts and bolts attaching the receiver-dehydrator brackets to the fender skirt.
4. Install the new receiver-dehydrator.
5. Uncap the inlet and outlet tubes and install the hose clamp connections.
6. Evacuate and recharge the system.

Sight Glass Replacement—All Vehicles

If damage to the sight glass should occur, a new sight glass kit should be installed. The kit contains the sight glass, seal and retainer. (See Figure 44.)

1. Purge system.
2. Remove the sight glass retainer nut using a screw driver and remove old glass and seal.
3. Install the new glass and seal and retainer nut, being careful not to turn the nut past the face of the housing. To do so may damage the "O" ring seal.
4. Evacuate and recharge the system.

EVAPORATOR

Chevrolet Four-Season System

The Chevrolet evaporator and blower case assembly is designed so that the core may be removed without the

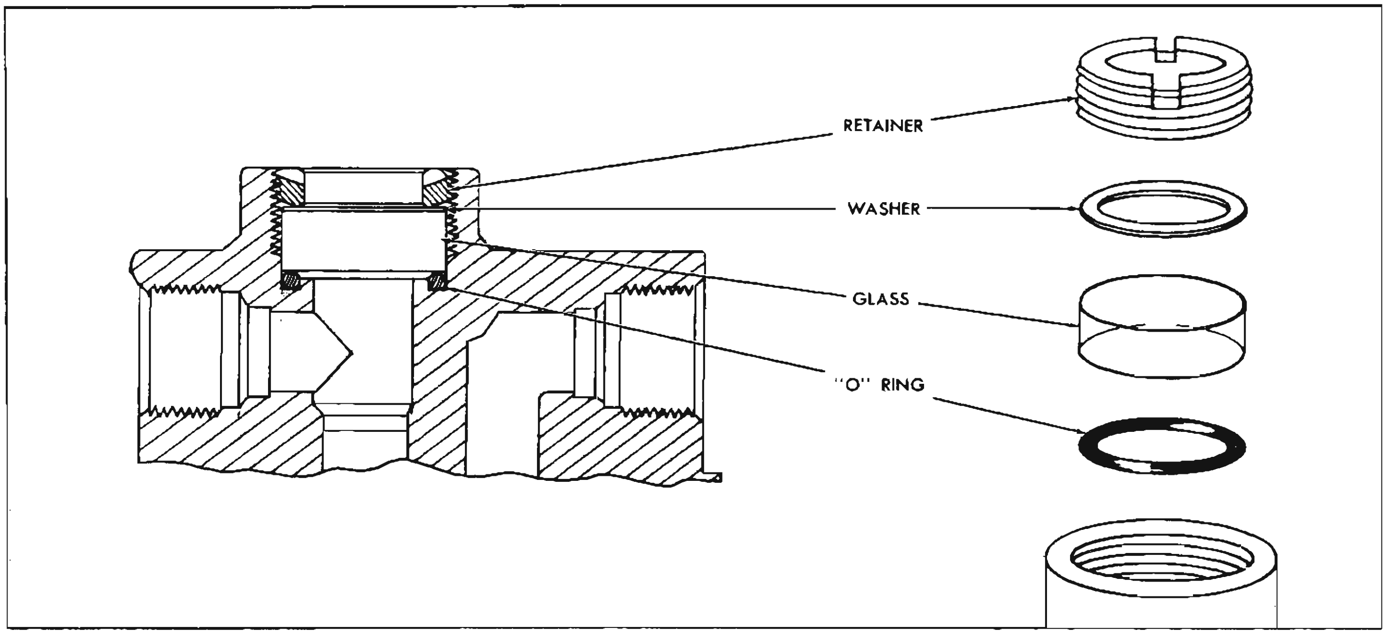


Fig. 44—Sight Glass Replacement

need for removing the entire unit from the vehicle. Instead, only the side cover must be removed.

Removal and Installation of Entire Assembly

1. Remove the inlet line at the expansion valve and the suction throttling valve outlet connection.
2. Remove the electrical connector from the blower motor.
3. To gain access to the blower motor end of the assembly, remove the fender skirt.
4. Remove the assembly to firewall attaching screws.
5. Remove the entire assembly from the vehicle.
6. Reverse the above procedure when installing the assembly into the vehicle.

Core Replacement

1. Disconnect the connections at the suction throttling valve inlet and the expansion valve outlet. Remove the expansion valve bulb from the core outlet line. Cap all open lines.
2. Remove the screws attaching the evaporator cover to the firewall and to the evaporator assembly and

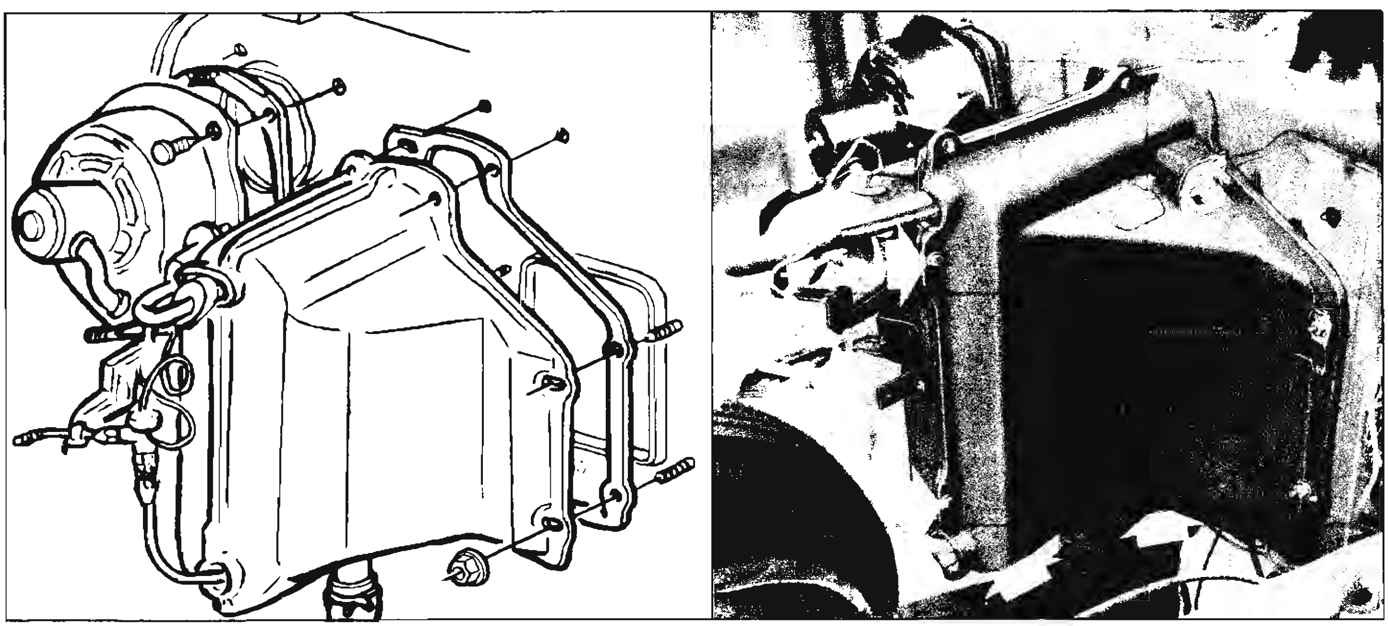


Fig. 45—Evaporator Removal—Four-Season System Chevrolet

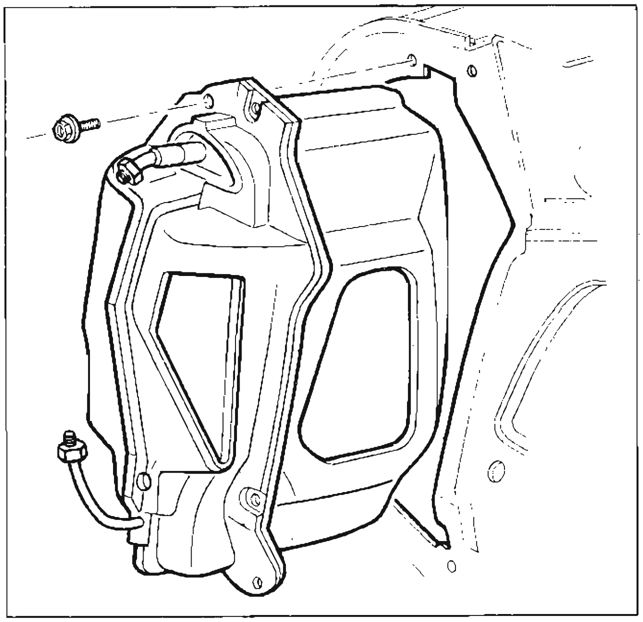


Fig. 46—Evaporator Removal—Four-Season System Chevelle

remove the cover.

3. Remove the screws attaching the core to the assembly and remove the core.
4. Reverse the above steps for core replacement.

Chevelle Four-Season System

Removal

1. Purge the system of refrigerant, then remove the right fender skirt and the hood hinge. Do not remove the fender.
2. Disconnect the high pressure line (between the receiver-dehydrator and the thermostatic expansion valve) at the expansion valve, and the suction throttling valve to compressor line at the suction throttling valve. Cap and seal all open lines.
3. Remove the three screws attaching the duct assembly to the evaporator housing and the blower assembly.
4. Remove the bolts attaching the evaporator assembly to the cowl and carefully pull the assembly from the vehicle. The duct assembly will be removed at this time also.

Core Replacement

1. With the evaporator assembly removed from the vehicle, remove the expansion valve and its bulb.
2. Remove the four nuts and bolts holding the two halves of the evaporator housing together and separate the halves.
3. The evaporator core may now be removed.
4. Leak test the new core and connections, before installing the core in the housing, by installing the expansion valve and all refrigerant lines. Connect an R-12 cylinder to the low pressure compressor gauge fitting and charge the system to cylinder pressure, then leak test.
5. After satisfactorily testing the core, install it into the housing and reassemble the two sides of the housing.

Installation

1. Remove the right trim pad and the screws attaching the air conditioning duct to the kick panel. This should allow the duct to be pulled slightly loose from the kick panel. If not it may be necessary to loosen the entire duct to obtain the necessary clearance.
2. Install the evaporator in the cowl being sure that the duct assembly is in place between the evaporator housing and the blower assembly.
3. Replace all bolts and screws.
4. Move the interior air conditioning duct until sure that the duct gasket is properly positioned over the evaporator housing flange. Proper gasket fit at this point is of great importance.
5. Replace all refrigerant lines.
6. Evacuate and charge the system.
7. Replace the fender skirt and hood hinge.

Custom System

All Vehicles

Removal (Fig. 48)

1. Purge the refrigerant from the system.
2. Remove the glove box and then the duct-to-blower case attaching screw.
3. Remove the nuts and washers attaching the evaporator assembly stud to the lower instrument panel flange and reinforcement and the bolts attaching the right and left case brackets to the hanger and the panel brace.
4. Disconnect the drain hoses and the radio antenna lead from its plug in the radio receiver and carefully pull the evaporator unit toward the rear of the vehicle.
5. Remove the refrigerant hoses from the evaporator inlet and outlet connections.
6. Disconnect wiring connectors as necessary and remove the evaporator unit from the vehicle. Remove the duct-to-case screw.

Core and/or Expansion Valve Replacement

Since repairs should never be made on the evaporator core, a defective unit must be replaced. Before replacing the core, however, check to be sure that any leaks present are not located at the hose connections or expansion valve connections. The following procedure assumes that the evaporator unit has been removed from the vehicle as outlined above.

1. Using a small screw driver, loosen the lock screws and remove the two control knobs from the front of the evaporator unit. Then use a suitable spanner wrench to remove the two bezels beneath the control knobs.
2. Remove the screws attaching the face plate to the evaporator case. Then remove the face plate and, reaching through this opening, carefully remove the plugs attaching the thermostatic switch capillary tube to the evaporator core.
3. Turning the unit over, remove the screws attaching the back cover and gasket to the case and remove the cover and gasket.
4. From the top of the case, remove the screws attaching the evaporator core brackets to the case.
5. Carefully draw the cone and expansion valve assembly out of the case.
6. Remove the expansion valve power element from the low pressure line.

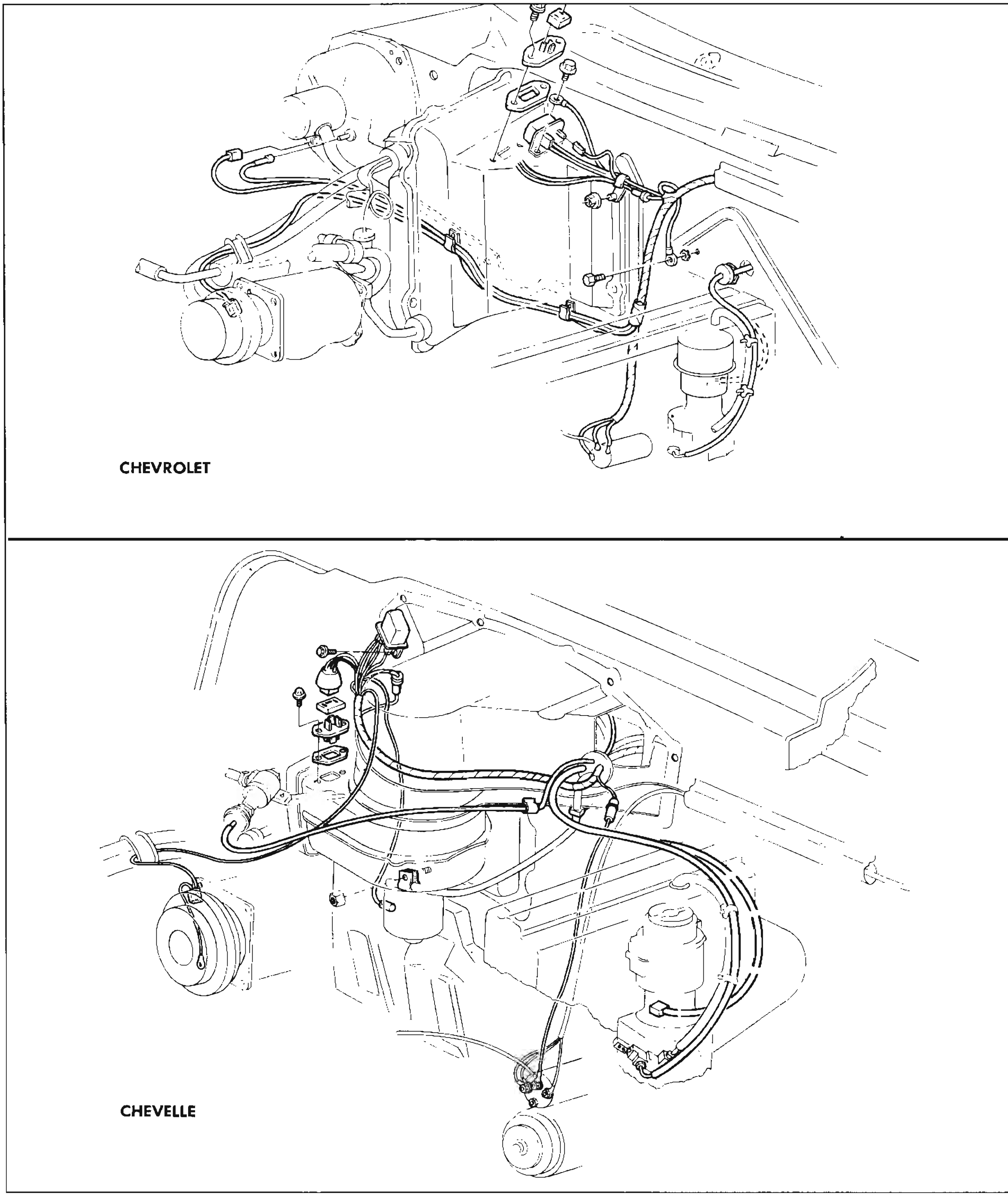


Fig. 47—Wiring and Vacuum Lines—Four-Season System

7. Disconnecting the high pressure and low pressure lines from the valve, remove the valve from the core.
8. At this point either the expansion valve, evaporator core or both may be replaced.

   Always use new "O" rings at the expansion valve connections and make the connections carefully to eliminate possible refrigerant leaks. Position the power element bulb so that it lies flush with the low pressure line and has the insulating material properly in place.

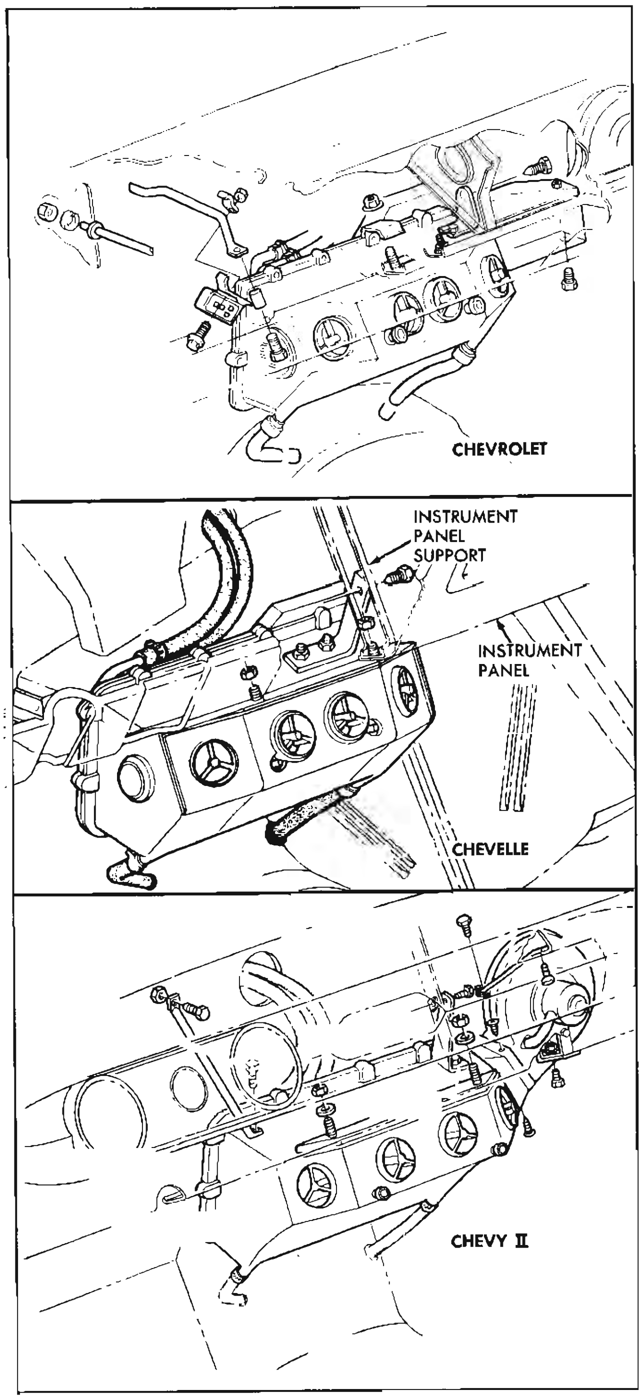


Fig. 48—Evaporator Removal—Custom System

9. Replace the core and valve assembly in the evaporator case and loosely install the case-to-core bracket attaching screws from the top of the case.
10. With the gasket in place, install the back cover of the evaporator case and its attaching screws and the seal around the evaporator inlet and outlet tubes.
11. Reach through the face plate opening and, using the plastic plugs, attach the thermostatic switch capillary tube to the evaporator core outlet pipe.

Installation

Within the Car

1. Install duct and attaching screw on evaporator case.
2. Attach system wiring as necessary to the evaporator case.
3. Replace inlet and outlet hoses and hose clamp connections.
4. Fit the case flange into the blower duct.
5. Insert the evaporator studs through the drilled hole in the instrument panel flange and reinforcement and, install the nuts and washers.
6. Replace the screws attaching the two evaporator case brackets to the hanger and panel brace and replace the screw attaching the duct to the blower flange.
7. Replace the drain hoses and the radio antenna lead.

Under the Hood

8. Evacuate and charge the system.
9. Check system performance.

Chevy II All-Weather System

Removal

Under the Hood

1. Purge the refrigerant from the system.
2. Remove the refrigerant hoses from the evaporator inlet and outlet connections extending through the special grommet in the dash panel and into the engine compartment (fig. 54).
3. Remove the screw, nut, spacer bracket and grommet from the outlet connection pipes (fig. 54).

Within the Car

4. Remove the glove box, ash tray and ash tray retainer.
5. Reach through the glove box door to disconnect the air conditioning "on" door bowden cable (fig. 55).
6. Remove the two shield attaching screws and shield (A, fig. 56) which covers the lower right evaporator bracket-to-blower bracket attaching screw (B, fig. 56), then remove this screw.
7. Behind the lower left side of the evaporator, remove the evaporator bracket-to-heater distributor bracket attaching screw (C, fig. 56).
8. Reaching through the glove box door and ash tray openings, remove the two nuts and washers (D, fig. 56) attaching the evaporator assembly studs to the lower instrument panel flange and reinforcement.
9. Disconnect the drain hoses and carefully pull the evaporator unit toward the rear of the vehicle.
10. Disconnect wiring connectors (see fig. 57) as necessary and remove the evaporator unit from the vehicle.

Core and/or Expansion Valve Replacement

A defective unit must be replaced since repairs should

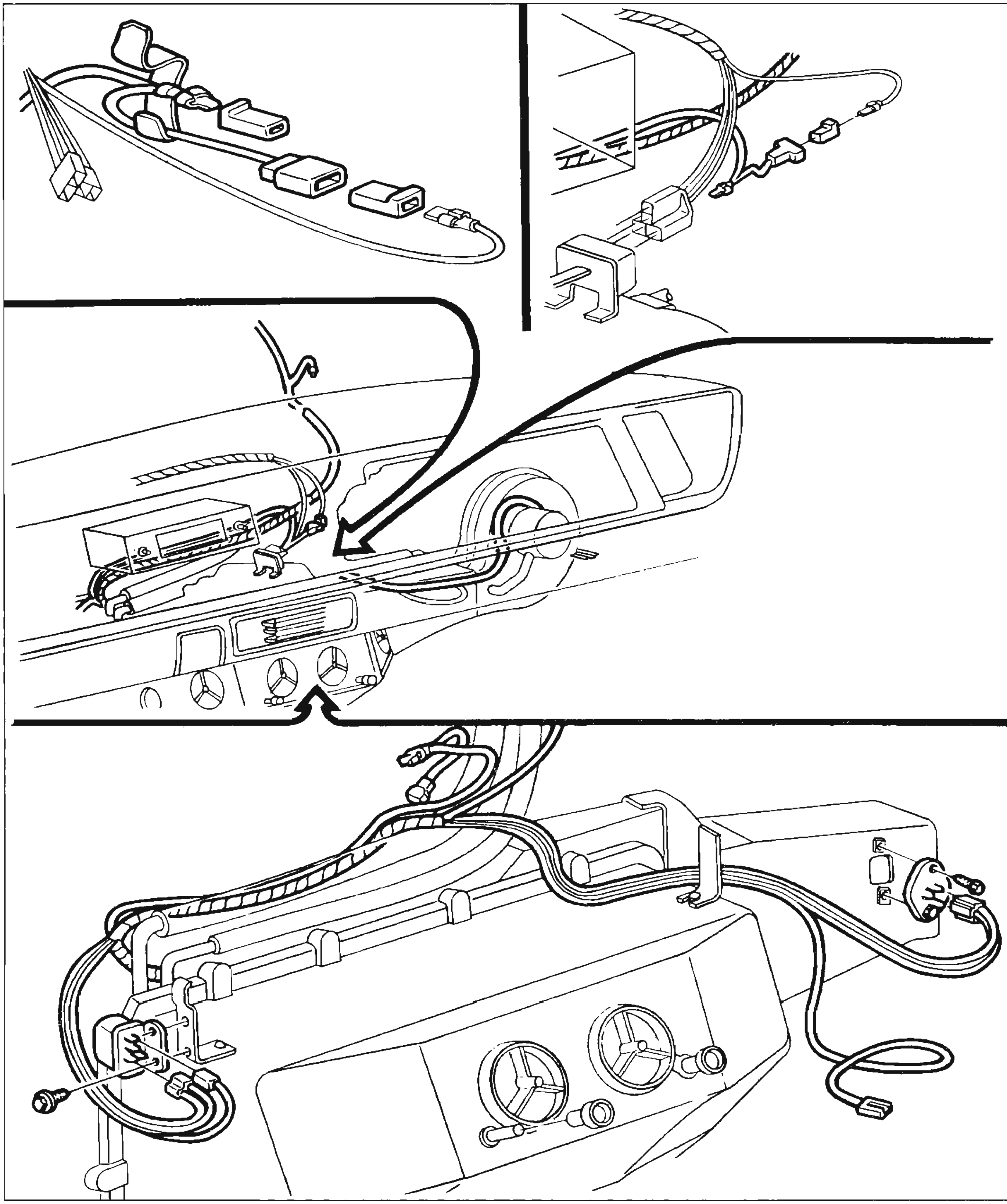


Fig. 49—Underdash Wiring—Custom System—Chevrolet

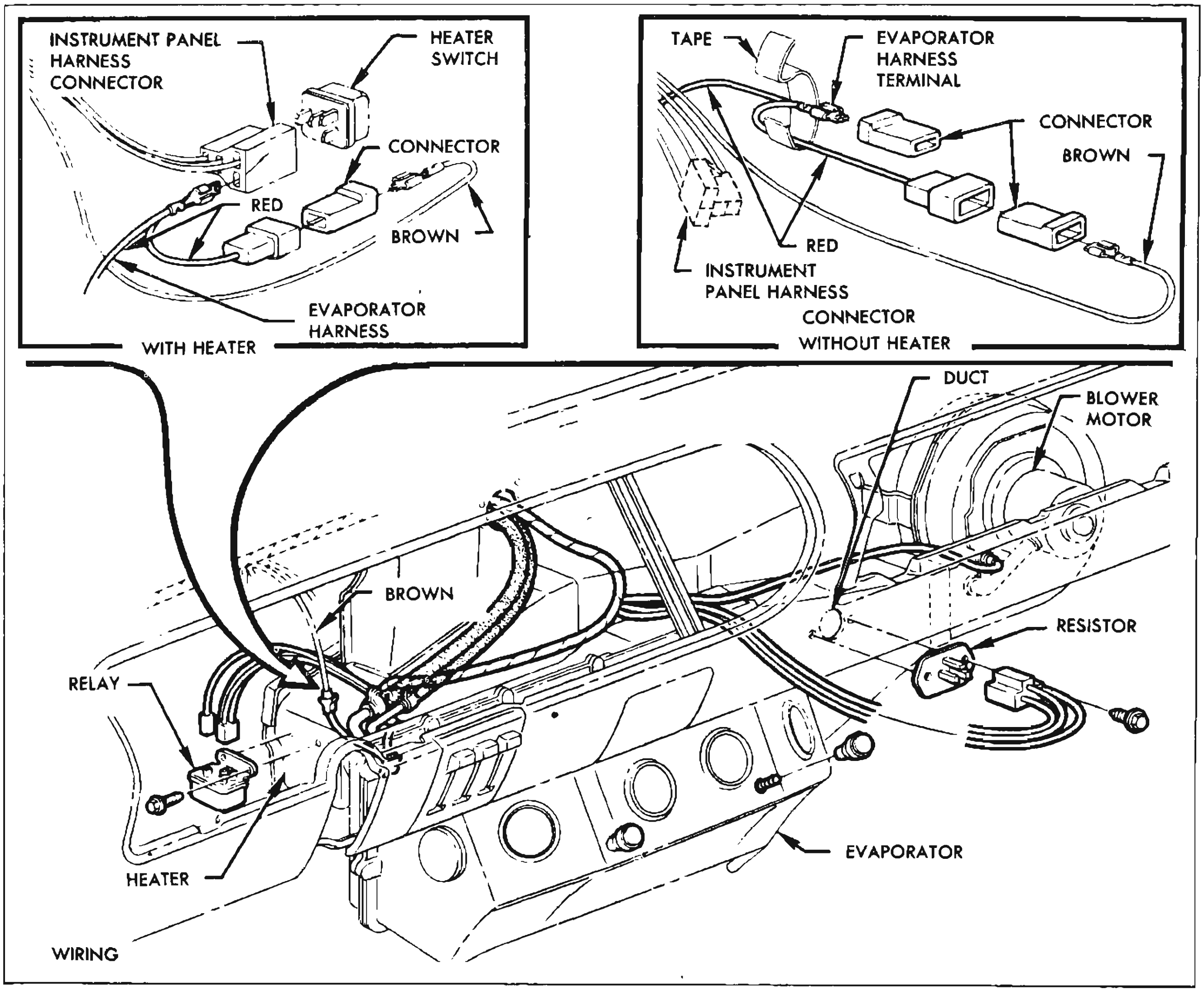


Fig. 50—Underdash Wiring—Custom—Chevelle

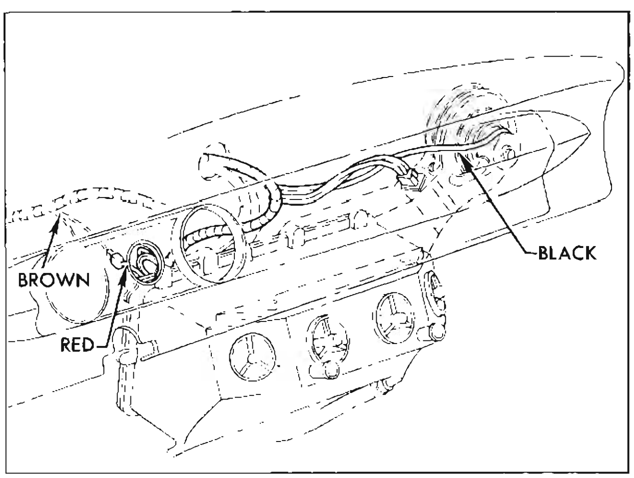


Fig. 51—Underdash Wiring—Custom—Chevy II

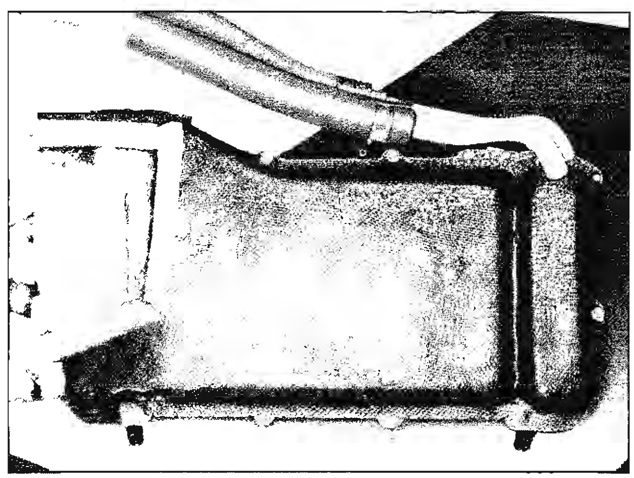


Fig. 52—Evaporator Case—Custom System

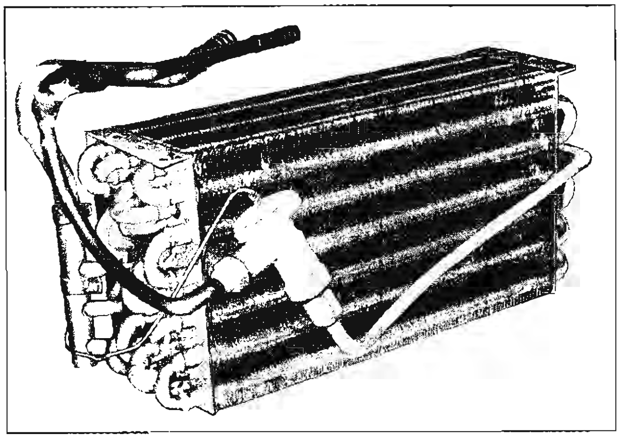


Fig. 53—Evaporator Core Removed

never be made on the evaporator core. Before replacing the core, however, check to be sure that any leaks present are not located at the hose connections or expansion valve connections. The following procedure assumes that the evaporator unit has been removed from the vehicle as outlined above.

1. Using a small screw driver, loosen the lock screws and remove the two control knobs from the front of the evaporator unit. Then use a suitable spanner wrench to remove the two bezels beneath the control knobs.
2. Remove the four screws attaching the face plate to the evaporator case. Then remove the face plate and, reaching through this opening, carefully remove the plug attaching the thermostatic switch capillary tube to the evaporator core.
3. Turning the unit over, remove the screws attaching the back cover and gasket to the case and remove the cover and gasket.
4. From the top of the case, remove the screws attaching the evaporator core brackets to the case.
5. Carefully draw the core and expansion valve assembly out of the case.

NOTE: The air conditioning "on" door bowden cable, which extends through the core, will also be removed at this time.

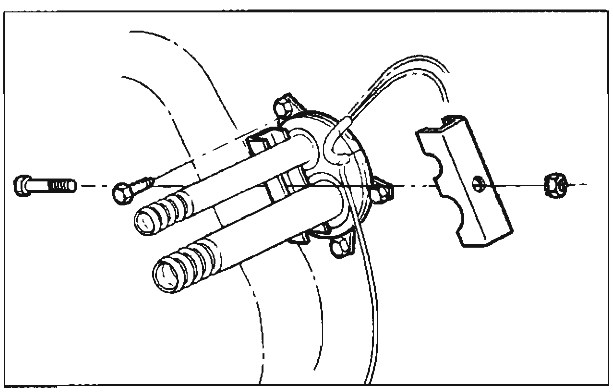


Fig. 54—Grommet and Spacer Bracket

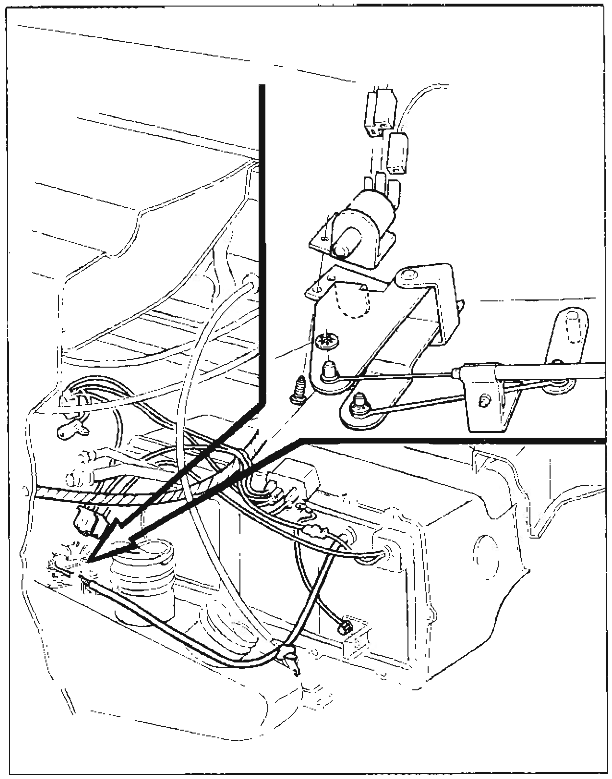


Fig. 55—Cable Removal

6. Remove the expansion valve power element from the low pressure line.
7. Disconnecting the high pressure and low pressure lines from the valve, remove the valve from the core.
8. At this point either the expansion valve, evaporator core or both may be replaced.

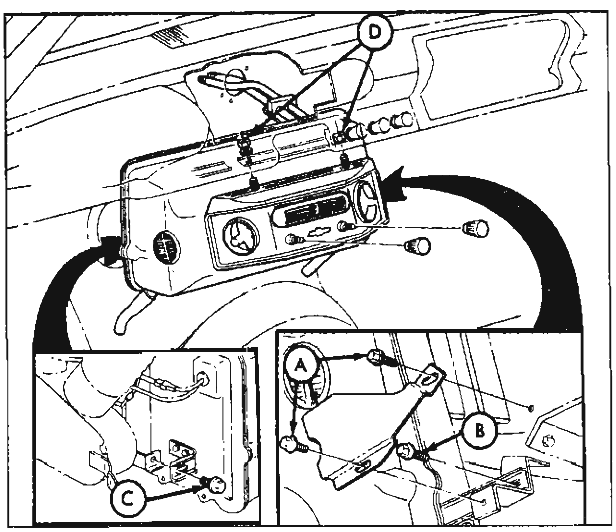


Fig. 56—Evaporator Removal

a. If replacing the expansion valve, use new "O" rings and make the connections carefully to eliminate possible refrigerant leaks. Position the power element bulb so that it lies flush with the low pressure line and has the insulating material properly in place.

b. If the evaporator core is to be replaced, it will be necessary to remove the air conditioning door bowden cable from the core and install it in the same location in the replacement core. If no passage has been provided for this purpose in the replacement core, a pointed instrument such as a pencil may be forced through core vanes at the proper location to provide the required opening. Also remove the spacer bracket, nut and screw from the inlet and outlet pipes of the evaporator core and place them in a like position on the replacement core.

9. Replace the core and valve assembly, with the bowden cable in place, in the evaporator case and install the two case-to-door bracket attaching screws.
10. With the gasket in place, install the back cover of the evaporator case and its attaching screws and the seal around the evaporator inlet and outlet tubes.
11. Reach through the face plate opening and, using the plastic plug, attach the thermostatic switch capillary tube to the evaporator core.

Installation

Within the Car

1. Attach system wiring as necessary to the evaporator case.
2. Carefully pass the evaporator inlet and outlet pipes through the special grommet in the dash panel.
3. Insert the evaporator studs through their drilled holes in the instrument panel flange and reinforcement and, reaching through the glove box door and ash tray opening, install the nut and washer on each stud.
4. Replace the screws attaching the two evaporator case brackets to the blower bracket and distributor bracket.
5. Replace the shield and attaching screws protecting the lower right mounting bracket.
6. Reaching through the face plate opening, attach the evaporator bowden cable.
7. Replace the face plate and attaching screws, feeding the control knob stems through the proper openings in the face plate.
8. Replace the control stem bezels and control knobs.
9. Replace the drain hoses.
10. Replace the glove box and ash tray.

Under the Hood

11. Replace the spacer bracket, screw and nut on the evaporator outlet pipes. Locate the bracket about 1/2" from the dash panel.
12. Replace the inlet and outlet hoses and hose clamp connections.
13. Evacuate and charge the system.
14. Check system performance.

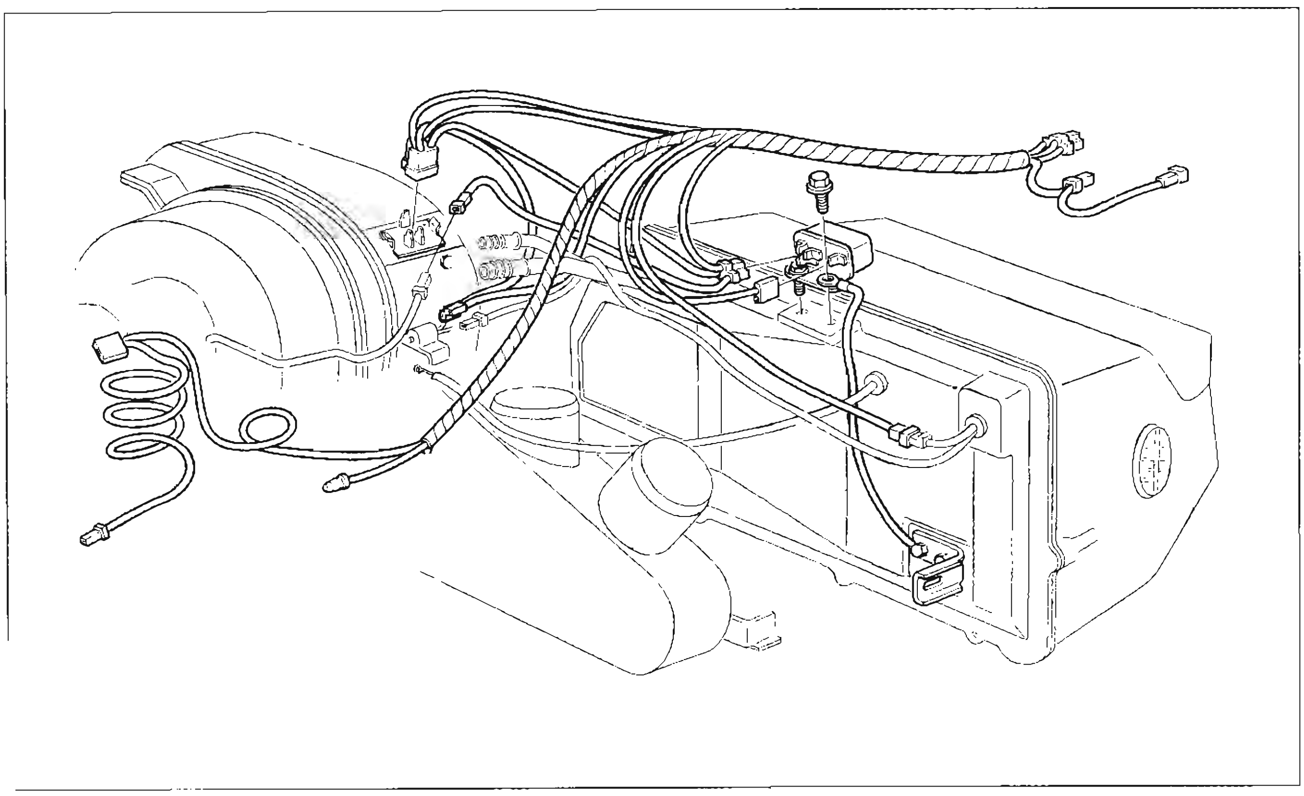


Fig. 57—Underdash Wiring—Chevy II All-Weather

EXPANSION VALVE

As in the past, the thermostatic expansion valve is factory adjusted and pre-set and cannot be adjusted after installation. A malfunctioning valve must be replaced. However, before proceeding, check all other possible causes of the trouble. Make certain that the power element bulb is properly positioned on the low pressure line, tightly clamped and has the insulation in place. Make certain the liquid inlet screen between valve and receiver-dehydrator line is not clogged. After checking the screen and the location and mounting of the thermobulb, proceed with replacement of the valve assembly. A malfunctioning valve may result from a stuck open or shut needle caused by corrosion, or a discharged power element caused by a broken capillary line or tip.

Four-Season System
Chevrolet and Chevelle
Replacement

1. Purge the system and, on Chevelle models, remove the right fender skirt.
2. Remove the expansion valve power element bulb from the low pressure line and the equalizing line from the suction throttling valve.
3. Remove the low and high pressure connectors from the valve, in that order. Remove the screw and bracket attaching the expansion valve to the evaporator case and remove the valve.
4. Before replacing the valve, check to be certain the inlet screen is not clogged. If the screen is plugged, replace it and check valve operation. If screen is clear or if valve still malfunctions after screen replacement proceed with the valve replacement.
5. Install the new valve by connecting the lines. Clamp the power element bulb of the new valve to the top of the low pressure line and the equalizing line to the suction throttling valve.

   NOTE: Be sure to replace the insulation around the power element bulb and that the power element makes good physical contact with the suction line.

6. Evacuate and charge the system.
7. Check the system for proper operation.

Custom System—
Chevrolet, Chevelle Chevy II and Chevy II All-Weather System

Replacement of Valve Assembly

1. Purge the system of refrigerant and remove the evaporator unit from the vehicle and the core from the unit as described under "Evaporator."
2. Remove the expansion valve power element bulb and the equalizing line connection from the low pressure line.
3. Remove the low pressure and high pressure lines from the valve. Remove the valve.
4. Install the new valve by connecting the low pressure, high pressure and equalizing line connections and clamp the power element of the new valve to the low pressure line.
5. Replace the core and evaporator as covered under "Evaporator."

SUCTION THROTTLING VALVE (STV)

Chevrolet and Chevelle

Dirt and other foreign material in the system and scoring of the piston represent the most frequent causes of sticking and "hanging-up" of the suction throttling valve. A clean, properly installed system represents the best method of assuring proper suction throttling valve operation. If valve malfunctioning occurs, proceed as follows:

Removal

1. Purge the system of refrigerant.
2. Chevelle only - remove the right front fender skirt as outlined in Section 1 of this shop manual.
3. Remove and cap the refrigerant line at the STV outlet and at the thermostatic expansion valve external equalizer and oil bleed line connections at the suction throttling valve.
4. Remove the bracket to STV attaching bolts.
5. Back off the connector at the STV inlet and remove the valve. Cap the evaporator outlet line.

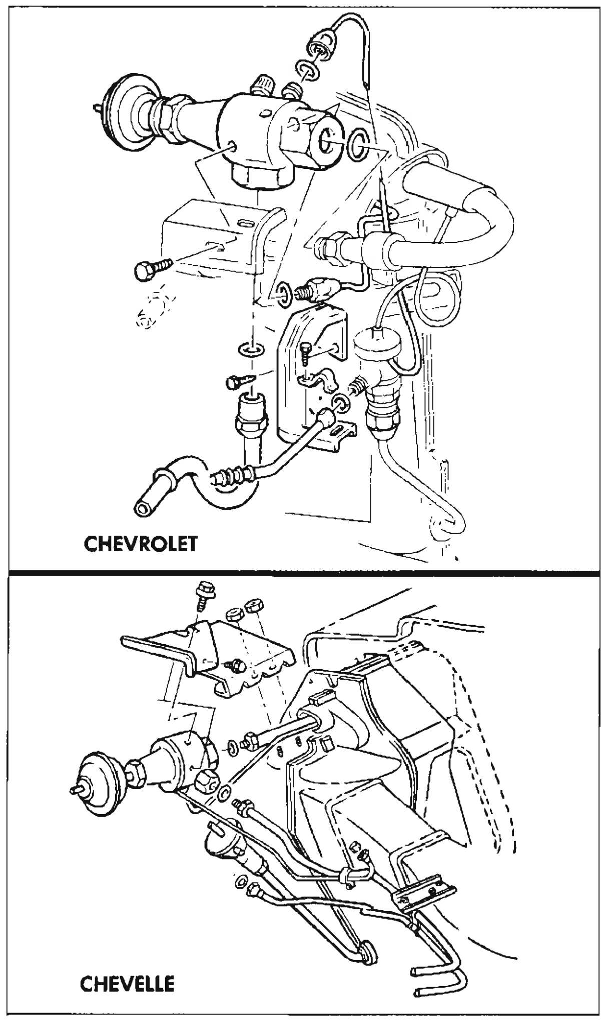


Fig. 58—Suction Throttling Valve

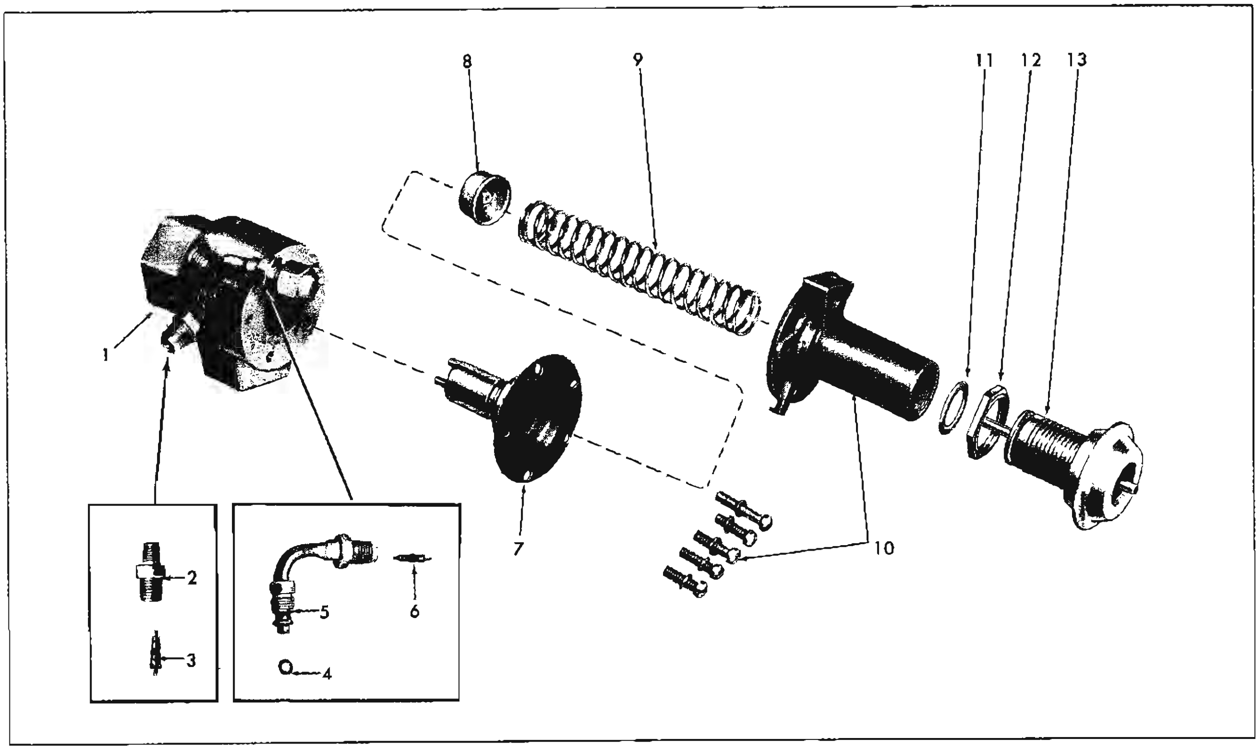


Fig. 59—Suction Throttling Valve—Exploded View

1. Body
2. Oil Bleed Line Connector
3. Oil Bleed Line Connector Valve
4. Evaporator Pressure Gauge Connection "O" Ring
5. Evaporator Pressure Gauge Connection
6. Evaporator Pressure Gauge Connection Valve
7. Piston and Diaphragm Assembly
8. Spring Retainer Cup
9. Spring
10. Cover and Cover Screws
11. Thrust Washer
12. Locknut
13. Vacuum Head Assembly

Disassembly

1. Securely hold the valve, loosen the jam nut and remove the vacuum head and actuating pin assembly.

   CAUTION: The spring is under considerable compression and should be restrained until this force has been removed from it. If this is not done, the spring may pop out.

2. When the spring has been removed the spring retainer cup and thrust washer will drop out freely.
3. Remove the five screws from the flange of the cover and body. Usually the cover will be easily removed from the body but it may in some cases be necessary to rock the cover slightly back and forth to remove it.
4. The diaphragm and piston assembly can now be removed.

   NOTE: The diaphragm should be handled with care to avoid damage to the rubber and fabric surfaces.

5. Examine the screen and retainer in the lower portion of the piston for any foreign material or contamination. Clean if necessary using an approved solvent. Do not remove the screen.

   NOTE: Solvent should be thoroughly removed from the parts prior to reassembly.

6. Replace the piston if its exterior surface is scored, scratched or nicked.

   NOTE: Do not scrape, stone or crocus cloth these damaged areas due to the close tolerance that is required in the fitting of the parts for proper operation.

7. If either the diaphragm or piston is found to be damaged replace the entire assembly.
8. Examine the body bore surfaces for any surface imperfections, foreign material and any obvious damage that would cause the piston to not operate freely. The body should be replaced if the bore is damaged or if any cross threading or damage has been sustained around the connector ports.

   NOTE: Do not scrape, stone or "dress out" any damage as it may result in improper performance of the valve.

Inspection and Repair

Check valve components for broken or bent parts. Check the piston and valve body for dirt or other foreign material or scored condition. Clean or replace as necessary. When cleaning the valve components use extreme care not to leave any grit, lint or other foreign material, particularly on the piston or adjacent areas of the valve body. Check the condition of the valve diaphragm and replace the piston and diaphragm assembly if it has been damaged. If the filter screen in the piston is dirty, clean it or replace the assembly. Check the condition of the vacuum head assembly diaphragm by placing the vacuum connection in your mouth and attempting to draw a vacuum. A defective diaphragm will be readily apparent.

Assembly

1. A very light application of powdered Molykote Type Z should be applied to the upper or fabric surface of the depressed section of the diaphragm where the spring retainer cup will fit into it.
2. Apply a light coat of 525 viscosity oil to the wall of the piston and insert it into the body of the valve.
3. Assemble the spring cup to the diaphragm and place the cover in proper location over the diaphragm, being sure the diaphragm holes are in line with the locating protrusions under the cover flange. Start the five screws into the body, but DO NOT TIGHTEN.
4. With the cover and body held loosely in one hand, insert a clean smooth rod, approximately 3/8 in diameter, through the inlet opening so as to contact the screen retainer in the bottom of the piston. Carefully press the piston upward into the cover so as to cause convolution of the diaphragm to position properly into the cavity of the cover and so not become "pinched" under the flange.
5. Remove the rod from the inlet opening and insert it through the upper portion of the cover. It should contact the center post of the cup. Press lightly downward so as to cause the piston to seat against the inner shoulder of the body. While the cup, diaphragm and piston are held down, tighten the five screws to 35 to 40 inch pounds torque.
6. Install the spring into the cup over the center post.
7. After being certain the spring is properly located in the cover, place the thrust washer on top of the outer spring.
8. Insert the vacuum head assembly actuating pin into the cover being sure the small diameter end of the pin enters the hole in the spring retainer cup. Compress the spring until it is possible to start and engage the threads on the vacuum head assembly with the cover. Then run the screw down about one-half of its thread length.

Installation and Adjustment

1. Using a new "O" ring, install the suction throttling inlet to the evaporator outlet connector.
2. Install the bracket to valve attaching bolts.
3. Using new "O" rings, install the STV outlet line, expansion valve equalizer line and oil bleed line to the valve.

   CAUTION: Do not over-tighten these connections.

4. Install the vacuum line on the STV.
5. Evacuate and charge the system.
6. With the low pressure gauge line on the STV gauge fitting, adjust the valve (by turning the vacuum head as required) until, with the system in operation, the evaporator pressure holds at 28 psi.

   NOTE: Three turns of the head will result in approximately 1 psi pressure difference.

7. Pull the vacuum line off the vacuum can. The evaporator pressure should rise approximately 3 psi.

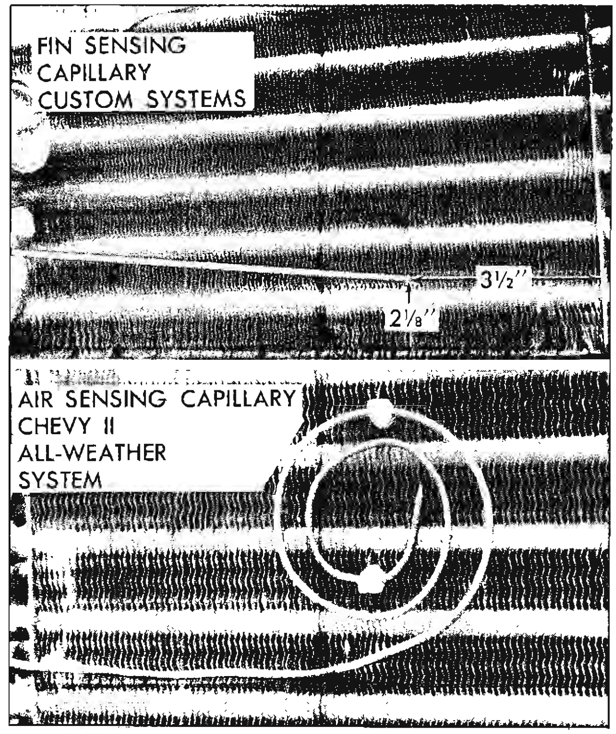


Fig. 60—Thermostatic Switch Capillary Tubes

Replace the vacuum hose.

8. Replace the fender skirt (Chevelle).

THERMOSTATIC SWITCH

Custom System — Chevrolet, Chevelle and Chevy II

Replacement (see Fig. 61)

1. Remove both control knobs and control stem bezels from the evaporator assembly.
2. Remove the face plate attaching screws and lift off the face plate.
3. From the front of the evaporator case remove the thermostatic switch attaching screw and remove wiring connectors from the switch.
4. Draw the switch out of the case through the face plate opening. Carefully remove the fin sensing capillary from the evaporator core (fig. 60).
5. Reinstall the new switch by reversing the removal procedure.

All-Weather System Chevy II

Replacement (see Fig. 61)

1. Remove both control knobs and control stem bezels from the evaporator assembly.
2. Remove the face plate attaching screws and lift off the face plate.
3. Remove the two thermostatic switch attaching screws.
4. Disengage the plastic plug attaching the thermostatic switch capillary tubing to the face of the evaporator core (fig. 60).

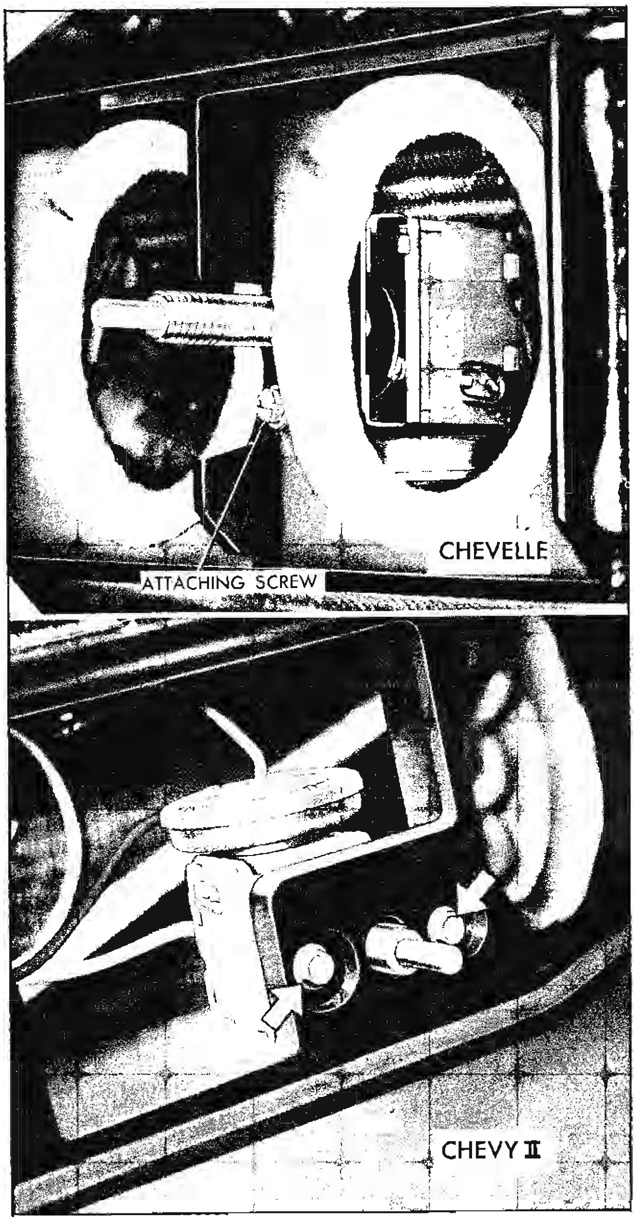


Fig. 61—Thermostatic Switch Removal All-Weather System

5. Draw the switch out of the case through the face plate opening, disconnecting the electrical connectors.
6. Reinstall the new switch by reversing the removal procedure.

BLOWER ASSEMBLY

Four-Season System

Chevrolet and Chevelle

The blower assembly (fig. 62) is mounted to the dash panel and contains the outside air-recirculated air di-

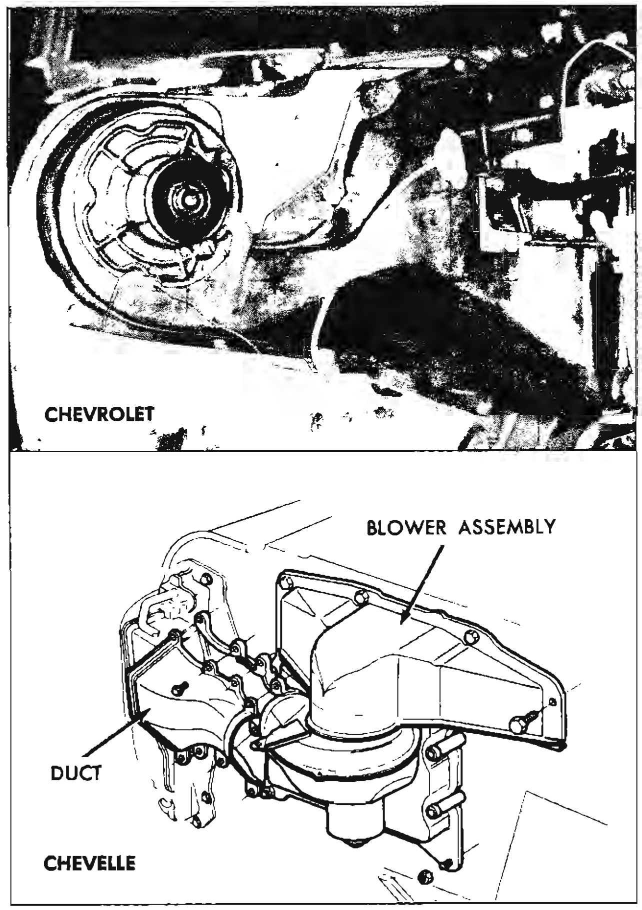


Fig. 62—Blower Assembly—Four-Season System

verter door, the heating-cooling diverter door, the air conditioning relay and resistor, the compressor actuating switch, and the blower motor.

Replacement

1. Disconnect the blower motor "hot" wire at the connector and the ground lead on the Chevrolet.
2. Detach the rubber cooling tube from the blower assembly and remove the five bolts attaching the blower motor to the blower assembly.
3. Remove the motor and fan, disassemble fan from motor and install on a new motor.
4. Reinstall motor and fan into blower assembly. Replace cooling tube, ground wire and connect hot wire to connector.
5. Check blower operations.

Custom System

Chevrolet, Chevelle and Chevy II

Replacement

1. Remove blower to duct attaching screws.
2. Remove the two bolts attaching the blower bracket to the instrument panel flange and the bolt attaching the blower motor to the dash panel bracket (fig. 63).
3. Remove the blower and bracket assembly far enough to unplug the wiring connector at the blower.
4. Remove the bolts attaching the blower to the housing. Install new blower in the housing.

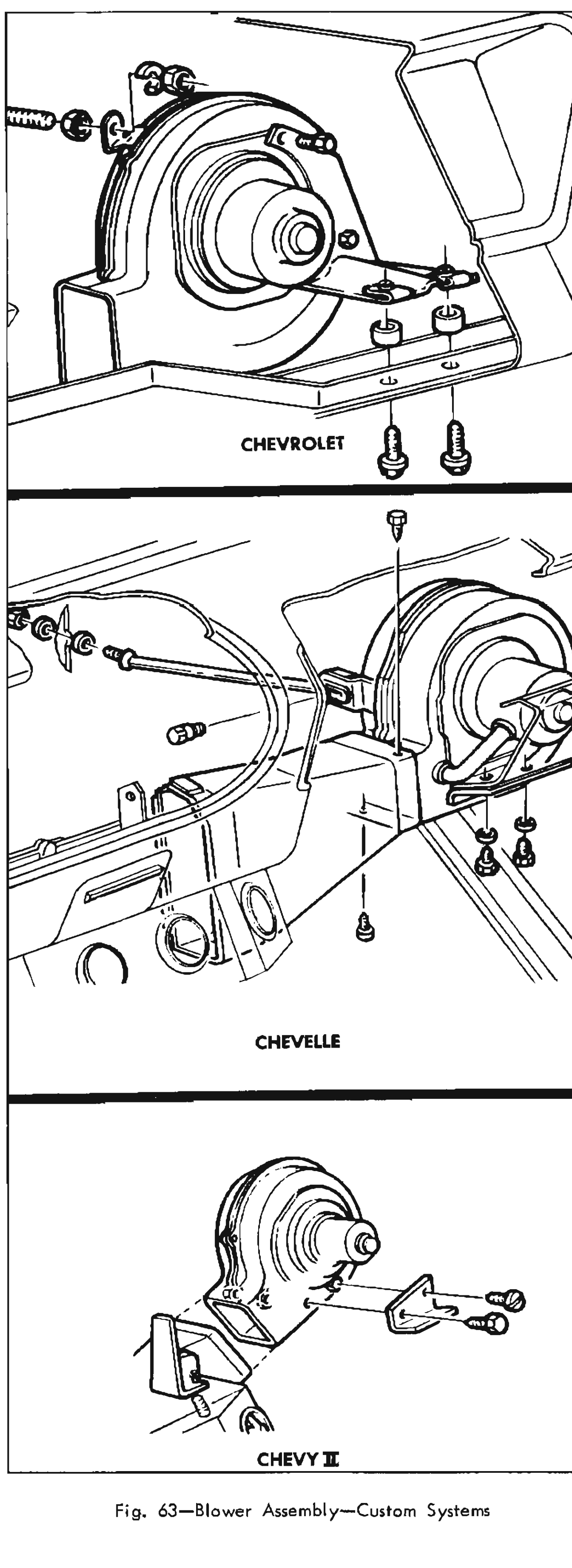


Fig. 63—Blower Assembly—Custom Systems

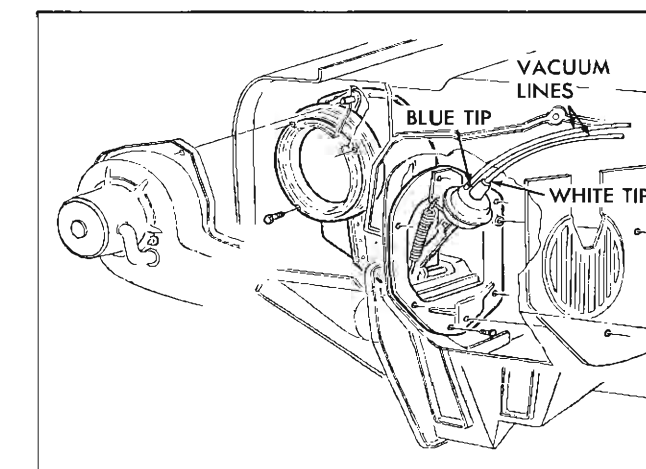


Fig. 64—Air Inlet Assembly and Vacuum Lines (Chevrolet Four-Season System)

5. Reinstall the wiring connector and bolt the blower and bracket assembly into place. Replace the blower to duct attaching screws.

All-Weather System

Chevy II

The blower motor for the Chevy II System is serviced as previously outlined for the Chevy II heater blower motor.

AIR INLET VACUUM VALVE

Four-Season System (Chevrolet)

Figure 64 illustrates the vacuum valve which controls the air inlet operation of the Four-Season System.

A vacuum tank and check valve is used to assure that the air door will not change its position due to variations in engine vacuum.

COMPRESSOR

The same basic six cylinder reciprocating compressor is used in all 1965 systems.

Two variations of the basic compressor are used. One, with a displacement of 12.6 cu. in. is used with the Four-Season System. The second model, having displacement of 10.8 cu. in. is used with the Custom and All-Weather Systems. The difference in capacity is achieved by counterboring the face of the pistons used in the 12.6 cu. in. compressor thus reducing the capacity to 10.8 cu. in.

All Systems

Removal

1. Purge the refrigerant from the system.
2. Remove connector attaching bolt and connector. Seal connector outlets.
3. Disconnect electrical lead to clutch actuating coil.
4. Loosen brace and pivot bolts and detach belt.
5. Remove the nuts and bolts attaching the compressor brackets to the mounting bracket.
6. Before beginning any compressor disassembly, drain

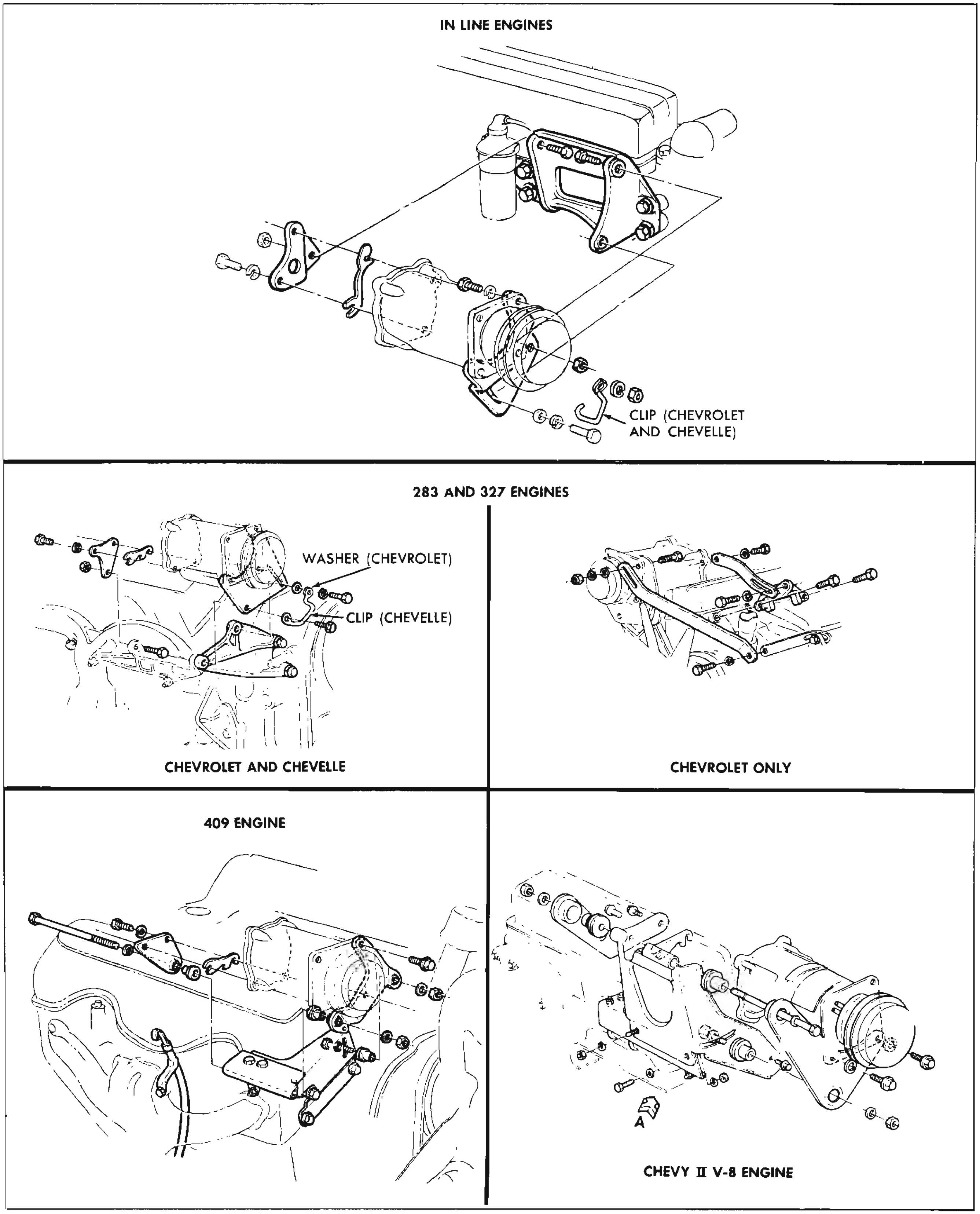


Fig. 65—Compressor Mounting

and measure oil in the compressor. Check for evidence of contamination to determine if remainder of system requires servicing.

Installation

1. If oil previously drained from the compressor upon removal shows no evidence of contamination, replace a like amount of fresh refrigeration oil into the compressor before reinstallation. If it was necessary to service the entire system because of excessive contamination in the oil removed, install a full charge of fresh refrigeration oil in the conpressor.
2. Position compressor on the mounting bracket and install all nuts, bolts and lock washers.
3. Install the connector assembly to the compressor rear head, using new "O" rings.
4. Connect the electrical lead to the coil and install and adjust compressor belt.
5. Evacuate and charge the system.
6. Leak test the system and check for proper operation.

Compressor Belt Tension Adjustment

Adjust the compressor belt to give 1/2" to 3/4" deflection under a fifteen lb. load measured midway between the compressor pulley and the crankshaft pulley.

CHECKING AND ADDING OIL

In the six cylinder compressor it is not recommended that the oil be checked as a matter of course. Generally, compressor oil level should be checked only where there is evidence of a major loss of system oil such as might be caused by:

- A broken refrigerant hose.
- A severe hose fitting leak.
- A very badly leaking compressor seal.
- Collision damage to the system components.

As a quick check on compressor oil charge, with the engine off, carefully crack open the oil drain plug on the bottom of the compressor. If oil comes out, the compressor has the required amount of oil. To further check the compressor oil charge, should the above test show insufficient oil, it is necessary to remove the compressor from the vehicle, drain and measure the oil.

Checking Compressor Oil Charge

1. Run the system for 10 minutes at 500-600 engine rpm with controls set for maximum cooling and high blower speed.
2. Turn off engine, discharge the system, remove compressor from vehicle, place it in a horizontal position with the drain plug downward. Remove the drain plug and, tipping the compressor back and forth and rotating the compressor shaft, drain the oil into a clean container, measure and discard the oil.
3. a. If the quantity drained was 4 fluid oz. or more, add the same amount of new refrigeration oil to the replacement compressor.
   b. If the quantity drained was less than 4 fluid oz., add 6 fluid oz. of new refrigeration oil to the replacement compressor.
   c. If a new service compressor is being installed, drain all oil from it and replace only the amount specified in Steps 3a and 3b above.
   d. If a field repaired compressor is being installed, add an additional 1 fluid oz. to the compressor.
4. In the event that it is not possible to idle the compressor as outlined in Step 1 to effect oil return to it, proceed as follows:
   a. Remove the compressor, drain, measure and discard the oil.
   b. If the amount drained is more than 1-1/2 fluid oz. and the system shows no signs of a major leak, add the same amount to the replacement compressor.
   c. If the amount drained is less than 1-1/2 fluid oz. and the system appears to have lost an excessive amount of oil add 6 fluid oz. of clean refrigeration oil to replacement compressor, 7 fluid oz. to a repaired compressor.

      If the oil contains chips or other foreign material, replace the receiver-dehydrator and flush or replace all component parts as necessary. Add the full 11 fluid oz. of new refrigeration oil to the replacement compressor.
5. Add additional oil in the following amounts for any system components being replaced.

Evaporator	3 fluid oz.
Condenser	1 fluid oz.
Receiver-Dehydrator	1 fluid oz.

NOTE: When adding oil to the compressor, it will be necessary to tilt the rear end of the compressor up so that the oil will not run out of the suction and discharge parts. Do not set the compressor on the shaft end.

COLLISION PROCEDURE—All Systems

Whenever a car equipped with air conditioning unit is involved in a collision or wreck, it should be inspected as soon as possible. The extent of damage to any or all of the component parts and the length of time the system has been exposed to the atmosphere will determine the replacement of parts and processing that will be required. The greater the length of time of exposure to the atmosphere, the greater will have been the chances for air, moisture and dirt to have entered and damaged the system. Every case may be entirely different so it is not possible to establish a hard and fast procedure to follow each time. Good judgment must be used to determine what steps should be taken in each specific case.

The following procedure is presented as a guide for use when inspecting a damaged vehicle equipped with air conditioning.

1. Remove the drive belt. Cut belt off if necessary.
2. Visually inspect the condenser, receiver-dehydrator, compressor, mounting brackets, conditioning unit, all connecting lines, and all controls to determine the extent and nature of the damage.
   a. No repairs, such as soldering, welding or brazing, should be attempted on the condenser because of its construction. If the vapor passages in the horizontal tubes or return bends or manifolds have been damaged in any way, the condenser should be replaced with a new one.
   b. The receiver-dehydrator should be replaced if there is any evidence of its having sustained either internal damage or a fracture at any of the lines or welded joints or if the system has been exposed to the atmosphere for an undetermined period of time.

c. Examine the compressor for any visible external damage.
d. The evaporator should be examined for damage and, if necessary, removed or replaced or the entire unit processed where damaged or exposed to the atmosphere.
e. All connecting lines and flexible hoses should be examined throughout their entire length for damage. If damaged in any manner, replace with new lines.
f. Check all controls and connecting wires for damage and replace with new parts where needed.
g. Check the clutch pulley for proper operation and freedom from damage.

3. Install gauge set.
4. Purge the system. Pressure should not exceed 3 to 5 pounds.
5. Remove the compressor from mounting and remove the oil test fitting.
6. Pour out the oil into a clean glass container and examine it for any foreign substance such as dirt, water, metal particles, etc. If any of these are present, the compressor and receiver-dehydrator should be replaced and the other system components should be flushed with liquid refrigerant.
7. If the oil is clean and free of any harmful substance, replace oil with Frigidaire Oil available through Parts Stock.

NOTE: If the system components have been replaced or flushed, replace the full charge of oil. If not, add no more fresh oil than was drained in Step 6.

8. Charge up the compressor to drum or can pressure and leak test the compressor seals prior to installation of compressor.
9. Reinstall the compressor and evacuate the system by following the Evacuating Procedure.
10. Introduce R-12 vapor at cylinder (room) temperature and pressure.
11. Leak test all fittings and connections and give particular attention to a leak test at the compressor shaft seal if compressor has not been leak tested on the bench.
12. Complete system processing and charge system.

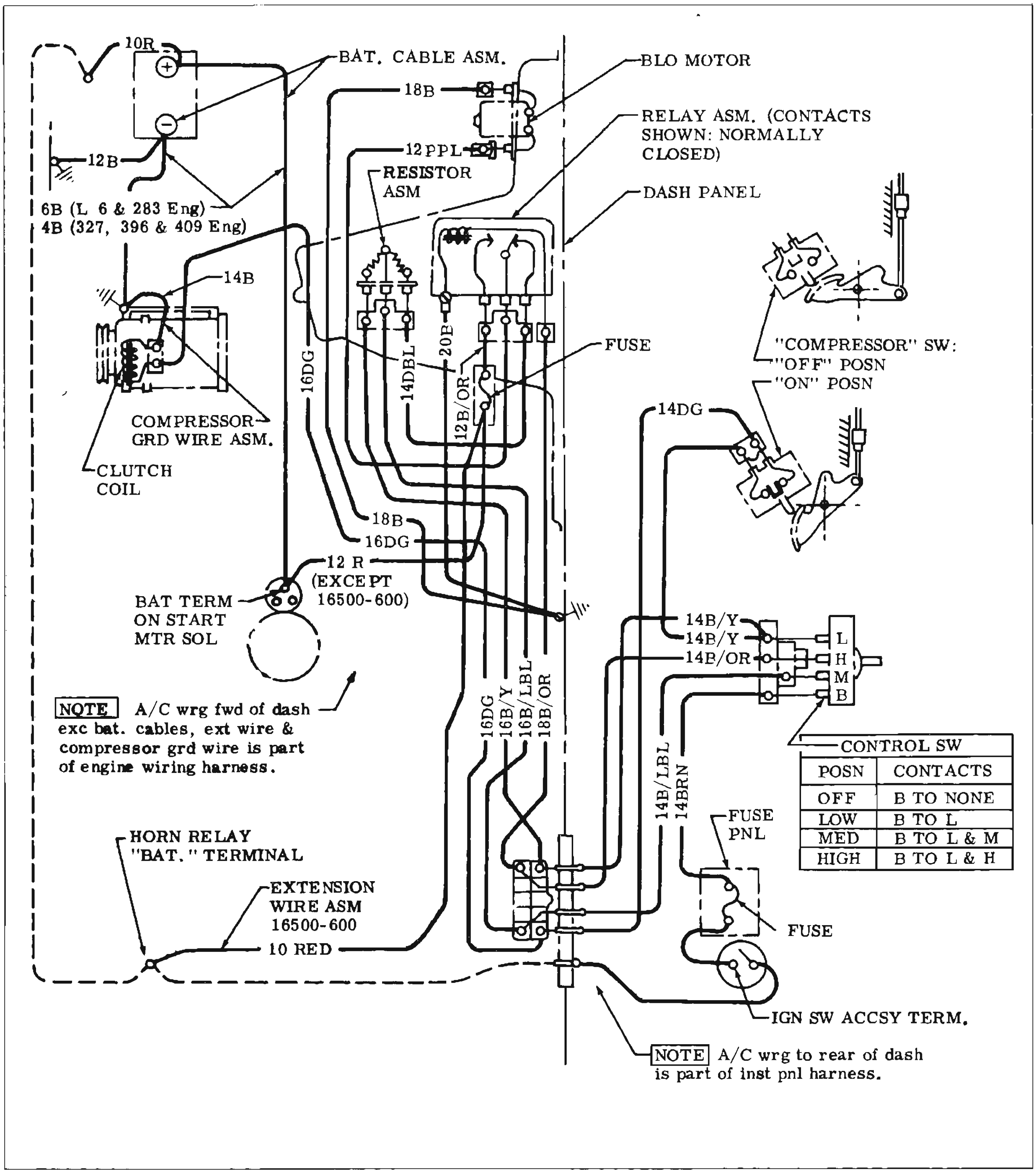
FUSES

A fuse, located in the junction block protects the entire air conditioning system except for the blower when operating at high speed.

A second fuse, to protect the high speed blower circuit, is located in the electrical wiring between the starter solenoid and the dash panel grommet.

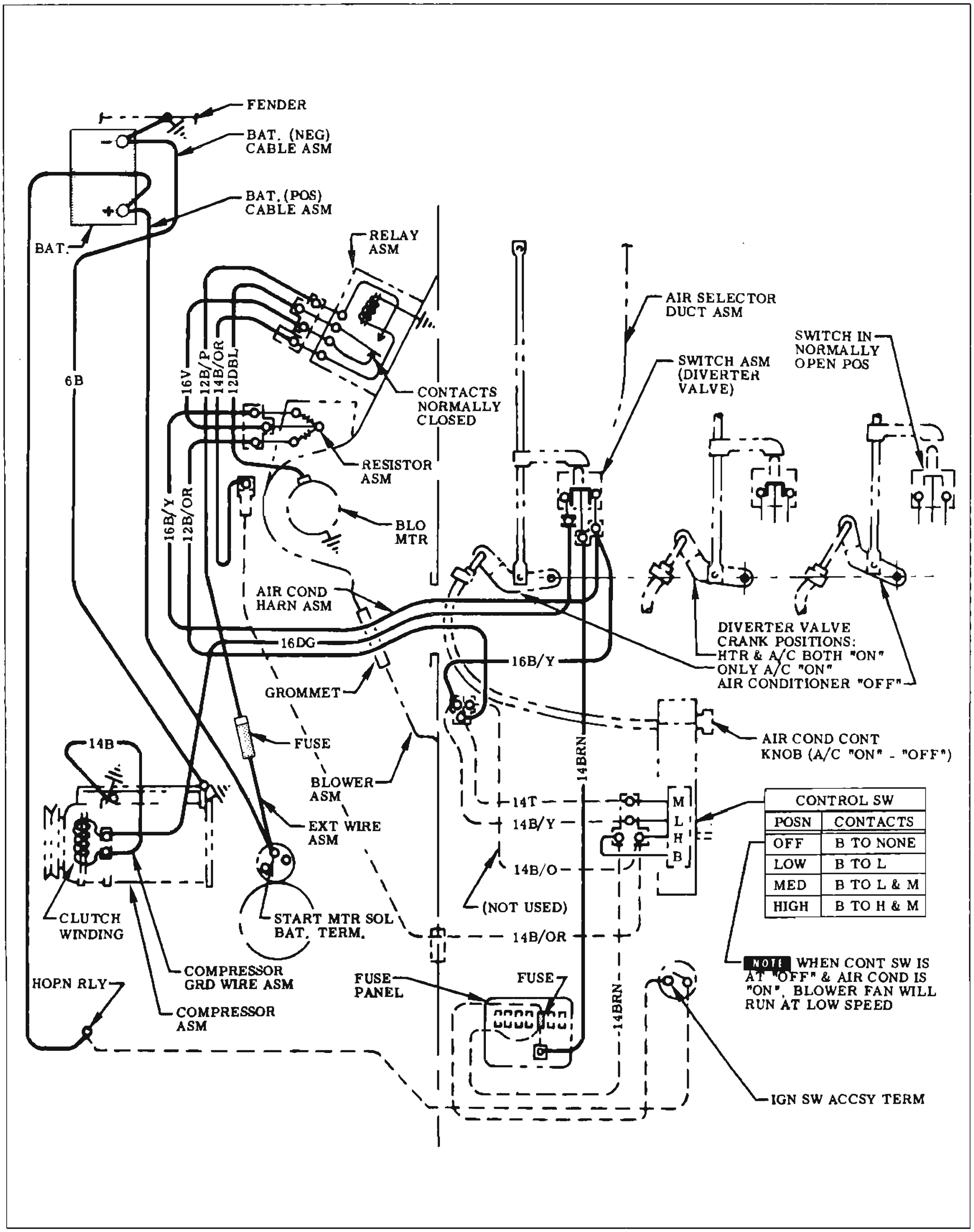
	Fuse Block	In Line
Four Season Systems		
Chevrolet	20	30
Chevelle	20	30
Custom Systems		
Chevrolet	15	20
Chevelle	15	20
Chevy II	15	20
All-Weather System		
Chevy II	15	20

WIRING DIAGRAMS



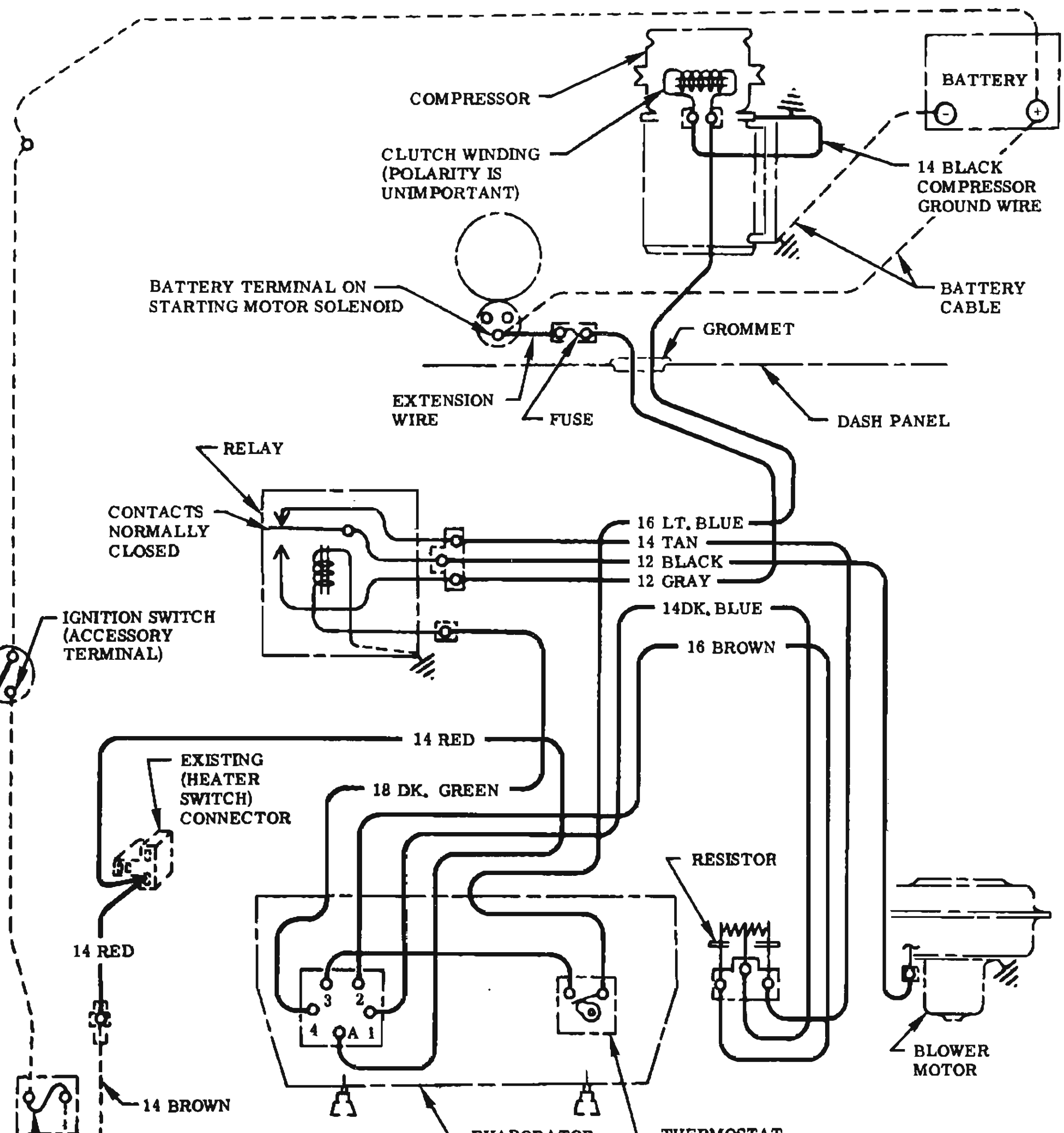
POSN	CONTACTS
OFF	B TO NONE
LOW	B TO L
MED	B TO L & M
HIGH	B TO L & H

Fig. 66—Chevrolet Four-Season System



CONTROL SW	
POSN	CONTACTS
OFF	B TO NONE
LOW	B TO L
MED	B TO L & M
HIGH	B TO H & M

Fig. 67—Chevelle Four-Season System



CONTROL SWITCH	
SET AT	CONNECTIONS
OFF	A TO NONE
LOW	A TO 2 & 3
MED	A TO 1 & 3
HIGH	A TO 1,3 & 4

Fig. 68—Chevrolet, Chevelle and Chevy II Custom System

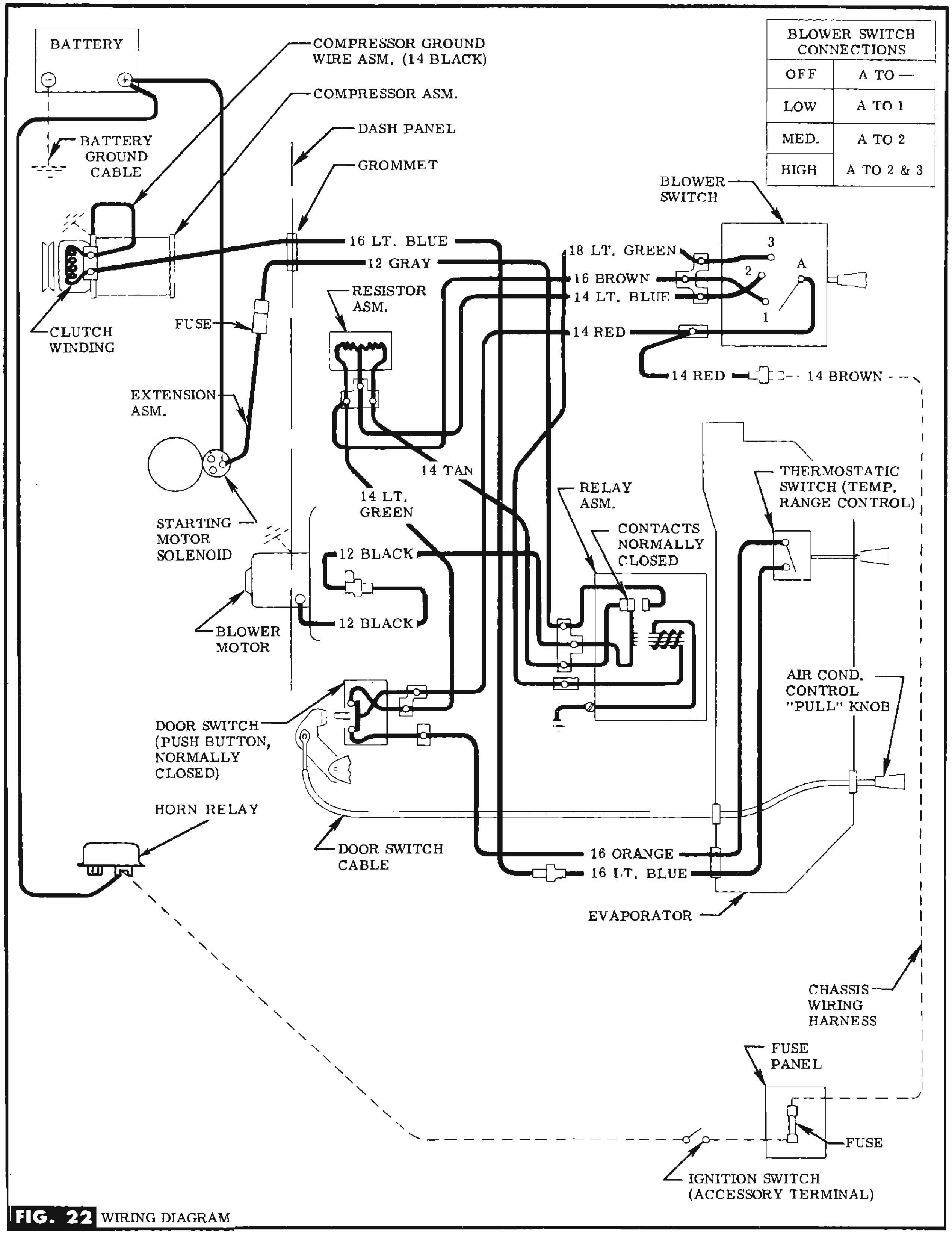


Fig. 69—Chevy II All-Weather System

CRUISE CONTROL

INDEX

GENERAL DESCRIPTION

The automatic lock-in Cruise Control is a driver-operated speed regulating device that may be used either as a speed reminder or as an automatic speed control for any car speed between 25 MPH and 85 MPH. The unit is available on Chevrolet and Chevelle vehicles.

The major components of the automatic lock-in Cruise Control are: the power unit, mounted under the hood; and the selector control assembly, located on the lower left side of the instrument panel.

The power unit is driven by a flexible drive cable from the transmission, Figure 70. The drive cable also drives the speedometer cable that runs from the power unit to the speedometer. The selector control assembly is connected to the power unit by means of a bowden cable. Mechanical linkage connects the power unit to the accelerator and carburetor throttle rod.

The selector control assembly is shown in Figure 71. Speed settings are secured by use of a calibrated thumb wheel. The selector dial is numbered with speed markings from 30 MPH to 80 MPH, in increments of 5 MPH. The numbers on the dial are illuminated for night driving. The slide switch located to the right of the selector dial turns the unit on and off, and activates the unit for automatic control. A red indicator light, located on the escutcheon above the selector dial, glows whenever the unit is set for automatic control.

When the slide switch is in the OFF position, the unit has no effect at any car speed. Once the switch has been moved to the ON position, the unit is on and accelerator back pressure will be felt as a warning at the speed the selector dial is set for. Moving the slide switch momentarily to the AUTO position activates an automatic relay switch in the power unit and the red indicator light will glow indicating the unit is set for automatic control. The switch, which is spring loaded, will return to the ON position. Once the unit is set for automatic control, the

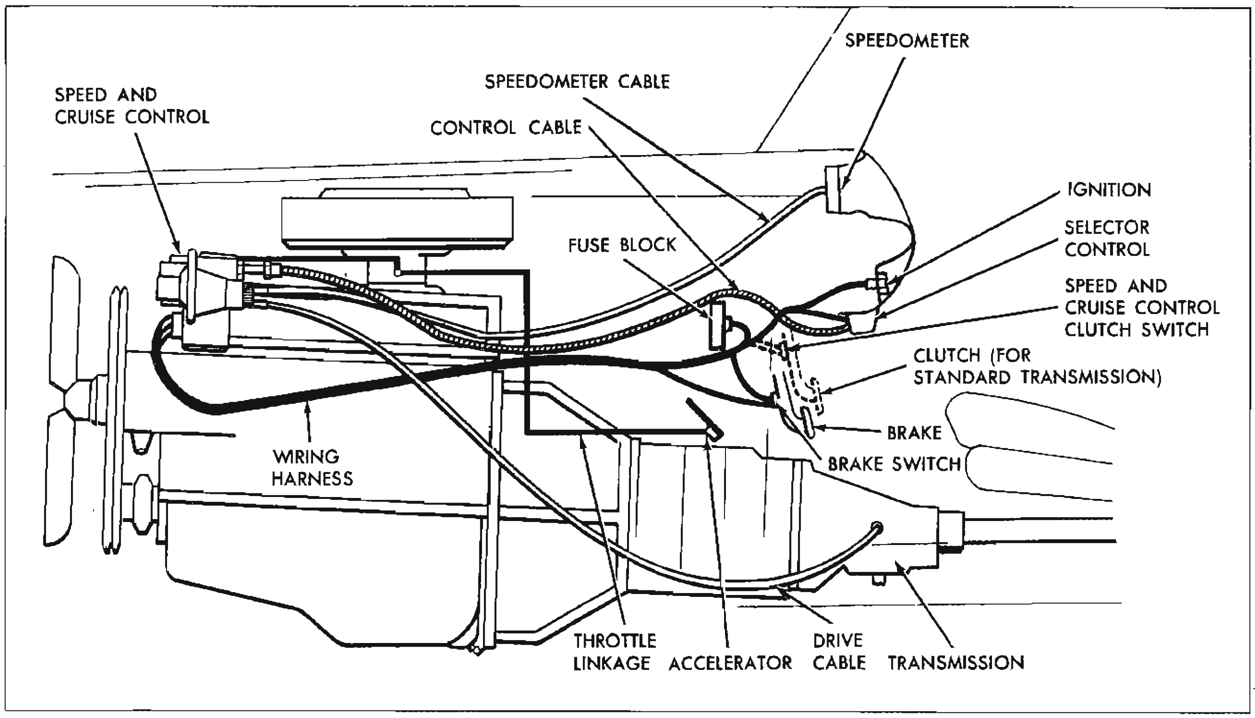


Fig. 70—Cruise Control Installation

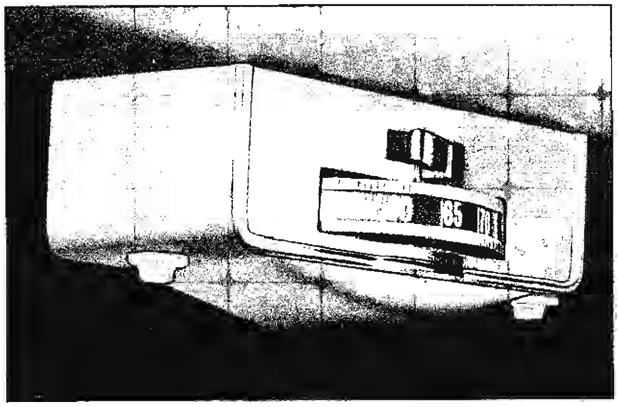


Fig. 71—Selector Control Assembly

unit will lock-in automatically whenever back pressure is felt on the accelerator pedal at the speed the selector dial is set for.

A reversible electric motor in the power unit actuates the mechanical linkage between the power unit and the carburetor. Motor feed points for forward and reverse energizing of the motor are closed and opened by a governor, under control of a governor spring that is compressed or relaxed to calibrated positions, corresponding to selected speeds, by the bowden cable leading to the selector control.

SPEED REMINDER OPERATION

Move the slide switch to "ON" position and rotate the selector dial to the desired speed setting, with speed setting lined up with center of slide switch. The Cruise Control will then function as a speed reminder by exerting back pressure on the accelerator pedal whenever the speed setting is reached. The unit will function in the same way whenever the speed setting is changed.

Cruise Control does not interfere with normal acceleration up to the selected speed setting. Further acceleration may be obtained above that speed by pressing the accelerator pedal past the warning back pressure position.

AUTOMATIC SPEED CONTROL OPERATION

For automatic speed control, move slide switch momentarily to AUTO position until red indicator light glows. Then rotate selector dial to the desired speed setting. The unit is now set for automatic control and will lock-in automatically when back pressure is felt on the accelerator at the speed the selector dial is set for. The car will now maintain the selected speed automatically and the driver may remove his foot from the accelerator pedal if desired. Selected speed will be maintained regardless of road terrain, within limits of engine performance.

When the unit is in automatic control, car speed can be changed by slowly rotating the selector dial forward to increase speed or rearward to decrease speed.

CAUTION: When increasing car speed during automatic control, always rotate dial slowly, to prevent sudden acceleration.

Car speed can be increased at any time by pushing the accelerator pedal through the back pressure. When the accelerator is released, the car will return automatically to the desired speed.

Automatic control is disengaged when the brake pedal is depressed. It can be re-engaged by simply accelerating until back pressure is felt. It is not necessary to push slide switch button to AUTO position to re-engage automatic control. The unit can be canceled by turning the ignition switch off and disengaged completely by moving the slide switch to the OFF position, without touching the speed setting.

SERVICE OPERATIONS

PRELIMINARY ELECTRICAL CHECKS

It is not always necessary to remove and disassemble the power unit in cases of an inoperative Cruise Control. The following checks should be performed as part of your diagnosis to determine the cause and correction of Cruise Control trouble and to eliminate unnecessary service work on the power unit.

1. Disconnect multiple connector at power unit.
2. Turn ignition switch on. Do not start engine.
3. Push slide switch to OFF position.
4. Using a test lamp, ground one test lamp lead and touch other lead to terminal #1, Figure 72. Test lamp should light. If lamp fails to light, check for blown fuse, defective car wiring, or defective wiring in selector control assembly.
5. Ground one test lamp lead, touch other lead to terminal #2, and push slide switch to ON position. Test lamp should light. If lamp fails to light, check for defective wiring in selector control assembly.
6. Ground one test lamp lead and touch other lead to terminal #3. Push slide switch to AUTO position and allow switch to come back to ON position. Test lamp and red indicator light should light when slide switch reaches AUTO position and then should go out when slide switch returns to ON position. If test lamp and red indicator light fails to operate as described above, check for defective wiring in selector control assembly or burned out red indicator bulb.
7. Ground one test lamp lead and touch other lead to terminal #4 wire. Push slide switch to AUTO position and manually hold slide switch in AUTO position. Depress brake pedal. Test lamp should go out and then come on when brake pedal is released. If lamp fails to operate as described above, check for improperly adjusted brake release switch or defective wiring in selector control assembly. Allow slide switch to return to ON position.
8. Connect multiple connector to power unit.
9. Ground one test lamp lead and touch other lead to terminal #3. Push slide switch to AUTO position and allow switch to come back to ON position. Test lamp should light when slide switch reaches AUTO position, and remain lit when slide switch returns to ON

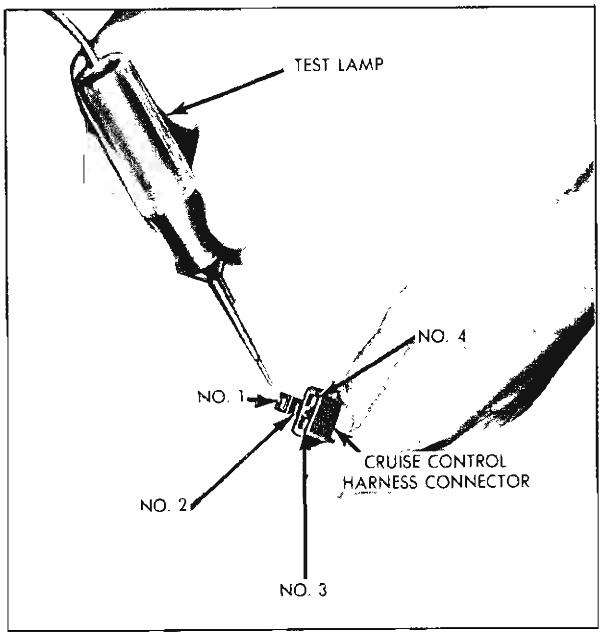


Fig. 72—Electrical Connections

position. If test lamp fails to operate as described above, check for loose connections at relay switch or a defective relay switch.

10 Remove test lamp, turn ignition switch off, and slide switch off.

11. If the above electrical checks in Steps 4 through 9 fail to correct the Cruise Control trouble, check the following adjustments before removing the power unit for service work.
    a. Selector control cable adjustment.
    b. Accelerator linkage adjustment.
    c. Selector dial adjustment.
    d. Motor feed points adjustment.
    e. Limit switch and throttle switch points adjustment.

CONTROL CABLE ADJUSTMENT

1. Rotate selector dial rearward as far as it will turn without forcing.
2. Loosen set screw on dust shield, Figure 73. (This screw retains control cable in dust shield.)
3. Again try to rotate selector dial rearward only, in order to make certain it is against the stop.
4. Push in lightly on control cable at dust shield, making certain that cable is against stop, Figure 73.

   CAUTI(Do not force cable beyond stop.

5. Hold cable against stop and tighten set screw on dust shield securely.

SELECTOR DIAL ADJUSTMENT

NOTE: Do not attempt to adjust selector dial until control cable is properly adjusted.

1. Perform control cable adjustment as described previously.
2. Rotate selector dial forward to high speed position against its stop.
3. Push slide switch to ON position.
4. Operate car at a steady speed of 50 MPH, as indicated on speedometer.

   CAUTION: This adjustment must be performed on highway. Do not perform on hoist or jack stands in shop area.

5. Rotate selector dial rearward until back pressure is felt on accelerator pedal, then lock in Cruise Control by momentarily pushing slide switch to AUTO position.
6. With car speed at 50 MPH, as indicated on speedometer, the numeral 50 on selector dial should be lined up with center of slide switch button. Observe reading on dial then move slide switch to OFF position. Do not rotate selector dial.
7. If reading on selector dial agrees with reading on speedometer, selector dial is properly adjusted.
8. If readings do not agree, adjust selector dial as follows:
    a. With slide switch in OFF position, rotate selector dial either forward (if dial reading is on the low side) or rearward (if dial reading is on the high side) against its stop. Then rotate dial by hand beyond its stop the necessary amount of travel as observed in Step 6 to correct the selector dial setting.
    b. Repeat adjustment procedure until reading on selector dial agrees with reading on speedometer.

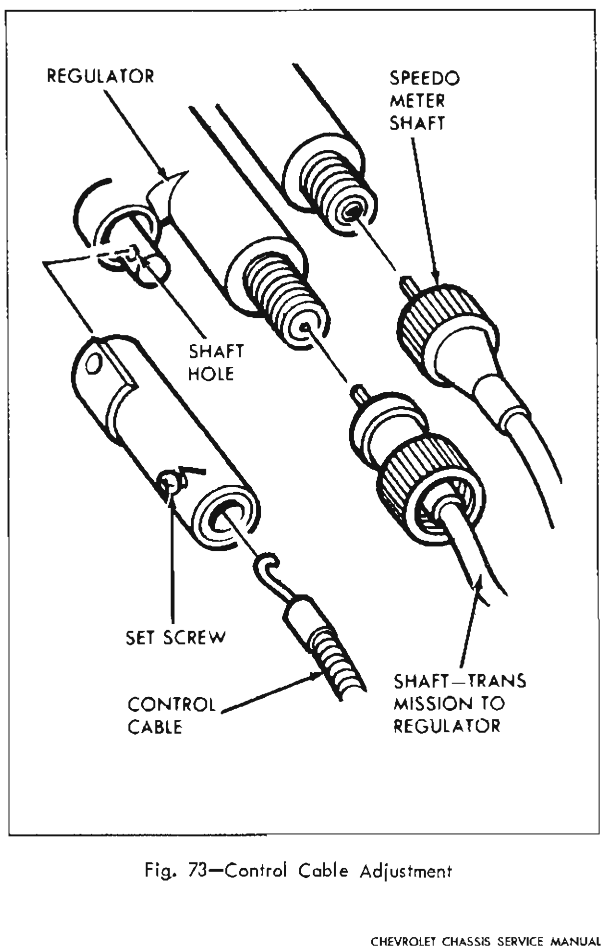


Fig. 73—Control Cable Adjustment

LINKAGE ADJUSTMENT

1. Adjust throttle rod.
2. Start engine and operate at slow idle with transmission lever in "Park".
3. Remove cotter pin securing accelerator linkage to exterior arm; then, remove washer and separate linkage from exterior arm.
4. Adjust trunnion so that when it is installed through exterior arm, the stop stud will be aligned with the locating notch and the throttle valves will be closed.

   NOTE: Due to the angle at which the trunnion enters this hole, it is necessary to rotate the exterior arm slightly forward when inserting the trunnion. Repeat this operation until proper alignment is obtained. Be careful not to turn trunnion too far back or throttle valves will unseat and cause an incorrect adjustment.

5. Insert Locking Arm Gauge, J-7652, over stop stud to check alignment.
6. Install washer on trunnion and secure trunnion to exterior arm with cotter pin.

BRAKE RELEASE SWITCH ADJUSTMENT

1. Turn ignition switch on. Do not start engine.
2. Momentarily move slide switch to AUTO position until red indicator light glows.
3. Using a test lamp, ground one test lamp lead and touch other lead to terminal #4, Figure 72.
4. Loosen mounting screw securing release switch to brake pedal mounting bracket.
5. Adjust release switch so that lamp will light when brake pedal is fully released, and will go out when brake pedal is depressed approximately 1/4 inch. Tighten switch mounting screw.
6. If switch cannot be adjusted, it is defective and should be replaced.

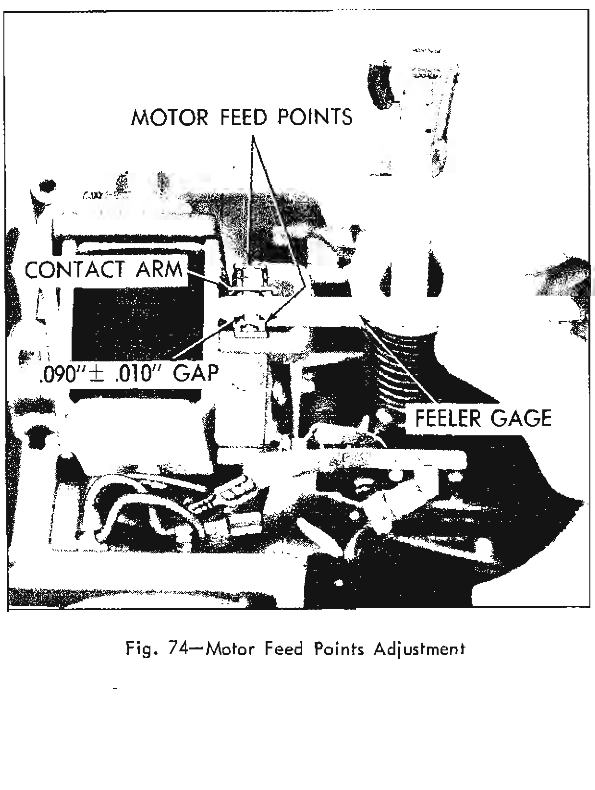


Fig. 74—Motor Feed Points Adjustment

7. Install new switch, and repeat Step 5.
8. Remove test lamp, turn ignition switch off and slide switch off.

MOTOR FEED POINTS ADJUSTMENT (ON CAR)

There are two sets of electrical motor feed points that operate the Cruise Control motor in the forward and reverse direction. The motor feed point on the motor side of the magnet controls acceleration, while the other motor feed point on the locking arm side of the magnet controls deceleration.

The center contact arm is energized, and any grounding resulting from contact with a screw driver or similar tool can cause a short or blow a fuse.

The motor feed points are still operative when blackened or pitted.

1. Remove four screws that hold cover to power unit and remove cover.
2. Disconnect drive cable at base of power unit.
3. Move contact arm against either motor feed point and use a feeler gauge to measure the full gap between contact arm and other point, Figure 74. This gap must be .090 inch ± .010 inch. If gap is not within specifications, carefully bend either motor feed point on adjuster assembly until proper gap is obtained.
4. Insert Locking Arm Gauge, J-7652, over stop stud. Turn ignition switch on and slide switch on. Do not start engine.
5. Move contact arm against motor feed point on locking arm side of magnet. When magnet is in low speed position, disconnect plug from terminal block on power unit while still holding contact arm against point. Do not use screw driver to turn drive screw.
6. Turn governor weights until they are parallel with drive screw, then place Governor Weight Wedge, J-8547, between governor weights, pressing down lightly on wedge until weights are held out to their stop position.
7. Use a feeler gauge to measure gap between contact arm and either motor feed point on point adjuster assembly. This gap should be approximately one-half of the full gap measurement in Step 3. If gap is not within specifications, contact arm is not centered properly. Loosen screw on point adjuster assembly, Figure 74, and move point adjuster until contact arm is centered between the two motor feed points on point adjuster. Then tighten point adjuster screw and recheck gap.
8. Remove Locking Arm Gauge and Governor Weight Wedge.
9. Connect multiple connector at power unit.
10. Turn ignition switch off and slide switch off.
11. Connect drive cable to base of power unit.
12. Install cover, making certain that rubber seal and felt seal are properly seated in grooves of cover and housing. Secure cover with four screws.

LIMIT SWITCH AND THROTTLE SWITCH POINTS ADJUSTMENT (ON CAR)

1. Remove four screws that hold cover to housing and remove cover.
2. Turn ignition switch ON and move slide switch to OFF position. Do not start engine.

NOTE: This will move magnet assembly to wide open throttle position and open points of limit switch and throttle switch.

3. Turn ignition switch OFF.
4. Using a feeler gauge, measure gap opening between points of limit switch and throttle switch, Figure 75. This gap must be .025 inch ± .005 inch. If gap is not within specifications, bend inboard point contact bar of limit switch until proper gap is obtained and points are aligned.
5. Turn ignition switch ON and move slide switch to ON position.
6. Hold contact arm against motor feed point on locking arm side of magnet assembly until magnet reaches low speed position, then disconnect multiple connector from power unit.
7. With magnet assembly in low speed position, check to see that both sets of points are closed, using a powered test lamp. If points are closed, limit switch and throttle switch are properly adjusted.
8. If either set of switch points are opened, lightly bend inboard point contact bar until points are closed. Then recheck point gap openings with magnet assembly at wide open throttle position to be sure gap openings are still within specifications. Readjust if necessary.
9. Turn ignition switch OFF and move slide switch to OFF position.
10. Connect mutliple connector to power unit and install cover on power unit.

CHECKING MOTOR OPERATION

1. Turn ignition switch ON. Do not start engine.
2. Momentarily move slide switch to AUTO position to set unit for automatic control.
3. Remove four screws securing power unit cover and remove cover.

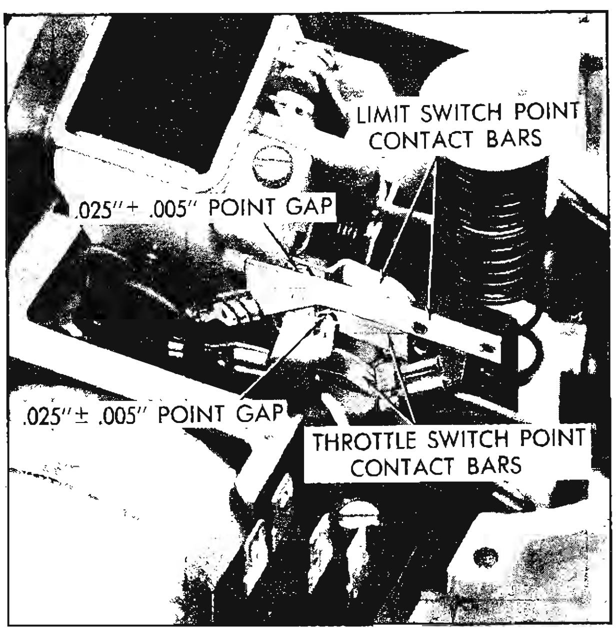


Fig. 75—Limit Switch and Throttle Switch Adjustment

4. Check accelerator linkage adjustment.
5. Move locking arm against magnet, simulating automatic control.
6. Move contact arm to touch motor feed point on locking arm side of magnet. Motor should rotate drive screw and close the throttle through the accelerator linkage. Motor should move magnet to wide open throttle position when contact arm is released.
7. If motor will not open or close throttle through accelerator linkage, motor may be binding. Check alignment of motor with housing. To check motor for binding, loosen motor from housing without disconnecting motor leads and disengage motor shaft from drive screw. Move contact arm against motor feed point on motor side of magnet assembly to check reverse operation, and against motor feed point on locking arm side of magnet assembly to check forward operation. If motor does nut run free, replace motor. If motor does run free, stall test motor.
8. The drive screw or carburetor linkage may also be binding. To check drive screw for binding, disengage motor shaft from drive screw, insert screw driver in slotted end of drive screw, and check for free rotation. If drive screw does not rotate freely, it is defective and should be replaced. If motor and drive screw operate satisfactorily, then adjust carburetor linkage.
9. Turn ignition switch OFF, and move slide switch to OFF position, and replace power unit cover.

MOTOR STALL TEST

1. Disconnect multiple electric connector at power unit.
2. Remove four screws securing power unit to housing and remove cover.
3. Connect red lead of an ammeter tester to positive battery terminal.
4. Insert Locking Arm Gauge, J-7652, over stop stud to limit travel of locking arm and prevent rotation of drive screw.
5. Connect black lead of tester to terminal #2 on front of power unit.
6. Hold contact arm against motor feed point on locking arm side of magnet, and observe reading on ammeter. If reading on ammeter indicates more than 7 amps, motor is drawing too much current and should be replaced.
7. Disconnect tester leads, remove Locking Arm Gauge install cover, and connect multiple connector.

CHECKING FOR DAMAGED CABLES AND GEARS

1. Raise rear end of car and place on jack stands.
2. Start engine and move transmission shift lever to either "Drive" range.
3. Remove speedometer cable at power unit and check to see if nylon gear is turning. This will determine if cable from transmission to power unit is turning and if gear is operating.
4. If nylon gear is turning, cable to speedometer is broken or speedometer is inoperative.
5. If nylon gear is not turning, disconnect transmission cable at power unit.
6. If cable is turning, gears are stripped inside power unit.

7. If cable is not turning, check for a broken cable or stripped transmission speedometer drive gear.
8. Shut engine off and lower car.
9. Replace parts as required.

SELECTOR CONTROL ASSEMBLY REMOVAL AND INSTALLATION

For removal and installation of the selector control assembly, refer to Figure 76.

POWER UNIT

Whenever a power unit is removed, the car can be driven with the speedometer operating by removing the power unit cables from the speedometer and transmission, and installing a standard speedometer cable and housing assembly between the transmission and speedometer.

Removal

1. Disconnect multiple electric connector at power unit.
2. Disconnect drive cable and speedometer cable at power unit.
3. Loosen set screw at lower end of control cable dust shield.
4. Remove dust shield from housing, then slide dust shield down cable and disconnect end of control cable from compressor rod and spring assembly.
5. Disconnect accelerator linkage at exterior arm on power unit.
6. Remove bolts securing power unit to mounting brackets and remove power unit, (See Figure 77).

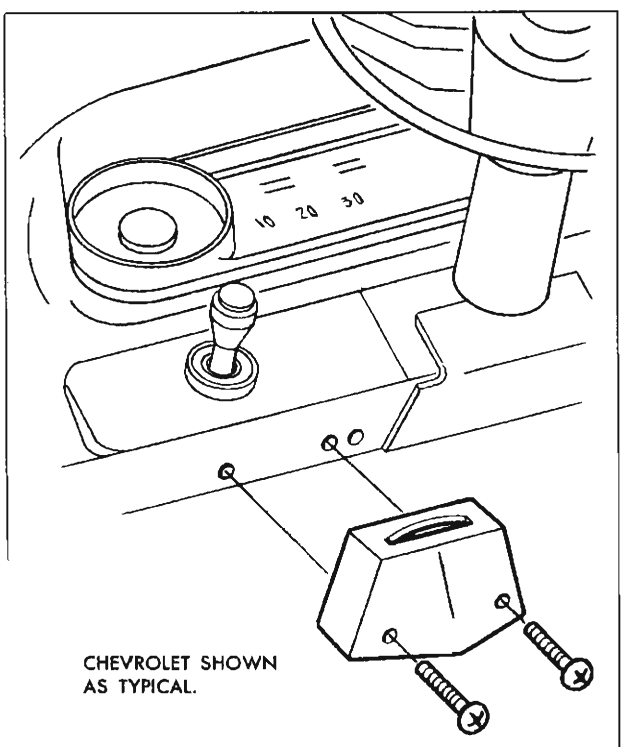


Fig. 76—Control Assembly Installation

Disassembly (Fig. 78)

1. Remove four screws that hold cover to housing and remove cover, being careful not to lose rubber seal or felt seal in cover grooves.
2. Remove governor spring and plastic cap.
3. Remove locknut from lower end of compressor rod and spring assembly, and remove compressor rod and spring assembly from housing.
4. Disconnect red and black wires from terminals on point adjuster assembly.
5. Disconnect three red wires from terminals on limit switch and remove red jumper lead.

   NOTE: The limit switch prevents motor from running when magnet assembly is in wide open throttle position.

6. Disconnect two green wires from terminals on throttle switch.

   NOTE: The throttle switch prevents automatic engagement before selected speed is obtained.

7. Remove spring retainer securing terminal block wires to side of housing.
8. Disconnect grey, green, and black wires from terminals on automatic relay switch.
9. Disconnect yellow and green wires from terminals on magnet assembly and remove green jumper lead.
10. Remove screw securing automatic relay switch to housing and remove relay switch from housing.
11. Remove screw securing terminal block to housing and remove terminal block from housing.
12. Disconnect torsion spring from exterior arm and remove spring and exterior arm.
13. Remove locking arm stop stud and washer, and two screws and washers that hold pintle to housing.
14. Lift magnet and pintle assembly out of housing, disengaging contact arm from actuator. Be careful not to lose felt seal in groove of housing.
15. Remove locking arm and wave washer from pintle shaft.
16. Remove screw and washer that hold point adjuster assembly to point adjuster bracket and remove point adjuster assembly.
17. Remove snap ring and fabric washer from end of pintle shaft and remove contact arm from pintle shaft.
18. Remove pintle from magnet assembly.
19. Remove two screws that hold point adjuster bracket to magnet assembly and remove point adjuster bracket with stop attached.

   NOTE: The magnet assembly and holding switch are serviced as a single unit.

20. Lift contact arm actuator off governor drive shaft.
21. Remove two nuts that hold motor to housing and remove motor from housing.

   NOTE: One nut is located on inside of housing.

22. Remove two screws that hold unit serial number plate to housing and remove plate from housing.
23. Remove bushing from end of drive screw.
24. Remove snap ring, outer bearing race, bearing, and inner bearing race from end of drive screw. Then remove drive screw and nut assembly from motor end of housing. Discard snap ring.

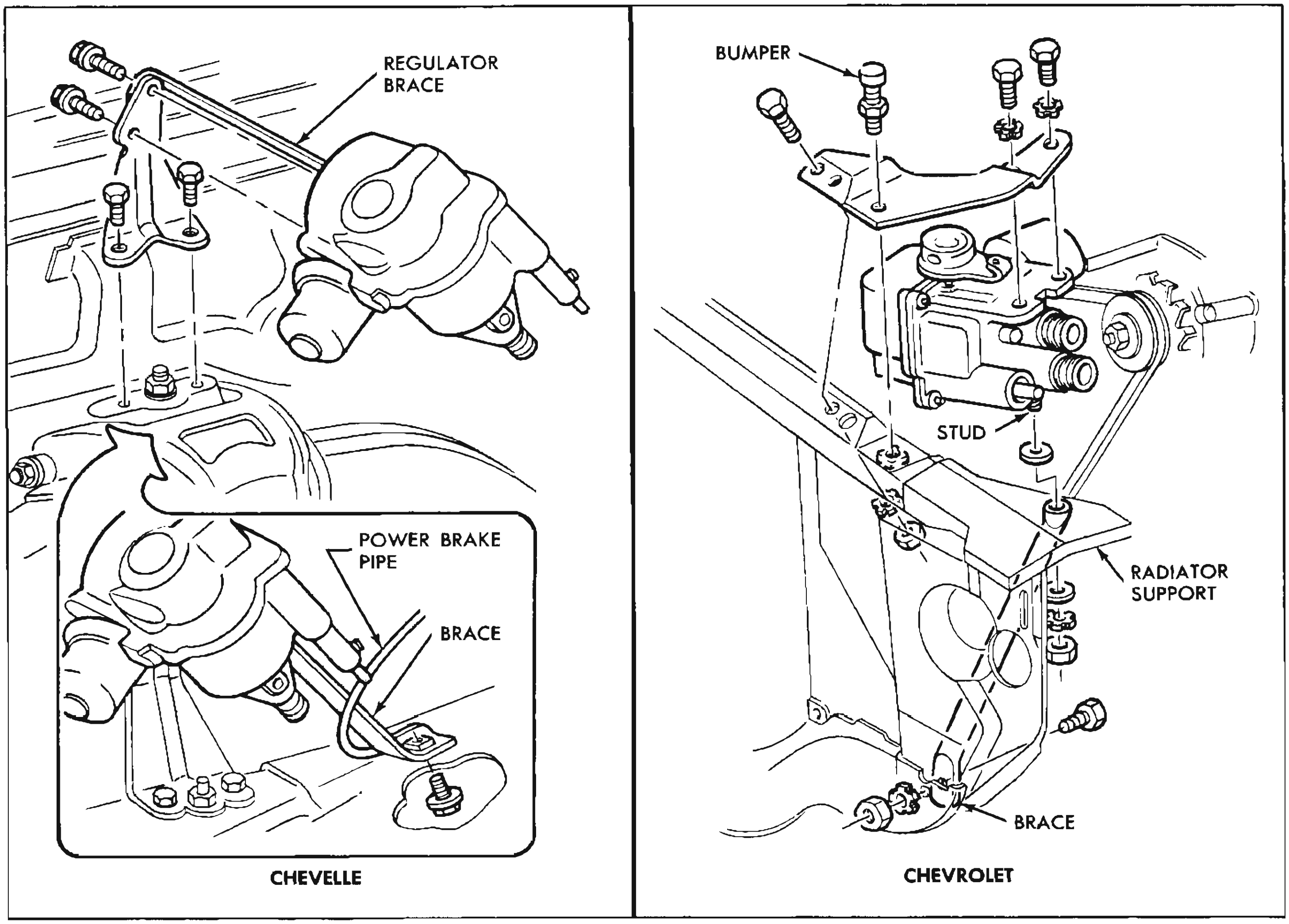


Fig. 77—Power Unit Installation

CAUTION: When handling drive screw assembly, keep parts clean, as dirt particles can become wedged between the small ball bearings on end of drive screw, or in drive screw nut, and cause drive screw to stick.

25. Remove two screws that hold governor drive adapter to housing and remove adapter.
26. Remove spring grip nut securing governor drive shaft and weight assembly to housing and remove drive shaft and weight assembly from housing. Discard spring grip nut.
27. Remove outer bearing race, bearing, and inner bearing race from lower end of governor drive shaft and gear assembly.
28. Remove snap ring, spacer, wave washer, and governor weight assembly from governor drive shaft. Discard snap ring.
29. Remove two screws that hold speedometer adapter to housing and remove adapter.
30. Remove spring grip nut securing plastic speedometer gear in housing and remove gear. Discard spring grip nut.

Assembly (Fig. 78)

1. Lubricate plastic gear with cam and bearing lubricant. Then install plastic gear in housing.
2. Secure plastic gear in housing with new spring grip nut.
3. Install speedometer adapter on bottom of housing and secure with two attaching screws.
4. Install governor weight assembly, wave washer, and spacer on governor drive shaft and secure with new snap ring.
5. Install inner bearing race, bearing, and outer bearing race on lower end of governor drive shaft and gear assembly. Then install governor drive shaft and weight assembly in housing, meshing drive gear with plastic gear.

   NOTE: Hold housing upside down when installing governor drive shaft and gear assembly to prevent ball bearing and races from falling out of opening in bottom of drive gear.

6. Secure governor drive shaft and weight assembly in housing with new spring grip nut.

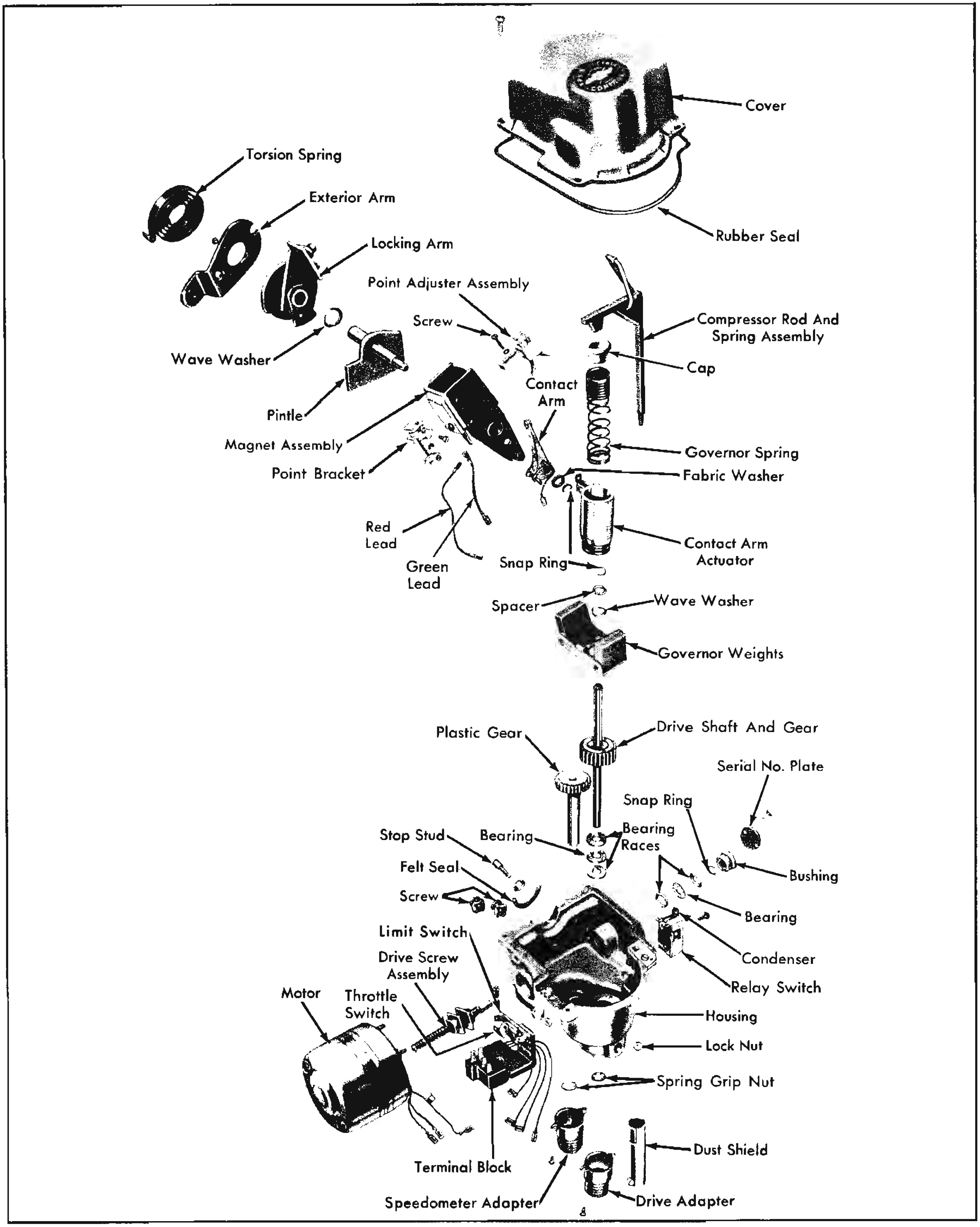


Fig. 78—Power Unit Exploded View

NOTE: The drive adapter and speedometer adapter are interchangeable.

7. Install governor drive adapter on bottom of housing and secure with two attaching screws.
8. Lubricate drive screw assembly sparingly with cam and bearing lubricant and install through motor end of housing.
9. Insert bearing end of drive screw through boss in housing and install inner bearing race, bearing, outer bearing race, and new snap ring on end of drive screw.
10. Install bushing over end of drive screw in opening in housing.
11. Install unit serial number plate on housing and secure with two attaching screws.
12. Install motor on housing, threading wires through upper hole in housing. Make certain that end of motor shaft engages in slot of drive screw.
13. Connect green motor wire to inside housing motor mounting stud and secure motor to housing with two attaching nuts.

    NOTE: Do not tighten nuts on motor end cover as this may result in binding of the motor bearings.

14. Install point adjuster bracket on magnet assembly and secure with two attaching screws.

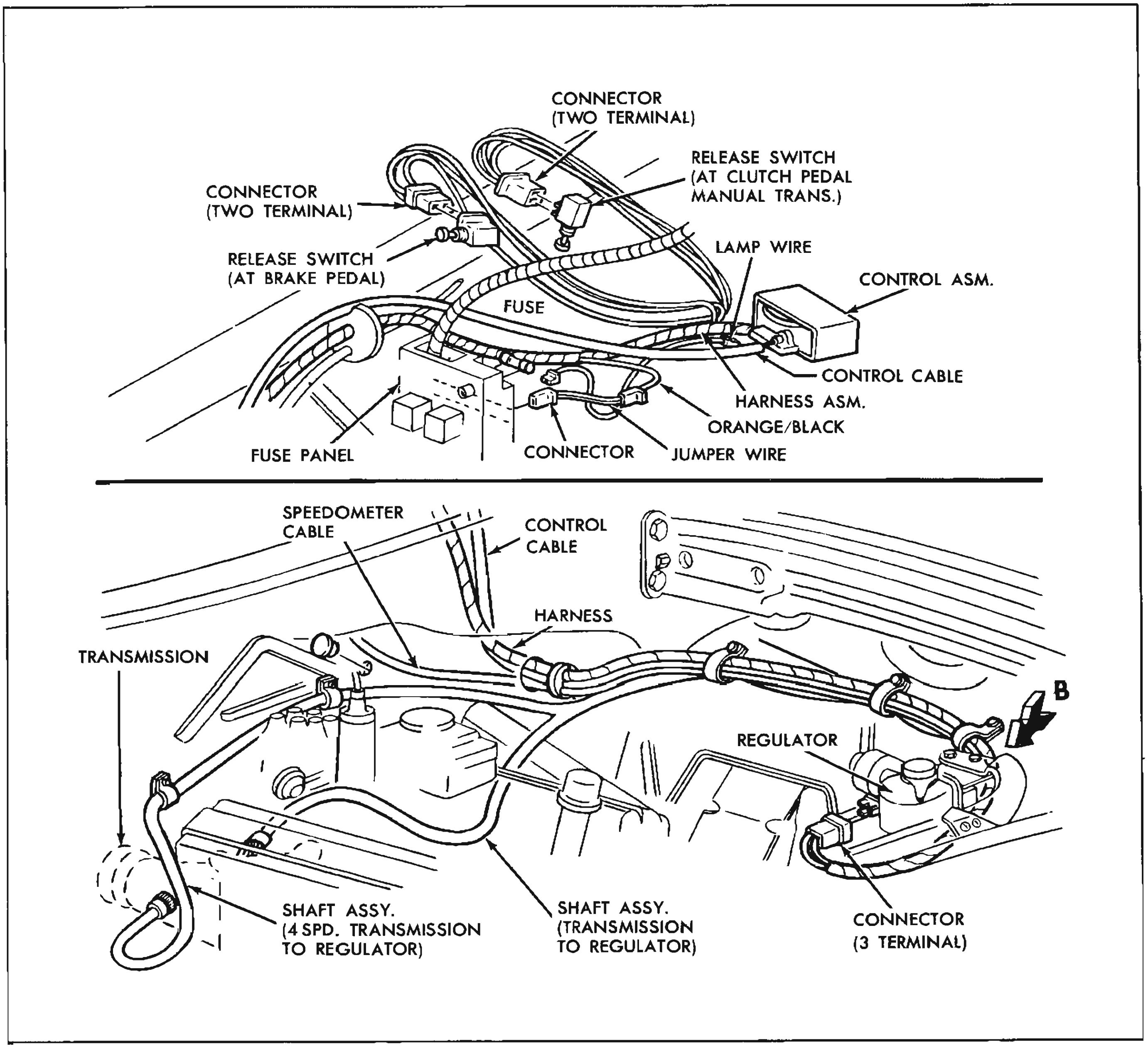


Fig. 79—Cruise Control Wiring—Chevrolet

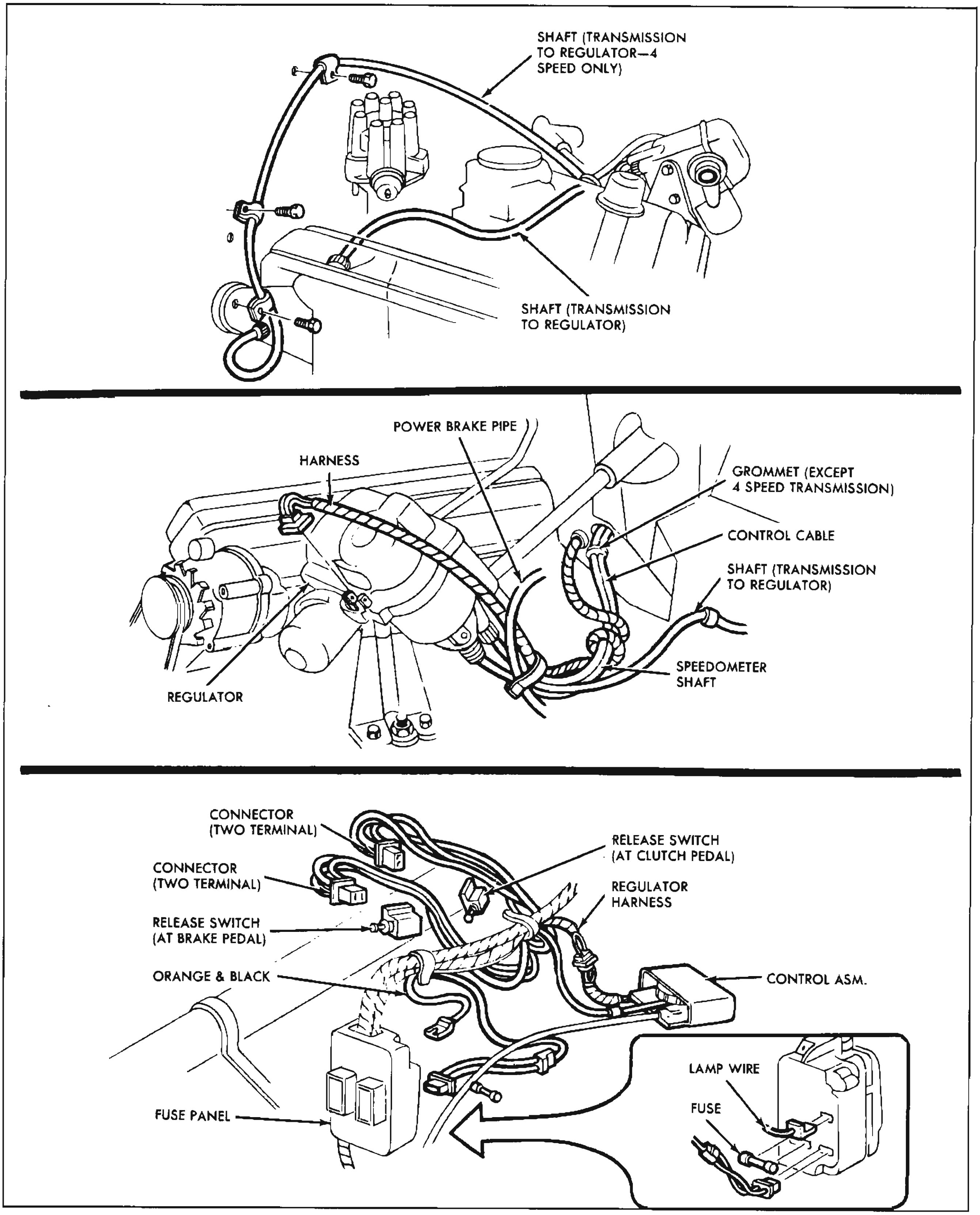


Fig. 80—Cruise Control Wiring—Chevelle

15. Insert pintle in magnet assembly, through side opposite motor feed points.
16. Install contact arm on end of pintle shaft with actuator pin facing away from magnet assembly, and install fabric washer. Secure contact arm to pintle shaft with new snap ring.
17. Install point adjuster assembly on point adjuster bracket, positioning contact arm between motor feed points, and loosely install attaching screw and washer.
18. Install wave washer and locking arm on pintle shaft.
19. Position drive screw nut in center of drive screw.
20. Attach actuator assembly on contact arm and install complete assembly in housing, positioning actuator over governor drive shaft, and align bracket tangs on bottom of magnet assembly with grooves in drive screw nut. Press down on complete assembly until it seats itself in housing.
21. Install locking arm stop stud and lock washer, and two screws and lock washers that hold pintle to housing.
22. Install exterior arm on locking arm shaft.
23. Install torsion spring on exterior arm. Using a pair of pliers, tighten spring one complete turn before connecting to stud on locking arm.
24. Install terminal block on housing and secure with attaching screw.
25. Install automatic relay switch on housing and secure with attaching screw.
26. Connect green terminal block wire (No. 3) to terminal on side of relay switch; connect grey wire to inboard terminal on front of relay switch;.connect black terminal block wire (No. 2) to outboard terminal on front of relay switch.

    CAUTION: Be careful when routing wires so they will not come into contact with any moving parts.

27. Secure grey, green, and black wires to side of housing with retainer clip.
28. Connect red terminal block wire (No. 1) to outside terminal on outboard contact bar of limit switch.
29. Connect red motor wire to terminal on inboard contact bar of limit switch.
30. Route black motor wire under pintle shaft between legs of magnet, and connect to terminal of motor feed point on locking arm side of magnet.
31. Route green jumper wire from terminal on inboard contact bar of throttle switch over and under pintle shaft between legs of magnet, and connect to terminals of magnet and holding switch.
32. Route red jumper wire from terminal of motor feed point on motor side of magnet, under and over pintle shaft between legs of magnet, and connect to inside terminal on outboard contact bar of limit switch.
33. Route yellow terminal block wire (No. 4) under pintle shaft between legs of magnet, and connect to terminal on magnet on locking arm side.
34. Connect green motor wire to terminal on outboard contact bar of throttle switch.
35. Lubricate compressor rod with cam and bearing lubricant, install compressor rod through guide into housing, and loosely install locknut on threaded end of compressor rod.
36. Install governor spring with plastic cap into actuator assembly.
37. Move contact arm against either motor feed point and use a feeler gauge to measure the gap between contact arm and other point, Figure 74. This gap must be .090 inch ± .010 inch. If gap is not within specifications, carefully bend either motor feed point on point adjuster assembly until proper gap is obtained.
38. Insert Locking Arm Gauge, J-7652, over stop stud. Move magnet assembly to low speed position (magnet away from motor). Turn governor weights until they are parallel with drive screw, then place Governor Weight Wedge, J-8547, between governor weights, pressing down lightly on wedge until weights are held out to their stop position.
39. Use a feeler gauge to measure gap between contact arm and either motor feed point on point adjustor assembly, Figure 74. This gap should be approximately one-half of the full gap measurement in Step 37. To obtain this gap measurement, move point adjuster assembly until gap is within specifications. Then tighten screw on point adjuster and recheck gap.
40. Remove Locking Arm Gauge and Governor Weight Wedge.
41. Move magnet assembly to wide open throttle position (magnet away from locking arm). This must be done to prevent preloading of the governor spring by the contact arm before adjusting the compressor rod.
42. Hold housing in an upright position, and adjust locknut on end of compressor rod until lower edge of compressor rod arm rests against plastic cap, without exerting pressure against governor spring. Then back-off locknut two complete turns. This will provide the correct low speed calibration for the power unit.
43. With magnet assembly still in wide open throttle position, measure gap opening between points of limit switch and points of throttle switch, Figure 75. These gaps must be .025 inch ± .005 inch. If gaps are not within specifications, bend inboard point contact bar of each switch until proper gaps are obtained and points are aligned.
44. Move magnet assembly to low speed position (magnet away from motor). With magnet in low speed position, check to see that points of limit switch and points of throttle switch are closed, using a powered test lamp. If points are closed, switches are properly adjusted.
45. If either set of switch points is opened, lightly bend inboard point contact bar until points are closed. Then recheck point gap opening with magnet assembly at wide open throttle position to be sure gap opening is still within specifications. Readjust if necessary.
46. Install cover, making certain that rubber seal and felt seal are properly seated in grooves of cover and housing. Secure cover with four screws.

Installation

1. Position power unit on mounting brackets and secure with mounting bolts.
2. Connect accelerator linkage to exterior arm. Adjust linkage as previously described.
3. Connect end of control cable to compressor rod and spring assembly.

4. Install dust shield in housing. Dust shield has bayonet type retention. Push in and turn clockwise. Do not tighten set screw on end of dust shield until control cable is properly adjusted.
5. Adjust control cable as previously described.
6. Connect drive cable and speedometer cable to power unit.
7. Connect multiple electric connector at power unit.

SPECIAL TOOLS

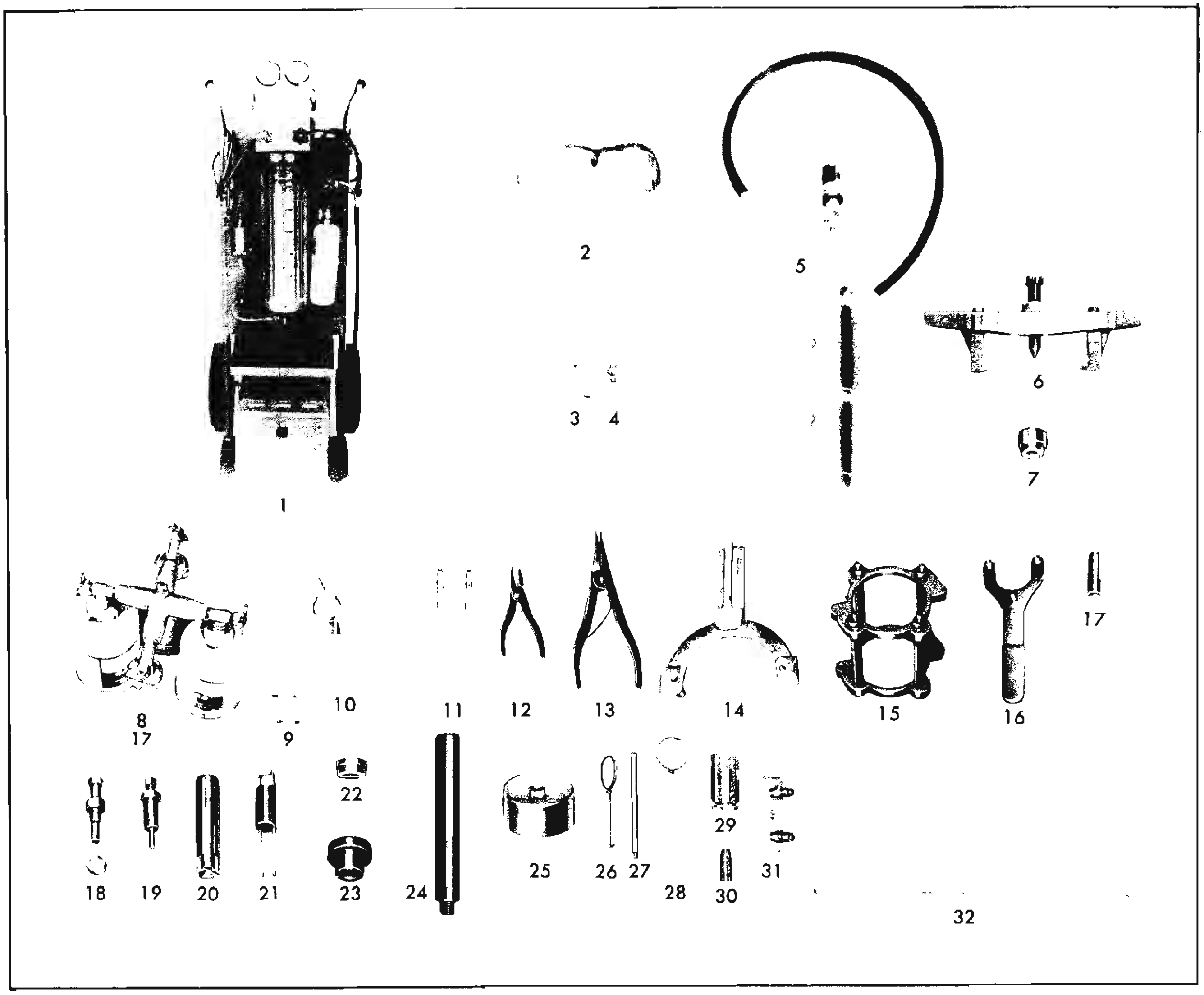


Fig. 61—Air Conditioning Special Tools

1. J-8393 Charging System
2. J-5453 Goggles
3. J-9459 90° Gauge Line Adapter
4. J-5420 Gauge Line Adapter
5. J-6084 Leak Detector
6. J-8433 Puller
7. J-9395 Puller Pilot
8. J-6272 Multi-Opener (4 Can)
9. J-6271 Fitzall Valve (Single Can)
10. J-7151 Non-Magnetic Clutch Shims
11. J-5421 Pocket Thermometers (2)
12. J-5403 #21 Snap Ring Pliers
13. J-6435 #26 Snap Ring Pliers
14. J-9396 Compressor Holding Fixture
15. J-9397 Compressing Fixture
16. J-9403 Clutch Hub Holding Tool
17. J-9399 9/16" Thin Wall Socket
18. J-9480 Hub and Drive Plate Assembly Installer
19. J-9401 Hub and Drive Plate Assembly Remover
20. J-9392 Seal Remover
21. J-9393 Seal Seat Remover
22. J-9398 Pulley Bearing Remover
23. J-9481 Pulley and Bearing Installer
24. J-8092 Handle
25. J-9521 Internal Assembly Support Block
26. J-5139 Oil Pickup Tube Remover
27. J-9432 Needle Bearing Installer
28. J-9553 Seal Seat "O" Ring Remover
29. J-21508 Seal Seat "O" Ring Installer
30. J-21303 Shaft Seal Protector
31. J-9527 Pressure Test Connector
32. J-9402 Parts Tray

SPECIFICATIONS
FRONT SUSPENSION
(SECTION 3)

	Chevrolet	Chevelle	Chevy II
CASTER	Pos. 1/4° ± 1/2°*	(SS and El Camino) Neg. 1/2° ± 1/2°* (All Others) Neg. 1° ± 1/2°*	1° ± 1/2°*
CAMBER	Pos. 1/4° ± 1/2°*	Pos. 1/2° ± 1/2°*	1/2° ± 1/2°*
STEERING AXIS INCLINATION	7 1/2° ± 1/2°	8 1/4° ± 1/2°	7° ± 1/2°
TOE-IN (TOTAL)	1/8" to 1/4"	1/8" to 1/4"	1/4" to 3/8"
WHEEL BEARING Adjustment Preload End Movement	 15 lbs. ft. zero .000" to .007"	 15 lbs. ft. zero .000" to .007"	 9 lbs. ft. zero .000" to .004"

*Must not vary more than 1/2° from side to side.

Riding Height Measurement* (See Page 3-6)

Chevrolet	L-6	All 2 door and 4 door models (except Impala) and 3 Seat Station Wagons; Impala Sport Sedan and Convertible; Impala SS Sport Coupe	4.75" ± .50"
		Impala 4 door; All 2 Seat Station Wagons	4.95" ± .50"
		Impala SS Convertible	4.25" ± .50"
		Impala Sport Coupe	5.15" ± .50"
	V-8	All 2 door and 4 door models; All 2 Seat Station Wagons; Impala Sport Sedan	4.85" ± .50"
		Impala SS Sport Coupe; Impala Convertible; all 3 seat Station Wagons	4.65" ± .50"
		Impala SS Convertible	4.45" ± .50"
		Impala Sport Coupe	5.10" ± .50"
Chevelle		All 2 door Sedans; All 4 door Sedans except V-8 300 and 300 Deluxe; 300 Deluxe 4 door Station Wagons	2.34" ± 1/2"
		V-8 300 and 300 Deluxe; 300 Deluxe 4 door Sedans	2.47" ± 1/2"
		Malibu and Malibu SS Sport Coupe and Convertible	1.85" ± 1/2"
		300 2 door Station Wagons; Malibu 4 door Wagons; and All Pickups	2.20" ± 1/2"

Riding Height Measurement (Continued)

Chevy II	L-4	All Models	3.50" ± .50"
	L-6	All 2 doors; All 4 doors Station Wagons with A/C	3.65" ± .50"
		Station Wagons without A/C	4.00" ± .50"
		Sport Coupe (Nova & Nova SS)	3.00" ± .50"
	V-8	All 2 doors; All 4 doors (except Nova)	3.40" ± .50"
		4 door Nova	3.20" ± .50"
		Station Wagons without A/C	3.65" ± .50"
		Station Wagons with A/C	3.50" ± .50"
		Sport Coupe (Nova & Nova SS)	3.00" ± .50"

*Must be within 1/2" from side to side.

TORQUES	Chevrolet	Chevelle	Chevy II
Spherical Joint Upper Stud Nut	40-60 lbs. ft.	40-60 lbs. ft.	42-47 lbs. ft.
Lower Stud Nut	70-95 lbs. ft.	70-95 lbs. ft.	42-47 lbs. ft.
Stud to Control Arm Nuts (Service)	20-25 lbs. ft.	20-25 lbs. ft.	20-25 lbs. ft.
Lower Forging Nut	35-45 lbs. ft.	—	—
Steering Arm Attaching Nuts	45-55 lbs. ft.	45-55 lbs. ft.	55-75 lbs. ft.
Brake Anchor Pin	70-90 lbs. ft.	70-90 lbs. ft.	60-90 lbs. ft.
Shock Absorber Upper Shaft Nut	5-8 lbs. ft.	5-8 lbs. ft.	5-8 lbs. ft.
Lower Attachment	10-15 lbs. ft.	10-15 lbs. ft.	6-9 lbs. ft.
Bracket to Spring Tower	—	—	6-9 lbs. ft.
Stabilizer Bar Frame Bracket Bolts	10-15 lbs. ft.	10-15 lbs. ft.	6-9 lbs. ft.
Link Nuts	5-8 lbs. ft.	5-8 lbs. ft.	9-12 lbs. ft.
Strut Rod Rod to Arm Nut	60-80 lbs. ft.	—	40-50 lbs. ft.
Adjustment Nut	70-85 lbs. ft.	—	70-90 lbs. ft.
Front Spring Spring Seat to Control Arm Nuts	—	—	25-35 lbs. ft.
Lower Control Arm Inner Pivot Nuts	100-125 lbs. ft.	60-75 lbs. ft.	55-70 lbs. ft.
Upper Control Arm Attaching Nuts	65-80 lbs. ft.	65-80 lbs. ft.	75-90 lbs. ft.
Collar Bolts	35-50 lbs. ft.	35-50 lbs. ft.	40-60 lbs. ft.

REAR SUSPENSION

(SECTION 4)

	Chevrolet	Chevy II	Chevelle
Type			
Heavy Duty Axle	4-Link System	Semi-Elliptical	4-Link System
Light Duty Axle	3-Link System	Single Leaf	
Springs			
Type	Coil	Leaf	Coil
Material	Steel Alloy	Chrome Carbon Steel	Steel Alloy
Shock Absorbers			
Make		Delco	
Type	Direct,	double acting, hydraulic	
Propeller Shaft			
Number (Std. Trans)	One	One	One
(P.G. Trans)	Two	One	One
Drive Taken Through	Lower Control Arms	Leaf Springs	Lower Control Arms
Torque Taken Through	Upper Control Arms	Leaf Springs	Upper Control Arms
Bolt Torque (ft. lbs.)			
Spring Retainer	20-30	45-55	30-40
Control Arm Upper			
Front Bracket	45-65	—	
Upper Bushings	90-115	—	50-65
Lower Bushings	90-115	—	50-65
Shock Absorber			
Upper Nut	10-15	9-12	10-15
Upper Bracket	—	5-10	—
Lower Nut	40-60	45-55	40-60
Spring Shackle			
Front	—	45-60	—
Rear	—	40-60	—
Tie Rod			
Attaching Nuts	51-73	—	—
Stud to Axle Bracket	95-125	—	—
Universal Joint	12-15	12-15	12-15

BRAKES

(SECTION 5)

Item			Chevrolet	Chevelle	Chevy II
Main Cylinder Diameter		Organic	1.0"		
		Metallic	.875"		
Wheel Cylinder Diameter		Front	1.1875"	1.12"	1.06"
		Rear	1.0"	.9375"	.875"
Organic Lining	Width	Front	2.75"	2.5"	
		Rear	2.0"	2.0"	
	Thickness	Primary	.168"	.17"	
		Secondary	.168"	.20"	
		Min. Servicable	.030"		
	Length	Primary	9.25"	9.01"	
		Secondary	11.63"	9.75"	
Metallic Linning Segments	Width	Front	1.37"	1.25"	
		Rear	1.0"	1.0"	
	Thickness	Primary	1.75"	.175"	
		Secondary	.295"	.285"	
		Min. Serviceable	.090"		
	No. per Shoe	Front	12	10	
		Rear	10	10	

ENGINE
(SECTION 6)
ENGINE MECHANICAL

GENERAL DATA:												
Engine Displacement		153	194	230		283	327				409	
Horsepower @ rpm		90 @ 4000	120 @ 4400	125 @ 3400	140 @ 4400	195 @ 4800	250 @ 4400	300 @ 5000	350 @ 5800	365 @ 6200	340 @ 5000	400 @ 5800
Torque @ rpm		152 @ 2400	177 @ 2400	210 @ 1600	220 @ 1600	285 @ 2400	350 @ 2800	360 @ 3200	360 @ 3600	350 @ 4000	420 @ 3200	425 @ 3600
Type		Valve-in-Head										
Cylinders		L-4	L-6			V-8						
Bore		3 7/8"	3 9/16"	3 7/8"			4"				4 5/16"	
Stroke		3 1/4"				3"	3 1/4"				3 1/2"	
Firing Order		1-3-4-2	1-5-3-6-2-4			1-8-4-3-6-5-7-2						
Compression Ratio		8.5:1				9.25:1	10.5:1		11:1		10:1	11:1
CYLINDER BORE:												
Out-of-Round		.002" (Max.)										
Taper		.005" (Max.)										
Diameter		3.8745"	3.5620"	3.8745"			3.9995"				4.3120"	
PISTONS:												
Clearance Limits	Top Land	.035" - .044"	.033" - .044"	.035"-.044"			.0365"-.0455"				.026" - .035"	.042" - .051"
	Skirt	.0005"-.0011"							.0039"-.0045"		.0009" - .0015"	.0030" - .0036"
Groove Depth	Compression	.2153" - .2218"	.1960" - .2025"	.2153"-.2218"			.2217"-.2283"				.2390"-.2455"	
	Oil	.2093" - .2158"	.1985" - .2050"	.2093"-.2158"			.2038"-.2103"				.2125"-.2190"	
PISTON RINGS:												
Compression	Width	.0770"-.0780"										
	Clearance (In Groove)	.0012"-.0032"										
	Gap	.010"-.020"					.013"-.023"					.010" - .020"
Oil	Width	.177"-.182"									.184"-.189"	
	Clearance (In Groove)	.0012"-.0050"										
	Gap	.015"-.055"										

Engine Displacement			153	194	230		283	327				409	
Horsepower			90	120	125	140	195	250	300	350	365	340	400
PISTON PINS:													
Length			2.990"-3.010"									3.250"-3.270"	
Diameter			.9270"-.9273"									.9895"-.9898"	
CLEARANCE	In Piston	New	.00015"-.00025"							.00045"-.00055"		.00025" - .00035"	.00045" - .00055"
		Wear Limit	.001"										
	In Rod		Press Fit										
CONNECTING RODS:													
BEARING	Clearance	New	.0007"-.0027"					.0007"-.0028"				.0009"-.0030"	
		Wear Limit	.004" (Max. Total Clearance)										
	End Play		.009"-.013"									.016"-.020"	
CRANKSHAFT:													
MAIN BEARING	CLEARANCE NEW	#1	.0003"-.0029"					.0008"-.0034"				.0006"-.0032"	
		#2	.0003"-.0029"					.0008"-.0034"				.0006"-.0032"	
		#3	.0003"-.0029"					.0008"-.0034"				.0006"-.0032"	
		#4	.0003"-.0029"					.0008"-.0034"				.0006"-.0032"	
		#5	.0003"-.0029"					.0010"-.0036"				.0010"-.0036"	
		#6	N.A.	.0003"-.0029"				N.A.				N.A.	
		#7	N.A.	.0003"-.0029"				N.A.				N.A.	
	CLEARANCE	Wear Limit	.004" (Max. Total Clearance)										
		End Play	.002"-.006"									.006"-.010"	
	Thrust Bearing		#5	#7			#5						
Main Journal	Diameter		2.300"									2.500"	
	Taper		.001" (Max.)										
	Runout		.001" (Max.)										
Crankpin Journal	Diameter		1.999"-2.000"									2.198"-2.199"	
	Taper		.001" (Max.)										
	Runout		.001" (Max.)										

Engine Displacement			153	194	230		283	327				409	
Horsepower			90	120	125	140	195	250	300	350	365	340	400
CAMSHAFT:													
Lobe Lift At Push Rod	Intake		.227"	.1896"			.2658"			.2981"		.2288"	.3181"
	Exhaust		.227"	.1896"			.2658"			.2981"		.2354"	.3181"
Journal Diameter			1.8682"-1.8692"										
Journal Runout			.001" (Max.)										
VALVE SYSTEMS:													
Lifters			Hydraulic								Mech.	Hyd.	Mech.
Rocker Arm Ratio			1.75:1				1.5:1					1.75:1	
Valve Lash	Intake (Hot)		*								.030"	*	.025"
	Exhaust (Hot)		*								.030"	*	.025"
INTAKE	Face Angle		45°										
	Seat Runout		.002" (Max.)										
	Seat Angle		46°										
	Seat Width		1/32"-1/16"										
	Stem Clearance		.0010"-.0033"									.0010"-.0027"	
	Lift at Stem		.3973"	.3318"			.3987"			.4471"		.4005"	.5567"
EXHAUST	Face Angle		45°										
	Seat Runout		.002" (Max.)										
	Seat Angle		46°										
	Seat Width		1/16"-3/32"										
	Stem Clearance		.0010"-.0027"									.0015"-.0032"	
	Lift at Stem		.3973"	.3318"			.3987"			.4472"	.4850"	.4119"	.5567"
SPRINGS	Outer Spring	Free Length	2.08"	2.03"			2.08"					2.03"	2.06"
		Press lbs. @ in.	78-86 @ 1.66"	56-64 @ 1.66"			78-86 @ 1.66"					84-92 @ 1.66"	94-106 @ 1.74"
		Press lbs. @ in.	170-181 @ 1.26"	170-184 @ 1.33"			170-180 @ 1.26"					166-176 @ 1.33"	271-299 @ 1.26"
	Inner Spring or Damper	Free Length	Damp. 2.00"	N.A.			Damper 2.00"					20-24 @ 1.49"	Damp. 2.00"
		Coils	Approx. 4	N.A.			Approximately 4					55-61 @ 1.11"	Approx. 4
	Installed Height		1-21/32" ± 1/32"										

*1 Turn Down from "O" Lash

ENGINE COMPONENT TORQUES

Attaching Part	In-Line		V-8 (283-327)		V-8 (409)	
	Size	Torque	Size	Torque	Size	Torque
Camshaft Thrust Plate	1/4 -20	72-90 in. lb.	—	—	—	—
Camshaft Sprocket	—	—	5/16-18	15-20 ft. lb.	5/16-18	15-20 ft. lb.
Connecting Rods	11/32-24	30-35 ft. lb.	11/32-24	30-35 ft. lb.	3/8 -24	35-45 ft. lb.
Clutch Pressure Plate	5/16-18	15-20 ft. lb.	3/8 -16	25-35 ft. lb.	7/16-14	55-75 ft. lb.
Crankcase Front Cover	1/4 -20	72-90 in. lb.	1/4 -20	72-90 in. lb.	1/4 -20	72-90 in. lb.
Cylinder Head	1/2 -13	90-100 ft. lb.	7/16-14	60-70 ft. lb.	7/16-14	60-70 ft. lb.
Flywheel	7/16-20	55-70 ft. lb.	7/16-20	55-65 ft. lb.	7/16-20	55-65 ft. lb.
Flywheel Housing	3/8 -16	25-35 ft. lb.	3/8 -16	25-35 ft. lb.	3/8 -16	25-35 ft. lb.
Flywheel Housing Pans	1/4 -20	72-90 in. lb.	1/4 -20	72-90 in. lb.	1/4 -20	72-90 in. lb.
Main Bearing Cap	7/16-14	60-70 ft. lb.	7/16-14	60-70 ft. lb.	1/2 -13	90-100 ft. lb.
Manifold Clamp (Outer L-6 Only)	3/8 -16	15-20 ft. lb.	—	—	—	—
Manifold Clamp (All Others)	3/8 -16	25-30 ft. lb.	—	—	—	—
Manifold Exhaust to Inlet	3/8 -16	20-25 ft. lb.	—	—	—	—
Manifold - Exhaust	—	—	3/8 -16	18-22 ft. lb.	3/8 -16	18-22 ft. lb.
Manifold - Inlet	—	—	3/8 -16	25-35 ft. lb.	3/8 -16	25-35 ft. lb.
Oil Filter	—	Hand Tight	1/2 -20	20-25 ft. lb.	1/2 -20	20-25 ft. lb.
Oil Pan - Side	1/4 -20	72-90 in. lb.	1/4 -20	72-90 in. lb.	5/16-18	72-90 in. lb.
Oil Pan - (To Front Cover)	1/4 -20	72-90 in. lb.	—	—	—	—
Oil Pan (End)	5/16-18	108-144 in. lb.	5/16-18	150-180 in. lb.	5/16-18	120-150 in. lb.
Oil Pan Drain Plug	1/2 -20	15-20 ft. lb.	1/2 -20	15-20 ft. lb.	1/2 -20	15-20 ft. lb.
Oil Pump Cover	1/4 -20	60-72 in. lb.	1/4 -20	72-90 in. lb.	1/4 -20	72-90 in. lb.
Oil Pump Mounting	5/16-18	100-132 in. lb.	5/16-18	60-70 ft. lb.	7/16-14	60-70 ft. lb.
Push Rod Cover	5/16-18	75-85 in. lb.	—	—	—	—
Rocker Arm Cover	1/4 -20	25-50 in. lb.	1/4 -20	25-50 in. lb.	1/4 -20	25-50 in. lb.
Spark Plugs	14 mm.	20-25 ft. lb.	14 mm.	20-25 ft. lb.	14 mm.	20-25 ft. lb.
Temperature Indicator	1/2-14 (Pipe)	15-20 ft. lb.	1/2 -14 (Pipe)	15-20 ft. lb.	1/2 -14 (Pipe)	15-20 ft. lb.
Thermostat Housing	3/8 -16	25-30 ft. lb.	—	—	—	—
Water Outlet Housing	3/8 -16	18-23 ft. lb.	3/8 -16	18-23 ft. lb.	3/8 -16	25-35 ft. lb.
Water Pump	5/16-18	13-17 ft. lb.	3/8 -16	25-35 ft. lb.	3/8 -16	25-35 ft. lb.

ENGINE MOUNT TORQUES

Attaching Parts	Torque In Ft. Lbs.		
	Chevrolet	Chevelle	Chevy II
Mount Through	45-60	45-60	25-35
Mount-to-Engine	20-30 (V-8)	20-30 (V-8)	40-50 (V-8)
Mount-to-Bracket	25-35 (L-6)	25-35 (L-6)	25-35 (L-6) 35-55 (L-4)
Bracket-to-Engine	20-30 (L-6)	20-30 (L-6)	22-30 (L-6) 55-75 (L-4) (L/H) 40-50 (L-4) (R/H)
Bracket-to-Frame	20-30	20-30	20-30 (L-6 - V-8) 14-22 (L-4)
Mount-to-Transmission	35-45	35-45	25-35 (L-6 - V-8) 35-55 (L-4)
Crossmember-to-Mount	35-45	35-45	25-35
Crossmember-to-Frame	20-30	20-30	20-30

CARBURETORS

(SECTION 6M)

ROCHESTER

Carburetor	Model	BV				2GV		
	Part No.	7025105	7025108	7025003	7025000	7024101	7024110	7024112
	Engine	194 Syn.	194 P/G	230 Syn.	230 P/G	283 Syn.	283 P/G	283 A/C
Float Level	Primary	1 9/32"				1 23/64"		
	Secondary							
Float Drop	Primary	1 3/4"				1 29/32"		
	Secondary							
Pump Rod						57/64"		
Idle Vent		.050" @ Idle				49/64"		
Choke Setting		1 Rod Dia. Interference				1/2 Rod Dia. Interference		
Choke Rod		.095"-.115"				.062"		
Unloader		.350"				.187"-.228"		
Bowl Vents		2 Internal - 1 External Idle				1 Internal - 1 External Idle		
Choke Piston Adjustment						.108"-.133"	.080"-.105"	
Main Metering Jet	Primary	.060"	.059"	.059"	.058"	.056"	.055"	
	Secondary							
Throttle Bore	Primary	1 9/16"				1 7/16"		
	Secondary							
Main Venturi	Primary	1 11/32"				1 3/32"		
	Secondary							
Small Venturi	Primary	19/32"				1/8"		
	Secondary							
Pump Discharge Jet		.025"				.026"		
Idle Jet (Idle Tube)		.059"	.055"	.064"	.057"	.029"		

ROCHESTER

Carburetor								
	Model	4GC					4GC (Low Silhouette)	
	Part No.	7025121	7025122	7025127	7025126	7025128	7025123	7025124
	Engine	327 P/G	327 A/C	327 Syn.	327 P/G	327 A/C	409 Syn.	409 P/G
Float Level	Primary	1 33/64"					Heel 1 1/2" Toe 25/32" Vacuum Assist 1 5/32"	
	Secondary	1 37/64"					Heel 1 5/16" Toe 21/32"	
Float Drop	Primary	2 1/4"					1 1/2"	
	Secondary	2 1/4"					1 1/8"	
Pump Rod		1 1/16"					1 1/32"	29/32"
Idle Vent		31/32"					15/16"	13/16"
Choke Setting		Index					Index	
Choke Rod		.055"					.089"	
Unloader		.235"					.130"	
Bowl Vents		4 Internal - 1 External Idle					8 Internal 1 External	
Choke Piston Adjustment		Piston Flush - With Choke Valve Closed					Piston Flush With Choke Value Closed	
Main Metering Jet	Primary	.059"		.062"	.060"		.062"	.063"
	Secondary	.067"					.080"	.081"
Throttle Bore	Primary	1 7/16"					1 9/16"	
	Secondary	1 7/16"					1 11/16"	
Main Venturi	Primary	1 1/8"					1 5/16"	
	Secondary	1 1/4"					1 15/32"	
Small Venturi	Primary	1/8"					1/4"	
	Secondary	1/4"					1/4"	
Pump Discharge Jet		.026"					.026"	
Idle Jet (Idle Tube)		.028"		.031"	.028"		Prim. .029" Sec. .030"	Prim. .026" Sec. .030"

CARTER

Carburetor								
	Model	YF		WCFB		AFB		
	Part No.	(3379S) 3792945	(3402S) 3793019	(3697S) 3846247	(3696S) 3846246	(3721SA) 3851761	(3720SA) 3851762	(3499S) 3827324
	Engine	153 Syn.	153 P/G	327 Syn.	327 P/G	327 Syn.	327 P/G	409 Syn.
Float Level	Primary	7/16" Without Gasket at Outer End		7/32"		7/32"		
	Secondary			1/4"		7/32"		
Float Drop	Primary	1 3/16" Without Gasket At Outer End Top of Float		3/4"		3/4"		
	Secondary			3/4"		3/4"		
Pump Rod				1/2"		1/2"		
Idle Vent		.025"-.030" @ Idle Position Choke Open		3/32"				
Choke Setting				Index		1 Notch Lean		2 Notches Lean
Choke Rod								
Unloader				3/16"		1/4"		
Fast Idle Setting				1750 rpm Hot On Car		1750 rpm Hot On Car		
Throttle Lockout Adj.				.020"		.020"		
Bowl Vents		1 Internal 1 External Idle		5 Internal 1 External Idle		4 Internal 1 External		
Choke Piston Adj.				.060"	.035"	.080"		.190"
Main Metering Jet	Primary	.096"		.086"		.0995"		.1015"
	Secondary			.0635"		.067"		.084"
Metering Rod		.052"-.070"	.052"-.071"	.042"/.067"		.063"/.069"	.063"/.073"	.044"/.060"
Throttle Bore	Primary	1 11/16"		1 7/16"		1 9/16"		1 5/8"
	Secondary			1 7/16"		1 11/16"		1 11/16"
Main Venturi	Primary	1 5/16"		1 1/16"		1 1/4"		1 11/32"
	Secondary			1 1/4"		1 9/16"		1 9/16"
Pump Discharge Jet		.0225"		.021"		.028"		
Idle Speed Jet		.026"		.031"		.035"		.040"

HOLLEY

Carburetor	Model	4150
	Part No.	(3043A) 3863150
	Engine	327
Float Level		Use Sight Plug
Pump Lever		.015"
Choke Setting		3 Notches Lean
Unloader		.180" (3/16" Drill)
Fast Idle Setting	Bench	.028"
	On Car	22-2300 rpm
Bowl Vents		2 Internal

Main Metering Jet	Primary	.067"
	Secondary	.074"
Power Valve Jets		.040" #60 Drill
Throttle Bore	Primary	1 9/16"
	Secondary	1 9/16"
Main Venturi	Primary	1 1/4"
	Secondary	1 5/16"
Pump Discharge Jet		.028" #70 Drill
Idle Feed Restriction		Primary .035" Secondary .028"

ENGINE ELECTRICAL
(SECTION 6Y)

BATTERY MODEL	1980458	1980554	1980558	1980568
Application	Deluxe and Custom Air Cond.	153 L-4 194-230 L-6 283 V-8 & 283 w/AC (Chevy II)	327 V-8 409 V-8 (Mech Tappets) Base Taxi	Optional 409 V-8 w/Hyd. Tappets
Ground	Neg.	Neg.	Neg.	Neg.
Plates	54	54	66	66
Capacity (20 Hour Rate)	53	44	61	60

GENERATOR MODEL	1100695	1100693	1100696	1100694	1100697	1117765
Application	Base Chevy II	Chevy II w/V-8, Base Chevelle, Chevrolet	Optional All Models Except Corvair Base	All Weather A/C and Optional	Optional w/K66 & FOA A/C	Optional
Field Amp. Draw	2.2-2.6	2.2-2.6	2.2-2.6	2.2-2.6	2.8-3.2	3.7-4.4
Hot Output -- Amps.	32	37	42	55	60	62
Cold Output -- Volts	14	14	14	14	14	14

REGULATOR MODEL	1119515	1116368
Application	All except with Generator 1117765 and 1100697	With Generator 1100697 Optional other Models
Field Relay: Air Gap	.015	.011-.018
Point Opening	.030	.020-.030
Closing Voltage	1.5-3.2	2.5-3.5
Voltage Regulator: Air Gap	.067	--
Point Opening	.014	--
Voltage Setting	13.8-14.8 @ 85°F.	13.7-14.4 @ 85°F. O" Position of Adjusting Screw

TRANSMISSIONS AND CLUTCH

(SECTION 7)

CHEVY II AND CHEVELLE MODEL CLUTCHES

ENGINE	Name		Super-Thrift 153		Hi-Thrift 194		Turbo-Thrift 230		Turbo-Fire 283	
	Horsepower		90		120		140		195 220	195 220
	Displacement, cu. in.		153		194		230		283	
Clutch Identification			Regular Production	Heavy Duty	Regular Production and OD	Heavy Duty	Regular Production and OD	Heavy Duty	Regular Production and OD	4-Speed
Clutch Assembly										
Type			Single Dry Disk							(a)
Clutch Cover and Pressure Plate Assembly	Effective Plate Load, lb.		1250-1450	1900-2200	1250-1450	1900-2200	1700-1950	1900-2200	1700-1950	2100-2300
	Type of Drive		Steel Straps							
	Pressure Plate	Material	Cast Iron							(b)
		OD	9.28	10.14	9.28	10.14				10.48
	Clutch Spring	Type	Diaphragm							(c)
		Material	Heat Treated Spring Steel							
	Attachment to Flywheel		6 Bolts, 5/16-18				6 Bolts, 3/8-16			
Driven Plate Assembly	Type		Single Disk with 2 Friction Surfaces							
	Cushion		Flat Spring Steel between Friction Rings							
	Dampers		4 Springs	6 Coil Springs					12 Coil Springs (6 sets of 2)	10 Coil Springs (5 sets of 2)
	Friction Rings	OD	8.00	10.00	9.12	10.0	9.12	10.0	10.0	10.4
		ID	6.00	6.00	6.12	6.0	6.12	6.0	6.5	6.5
		Total Area (sq. inches)	44.0	100.5	71.8	100.5	71.8	100.5	90.7	103.5
		Material	Woven Asbestos (d)							(e)
Flywheel Assembly	Flywheel	Material	Cast Iron							
		OD	12.54							
	Ring Gear	Material	Heat Treated HR Steel							
		No. of Teeth	153							
		Width	.4110-.4220				.4010-.4130			
		PD	12.75							
		Attachment	Shrink Fit							
Bearings	Release	Type	Single Row Ball							
		Lubrication	Packed with High Temperature, High Viscosity Grease							
	Pilot	Type	Bronze Bushing							
		Lubrication	None, Sintered and Oil Impregnated							
Controls	Clutch Fork		Drop Forged Steel, Pivot Mounted on Ball							
	Pedal Mounting		Pendent, from Brace on Dash							
Clutch Housing	Material		Aluminum Alloy							

(a) Single Dry Disk, Centrifugal
(b) Perlitic Malleable or Nodular Iron
(c) Diaphragm, Bent Finger Design
(d) Woven Front and Molded Rear for Heavy Duty Clutch
(e) Premium Woven Asbestos

CHEVROLET MODEL CLUTCHES

ENGINE	Name		Turbo-Thrift L6		Turbo-Fire V-8		
	Horsepower		125 140		195	250 300	340 400 425
	Displacement, Cubic Inches		230		283	327	409
Clutch Identification			Regular Production (b)	Heavy Duty	Regular Production (c)		4-Speed
Clutch Assembly							
Type			Single Dry Disk			(d)	
Clutch Cover and Pressure Plate Assembly	Effective Plate Load, lb.		1500-1800	1900-2200	1750-1950	2100-2300	2300-2600
	Type of Drive		Steel Straps				
	Pressure Plate	Material	Cast Iron			(e)	
		Outside Diameter	10.14			10.48	
	Clutch Spring	Type	Diaphragm			Diaphragm, Bent Fingers	
		Material	Heat Treated Spring Steel				
	Attachment to Flywheel		6 Bolts, 3/8-16 UNC 3A, 1.00 Long				
Driven Plate Assembly	Type		Single Disk with 2 Friction Surfaces				
	Cushions		Flat Steel Springs between Friction Rings				
	Dampers		6 Coil Springs		12 Coil Springs (6 sets of 2)	10 Coil Springs (5 sets of 2)	
	Friction Rings	Outside Diameter	9.12	10.0	10.0	10.4	
		Inside Diameter	6.12	6.0	6.5	6.5	
		Total Area (square inches)	71.80	100.5	90.7	103.5	
		Material	Woven Asbestos	(a)	Woven Asbestos	Premium Woven Asbestos	
Flywheel Assembly	Flywheel	Material	Cast Iron				
		Outside Diameter	12.54				13.44
	Ring Gear	Material	Heat Treated HR Steel				
		No. of Teeth	153				168
		Width	.4070				.4160
		Pitch Diameter	12.75				14.00
		Attachment	Shrink Fit				
Bearings	Release	Type	Single Row Ball				
		Lubrication	None, Prepacked				
	Pilot	Type	Bronze Bushing				
		Lubrication	None, Sintered and Oil Impregnated				
Controls	Clutch Fork		Drop Forged Steel, Pivot Mounted on Ball				
	Pedal Mounting		Pendent, from Brace on Dash				
Clutch Housing	Material		Aluminum Alloy				
	Attachment to Engine		6 Bolts, 3/8-16 UNC-2A, 1.25 Long				

(a) Woven Asbestos Front and Molded Asbestos Rear.
(b) Also for Overdrive Transmission
(c) Also for 283 Cubic Inch Engine Overdrive and 327 Cubic Inch Engine 4-speed
(d) Single Dry Disk, Centrifugal
(e) Perlitic Malleable or Nodular Iron

CHEVY II AND CHEVELLE
3 AND 4-SPEED TRANSMISSIONS

ENGINE	Name		Super-Thrift 153	Hi-Thrift 194	Turbo-Thrift 230	Turbo-Fire 283	
	Horsepower		90	120	140	195 220	195 220
	Displacement, cu. in.		153	194	230	283	
Transmission Type			3-Speed				4-Speed
Case	Material		Cast Iron				Aluminum
Gear-shift	Type		Remote				
	Location		Steering Column				Floor
	Control		Lever through Linkage				
Gears	Type		Helical				
	Material		Forged Steel, Heat Treated				
	Synchronization		2nd and 3rd				All Forward Gears
	Constant Mesh Gears		2nd, 3rd				All Forward Gears
	Sliding Gears		1st and Reverse				Reverse
	Ratios	First	2.94			2.58	2.56
		Second	1.68			1.48	1.91
		Third	1.00			1.00	1.48
		Fourth	--			--	1.00
		Reverse	2.94			2.58	2.64
Lubri-cant	Type		Meeting Military Specification MIL-L-2105-B				
	Capacity (pts)		2.0				2.5
Exten-sion	Material		Aluminum		Cast Iron		Aluminum
	Oil Seal		Steel Encased Double Seal of Spring Loaded Synthetic Rubber or Felt				

CHEVROLET
3 AND 4-SPEED TRANSMISSIONS

ENGINE	Name		Turbo-Thrift L-6	Turbo-Fire V-8			
	Horsepower		125 140	195	250 300	250 300	340 400 425
	Displacement, cu. in.		230	283	327	327	409
Transmission Type			3-Speed			4-Speed	
Case Material			Cast Iron			Aluminum	
Gear Shift	Type		Remote				
	Control		Lever				
	Location		Steering Column			Floor	
Gears	Type		Helical				
	Material		Forge Steel, Hardened				
	Synchronization		Second and Third			All Forward Gears	
	Constant Mesh Gears		Second, Third			All Forward Gears	
	Sliding Gears		First and Reverse			Reverse	
	Ratios	First	2.94		2.58	2.56@	
		Second	1.68		1.48	1.91	
		Third	1.0		1.0	1.48	
		Fourth	--		--	1.0	
		Reverse	2.94		2.58	2.64	
Lubri-cant	Type		Meeting Military Specification MIL-L-2105-B				
	Capacity (Pints)		2			2.5	
Exten-sion	Material		Aluminum				
	Oil Seat		Steel Encased Double Seal of Spring Loaded Rubber or Felt				

@ Close ratio offered optionally with 400 and 425 HP Engines; 2.20, 1.64, 1.28, 1.0 and 2.27.

OVERDRIVE TRANSMISSION

GENERAL

Type . . . . 3 pinion planetary drive unit

Description . . . . Adaptable to 3-speed transmission. Overdrive drive unit with integral mainshaft and extension of 3-speed.

Operation . . . . Actuation by manually operated pull type lockout switch located under instrument panel to right of steering column; when fully extended, overdrive unit is inoperative. Overdrive unit can be over-ridden by a downshift switch located at the carburetor and controlled by the accelerator pedal; over-riding achieved by tramping accelerator.

Lubricant
- Type . . . . Meeting Military Specification MIL-L-2105-B
  - Viscosity . . . . SAE 80
- Capacity . . . . Total 3 pints (2 for Transmission, 1 for Overdrive Unit)

Gear ratios with overdrive locked in
- Regular production and optional L-6 engines
  - First 2.058
  - Second 1.176
  - Third 7

Regular production and optional V-8 engines
  - First 1.806
  - Second 1.036
  - Third 7

CHEVROLET AUTOMATIC TRANSMISSION

ENGINE	Displacement, cubic inches		230		283	327	327	409
ENGINE	Horsepower		125	140	195	250	300	340
Automatic Transmission								
General Data	Type		Automatic Hydraulic Torque Converter with Planetary Gear System for Low and Reverse					
	Selector Level	Location	Steering Column (exc. SS Floor Mounted)					
		Operation	Actuates Manual Valve in Hydraulic Control System					
		Quadrant Position	P-R-N-D-L					
	Parking Lock	Type	Pawl and Gear (on Planetary)					
		Operation	Applied by Selector Lever thru Spring Loaded Linkage					
	Method of Cooling		Air		Water			
	Flywheel Assembly		Steel Stamping with Welded on Ring Gear					
Converter Assembly	Type		Three Element					
	Pump		Inner and Outer Sheet Steel Shells separated by Sheet Steel Vanes. Outer Shell is Pump Housing which is Welded to Converter Housing.					
	Turbine		Inner and Outer Shells separated by Sheet Steel Vanes. Assembly supported in Converter Cover. Operation independent of Cover and Pump Housing.					
	Stator		Aluminum Air Foil supported on a Stationary Sleeve by an overrunning Clutch of Cam and Roller design.					
	Stall Torque Ratio		2.10:1					
	Diameter (nominal)		11.0		11.75			
Planetary Gear Set	Type		Compound Planetary					
	Range	Drive	1.82:1 to 1:1			1.76:1 to 1:1		
		Low	1.82:1			1.76:1		
		Reverse	1.82:1			1.76:1		
	Low Band		Three Linked Circular Segments					
	Low Band Servo		Piston with Release Spring and Inner Cushion Spring					
Case	Material		Aluminum (one piece)					

ENGINE	Displacement, cubic inches		230		283	327	327	409
	Horsepower		125	140	195	250	300	340
Automatic Transmission - Continued								
High Clutch	Type		Multi-disk					
	Drive Plates	Description	Waved Steel with Bonded Organic Facings					
		Number	3		4			5
	Driven Plates	Description	Flat Steel					
		Number	4		5			6
Reverse Clutch	Type		Multi-disk					
	Drive Plates	Description	Flat Steel with Bonded Organic Facings					
		Number	4		5	6		
	Reaction Plates	Description	Flat Steel					
		Number	3		4	5		
Torque Multi.	Maximum Overall Ratio		3.82:1			3.70:1		
	Low and Reverse		3.82:1 to 1.82:1			3.70:1 to 1.76:1		
Lubricant	Type		Type A, Suffix A					
	Capacity (Pints)	Dry	15		18			
		Refill	3					
Governor	Type		Centrifugal					
	Operation		Regulates Pump Oil Pressure to Automatic Shift Control Valve Body					
	Drive		Mounted on Output Shaft					
	Location		In Extension					
Oil Pumps	Type		Internal-External Gear					
	Number		Two, Front and Rear					
	Function		To Supply Pressure					
	Front Pump	Drive	Converter Pump					
		Function	Supply Main System Pressure at Low Vehicle Speeds					
	Rear Pump	Drive	Output Shaft					
		Function	Supply Main System Pressure at High Vehicle Speeds and during Push Starts					

CHEVY II AND CHEVELLE AUTOMATIC TRANSMISSION

ENGINE	Name		Super-Thrift 153	Hi-Thrift 194	Turbo-Thrift 230	Turbo-Fire 283	Turbo-Fire 283
	Horsepower		90	120	140	195	220
	Displacement, cubic inches		153	194	230	283	283
Automatic Transmission							
General Data	Type		Automatic Hydraulic Torque Converter with Planetary Gear System for Low and Reverse				
	Selector Lever	Location	Steering Column except; Super Sport Floor Mounted				
		Operation	Actuates Manual Valve in Hydraulic Control System				
		Quadrant Position	P-R-N-D-L				
	Parking Lock	Type	Pawl and Gear (on Planetary)				
		Operation	Applied by Selector Lever through Spring Loaded Linkage				
	Method of Cooling		Air			Water	
	Flywheel Assembly		Steel Stamping with Welded on Ring Gear				
Converter Assembly	Type		Three Element				
	Pump		Inner and Outer Sheet Steel Shells separated by Sheet Steel Vanes. Outer Shell Pump Housing which is Welded to Converter Housing				
	Turbine		Inner and Outer Shells separated by Sheet Steel Vanes. Assembly supported in Converter Cover. Operation independent of Cover and Pump Housing.				
	Stator		Aluminum Air Foil supported on a Stationary Sleeve by an over-running Clutch of Cam and Roller Design.				
	Stall Torque Ratio		2.40:1		2.10:1		
	Diameter (Nominal)		11.0			11.75	
Case	Material		Aluminum (one piece)				
High Clutch	Type		Multi-disk				
	Drive Plates	Description	Waved Steel with Bonded Organic Facings				
		Number	3			4	
	Driven Plates	Description	Flat Steel				
		Number	4			5	
Reverse Clutch	Type		Multi-disk				
	Drive Plates	Description	Flat Steel with Bonded Organic Facings				
		Number	4			5	
	Reaction Plates	Description	Flat Steel				
		Number	4			5	
Torque Multiplication	Maximum Overall Ratio		4.37:1		3.82:1		
	Low and Reverse		4.37:1 to 1.82:1		3.82:1 to 1.82:1		
Lubricant	Type		A, Suffix A				
	Capacity (pts)	Dry	15			18	
		Refill	3				
Governor	Type		Centrifugal				
	Operation		Regulates Pump Oil Pressure to Automatic Shift Control Valve Body				
	Drive		Output Shaft				
	Location		In Extension				
Oil Pumps	Type		Internal-External Gear				
	Number		Two, Front and Rear				
	Function		To Supply Pressure				
	Front Pump	Drive	Converter Pump				
		Function	Supply Main System Pressure at Low Vehicle Speeds				
	Rear Pump	Drive	Output Shaft				
		Function	Supply Main System Pressure at High Vehicle Speeds and during Push Starts				

STEERING

(SECTION 9)

STANDARD STEERING

Item			Chevrolet	Chevelle	Chevy II
Steering Gear	Type		Recirculating Ball		
	Ratio	Gear	24:1	24:1	20:1
		Overall	28.2:1	28:1	25.4:1
Linkage	Type		Parallel Relay Rod		
	Location		Rear	Front	Rear
	# Tie Rods		2		

POWER STEERING

			Chevrolet	Chevelle	Chevy II
Pump	Type		Vane Impeller		
	Pressure		1000 - 1100	850 - 1000	850 - 1000
Steering Gear	Type		Integral Recirculating Ball		Same Gear as Manual
	Ratio	Gear	17.5:1	17.5:1	
		Overall	20.5:1	20.4:1	

TORQUE CHART

Item	Chevrolet	Chevelle	Chevy II
Worm Bearing Preload	4 - 7 in. lbs.		1-1/2 - 5-1/2 in. lbs.
Sector Lash Adjustment	4 - 10 in. lbs. in Excess of Above		3 - 7 in. lbs. In Excess of Above
Maximum Steering Gear Preload	14 in. lbs.		11 in lbs.
Steering Gear Mounting Bolts	60 - 75 ft. lbs.		25 - 35 ft. lbs.
Pitman Shaft Nut	100 - 125 ft. lbs.		
Steering Wheel Nut	30 - 40 ft. lbs.		
Steering Coupling Bolts	15 - 20 ft. lbs.		None
Steering Coupling Clamp Bolt	25 - 35 ft. lbs.		None
Tie Rod End Nut	29 - 43 ft. lbs.		
Tie Rod Clamp Bolts	12 - 16 ft. lbs.		
Idler Arm Mounting Bolt	90 - 115 ft. lbs.	25 - 35 ft. lbs.	14 - 22 ft. lbs.
Steering Arm Bolts	45 - 55 ft. lbs.		55 - 75 ft. lbs.

CHASSIS ELECTRICAL
(SECTION 12)

BULBS	Candle-Power	Number
Headlamp Unit (Sealed Beam)- Chevrolet and Chevelle		
Outer—High Beam	37 1/2W	4002 L
Outer—Low Beam	55 W	4001 L
Inner—High Beam Only	37 1/2W	4001
Headlamp-Chevy II		
High Beam	55 W	(Sealed
Low Beam	45 W	Beam)
Parking Lamp and Front Directional Signal	4-32	1157
Tail and Stop and Rear Directional Signal Lamps	4-32	1157
Tail Lamp (Bel Air)	4	1155
Back-up Lamp	32	1156
Instrument Lamps		
Chevrolet and Chevelle	2	1895
Chevy II	3	1816
Instrument Panel Compartment Lamp	2	1895
Seat Separator Console Lamp (Cartridge Type)	12	211
Temperature Indicator Lamp	2	1895
Oil Pressure Indicator Lamp	2	1895
Generator Indicator Lamp	2	1895
Headlamp Hi-Beam Indicator Lamp	2	1895
Directional Signal Indicator Lamp		
Chevrolet and Chevelle	1	1445
Chevy II	2	1895
Automatic Transmission Quadrant Lamp	1	1445
Ignition Lock Lamp	1	1445
Heater Control Panel Lamp	1	1445
Tachometer Lamp	1	1445
Dome Lamp	12	211
Side Rail Lamp—Sport Coupe and Sport Sedan	6	90
Courtesy Lamp		
Convertible	6	631
Rear Quarter Lamp		
9 Passenger Station Wagon	6	90
License Plate Lamp	4	67
Radio Dial Lamp	2	1893
Clock Lamp	2	1895
Brake Alarm Lamp	2	257
Traffic Hazard Lamp	1	1445
Luggage Compartment		1003
Underhood		93

WINDSHIELD WIPERS

Non-Depressed Park	Single Speed	Two Speed
Operation		
Test Voltage	12 V.	12 V.
Crank Arm Rotation	CCW	CCW
Current Draw		
No Load	3 Max.	3.6 Max.
Dry W/S	3.5 Max.	4.5 Max.
Stall	11.0 Max.	12 Max.
Crank Arm Speed (RPM's)		
Low		34 Min.
Hi		65 Min.

Depressed Park	Two Speed
Operating Voltage	12 VDC
Gear Ratio	3.36:1
Crank Arm Rotation (Looking at Crank Arm)	Clockwise
Crank Arm Speed (No Load)	
Lo	34 RPM/min.
Hi	65 RPM/min.
Current Draw (amperes)	
No load (low speed)	3.6
Installed in Car (dry windshield)	4.5
Stall	12
Shunt Field Resistance (OHMS)	24

WASHER PUMP

Number of "squirts" at full pressure	12
Pressure (PSI)	11-15
Coil Resistance (OHMS)	20

FUSES AND CIRCUIT BREAKER

A 19-20 amp. circuit Breaker in the light control switch protects the headlamp circuit, thus eliminating one fuse. Where current load is too heavy, the circuit breaker rapidly opens and closes, protecting the circuit until the cause is found and eliminated.

Fuses, located in the Fuse Panel under the dash are:

Instrument Lights	3AGC/AGC- 3 amp.
Tail, Stop, Courtesy, Glove Box, License Plate, Dome Lights and Clock	3AGC/AGC-15 amp.
Radio (Manual and Push Button)	3AG/AGC-2.5 amp.
Heater	3AG/AGC-10 amp.
Backup Light, Brake Signal Light	3AG/AGC-10 amp.
Windshield Wiper	3AG/AGC-15 amp.
Spotlight	3AG/AGC-15 amp.

Overdrive Fuse—3AG/AGC-15. Located in wiring harness on engine side of the dash panel just forward of the instrument panel.

Air Conditioning Systems	Fuse Block	In Line
Four Season Systems		
Chevrolet	20 amp.	30 amp.
Chevelle	20 amp.	30 amp.
Custom Systems		
Chevrolet	15 amp.	20 amp.
Chevelle	15 amp.	20 amp.
Chevy II	15 amp.	20 amp.
All-Weather System		
Chevy II	15 amp.	20 amp.

ACCESSORIES

(SECTION 15)

AIR CONDITIONING

Compressor	
Make	Frigidaire
Type	6 Cylinder Axial
Displacement	
Four-Season	12.6 Cu. In.
Custom and All-Weather	10.8 Cu. In.
Rotation	Clockwise
Compressor Clutch Coil	
Ohms (at 80°F)	4.18-4.38
Amps (at 80°F)	2.86 @ 12 Volts
Refrigerant	12
Compressor Oil	Frigidaire 525 Viscosity
System Capacities	
Refrigerant	R-12
Four-Season Systems	3 lbs., 12 oz.
Custom Systems	
Chevrolet and Chevelle	3 lbs.
Chevy II	2 lbs., 8 oz.
All-Weather System	
Compressor Oil	Frigidaire 525 Viscosity
All Systems	11 oz.

Fuses	Fuse Block	In Line
Four-Season Systems	20 amp.	30 amp.
Custom Systems	15 amp.	20 amp.
Chevy II All-Weather System	15 amp.	20 amp.

SPEED AND CRUISE CONTROL

Motor	12-Volt Reversible
Fuse	10 Amp. in Junction Block
Accelerator Linkage	
Adjustment	.0625" (use gauge pin)
Electrical Points	4 (Replaceable)
Gap between Contact Arm and Point	
(Full Gap)	.090" ± .010"
Omni-Switch Point Gap	.025" ± .010"